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INTEGRATED REGULATORY REVIEW SERVICE (IRRS)

FOLLOW-UP MISSION

TO

THE UNITED STATES OF AMERICA

Washington D.C.

3 to 11 February 2014

US NUCLEAR REGULATORY COMMISSION

INTEGRATED REGULATORY REVIEW SERVICE (IRRS)
FOLLOW-UP REPORT TO
THE UNITED STATES OF AMERICA

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THE UNITED STATES OF AMERICA

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IAEA 2014

The number of recommendations, suggestions and good practices is in no way a measure of the status of the regulatory body. Comparisons of such numbers between IRRS reports from different countries should not be attempted.

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EXECUTIVE SUMMARY

In October 2010, at the request of the Government of the United States of America, an international team of twenty senior safety experts visited the United States Nuclear Regulatory Commission (NRC) to conduct an Integrated Regulatory Review Service (IRRS) Mission. The purpose of the initial IRRS mission was to review the regulatory framework for safety of the operating nuclear power plants in the United States and the effectiveness of regulatory functions implemented by the NRC.

At the request of the Government of the United States of America, an international team of senior safety experts met the representatives of the USNRC from 3 to 11 February 2014 to conduct a follow-up IRRS mission. The mission took place at the headquarters of the USNRC in Washington, D.C.. The purpose of the peer review was to review the national regulatory framework for nuclear safety of the operating nuclear power plants in the US and specifically the measures undertaken following the recommendations and suggestions of the 2010 IRRS mission. The review compared the US regulatory framework for safety against IAEA safety standards as the international benchmark for safety. The mission was also used to exchange information and experience between the IRRS Team members and the US counterparts in the areas covered by the IRRS.

The IRRS Team consisted of 5 senior regulatory experts from 5 IAEA Member States and 3 IAEA staff members.

The IRRS Team carried out a review of the measures undertaken following the recommendations and suggestions of the 2010 IRRS mission in the following areas: responsibilities and functions of the government; the global nuclear safety regime; responsibilities and functions of the regulatory body; the management system of the regulatory body; the activities of the regulatory body related to regulation of nuclear power plants, including authorization, review and assessment, inspection, enforcement, and the development and content of regulations and guides; emergency preparedness and response. In addition, the interface with nuclear security was reviewed.

As recommended by the IAEA Nuclear Safety Action Plan, special attention was given to regulatory implications to the US framework for safety in relation to the lessons learned from the TEPCO Fukushima Daiichi accident.

The mission included interviews, reviewing information provided in response to IAEA recommendations and suggestions and discussions with USNRC staff on current and future planned activities.

The USNRC provided the IRRS Team with advance reference material and supporting documentation in all areas within the scope of the mission.

Throughout the mission, the IRRS Team was provided with full cooperation in regulatory and technical issues by all parties; in particular, the staff of the USNRC provided the fullest practicable assistance and demonstrated extensive openness and transparency.

The IRRS Team concluded that the recommendations and suggestions from the 2010 IRRS mission have been taken into account systematically. Significant progress has been made in many areas and many improvements were carried out following the implementation of the action plan.

During this follow-up mission, the IRRS Team determined that one of two recommendations and 19 out of 20 suggestions made by the 2010 IRRS mission had been effectively addressed and therefore could be considered closed. The USNRC should be commended for this accomplishment.

The IRRS Team also concluded that the USNRC should continue the implementation of its actions towards completion of the remaining findings.

The IRRS Team made the following general observations:

- The USNRC has put in place measures to clarify that the prime responsibility for safety lies with the licensees

- The USNRC has made a clear commitment towards completing and implementing its Management System description and process map

- The USNRC has implemented procedures to ensure that a systematic review of its Guides is carried out, taking account of operational experience feedback and IAEA safety standards

- Emergency preparedness requirements have been expanded to ensure the emergency exercise programme is challenging to all those involved

- The importance of the safety-security interface has been enhanced through an improved analysis of operating experience and the development of an integrated safety security culture

The IRRS Team considers the NRC to have acted promptly and effectively after the TEPCO Fukushima Daiichi accident in the interest of public health and safety in both the US and Japan. The results of the Near Term Task Force (NTTF) represent a sound and ample basis for taking into account the lessons learned from the accident. The IRRS team encourages the NRC to be proactive in the oversight of the licensees' implementation strategies and to set clear timelines for the resolution of all related actions.

Within the scope of the mission, the IRRS Team identified the following good practice:

- The systematic analysis of significant non-nuclear events in the entire operating experience program, the coordination and communication of the operating experience analysis and the diversity of products to make them suitable for different uses and applications.

The IRRS Team identified one new suggestion:

- The NRC should consider developing a consolidated rulemaking and corresponding guidance in order to facilitate the orderly transition from operation to decommissioning.

Open findings from the 2010 IRRS mission can be found in Appendix IV.

The current IRRS Team observations are summarized in Appendix V.

An IAEA press release was issued and a press conference was conducted at the end of the mission.

I. INTRODUCTION

In October 2010, at the request of the Government of the United States of America, an international team of twenty senior safety experts visited the United States Nuclear Regulatory Commission (NRC) to conduct an Integrated Regulatory Review Service (IRRS) Mission. The purpose of this IRRS mission was to review the regulatory framework for safety of the operating nuclear power plants in the United States and the effectiveness of regulatory functions implemented by the NRC.

At the request of the Government of the United States of America, an international team of senior safety experts met the representatives of the USNRC from 3 to 11 February 2014 to conduct a follow-up IRRS mission. The mission took place at the headquarters of the USNRC in Washington, D.C.. The purpose of the peer review was to review the national regulatory framework for nuclear safety of the operating nuclear power plants in the US and specifically the measures undertaken following the recommendations and suggestions of the 2010 IRRS mission. The review compared the US regulatory framework for safety against IAEA safety standards as the international benchmark for safety. The mission was also used to exchange information and experience between the IRRS Team members and the US counterparts in the areas covered by the IRRS. A preparatory mission was conducted from 7 to 8 November 2013 at the USNRC Headquarters, to discuss the purpose, objectives, scope and detailed preparations of the review in connection with the previous IRRS mission.

The IRRS Team consisted of 5 senior regulatory experts from 5 IAEA Member States and 3 IAEA staff members.

The IRRS Team carried out a review of the measures undertaken following the recommendations and suggestions of the 2010 IRRS mission in the following areas: responsibilities and functions of the government; the global nuclear safety regime; responsibilities and functions of the regulatory body; the management system of the regulatory body; the activities of the regulatory body related to regulation of nuclear power plants, including authorization, review and assessment, inspection, enforcement, and the development and content of regulations and guides; emergency preparedness and response. In addition, the interface with nuclear security was reviewed.

As recommended by the IAEA Nuclear Safety Action Plan, special attention was given to regulatory implications to the US framework for safety in relation to the lessons learned from the TEPCO Fukushima Daiichi accident.

The USNRC conducted a self-assessment of the status of implementation of the findings of the 2010 IRRS mission and provided its results and the supporting documentation to the team as advance reference material for the mission. During the mission, the IRRS Team performed a systematic review of all topics by reviewing the advance reference material and by conducting interviews with management and staff from the USNRC. A meeting with an USNRC Commissioner was also organized. All through the mission, the IRRS Team received excellent support and cooperation from the USNRC.

II. OBJECTIVE AND SCOPE

The purpose of the peer review was to review the national regulatory framework for nuclear safety in the US and specifically the measures undertaken following the recommendations and suggestions of the 2010 IRRS mission. The IRRS review scope addressed the operating power reactors in the US. The review was carried out by comparing existing arrangements against the IAEA safety standards.

It is expected that the IRRS mission will facilitate regulatory improvements in the US and in other Member States from the knowledge gained and experiences shared by the USNRC and IRRS reviewers, as well as through the evaluation of the effectiveness of the US regulatory framework for nuclear safety and its good practices.

The key objectives of this mission were to enhance nuclear and radiation safety, as well as emergency preparedness and response by:

- Providing the US and the USNRC, through completion of the IRRS questionnaire, with an opportunity for self-assessment of its activities against IAEA safety standards;

- Providing the US and the USNRC with a review of its regulatory programme and policy issues relating to nuclear and radiation safety, and emergency preparedness;

- Providing the US and the USNRC with an objective evaluation of its nuclear and radiation safety, as well as emergency preparedness and response regulatory activities with respect to IAEA safety standards;

- Contributing to the harmonization of regulatory approaches among IAEA Member States;

- Promoting the sharing of experience and exchange of lessons learned;

- Providing reviewers from IAEA Member States and the IAEA staff with opportunities to broaden their experience and knowledge of their own fields;

- Providing key USNRC staff with an opportunity to discuss their practices with reviewers who have experience with different practices in the same field;

- Providing the US and the USNRC with recommendations and suggestions for improvement; and

- Providing other States with information regarding good practices identified in the course of the review.

III. BASIS FOR REVIEW

A. PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Government of the United States, a preparatory meeting for the Integrated Regulatory Review Service (IRRS) was conducted from 7 to 8 November 2013. The preparatory meeting was carried out by the appointed Team Leader Mr Colin Patchett, Deputy Team Leader Ms Isabel Mellado and the IAEA representatives, Ms Adriana Nicic, and Mr Jeff Lafortune.

The IRRS mission preparatory team held discussions regarding the progress made by the USNRC in addressing measures undertaken following the recommendations and suggestions of the 2010 IRRS mission. The USNRC team was led by senior management, represented by Mr Eric Leads, Director, Office of Nuclear Reactor Regulation and included other senior management and staff. The discussions resulted in an agreement regarding the follow-up IRRS mission addressing the findings from the 2010 mission and the regulatory implications of the TEPCO Fukushima Daiichi accident.

USNRC‘s representatives made presentations on: The USNRC structure, organisation, independence, responsibilities and activities; the general status of findings from the 2010 IRRS mission; major changes in each module/area since 2010 and USNRC Fukushima Programme outcomes.

IAEA staff presented the IRRS principles, process and methodology for a follow-up mission. This was followed by a discussion on the tentative work plan for the implementation of the IRRS in the US in February 2014.

The proposed IRRS Team composition (senior regulators from Member States to be involved in the review) was discussed and the size of the IRRS Team was tentatively confirmed. Logistics including meeting and work space, counterparts and Liaison Officer identification, lodging and transportation arrangements were also addressed.

The USNRC Liaison Officer for the preparatory meeting and the IRRS mission was Mr Jon Hopkins.

The USNRC provided the IAEA (and the review team) with the advance reference material for the review at the end of January 2014. In preparation for the mission, the IAEA review team members conducted a review of the advance reference material and provided their initial review comments to the IAEA Team Coordinator prior to the commencement of the IRRS mission.

B. REFERENCE FOR THE REVIEW

The most relevant IAEA safety standards were used as review criteria. A more complete list of IAEA publications used as reference for this mission is given in Appendix VII.

C. CONDUCT OF THE REVIEW

An IRRS Team opening meeting was conducted on Sunday, 2 February 2014, in Washington, D.C., by the IRRS Team Leader and the IRRS IAEA Team Coordinator to discuss the general overview of the mission, the areas of focus as well as specific issues of the mission; to clarify the basis for the review and the background, context and objectives of

the IRRS and to agree on the methodology for the review and the evaluation among all reviewers. They also presented the agenda for the mission.

In addition, the IAEA Review Area Facilitator presented the expectations regarding the module on the "Regulatory Implications from TEPCO-Fukushima Daiichi Accident" to be applied.

The USNRC designated representative was present at the opening IRRS Team meeting, in accordance with the IRRS guidelines, and presented logistical arrangements planned for the mission.

The reviewers also reported their first impressions of the advance reference material.

The IRRS entrance meeting was held on Monday, 3 February 2014, with the participation of USNRC Commissioners, senior management and staff. Opening remarks were made by Ms Allison Macfarlane, USNRC Chairman, Mr Colin Patchett, IRRS Team Leader, Ms Isabel Mellado, Deputy Team Leader, Ms Adriana Nicic, IRRS Team Coordinator, Mr Michael Johnson, Deputy Executive Director for Reactor and Preparedness Programs, Mr Eric Leeds, Director, Office of Nuclear Reactor Regulation, and Ms Jennifer Uhle, Deputy Director for Reactor Safety Programs.

The USNRC representative presented an overview of the USNRC response to the Fukushima Daiichi accident.

During the mission, a review was conducted for all the review areas with the objective of providing the US and the NRC with recommendations and suggestions for improvement as well as identifying good practices. The review was conducted through meetings, interviews and discussions with USNRC staff.

The IRRS Team also reviewed the NRC response to the TEPCO Fukushima Daiichi accident. This review was performed by conducting interviews with involved NRC staff, reviewing associated documents and the results of the self-assessment completed by the NRC. The results are provided in Chapter 12 of this report.

The IRRS Team performed its activities based on the mission programme given in Appendix II.

The IRRS exit meeting was held on Tuesday, 11th February 2014. The opening remarks at the exit meeting were given by Ms Alison Macfarlane, USNRC Chairman, Mr. William Magwood, NRC Commissioner, Mr. William Ostendorff, NRC Commissioner and Mr Mark Satorius, NRC Executive Director for Operations, and were followed by the presentation given by the IRRS Team Leader, Mr Colin Patchett on the results of the mission. Closing remarks were made by Mr Jim Lyons, Director, Division of Nuclear Installation Safety.

An IAEA press release was issued and a press conference was conducted at the end of the mission.

1. RESPONSIBILITES AND FUNCTIONS OF THE GOVERNMENT

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S1	**Suggestion: In the absence of a direct legal statement about the prime responsibility for safety, the NRC should provide a consistent, clear message to the licensees that they have responsibility to take their own initiatives to improve safety whenever reasonably practicable.**

Changes since the initial IRRS mission

Suggestion 1: To address this suggestion, the NRC has taken a number of initiatives. NRC management spoke to the industry on this subject in different forum (Regulatory Information Conference in March 2010 and Nuclear Energy Institute (NEI) Licensing Forum in November 2010). A clear message has been included in the Safety Culture Policy Statement, approved by the Commission and published in the Federal Register on June 14, 2011, as follows: *"Individuals and organizations performing regulated activities bear the primary responsibility for safely handling and securing these materials. The Commission, as the regulatory agency with an independent oversight role, reviews the performance of those individuals and organizations through its inspection and assessment processes, including their performance as it relates to areas important to safety culture."* The Reactor Oversight Process that the NRC applies to inspect and assess the performance of current operating Nuclear Power Plants (NPPs) addresses the main attributes of a strong safety culture.

These actions are clearly focused to comply with IAEA Requirement 5 of GSR Part 1 which formed the basis for the suggestion stating: "The government shall expressly assign the prime responsibility for safety to the person or organization responsible for a facility or an activity, and shall confer on the regulatory body the authority to require such persons or organizations to comply with stipulated regulatory requirements, as well as to demonstrate such compliance."

Suggestion S1, however, included an additional message in order to stress the licensee's responsibility to take their own initiatives to improve safety whenever reasonably practicable. This message is complementary with Suggestion S14 and is discussed together with S14 in Module 9. A number of industry initiatives are discussed periodically at senior management level with the NRC. Most of them are intended to address the NRC concern that the industry tries to solve without regulatory requirements. Others are common industry responses to operating experience lessons learned, material degradations, etc.

The NRC stated that most, if not all, licensees have taken the opportunity to improve safety. However, the IRRS Team is not convinced that all US licensees are sufficiently proactive in voluntarily upgrading their systems, structures and components with the objective to improve safety margins. The IRRS Team recognizes the efforts so far realized by the NRC senior management to influence the licensees to take voluntary action and encourages the NRC to make further efforts to this effect.

Status of the findings in the initial mission

Suggestion 1 is closed: A clear message on licensee's prime responsibility for safety has been included in the Safety Culture Policy Statement, approved by the Commission and published in the Federal Register on June 14, 2011. Even though the Safety Culture Policy Statement is not a legally binding document, it makes explicit the safety responsibility of the licensees, defined principally through the licensing process, the continuous regulatory oversight and the enforcement throughout all stages in the lifetime of a facility. This action appropriately addresses the first part of the suggestion. The second part relates to the licensee's responsibility to take its own initiatives to improve safety whenever reasonably practicable. This message is complementary with Suggestion S14 (See Module 9) and is similarly closed based on the basis of progress made and confidence in effective completion.

2. GLOBAL NUCLEAR SAFETY REGIME

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S2	**Suggestion: The NRC should evaluate the added value to safety of harmonizing its regulations and guides with the IAEA safety standards and consider the possible means to take into account the IAEA Safety Standards in the regulations and regulatory guides.**

Changes since the initial IRRS mission

Suggestion 2: This suggestion basically deals with the same issue as suggestion 13, namely harmonisation of regulations and guides with international safety standards. In suggestion 2, the IAEA standards are specifically mentioned. In suggestion 13, international safety standards are mentioned. International standards also include other standards than IAEA safety standards such as ISO and IEC. In the issuing of regulations and guides, the NRC considers all relevant international standards. However, the IAEA standards are often not sufficiently detailed to be directly promulgated in NRC regulations and guides - in those cases the intent of how the IAEA standard is reflected in the NRC draft regulation or guide is described. Since the 2010 IRRS mission, the NRC has increased its interest in using the IAEA safety standards. A large number of NRC staff is now participating in the development of the standards and each proposed IAEA safety standard is reviewed and benchmarked against current NRC regulations and guides. The purpose is to minimize the gap between the IAEA safety standards and the NRC rules and regulatory guidance. Other initiatives include the development of a data base linking regulatory guides to the corresponding IAEA standard and consideration of a gap analysis study for comparing US regulations to the design requirements in IAEA Specific Safety Requirements (SSR 1/2): Safety of Nuclear Power Plants: Design.

Status of the findings in the initial mission

Suggestion 2 is closed. The NRC has increased its interest in using the IAEA safety standards and each proposed IAEA safety standard is now reviewed and benchmarked against current NRC regulations and guides. A Management Directive (6.6) has been issued as well as detailed implementing guidance for a 5-year periodic review of its Regulatory Guides taking into account operating experience feedback and the development of international safety standards, especially mentioning the IAEA safety standards. Regulations are reviewed on a continuous basis and a gap analysis is planned for comparing IAEA safety requirements with US regulations.

3. RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY

There were no findings in the initial IRRS mission regarding this area.

4. MANAGEMENT SYSTEM OF THE REGULATORY BODY

2010 mission RECOMMENDATIONS, SUGGESTIONS	
R1	**Recommendation: The NRC should identify/confirm and describe its organizational wide core processes and support processes and include process inputs, flows and outputs (e.g., develop a process map) in order to confirm and document a fully integrated Management System.**
R2	**Recommendation: The NRC should develop a methodology and implement a holistic Management System Review at planned intervals to ensure the continuing effectiveness of the management system.**
S3	**Suggestion: The NRC should continue to develop its draft Management System Description Document and accommodate in this document the results of the recommendations given above.**

Changes since the initial IRRS mission

Recommendation 1: Since the 2010 mission, the NRC has developed its draft Management System Description Document (MS document) in a progressive way with additional information as required by GS-R-3, including a process map of the major processes, sub-processes and support processes for the regulation of Operating Reactors. The major processes: "Regulation and Guidance", "Licensing, Decommissioning and Certification", "Oversight", "Operational Experience", "Support for Decisions" and "Maintain Open Communications and Dialogue" include 35 sub-processes altogether. The process map is designed to provide electronic links to descriptions of all the sub-processes. The sub-process descriptions will contain further links to underlying documentation. The major processes will be described in the MS document but the sub-process descriptions will be available on a dedicated SharePoint Site. Seven out of 35 sub-process descriptions had been developed and were demonstrated for the follow-up mission. The draft MS document was last updated in October 2013. Further development of the process map and the final MS document is on hold until summer 2014. The NRC is assessing costs and benefits of completing these activities including whether to expand the scope of activities beyond Operating Reactors.

The follow-up mission considers that the NRC has demonstrated a full understanding of the recommendation given. However, additional work remains to complete the entire process map with all electronic applications. Ideas exist but no adopted plan on how to complete and launch the implementation of the process map is yet in place. Possibly, the NRC will run a pilot project in order to evaluate the electronic applications, solicit staff comments and assess the usability before completing the whole process map. The follow-up IRRS Team was informed that the project is supported by senior managers of the NRC and was assured that resources will be available to develop and implement the complete process map. Taking into account the pilot project and possible modifications of the electronic application, the NRC estimated that completion of the process map could be expected by 2016.

Recommendation 2: Since the 2010 mission, the NRC has further developed its methods for self-assessment, especially the Programmatic Internal Control that is a part of the Reasonable

Assurance process. Programmatic Internal Control is required according to Federal Acts and GAO Standards as well as the Management Directive 4.4. “Internal control”. This control is seen as an integral component of an organization management system that provides reasonable assurance that the following objectives are being achieved:

1. effectiveness and efficiency of operations
2. reliability of financial reporting
3. compliance with applicable laws and regulations
4. periodic assessments of programmatic operations on a rotating basis
5. a comprehensive annual assessment of the NRC´s management system is being completed

The internal control process administered by the Office of the Chief Financial Officer has been streamlined to be more effective with e.g. fewer assessable units, updated and standardized internal control plans and justification templates, creation of an Internal Control Working Group and a new database and SharePoint Site for findings. The Programmatic Internal Control makes use of available performance and assessment data and makes independent checks of the assurances provided by the 11 offices. This process has a similar approach as Management System Reviews according to GS-R-3 but is functionally oriented towards the business lines rather than process oriented. Furthermore, the Programmatic Internal Control is more focused on compliance with applicable laws and regulations than identifying opportunities for improvement of the management system processes and their links to ensure the effectiveness of the whole management system. The NRC informed the follow-up IRRS Team that staff is reviewing the effectiveness of the management system as part of development of the process map. Once the process map is completed, the NRC will re-evaluate the methods for continuing to evaluate the effectiveness of its MS. The follow-up IRRS Team agrees with the NRC that a holistic management system review cannot be completed before the process map and all process descriptions are in place and a methodology is defined to guide the review in a holistic perspective.

Suggestion 3: As described under Recommendation 1, the NRC has continued to develop its draft Management System Description Document and has included a process map with descriptions of the main processes and support processes for the regulation of Operating Reactors. However, all process descriptions are not yet completed.

Status of the findings in the initial mission

Recommendation 1 is closed on the basis of progress made and confidence in the effective completion. The NRC has developed the earlier draft MS document in a consistent way and according to the recommendation given. A formal issuing of the MS document with conventional process descriptions would satisfy GS-R-3, 2.8-2.10. Currently, only the regulation of Operating Reactors is covered (which is also the scope of the IRRS mission) and not New Reactors and other business lines. However, the same concept can be applied in other areas with much less effort than developing the first application. It is envisaged that the NRC will assess the usefulness in a pilot application and consider also less advanced IT applications of the process map also for the regulation of other facilities and activities. GS-R-3 has no requirements on electronic applications, only on user-friendliness of management system documentation.

The NRC has demonstrated full understanding of the intent of the recommendation and also showed a determination and an intention to commit resources to complete the descriptions of its Management System processes.

Recommendation 2 remains open. Although the Programmatic Internal Control has a similar approach as the Management System Review, the Control is functionally oriented rather than process oriented and more focused on compliance with laws and regulations than improvement. A Management System Review is also different to reviewing effectiveness as part of an already planned change process. A management system review uses results from all other assessments, as well as lessons learned from other organizations and identifies whether there is a need to make changes or improvements in policies, goals, strategies, plans, objectives and processes. For conducting the management system review, it is necessary to have a process map in place and develop a methodology. It still remains for the NRC to develop a methodology and to conduct a review in line with GS-R-3, 6.7-6.10.

Suggestion 3 is closed on the basis of progress made and confidence in effective completion. The Management System Description document is not yet completed to cover or refer to descriptions of all relevant processes and descriptions of Management System Reviews but the NRC has demonstrated a continued commitment to develop these and has also shown determination in completing the MS document with the results of Recommendations 1 and 2.

5. AUTHORIZATION

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S4	**Suggestion: The NRC should develop means to verify that the new operators have received adequate training on management of severe accidents.**

Changes since the initial IRRS mission

Suggestion 4: Following the recommendations of the post-Fukushima NTTF Report, the NRC has initiated a rulemaking process to strengthen and integrate onsite emergency response capabilities, including EOPs, SAMGs, and EDMGs. A preliminary rule language proposed with modifications of several parts of the *Code of Federal Regulations* has been published.

The 10 CFR 55.41, 10 CFR 55.43 and 10 CFR 55.45 modifications include severe accident procedures and guideline as topics for the examination of Operators and Senior Operators. The draft of the regulatory basis for those changes considers that training of licensed operators should require additional knowledge and abilities in the area of severe accident mitigation procedures. Specific consideration is being given to appropriate strategies for examining initial Operator and Senior Operator license applicants in the area of severe accidents, such as by testing the knowledge and abilities through written examination questions and/or Job Performance Measures (JPMs). Additionally, severe accident mitigation procedures were highlighted for coverage by licensed operator requalification programs. The proposed rule and draft implementation guidance are due to the Commission on July 25, 2014. Implementation of the final rule and guidance is expected by March 11, 2016.

Currently, SAMGs are addressed through an industry initiative and in those cases, the NRC usually does not take regulatory actions to oversight the practical way in which each licensee is applying them. In the context of post Fukushima actions, the NRC performed an *ad hoc* inspection of each NPP to receive information on the status of SAMGS implementation. Additional oversight activities are being planned to make sure that the new NRC orders on mitigation strategies for extreme external events are appropriately implemented, including the training of staff involved in its implementation.

Status of the findings in the initial mission

Suggestion 4 is closed based on the basis of progress made and confidence in effective completion: The NRC has initiated a rule making process to strengthen and integrate onsite emergency response capabilities. The proposed rule includes EOPs, SAMGs, and EDMGs and modifications of 10 CFR 55.41, 10 CFR 55.43 and 10 CFR 50.45 to considered severe accident procedures and guideline as topics for the examination of Operators and Senior Operators. Implementation of the final rule and guidance is expected by March 11, 2016. Currently, SAMGs are addressed through an industry initiative and the NRC is carrying out specific oversight activities on this subject in the framework of the orders on mitigation strategies for extreme external events.

New observations from the follow-up mission

In 2013, several plants announced plans to cease operations prior to the expiration of their operating licenses due to financial considerations. The licensing process to transition from operation to decommissioning relies on a series of license amendments and exemptions for each reactor. Though dated, NRC staff does have experience in the transition from operation to decommissioning of power reactors. The NRC had pursued a consolidated decommissioning rulemaking in the late 1990's and early 2000's to facilitate the orderly transition to decommissioned status; however, that rulemaking was terminated due to resource constraints and no additional plants predicted to shut down early in that specific moment of time.

This situation has changed and consequently, the NRC should consider restarting the rulemaking process. The transition phase from permanent shutdown to decommissioning poses unique challenges and the regulatory requirements should be adapted in a graded approach to the actual risk present in the plant at each moment. The IRRS Follow-Up Team is aware of the time frame required for a rulemaking procedure and that the new rule could disbenefit the licensing activities for the transition of the plant to permanently shut down. However, it is important to make sure that the current knowledge and experience of NRC staff on this matter remains imbedded in the processes and regulation.

Follow-up Mission **RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES**	
Observation: A number of NPPs have announced plans to cease operations prior to expiration of their operating licenses due to financial considerations. The licensing process to transition from operation to decommissioning relies on a series of license amendments and exemptions for each reactor that have not been systematically formalised in the regulations. Though dated, NRC staff does have experience in the transition of power reactors from operation to decommissioning but a consolidated rule and corresponding guidance for assessment and inspection would help to facilitate the orderly transition.	
(1)	**BASIS: GSR Part 1, 4.3 g states that** *"The objective of regulatory functions is the verification and assessment of safety in compliance with regulatory requirements. The performance of regulatory functions shall be commensurate with the radiation risks associated with facilities and activities, in accordance with a graded approach. The regulatory process shall provide a high degree of confidence, until the release of facilities and activities from regulatory control, that:* *(g) The shutdown and decommissioning (or closure with the continuation of institutional control) of facilities and termination of activities comply with the regulatory requirements".*
SF1	**Suggestion: The NRC should consider developing a consolidated rulemaking and corresponding guidance in order to facilitate the orderly transition from operation to decommissioning and ensure that current staff knowledge and experience on this subject remain imbedded in the processes and the regulation.**

6. REVIEW AND ASSESSMENT

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S5	**Suggestion: Future updates of the NRC's Standard Review Plans should take into account scientific and technological developments in the area of safety assessment as reflected in the relevant IAEA safety standards.**
S6	**Suggestion: The NRC should consider limiting its approval of codes submitted by vendors to a specific period of time to ensure the codes are periodically evaluated and updated, as necessary, to reflect lessons learned and the latest knowledge.**
S7	**Suggestion: The NRC should consider proper ways aimed at more direct implementation of ALARA principle in setting up the radiological acceptance criteria for design basis accidents as well as in assessment of acceptability of the results of relevant safety analysis.**
S8	**Suggestion: The NRC should assess whether the current regulations adequately provide for an independent verification of the safety assessment under the responsibility of the licensee before its use or submittal to the regulatory body and whether this verification is adequately confirmed by the NRC.**
S9	**Suggestion: The NRC should incorporate lessons learned from Periodic Safety Reviews performed in other countries as an input to the NRC's assessment processes.**

Changes since the initial IRRS mission

Suggestion 5: Since the IRRS mission, IAEA Safety Standards have been given significantly more consideration when updating NRC guides. A comparison with the relevant IAEA Standards is now performed in all updated NRC Regulatory Guides under the title "Harmonization with International Standards". It can be concluded that the NRC routinely reviews IAEA standards as part of the NRC Regulatory Guide update, presently having documented the completion in about 33 final and 11 draft regulatory guides.

Similarly to regulatory guides, the Standard Review Plan is also periodically updated so that it remains up-to-date and reflects the safety assessment lessons learned especially from the NRC's licensing application reviews. The Standard Review Plan routinely identifies technical positions in regulatory guides as acceptance criteria. In this way, the Standard Review Plan benefits from current efforts together with the regulatory guide updates programme to benchmark its position with the corresponding IAEA standards.

The overall update of the Standard Review Plan was performed in 2007, with many additional updates following afterwards. The updates included chapter 19.0 containing PSA and severe accident analysis, which was updated in September 2012, several other chapters also in 2013.

Suggestion 6: Since the IRRS mission, the NRC has had discussions with major fuel vendors concerning future code & method topical reports review and approval taking into consideration whether there should be a change to this process, what type of change best resolves the underlying issue, and how that change would best be implemented.

The current NRC practice in ensuring quality of safety analysis by means of using adequate computer codes was further discussed in detail during the follow-up IRRS mission. In all relevant cases, the NRC routinely evaluates the quality of codes during evaluation of submissions as a regulatory activity. These activities include license amendment requests such as fuel design changes or other plant modifications. Every year, there are several license amendments from each of the plants. Additionally, there are several inspection procedures specifically related to design control that could result in code applicability issues. When issues or problems are identified, staff takes action. There have been cases when staff formally withdrew the approval for approved topical reports. In other cases, the NRC has insisted on code updates when problems were identified with NRC approved codes. The NRC has also imposed conditions on code approval to require periodic evaluation of new data and reports the results to the NRC. The NRC continues to evaluate the use of similar conditions on future approved topical reports. These activities often result in a generic communication to industry and the public. Examples of the relevant NRC responses to situations were presented and discussed during the follow-up IRRS mission.

Suggestion 7: The substance of the issue and the basis for suggestion was comparably high value of the radiological acceptance criterion for design basis accidents. The validity of the original Suggestion S7 is now supported by recently published IAEA Safety Requirements for design (SSR-2/1) stating in para. 5.25. *"The design shall be such that for design basis accident conditions… they have no, or only minor, radiological impacts, on or off the site, and do not necessitate any off-site intervention measures."* Further on GSR Part 3, para. 1.27 states in connection with reference levels for emergency situations that *"... Any situation that resulted in a dose of greater than 100mSv being incurred acutely or in one year would be considered unacceptable…"*. A number of examples from several countries were provided by the IRRS Team in which the acceptance criteria for design basis accidents in terms of the effective dose incurred within one year are in the range of 1 to 10mSv (including Bulgaria, Finland, Slovakia, UK). The 250mSv effective dose received for any 2-hour period following the onset of fission product release by any individual from the public on the boundary of the exclusion area, and the same effective dose received during the entire period of the releases on the outer boundary of the low population zone is stated in the 10 CFR 50.67. Similarly, in 10 CFR 100.11, the same effective dose is used in connection with siting for the determination of the boundary of the exclusion area and the low population zone.

Since the IRRS mission, the NRC staff has taken action to survey international regulator counterparts for information on their use of ALARA in establishing acceptance criteria in safety analyses contacting Canada, Finland, France, Republic of Korea, Slovakia, Spain, Sweden, Switzerland, and United Kingdom. However, the survey resulted in limited feedback and did not allow for sufficient information to be used that could justify a substantial benefit from the use of the ALARA principle in establishing acceptance criteria for design basis accident safety analyses. Therefore, NRC's response to the suggestion, referenced the NRC's Backfit Rule (10 CFR 50.109) which prohibits staff from imposing new radiological acceptance criteria for previously approved design basis accident dose evaluations or to new design basis accident dose evaluations without demonstrating a safety benefit that is both substantial and justifies the cost of the required analysis, unless it is required to ensure

adequate protection of public health and safety. During the discussion of the follow-up IRRS mission, reference was also made to a footnote associated with both 10 CFR 50.67 and 10 CFR 100.11 limiting the use of 250mSv to potential reactor accidents of exceedingly low probability of occurrence. Since no substantial benefit was identified from changes of regulatory acceptance criteria, NRC staff does not recommend any changes in this regard.

The IRRS Team noted that the Commission has directed the NRC staff (SRM-SECY-12-0064 of December 15, 2012) to examine each regulation which contains dose criteria, and to examine that the relevant criteria are on the list of regulations to be examined. The Team suggests that in the framework of this examination, the NRC should seek further possibilities towards ensuring full harmonization of US regulations with the current IAEA Safety Standards.

Beyond the scope of Suggestion S7 but in line with ongoing NRC examinations, the Team highlighted the fact that in accordance with the SSR-2/1, radiological acceptance criteria should also be established for the design in connection with the design extension conditions including severe accidents so that consequences of an accident that cannot be practically eliminated, shall only make protective measures that are of limited scope in terms of area and timenecessary .

Suggestion 8: During the IRRS mission, the issue was raised whether existing regulations adequately provide for an independent verification by the licensee of the safety assessment performed by the vendor or any supplier of material, equipment and services. This was the basis for Suggestion S8 made by the IRRS mission. The question of independent verification remained open until the end of the IRRS mission. Although there were selected examples presented during the mission, which indicated use of the relevant practice including verification of the practice by the NRC, this was not considered as adequate demonstration of systematic practice required by the regulations.

After a more detailed analysis, the follow-up IRRS mission revealed that the licensee's obligation for independent verification is set up by the legislation, namely by the requirements for the license conditions specified in 10 CFR 50.34 and in Appendix B to the 10 CFR Part 50 Criterion VII dealing with control of purchased material, equipment and services.

In accordance with these requirements, there needs to be an independent organization checking safety-related activities such as design, construction and installation, or safety analysis on behalf of the licensee. Additionally, requirements associated with the control of purchased material, equipment and services (including analysis) make vendor supplies subject to this independent checking. There are routine inspection activities to verify the compliance.

Suggestion 9: Since the IRRS mission a number of steps have been taken by the NRC in line with Suggestion S9. In particular, the ANL was contracted to develop a pilot study aimed at reviewing several PSR reports for potential insights to be used for future revision of relevant NRC guidance documents and to identify the value added from PSR as compared to current NRC safety review processes. Based on the ANL Technical Letter Report and supplemental NRC staff evaluation, 371 issues were identified from the PSR reports. After screening those issues which were based on NRC regulations or guidance, the issues were categorized by 8 subject areas and prioritized into 3 classes:

- Issues addressed through NRC requirements or guidance
- Issues addressed under NRC regulatory processes
- Issues where further evaluation is needed to determine if they could be resolved undercurrent NRC regulatory processes.

The NRC continues to evaluate remaining issues in order to identify further insights and to feed these into appropriate regulatory processes. Since the issues associated with aging management topics were largely covered by the international community following the NRC practice, assessment of the issues by the NRC focuses on non-aging issues. Documentation of the findings from the pilot study is scheduled for June 2014, followed by the determination of the value added of the PSR review.

A number of examples were discussed between the NRC staff and IRRS Team in order to identify similarities and differences between the NRC and PSR processes.

Both IRRS Team members and NRC staff underlined the importance of sharing information from feedback from the operational experience and the harmonization of approaches to maintaining and improving safety of NPPs looking for broader international consensus.

Status of the findings in the initial mission

Suggestion 5 is closed. Standard Review Plan is regularly updated, at present taking into account comparison with existing IAEA Safety Standards. Spot checking of several chapters of the updated Standard Review Plan revealed that the issues identified during the IRRS mission (including quality of computer codes and analysis of severe accidents) are reasonably covered. The IRRS Team considers it important that the NRC ensures that the updated Standard Review Plan will also take into account new rules on integration of accident management procedures and that it applies not only to new plants, but as far as achievable also to existing plants.

Suggestion 6 is closed on the basis of progress made and confidence in effective completion. Although the current regulatory practice provides for adequate quality of computer codes used for safety analysis associated with licensees' submissions, the NRC is further considering how to optimize this process. The follow-up IRRS Team supports the NRC efforts devoted to the issue. Relevant update of the Standard Review Plan in compliance with the IAEA Standards seems to be an adequate supporting action to address the issue. In this regard, reference is made to the IAEA GSR Part 4, Req. 24 and para. 5.10, which requires periodical review and updating of the safety assessment taking into account safety significant modifications of the computer codes and SSG-2, para. .6.1, which suggests the use of the best available software engineering practices.

Suggestion 7 is open. This suggestion is open since in accordance with the Protective Action Guidelines in the US, the projected dose for sheltering to be initiated is 10mSv, and 250mSv which is used as criterion for design basis accidents does not exclude the need for off-site intervention measures.

Suggestion 8 is closed. Nevertheless, in order to ensure systematic checking of the licensee's obligation for performing independent safety assessment in accordance with GSR Part 4 art. 4.66 – 4.70, including spot checks with more detailed review of safety assessment that have

the highest impact on radiation risks, the IRRS Team encourages the NRC to include such checking into the Reactor Oversight Process.

Suggestion 9 is closed on the basis of progress made and confidence in effective completion. The IRRS Team concluded that taking into account the NRC actions already taken or scheduled in the near future, the intent of the suggestion will be met. Nevertheless, referring also to the reconfirmed importance of the PSR in recently published IAEA standards (e.g. SSR-2/2, requirement 12 and para. 4.44, further supported by lessons learned from the EU stress tests), the NRC is encouraged to continue with the evaluation of the PSR experience in other countries in order to maximize benefits for the NRC processes from the pilot study as well as from all lessons learned from the PSR. Despite the fact that the goals of the NRC and PSR processes are the same, the experience of the IRRS Team shows that there is additional value in comprehensive safety re-assessment performed by the licensees at regular intervals aimed at improving the safety level of existing NPPs as close as reasonably achievable to meeting the current national and international safety standards.

7. INSPECTION

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S10	**Suggestion: The NRC should ensure that Severe Accident Management (SAM) is properly addressed in the Reactor Oversight Process (ROP).**
S11	**Suggestion: The NRC should review its inspection event response guidance and interact with licensees with an objective of reconfirming that the role of the NRC is understood and does not unduly influence the actions taken by the licensee.**

Changes since the initial IRRS mission

Suggestion 10: In accordance with Suggestion S10 of the IRRS report and in response to the recommendations of the Fukushima NTTF, the NRC initiated and is currently in the process of rulemaking activities aimed at strengthening on-site emergency response capabilities of the licensees. The regulatory basis (On-site Emergency Response Capabilities: Regulatory Basis to Address Nuclear Regulatory Commission Near-Term Task Force Recommendation 8, October 1, 2013) addressing the issue and the preliminary proposed rule language (On-site Emergency Response Capabilities-Preliminary Proposed Rule Language, Revision Date November 5, 2013) was presented and discussed during the follow-up IRRS mission. According to the envisaged legislative processes, finalization of the rule is expected in March 2016.

This initiative addresses the strengthening and integration of accident management procedures including severe accident management guidelines and supporting procedures, defining the roles, responsibilities and clear lines of decision-making authority, and training and exercises for personnel who would implement the procedures. The final rule as currently proposed and if successfully implemented will make the integration of accident management procedures, the licensing requirement.

In connection with Suggestion S10, the NRC has near-term and longer term planned actions addressing modifications of the reactor oversight process (ROP) to properly address severe accident management. Upon completion of associated regulatory changes, the periodic inspections will be performed to ensure that SAM issues are properly addressed.

Suggestion 11: In response to the suggestion, the NRC took several actions to address the issue. The findings of the IRRS mission and suggestion 11 were discussed with the Nuclear Energy Institute (NEI) and other industry representatives. Further on, the existing Inspection Procedure 71153 and its Appendix B, which provide guidance to NRC inspectors regarding their control room conduct during events, was presented and discussed with the NEI and other industry representatives. In addition, staff at the NRC headquarters discussed this matter twice during its monthly ROP call with the NRC regional staff. Neither NEI and industry representatives, nor NRC regional staff had comments or suggestions on modifications of the Inspection Procedure.

Status of the findings in the initial mission

Suggestion 10 is closed on the basis of progress made and confidence in effective completion. The IRRS Team agrees that the implementation of the rule on strengthening on-site emergency response capabilities will adequately address the issue raised in the suggestion. The team noted that the actions taken by the NRC are also in line with the recently published new IAEA Safety Standards for design and operation of nuclear power plants (SSR-2/1, art. 5.27 and SSR-2/2 art. 5.9).

It is, however, understood that the implications of this rulemaking activities are broader than just the response to Suggestion S10 of the IRRS mission. The IRRS Team suggests that for the final rule or for the NRC guidance to further underline the requirement on the effectiveness of the accident management procedures , explicitly expressing the need for implementation of three components for effective severe accident management: hardware provisions as necessary, severe accident management guidelines and skilled manpower. It is also suggested to reflect the revised regulatory approach to severe accident management for existing reactors in other relevant regulatory documents, in particular in the guidance on the format and content of the safety analysis reports and standard review plan.

Suggestion 11 is closed. The follow-up IRRS Team concludes that the intent of the suggestion has been met through the actions taken by the NRC. Communication between the NRC and the industry reconfirmed that the existing Inspection Procedure adequately addresses the NRC staff involvement during responses to operational events and no modification to the procedure is necessary.

8. ENFORCEMENT

There were no findings in the initial IRRS mission regarding this area.

9. REGULATIONS AND GUIDES

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S12	**Suggestion: The NRC should prioritize the development and issuance of a formal procedure for development and revision of Regulatory Guides.**
S13	**Suggestion: The NRC should consider making an implementing procedure to guide the periodic systematic review for its regulations and guides based on operating experience feedback and the development of international safety standards.**
S14	**Suggestion: The NRC should consider possible measures to ensure that all licensees are more proactive in upgrading the systems, structures and components of their facilities with the objective to improve safety margins. (See also S1)**

Changes since the initial IRRS mission

Suggestion 12: The 2010 IRRS mission found that the NRC rulemaking process was very comprehensive, well documented, clear and transparent. A similar process was used to develop and revise Regulatory Guides but no formal procedure to guide this process was issued. A draft Management Directive 6.6 "Development and revision of Regulatory Guides" had been developed and was scheduled to be issued in the near future. Since the mission, the NRC has further developed this Management Directive and also included requirements on periodic review and review for harmonization with international standards. The revised Management Directive 6.6 was approved and issued on April 12, 2011. Additional guidance is given in Office of Nuclear Regulatory Research (RES) Office Instruction (TEC-004) on Regulatory Guide Review, Development, Revision and Withdrawal. This instruction was issued May 10, 2013.

Suggestion 13: The 2010 IRRS Team found that the NRC Regulations and Guides were revised over time to reflect operating experiences and technical advances. However, no general NRC implementing procedure to guide the periodic systematic review of its Regulations and Guides based on operating experience feedback and the development of international safety standards was in place. Since the mission, the NRC has worked towards accommodating this finding. With respect to improving the use of IAEA guidance, the NRC has used a two part strategy. The first part is to continue and increase the participation in the development of IAEA standards. A large number of NRC staff is now participating in this development and each proposed IAEA safety standard is reviewed and benchmarked against current NRC regulations and guides. The purpose is to minimize the gap between the IAEA safety standards and the NRC rules and regulatory guidance. The second part of the strategy to use the IAEA standards is to make use of the NRC regulatory guide program. This was chosen because regulatory guides are more frequently revised than the federal regulations. As a result, the draft Management Directive 6.6 on Development and Revision of Regulatory Guides and Directive Handbook 6.6 were updated and issued in April 12 2011. The Directive now includes a review requirement for harmonization with international standards as well as a requirement for a 5-year periodic review. The Handbook discusses reasons for a new or revised Regulatory Guide, including operating experience and harmonization to new or revised international standards (both IAEA and industrial standards, such as ISO and IEC).

When sufficiently detailed, the international standards could be directly considered for endorsement. When broadly written, the international standard could be discussed in the introduction or discussions section where staff could explain how the RG meets the intent of the international standard. The RES Office Instruction TEC-004 issued in May 2013 includes detailed guidance on responsibilities and procedures for these reviews. The NRC has implemented reviews of IAEA guidance on a regular basis as part of the regulatory guide update review. About 33 final and 11 draft regulatory guides have been updated so far.

Further plans to consider international standards include: 1/ active participation in the development of requirements documents and safety guides incorporating the Fukushima lessons learned, 2/ development of a data base linking regulatory guides to the corresponding IAEA standard and 3/ consideration of a gap analysis study for comparing US regulations to the design requirements in IAEA Specific Safety Requirements (SSR 1/2): Safety of Nuclear Power Plants: Design.

With regard to the regular review of federal regulations, the follow-up IRRS Team noted that according to the Regulatory Flexibility Act (RFA), every 10 years agencies have to review those regulations which have a significant economic impact on a substantial number of small entities. The purpose of this periodic review is to determine whether the rules should be unchanged, amended or rescinded. The NRC will update its procedures for submitting "Unified Agenda" entries (see below) for these periodic review items and solicit public comments as well as publish the results of the periodic review.

The NRC publishes a semi-annual regulatory agenda (the Agenda) on its website for public comment. The Agenda is a compilation of all rules which the NRC has recently completed action or has proposed or is considering action. The most recent Agenda posted in January 2014 contains 53 rule making activities.

The NRC is also in the process of adopting a Plan for Retrospective Analysis of Existing Rules. Retrospective analysis should identify "significant regulations" that may be outmoded, ineffective, insufficient, or excessively burdensome, and to modify streamline, expand or rescind them in order to achieve the agency´s regulatory objective. An initial plan was published in the *Federal Register* in November 2011 and a draft plan for public comments was published in November 2012. A final draft was issued in July, 2013, which includes the update of regulations in light of Fukushima experiences, efforts to incorporate risk assessments into regulatory decision making, assessment of performance based regulations and consideration of the impact from multiple regulatory actions implemented simultaneously.

Suggestion 14: The 2010 IRRS Team made an observation that some US plants have voluntary taken proactive measures to improve safety while other plants do not upgrade the quality and reliability of their equipment as long as they can demonstrate that the plant is in compliance with the regulations.

One reason for this may be the complexity of the analysis which the NRC is required to perform to support a backfit determination (according to 10 CFR 50.109) and the large amount of NRC staff effort needed to resolve stakeholder comments on this analysis, particularly with the estimated values and impacts expressed in monetary terms may make it difficult for the NRC to require non substantial safety enhancement at the operating NPPs.

The follow-up IRRS Team acknowledges that industry organisations such as INPO, NEI and the Owner Groups as well as individual licensees take a number of voluntary initiatives to improve safety. The cumulative effects of these improvements in plant design and performance are visible in the annual assessment of performance as reflected in SECY-13-0038, "Fiscal Year 2012 Results of the Industry Trends Program for Operating Power Reactors", and SECY-13-0107 "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models". These reports provide assessments of trends in safety performance that reflect the result of performance from NRC requirements and initiatives as well as improvements voluntarily undertaken by the industry.

The follow-up IRRS Team was provided examples of technical measures voluntarily undertaken by the licensees as a result of the Fukushima accident, in support of power up-rates and for other reasons.

The USNRC encourages the industry to take voluntary actions to improve safety. The NRC headquarters' management periodically meets with industry group executives to discuss industrial initiatives in order to avoid unnecessary duplication of activities and identify areas where independent activities by other organizations may be warranted.

The NRC stated that most, if not all, licensees take the opportunity to improve safety. However, the follow-up IRRS Team is not convinced that all US licensees are sufficiently proactive in voluntary upgrading their systems, structures and components with the objective to improve safety margins. The follow-up IRRS Team recognizes the efforts so far done by the NRC senior management to influence the licensees to take voluntary action and encourages the NRC to make further efforts to this effect.

Status of the findings in the initial mission

Suggestion 12 is closed. The NRC has issued a formal procedure for development and revision of Regulatory Guides.

Suggestion 13 is closed. The NRC has issued a Management Directive as well as detailed implementing guidance for a 5-year periodic review of its Regulatory Guides taking into account operating experience feedback and the development of international safety standards. Regulations are reviewed on a continuous basis and there are requirements on a 10 year review of "significant regulations".

Suggestion 14 is closed on the basis of progress made and confidence in effective completion. The NRC executives have regular meetings with industry organization executives to discuss voluntary initiatives to improve safety. A number of voluntary initiatives to improve reliability of components and robustness are taken across the industry, both initiated by industry groups and at the individual plant level. However, the follow-up IRRS Team is not convinced that all licensees are sufficiently proactive in taking voluntary actions to improve their safety margins. The NRC is encouraged to continue the discussion with industry on this issue.

10. EMERGENCY PREPAREDNESS AND RESPONSE

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S15	**Suggestion: The NRC procedures for the IAEA emergency notification (ENAC) should be improved and the emergency exercise programme should include periodic testing of ENAC reporting to the IAEA.**
S16	**Suggestion: The NRC should discuss with its Federal partners the consideration of a proposal for the development of initial operational intervention levels (OILs) in line with the GS-R-2 provisions.**
S17	**Suggestion: The NRC should discuss with its Federal partners the consideration of a proposal for merging of all field measurements performed during an emergency by different stakeholders in a single database. This database should be made available online for decision making purposes.**
S18	**Suggestion: The NRC should continue to explore options with the federal and state partners in order to expand the scope of the emergency exercise programme by adding elements to demonstrate the capability to responds to unpredictable courses of events and to make the exercise programme more challenging to all the participants.**

Changes since the initial IRRS mission

Suggestion 15: During the exercise observation of the 2010 IRRS mission it was noted that "IAEA call" and "IAEA second call" messages appeared among the exercise injects, indicating that the interest of the international community in case of an emergency at an US NPP, however, the ENAC message that would provide the necessary technical information to the IAEA IEC was not written up and sent to Vienna.

The NRC took the following actions as a response to the suggestion:

- Incident Response Procedure IRP 057006, "Liaison Team International Liaison," was revised to include an appendix that details the requirements for reporting emergency and incident information to the IAEA via USIE (Unified System for Information Exchange). This procedure is trained, routinely exercised and comprehensively tested whenever the Headquarters Emergency Operations Center is staffed.

- the NRC response organization includes a dedicated international desk which has more staff to meet the continuously increasing demand of external stakeholders, e.g. Department of State (DoS), foreign countries, and the IAEA. The procedure IRP 057006 foresees close cooperation of the NRC with the DoS Operations Center to determine the content of technical information should be provided via USIE to meet the IAEA guidelines and expectations.

- the Director, Division of Preparedness and Response, was named as the ENAC (Early Notification and Assistance Conventions) National Contact Point at the NRC.

In addition to the above, the team would like to propose the following: There were many NRC staff and employees of other Federal family institutions as well as the industry in Japan that assisted in the mitigation of the consequences of the Fukushima Daiichi accident. Since in most cases there were no pre-defined procedures in place, these people developed a series of *ad hoc* procedures and practices to perform their daily activities, resolve problems and communicate with the headquarters. The NRC is encouraged to collect lessons learned from their staff but also other staff involved in Fukushima operations in Japan as well as from those who liaise with them in the US in order to develop procedure(s) which would make rendering and receiving assistance easier in the future, taking account of the documents that the IAEA developed for the implementation of the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency as well as its provisions.

Suggestion 16: The 2010 IRRS mission concluded that the operational intervention levels contained in IAEA standard GS-R-2 were not found to be in place as the standard requires. It was suggested to pursue the provisions of the IAEA standard.

This suggestion was discussed at the January 20, 2011, meeting of the Federal Radiological Preparedness Coordinating Committee (FRPCC). The FRPCC is a federal interagency group chartered to assist Federal Emergency Management Agency (FEMA) in providing policy direction for the program of Federal assistance to State and local governments in their radiological emergency planning and preparedness activities.

A follow-up discussion was conducted during the May 2011 FRPCC meeting and at several meetings of the Protective Action Guidelines (PAG) subcommittee. This subcommittee believes that the current derived response levels (DRL) for exposure and derived intervention levels (DIL) for food (these are the dose rate/concentration levels at which introduction of protective measures should be considered) as described in the PAG manual provides for safety, is consistent with the system of OILs as described in IAEA GS-R-2. The NRC staff agrees with this view.

Although the FRPCC and the Protective Action Guidelines (PAG) subcommittee had OILs on the agenda at many meetings in 2011, the suggestion was not pursued. The team concluded:

- Protective Action Guides (PAGs), expressed as effective dose equivalent (in rems), are to a certain extent similar to Generic Intervention Levels (GIL) for different protective actions and for different members of the public as well as for the workers.

- The derived response levels (DRL) and derived intervention levels (DIL) are applied in a similar way as OILs, indicating when PAGs or GILs are reached or exceeded.

However, there are differences - the main one is that OILs assume relatively simple measuring devices such as dose rate or contamination meters, while derived response levels (DRL) and derived intervention levels (DIL) are radionuclide specific, which means that spectroscopy is mandatory and the preferred mode of measurements. The time period for PAGs over which the dose is accumulated is usually 4 days compared to 7 days at GILs with the exception of sheltering in both cases. Considering the radiation measuring capabilities and expertise at national and at State level, the team believes that the more sophisticated measuring method can be justified. The team also acknowledged that a new PAG Manual was drafted in July 2012 and it is in the interagency review now and provides guidance on radiological protection criteria for all accidents that would require consideration of protective

actions. It can be noted that the document considers individual protective actions as well as their combinations and the PAGs are consistent with the reference levels in GSG-2, i.e. they are between 1 and 5rems (from 10 to 50mSv). The PAG Manual provides guidance for all protective actions, their pros and cons as well as foreseen combinations of protective actions.

Suggestion 17: During the 2010 IRRS mission it was observed that in case of an emergency, the decision on longer term protective actions will be based on extensive environmental radiation monitoring performed by different organizations. Field monitoring will be performed by the FRMAC, operated by DoE and also coordinated by the DoE in the urgent protective action phase, but in a longer term, EPA takes the lead over coordination of work and results. It was understood that other stakeholders, such as State laboratories, universities, State health and environmental authorities would also perform measurements, but these measurements are not fed into a single comprehensive database.

The Department of Homeland Security (DHS) developed a data entry system known as "RadResponder" which allows State and local response officials to enter their radiation monitoring data into a consolidated system. The FRMAC, which is operated by the DoE, maintains its own database.

The "RadResponder" system showed that the suggestion has been taken aboard although not comprehensively implemented because not all stakeholders take part in this system (i.e. FRMAC which keeps their own database). The outcome of the suggestion can be positively understood in terms of coordination of environmental radiation monitoring performed for all stakeholders but one. The "RadResponder" system was developed and is in operation.

In addition, the NRC believes that they do not need such a system for implementing their regulatory function, i.e. requiring that the licensee has adequate radiation measuring capability in line with the regulations and this capability enables a licensee to propose adequate urgent protective actions in any conditions. However, the NRC agrees that such system can be useful for long term and ingestion pathway protective actions, which are the responsibility of the States, EPA and FDA, and are outside of the mission scope.

The team was informed about the coordination of emergency preparedness in cases where the NPP is located near an international border. There is one NPP (the Fermi NPP in Michigan), which has its plume exposure emergency planning zone (10 mi) extending across the US/Canada border. There are some other NPPs which have ingestion pathway emergency planning zones extending into Canadian territory. There are not any such plants in the area bordering Mexico. The NRC routinely monitors if the cross border notification and provision of additional information is implemented during exercises by the Fermi NPP. The NRC has bilateral agreements with respective nuclear regulators in Canada and Mexico on information exchange and exchange of technical staff. There is also the "United States-Canada Joint Radiological Emergency Response Plan" (Joint Plan) of 1996, which established the basis for cooperative response to radiological events in both countries. The Joint Plan was developed under the umbrella of the "Agreement between the Government of Canada and the Government of the United States on Cooperation in Comprehensive Civil Emergency Planning and Management" of 1986. There is the US/Canada Radiological Emergency Preparedness Group, of which EPA is a member. This group maintains and oversees cooperation in the area of radiological emergency preparedness and response.

Suggestion 18: In 2010, the IRRS Team noted that NRC emergency exercises should be more challenging by expanding their scope.

In the advance reference material of this mission, the NRC reported that they had amended emergency preparedness requirements in its regulations in 2011 (reflected in 10 CFR 50, App. E) and that they have made the exercise program significantly more challenging. The NRC worked hand in hand with FEMA on the Radiological Emergency Preparedness Manual that guides offsite response organizations' emergency planning activities. During this preparation of the manual, the following findings about predictability were identified:

- the release will occur only after the GE is declared,
- the emergency response organization (ERO) will not be allowed to mitigate the accident before a release occurs,
- the release will be terminated before the exercise ends, and
- the exercise will escalate sequentially through the emergency classifications.

The amended regulations established new exercise requirements to improve these conditions and make the biennial exercises more challenging. All biennial exercise onsite scenarios are submitted to the NRC for review and comment 60 days before the scheduled exercises, the NRC shares these scenarios with FEMA, which will review the onsite scenario against the scenario that FEMA receives from the offsite response officials (ORO). The scenario must provide the opportunity for the ERO to demonstrate proficiency in the key skills necessary to implement the principal functional areas of emergency response. After the introduced changes, the exercise scenarios for biennial exercises must also contain:

- hostile action directed at the plant site,
- no radiological release or an unplanned minimal radiological release that does not require public protective actions,
- an initial classification of or rapid escalation to a site emergency or general emergency,
- an event that results in the loss of large areas of the plant due to explosions or fire, and integration of offsite resources with onsite response.

In addition, the NRC amended its rule on remedial exercises to address exercises that failed to demonstrate that key Emergency Response Organization (ERO) skills had been maintained. The activity which has not met the criterion is repeated and re-evaluated without repeating the complete exercise.

The operator and the off-site response organizations shall decide on the parameters of the exercise and the scenario is submitted for approval to the NRC and FEMA. Sometimes there are shortages of evaluator resources (evaluators) which can cause delays in scheduling the exercises.

So far, seven licensees performed exercises under the new rule. It is expected that by the end of 2015 all licensees will be exercising under the new rule.

The team concludes that significant progress has been made since the IRRS mission and the exercises have become more challenging and less predictable than they used to be.

Status of the findings in the initial mission

Suggestion 15 is closed based on a thorough revision of a procedure which details communication with the IAEA by strengthening relations with the IAEA by naming an appropriate contact person who serves as a contact point and by augmenting the liaison team staff.

Suggestion 16 is closed considering the NRC discussed the applicability of initial operational intervention levels (OILs) with its Federal partners in line with the IAEA Safety Standard GS-R-2. However, it should be noted that the suggestion was not adopted, but the team acknowledged that the derived response levels (DRL) for exposure and derived intervention levels (DIL) for food are comparable to OILs and the application of DRLs and DILs provides assurance for protection of the public during potential emergencies in line with the international criteria.

Suggestion 17 is closed because the NRC launched a discussion with its Federal partners and the entry system for radiation monitoring data and their dissemination “RadResponder” was developed.

Suggestion 18 is closed based on the adoption of amended regulations, which introduce new exercise requirements, ensuring the exercises will be less predictable. Also there is evidence that these new regulations were applied by the licensees starting in 2013 and all licensees will have implemented the new exercise rule by the end of 2015.

11. INTERFACE WITH NUCLEAR SECURITY

2010 mission RECOMMENDATIONS, SUGGESTIONS	
S19	**Suggestion**: The **NRC's Operational Experience Branch procedures should be updated to include non-nuclear information which should be collected to evaluate understanding to any impact to safety or security that may inform the safety/security interface.**
S20	**Suggestion:** The **NRC should take further action to encourage the industry to take actions to ensure the effective co-ordination of the safety/security interface issues.**

Changes since the initial IRRS mission

Suggestion 19: The Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-401, *NRR Reactor Operating Experience Program*, has been strengthened by explicitly mentioning significant non-nuclear events as a source of potential operating experience (OpE) for nuclear reactors, and by the addition of a screening criterion to more clearly justify the expenditure of resources on the review of issues which did not in and of themselves pose a threat to nuclear safety. Revision 2 of LIC-401, effective December 27, 2010, reflects more accurately the process that was already in place. Coordination with the Office of Nuclear Security and Incident Response (NSIR) on consideration of the safety-security interface (reactor safety issues which could impact security and vice versa) had already been and continues to be included in LIC-401.

It should be pointed out that the NRC's Operating Experience Branch (IOEB) has not only addressed the suggestion including significant non-nuclear events in the analysis of the safety security interface, but have extended this practice to the entire operating experience field, taking significant non-nuclear events into consideration systematically. A new Operating Experience Center of Expertise has been established to coordinate and communicate the evaluations and applications of operating experience being carried out in different parts of the organization. Also, the products offered by IOEB have been improved and diversified to make them suitable for different uses and applications inside the NRC organization. New products are Operating Experience Notes, issued to summarize trending and causes of specific subjects, Operating Experience Communications, focused on one particular problem providing information on all relevant experiences related to it, and Periodic Operating Experience that inform on recent events on a monthly basis.

Additionally, IOEB continues to work with NSIR as necessary to identify potential improvements to the NSIR process for evaluating OpE related to security issues. IOEB has conducted an OpE event review (screening) process familiarization with NSIR staff and supported the actions needed for the development and installation of a Safeguards Information Local Area Network and Electronic Safe (SLES) terminal in the OpE screening conference room O7B02. These additional actions go beyond those prescribed by Suggestion S19 and will further strengthen the evaluation of issues affecting the safety-security interface.

Suggestion 20: Since the previous mission in 2010, the NRC and the industry have gained experience in working together on safety and security issues and putting the new rule and guidance that were published in 2009 into practice.

The NRC meets regularly with the industry's Nuclear Security Working Group, which was organized by the Nuclear Energy Institute (NEI). In this group, the IRRS Suggestion S20 was discussed, and the NRC encouraged the industry to take actions to ensure the effective coordination of the safety-security interface.

Increased attention has been paid on the inspection of the safety-security interface, particularly during the force-on-force exercises in which many aspects of security and safety could be at risk and a close relationship between security and operation is required. Maintenance activities, work planning and the impact of planned changes that could adversely affect safety or security are part of the activities that are regularly reviewed. Cyber security has also been addressed as an important matter in which safety or security can be adversely affected.

The Safety Culture Policy Statement, approved by the Commission and published in the Federal Register on June 14, 2011, has had a relevant contribution to encourage the industry to ensure an effective coordination of safety and security interface. A clear message in that direction is included: *"Organizations should ensure that personnel in the safety and security sectors have an appreciation for the importance of each, emphasizing the need for integration and balance to achieve both safety and security in their activities. Safety and security activities are closely intertwined. While many safety and security activities complement each other, there may be instances in which safety and security interests create competing goals. It is important that consideration of these activities be integrated so as not to diminish or adversely affect either".* After initial discussions, the decision of having only an integrated safety culture policy have benefited a better common understanding between operation and security organizations and promoted a more safe and effective way of managing and minimizing risks.

Status of the findings in the initial mission

Suggestion 19 is closed: The Nuclear Reactor Regulation (NRR) Office Instruction LIC-401, on the Operating Experience Program has been strengthened by explicitly mentioning significant non-nuclear events as a source of potential operating experience (OpE) for nuclear reactors. This practice is not limited to the safety-security interface, since it has been extended to the entire operating experience program.

Suggestion 20 is closed: The NRC meets regularly with the industry's Nuclear Security Working Group. In this group, the IRRS Suggestion S20 was discussed, and the NRC encouraged the industry to take actions to ensure the effective coordination of the safety/security interface. The Safety Culture Policy Statement, approved by the Commission and published in the *Federal Register* on June 14, 2011, integrated both safety and security matters and contains a clear message on the way in which interfaces have to be manage so as not to diminish or adversely affect either.

New observations from the follow-up mission

The NRC operating experience program has been considerably improved since the time of the IRRS mission. Significant non-nuclear events are analysed as a source of potential operating experience (OpE) for nuclear reactors, not only in the field of safety-security

interface but in the entire program. Screening criterion has been developed to more clearly justify the expenditure of resources on the review of issues which did not in and of themselves pose a threat to nuclear safety.

A new Operating Experience Center of Expertise has been established to coordinate and communicate the evaluations and applications of operating experience being carried out in different parts of the organization. Also the products offered by IOEB have been improved and diversified to make them suitable for different uses and applications inside the NRC organization.

Follow-up Mission **RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES**	
Observation: The NRC had a robust operating experience program at the time of the IRRS mission that has been substantially improved since then. Significant non-nuclear events are analysed as a source of potential operating experience (OpE) for nuclear reactors, not only in the field of safety-security interface but in the entire program. A new Operating Experience Center of Expertise has been established to coordinate and communicate the evaluations and applications of operating experience across all the organization and the products offered by IOEB have been improved and diversified to make them suitable for different uses and applications inside the NRC. New products are Operating Experience Notes, issued to summarize trending and causes of specific subjects, Operating Experience Communications, focused on one particular problem providing information on all relevant experiences related to it, and Periodic Operating Experience that inform on recent events on a monthly basis.	
(1)	**BASIS: GSR Part 1 Requirement 15 Sharing of operating experience and regulatory experience 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".*
(2)	**BASIS: SSR-2/2 Requirement 24 Feedback of operating experience states:** *"The operating organization shall establish an operating experience program to learn from events at the plant and events in the nuclear industry and other industries worldwide."*
GPF1	**Good Practice: The systematic analysis of significant non-nuclear events not only in the safety-security interface but in the entire operating experience program, the coordination and communication of the operating experience analysis through the new Operating Experience Center of Expertise and the diversity of products offered by the Operating Experience Branch (IOEB) to make them suitable for different uses and applications inside the NRC is considered a Good Practice.**

12. REGULATORY IMPLICATIONS OF THE TEPCO FUKUSHIMA DAIICHI ACCIDENT

12.1. IMMEDIATE ACTION TAKEN BY THE REGULATORY BODY

Emergency response activity of the NRC

Immediately after the first news on the TEPCO Fukushima Daiichi accident came out, the USNRC staffed its Emergency Operations Center and entered monitoring mode. It started to assess the potential impact of the accident on US territories on the West Coast, Hawaii, Alaska and in the Pacific Ocean. The Emergency Operating Centre was operational 24 hours a day from 11 March until 16 May 2011. The emergency response activity of the NRC included assessment and forecast of the radiological situation, evaluation of potential impacts on public health and safety and recommendations regarding protective actions to be taken for US citizens both in the US and in Japan. As an example, on 17 March US citizens were advised not to enter the 50 mile radius zone around the Fukushima Daiichi power plant. This warning was in force until early October 2011. The NRC coordinated its response activity with IAEA. It is worth mentioning that more than 400 NRC staff members participated in the response activity from both the NRC headquarters and from the regional offices.

Immediately after the accident, the NRC sent nuclear safety experts to Japan to assist the US Ambassador in Tokyo. On 16 March, a larger NRC team arrived in Japan to also assist the Japanese Government in its response activity and continued working there until 15 May when the size of the team was gradually reduced.

Inspections and reviews of facilities

On 23 March 2011, NRC resident inspectors were instructed to inspect emergency equipment and related items installed at US NPPs following the 9/11 terrorist attack. The inspected items included licensee capability to mitigate fires in large areas; station blackout conditions and design basis internal and external events as well as their capability to respond to beyond design basis fires, floods and seismic events. The inspections were completed by 15 April 2011 and concluded that while the individual observations did not raise significant safety concerns, they indicated a declining trend of maintenance of equipment and BDBA mitigation strategies resulting in non-operable equipment or inadequate procedures at several facilities.

On 11 May, the NRC required the NPPs to provide information on the same issues, i.e. on the emergency equipment and mitigating strategies installed after the 9/11 event. Parallel to this request, the INPO also asked the licensees to verify their flooding and fire mitigation capabilities also under severe seismic circumstances; increase their sensitivity and response capability to spent fuel storage events and to determine coping times and design limitations for extended loss of power events.

Another series of inspections was requested of the resident inspectors on 30 March 2011 to check the availability and readiness of the severe accident management guidelines (SAMGs) of the power plants. The inspections revealed that the implementation of the otherwise voluntary SAMG program was inconsistent. In some cases, the procedures were not available and in other cases they were not controlled. Periodic training and exercises were not held everywhere.

On 31 March, the NRC shared details of information on the accident at its disposal with the nuclear facilities in the US and requested the facilities to analyse the possible effects of extreme natural events on safety of the facilities.

On 30 September 2011, inspection of fuel cycle facilities was initiated by the NRC in order to evaluate licensee strategies for the prevention and/or mitigation of emergencies in these facilities. A number of unresolved issues of similar nature have been identified and as a consequence of this, the NRC staff is presently developing a draft generic letter to address natural phenomena hazard events and the design/licensing basis of fuel cycle facilities. The IRRS Team was provided with an example of findings of inspection in one of the fuel cycle facilities. Significant concern was raised as for the source term used as a basis for the emergency response plan. Furthermore, design deficiencies in the process equipment and in their seismic reinforcement were identified. (Note that this event has also been reported to the Congress in the NRC Report on Abnormal Occurrences in the Fiscal Year 2012.)

Actions to review NRC activity

On 1 April 2011, the NRC created a Near Term Task Force (NTTF) in order to "conduct a systematic and methodological review of USNRC processes and regulations to determine whether the agency should make additional improvements to its regulatory system … in light of the accident at the Fukushima Daiichi NPP." Results of the investigations and recommendations by the NTTF were published in a report in July 2011 and are detailed in Section 12.2.

Recommendation 1 by the NTTF is somewhat different in nature from the other recommendations and is also treated separately by the NRC. This recommendation relates to basic features of the regulatory activity of the NRC in the sense that it proposes the introduction of a new category of events (design-basis extension) and expects the revision of the definition of defence-in-depth principle in conformance with the new event type. The recommendation is also aimed at the clarification of the role of voluntary industry initiatives in the NRC regulatory process. More on this recommendation is also given in Section 12.2.

NRC staff prioritized the recommendations by the NTTF and suggested to consider six more issues that may necessitate regulatory actions but were not among the NTTF recommendations. The issues shall be detailed in Section 12.2.

On 19 October 2011, the Commission approved the creation of a Steering Committee and of a Japan Lessons Learned Project Directorate (JLD) in order to facilitate longer term review of the consequences of the accident and to prioritize and oversee assessment and implementation of the NTTF recommendations. The identification of additional recommendations addressing longer term reviews foreseen beforehand are also in the scope of the Steering Committee's and the Project Directorate's activity. The JLD staff prepares semi-annual progress reports (status updates) on the responses to lessons learned from the TEPCO Fukushima Daiichi accident. These reports describe how the activities foreseen in the Project are progressing as well as how these results are being transferred to the line organizations. The latest of such report at the time of the IRRS mission was completed on 6 September 2013.

In order to analyse the activity of the NRC emergency response organization and summarize the lessons learned from this activity after the accident, the Office of Nuclear Security and Incident Response set up a review team. The team collected data from the responders and compiled a report entitled "Japanese Incident Response After Action Report". About 1100 comments were collected and discussed in a 2-day meeting. The report was published in December 2011.

The report identifies NRC's ability to provide vital services to American citizens abroad, to the US Ambassador in Japan and to the Government of Japan as a strength. It also commended the adaptive attitude of the responders to the international nature of the event; the media and public response of the NRC and the interaction with other organizations and institutions. Primary areas for improvement were also identified, such as establishing an international response plan; leadership training to cope with competing priorities and the development of planning capabilities in case of long lasting emergencies.

The observations in the report are grouped into the following six categories: 1) NRC mission (including its role and coordination with federal and international organizations); 2) response structure (task management, leadership continuity, shifts, protracted multi-unit events, expertise and training, expert roster, conflicts with regular duties, international response considerations); 3) procedural issues (records, freedom of information issues, reports and procedures); 4) planning (staff and schedule, human limitations, equipment, facilities, security); 5) communication (internal, interagency, public, state and regional, technical); 6) technology (RASCAL, WebEOC, general technological issues).

The report does not intend to offer solutions or establish an action plan to answer the questions raised. As a follow-up, the NRC has made changes to its programs and procedures to improve future response efforts. Many of the issues are in the process of development and/or review. The proposed enhancements to response organization structure and procedural issues, in particular those related to Freedom of Information Act are in development and under review. The NRC has staffed a response coordination group. This group will be responsible for handling the many logistical and planning issues within the response.

A major project covered the update of the NRC dose projection code RASCAL. Updates included the increase of release time and distance for dose modelling, the enhancement of the output formats to allow RASCAL information to be directly imported into other models, and the capability to model accidents at multiple units on a site occurring simultaneously.

Fukushima lessons learned were also incorporated into the design of the new Emergency Operations Centre of the NRC. In addition, the NRC expanded its use of the WebEOC communications program so that all responders as well as senior NRC management are able to access the most up to date information.

NRC communication activity

NRC Commissioners and staff have been requested to provide information to various audiences on the accident and on the related activity of the NRC. Specifically, the Commission has been called upon to testify before approximately 20 Congressional Hearings on the plans of the NRC for new regulatory requirements related to the TEPCO Fukushima Daiichi accident. The recipients of the information in the various meetings included the White House, US State Department and other governmental agencies.

Most major issues were reviewed by and discussed with the Advisory Committee on Reactor Safeguards. There were approximately 35 such meetings. More than 20 sessions were held on the topics of the lessons learned from the TEPCO Fukushima Daiichi accident during the NRC's Regulatory Information Conferences.

The NRC has continuously communicated with the public informing about the accident progression and the implementation of activities stemming from the immediate lessons learned from the accident. All usual forms of communication have been applied, such as press releases, web-pages, blogs, correspondence and direct responses. The staff took part in a large number of public meetings and held several presentations to professional societies and to educational institutions.

The NRC has established dedicated pages on its website to provide information on the activity of the Japan Lessons Learned Project as illustrated on the figure enclosed.

During the Fukushima response there was considerable demand for information from other US Federal agencies. This demand exceeded the staffing level within the NRC's existing Liaison Team. As a result, the NRC developed the "Federal Coordination Team", whose mission is specifically focused on interactions with other federal departments and agencies.

12.2. TECHNICAL AND OTHER ISSUES CONSIDERED IN THE LIGHT OF THE ACCIDENT

The NearTerm Task Force completed its work on 12 July 2011 and delivered a report with recommendations to the Commission. On 3 October 2011, NRC staff proposed to the Commissioners prioritization of the actions recommended by the NTTF. The Commission approved the staff proposal on 15 December 2011.

General observations concerning the regulatory framework

The NTTF (among others) offered the following observations on the NRC regulatory approach:

- It is unlikely that a sequence of events similar to that at Fukushima would occur in the US
- Continued operation and continued licensing activities of US NPPs do not pose an imminent risk to the public health and safety.
- Adequate protection has been, and should continue to be, an evolving safety standard supported by new scientific information, technologies, methods and operating experience.

- The commission has come to rely on design-basis requirements and a patchwork of beyond-design-basis requirements and voluntary initiatives for maintaining safety.

- The NRC inspection and licensing programme pays little attention to beyond-design-basis requirements as well as to the industry voluntary initiatives since there are no requirements to inspect against. Due to this, the NRC gives much more attention to design-basis events than to severe accident.

- With a few exceptions, licensees of operating reactors are not required to develop or maintain PRA, although all licensees currently have a PRA.

As a conclusion to these observations the Task Force recommends establishing a logical, systematic, and coherent regulatory framework for adequate protection that appropriately balances defence-in-depth and risk considerations (Recommendation 1).

Further observations by the NTTF relate to the NRC inspection program and have led to the recommendation that the NRC should strengthen its ROP by focusing more attention on defence-in-depth requirements consistent with the recommended DiD framework (Recommendation 12).

Besides the results of the NTTF, other initiatives by the NRC have also identified possible changes in the regulation and oversight of nuclear power in the US. Three of these initiatives are certainly worth mentioning:

- "Considerations of economic consequences within the USNRC's regulatory framework" offering three options for the future practice of the NRC to consider the economic consequences associated with unintended nuclear material release. The option accepted by the Commission foresees enhanced consistency of regulatory analysis guidance as compared to the present practice.

- "Consideration of additional requirements for containment venting systems for BWR's with Mark I and Mark II containments".

- "USNRC staff recommendations for the disposition of Recommendation 1 of the NTTF report" in which the staff suggests three improvement activities to cover Recommendation 1 by the NTTF. The proposed improvement activities are: establish a design-basis extension category of events and requirements and associated internal NRC guidance; establish Commission expectations for DiD through the development of a policy statement; clarify the role of voluntary initiatives in the NRC regulatory process. At the time of the IRRS review this matter was under consideration by the Commission.

Further recommendations by the NTTF

Other than Nos. 1 and 12 above, recommendations offered by the NTTF were grouped as follows:

- Ensuring protection (re-evaluation and upgrading of design-basis seismic and flooding protection; potential enhancement of the capability to prevent or mitigate seismically induced fires and floods)

- Enhancing mitigation (SBO, hardened vent in BWR's, hydrogen control, spent fuel makeup capability and instrumentation, onsite emergency response)

- Strengthening emergency preparedness (addressing prolonged SBO and multiunit events and other related additional EP topics, decision-making, monitoring and public education)

Some of the ten recommendations mentioned above need longer term studies by the NRC.

Adaption and enhancement of recommendations by the NRC

On 9 September 2011, NRC staff presented their proposal to the Commission on those NTTF recommendations that should be initiated without delay. These initiatives pertained to the following actions:

- Seismic and flooding hazard re-evaluations

- Seismic and flood walk-downs

- Station blackout regulatory actions

- Equipment for maintaining or restoring core cooling, containment and spent fuel store cooling in case of explosion or fire

- Reliable hardened vents for Mark I containment

- Strengthening and integration of EOP's, SAMG's and EDMG's

- Emergency preparedness regulatory actions

Staff proposals were accepted by the Commission on 18 October 2011 and the completion deadline was set to 2016. The NRC issued the respective orders to modify licences on 12 March 2012. The orders require that licensees:

- of all plant types develop strategies to mitigate the effect of BDB natural phenomena;

- of all plant types install enhanced spent fuel pool instrumentation;

- with BWRs with Mark I and Mark II containments have reliable hardened containment vents

In its approval of the orders, the Commission also approved a letter to the reactor operators requesting the revision of their methods and procedures for seismic and flooding hazards walk-downs and the re-evaluation of the seismic and flooding hazards at their sites using up-to-date methods and data. Furthermore, the operators were requested to provide information on their emergency preparedness staffing and communication capabilities in coping with multi-unit emergencies and with prolonged station blackout situations.

On 3 October 2011, NRC staff proposed to the Commission a three tier prioritization for the recommendations by the NTTF. The tiers were defined as outlined below:

- The first Tier includes those recommendations which should be realized without delay and for which sufficient resources exist. These recommendations are basically those that on 18 October 2011were declared by the Commission to be completed by 2016.

- The second Tier consists of those recommendations which may need further assessment, may depend on Tier 1 issues or lack the necessary resources. They include issues related to spent fuel pool makeup capabilities and emergency preparedness regulatory actions.

- The third Tier outlines recommendations that require further study by staff, have associated shorter term actions to complete in order to feed into longer-term actions, or that depend on resources or on further decisions. Such issues are typically: ten-year confirmation of seismic and flooding hazards; hydrogen control in containments; emergency preparedness enhancement for prolonged SBO and multi-unit events; ROP modification; severe accident staff training.

In its proposal, staff identified six additional items that go beyond the NTTF recommendations. These additional issues in need of further consideration are: filtration of containment vents; instrumentation for seismic monitoring; basis for emergency planning zone; prestaging of potassium iodine beyond 10 miles; transfer of spent fuel to dry storage casks; loss of ultimate heat sink.

In its decision of 15 December 2011, the Commission approved the three tier prioritization proposed by the staff and requested the staff to submit an evaluation of the schedule and milestones, resources and critical skills as well as implementing challenges for the Tier 3 recommendations. At the same time, staff was instructed to integrate the Tier 1 activities into the 2012 work programme. The Commission also evaluated the proposed six new issues and decided to move the issue of filtration of containment vents to Tier 1 actions.

The Commission agreed that many of the NTTF Tier 2 and Tier 3 recommendations did not meet the necessary threshold to initiate immediate regulatory actions in order to assure public health and safety; therefore, those recommendations will be addressed in the longer term.

Further issues considered by the NRC

On 26 November 2012, NRC staff submitted its considerations on additional requirements for containment venting in severe accident circumstances in BWR's with Mark I and Mark II containments to the Commission. The Commission accepted the option that proposes the replacement or upgrade of the existing hardened containment vents with a containment venting system that remains functional during severe accident conditions. Further considerations and investigations have also been requested for the potential introduction of filtering strategies and confinement strategies.

Installation of hardened vents is to be performed in two phases, phase 1 relates to venting from the wetwell, phase 2 addresses venting from the drywell. Integrated plans shall be submitted by the licensees by June 2014 and December 2015, implementation is due by 2018

and 2019, for the two phases, respectively. The filtering option as well as other containment management possibilities are under evaluation by the NRC.

On 12 November 2013, NRC staff provided its evaluation on expedited transfer of spent fuel from the spent fuel pools to dry cask storage to the Commission. This issue is one of the Tier 3 recommendations. Staff concludes that there is no need for further investigation and the transfer is not necessary. At the time of the IRRS mission, the Commission was still considering the staff recommendation.

Given the need to evacuate nearby populations during the TEPCO Fukushima Daiichi accident, the NRC is evaluating lessons learned from the accident and intends to implement several improvements in its off-site emergency preparedness and response activity and to conduct studies of other possible changes to regulatory requirements. The need to improve the sharing of information from NPPs following a natural catastrophe or severe accident was addressed by improvements to the NRC's emergency response data system. The need for licensees to conduct periodic training and exercises for multiunit and prolonged station blackout scenarios, as well as having the appropriate equipment and facilities for such events, have been incorporated into the activities associated with mitigating strategies improvements. The NRC also ensured that licensees had the ability to estimate offsite releases from multi-unit events and will include requirements for such capabilities in a future rulemaking.

Finally, it should be mentioned that by the initiative of the Nuclear Energy Institute, a report entitled "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" has been prepared, which is meant to outline the process to be used by individual licensees to define and implement site-specific diverse and flexible mitigation strategies for beyond-design-basis conditions to prevent fuel damage in the reactor or in the spent fuel pools, and to maintain the containment functions. The BDBA scope of the report includes seismic, external flooding, and extreme weather conditions (storms, snow, and ice, extreme cold and high temperatures) events. It primarily relies on installed equipment, on-site portable equipment and pre-staged off-site resources in prevention and mitigation. The industry initiative is being used to address NRC requirements related to station blackout and accident mitigation.

CONCLUSION [1]
The IRRS Team considers that the NRC has acted promptly and effectively after the TEPCO Fukushima Daiichi accident in the interest of public health and safety in both the US and Japan. The results of the NTTF represent a sound and ample basis for taking into account the lessons learned from the accident. It is recognized that the NRC has issued an Order to establish mitigating strategies. The IRRS Team encourages the NRC to take proactive oversight of the licensees' implementation strategies.

12.3. PLANS FOR UPCOMING ACTIONS TO FURTHER ADDRESS THE REGULATORY IMPLICATIONS OF THE ACCIDENT

The actions foreseen by the NRC to address the implications of the accident have been discussed in the previous Sections. The plans for implementation correspond to the three-tier partition of the actions as discussed above. The status of the NRC staff's activities related to lessons learned from the accident is summarized and reported to the Commission every six

months. The plans for future actions summarized here are taken from the status update report issued on 6 September 2013.

Many of the items in the plans were affected by, or dependent upon, other activities. This became more apparent as the NRC developed plans for the recommendations and interacted with the regulated community on possible changes to facilities and procedures.

The approach selected by the NRC and US nuclear industry for improving plant capabilities for station blackout and beyond design basis external events was to build upon the requirements for mitigating strategies that were imposed following the events of 9/11. Those mitigating strategies subsequently incorporated into NRC regulations included requirements for spent fuel pool cooling.

A major part of the NRC and US nuclear industry activities following the Fukushima event involves the re-evaluation of seismic and flooding hazards for existing NPPs using up-to-date information and more modern analytical models than those that were available 30 or 40 years ago. In those cases where the re-evaluated hazards are found to exceed the original design basis seismic or flooding levels, licensees are required to provide information on interim measures that will be taken pending more in depth evaluations and decisions on how the new information will be incorporated into the licensing bases for each plant.

Status of and plans for regulatory activities

The regulatory activities related to the majority of the Tier 1 actions (i.e. identifying, information gathering and assessing; deliberation and decision; regulatory action) have been completed. The exceptions are

- Rulemaking for capability to maintain plant safety throughout a prolonged SBO
- Required integration of on-site emergency response processes, procedures, training and exercises
- Re-evaluate seismic and flooding hazards against current requirements and update design basis

In the first two cases, the regulatory action is expected to be taken in 2016, in the third case the first steps shall be initiated in 2014-2015.

In case of Tier 2 and Tier 3 actions, the NRC activity is still in the phase of preparations, the deadline for deliberation and decision is not yet determined. Exceptions to this are

- Requiring licensees to provide reliable spent fuel pool makeup capabilities, and
- Requiring a revision of emergency plan to address issues relevant for the accident, where the regulatory activities have been completed.

With the exception of venting for BWR Mark I and Mark II containments, the NRC is still evaluating severe accident issues as part of their Tier 3 activities. The NRC plans to use insights from its assessment of the Mark I and Mark II containments to inform the longer term evaluations of other containment designs as well as the control of hydrogen generated during a severe accident. These activities may also be covered by other Tier 3 items such as

a more detailed probabilistic risk assessment being developed as part of evaluating Fukushima-related items such as seismic induced fires and floods and other ongoing NRC initiatives such as performing a new Level 3 PRA for an operating reactor site.

Status of and plans for licensee actions

The seismic and flood protection walk-downs to verify compliance with existing seismic and flooding design basis were completed.

Tier 1 activities are scheduled to be completed by 2016, although some exceptions exist. Thus the items related to containment venting have their deadlines in 2018 and in 2019, while actions relating to regulatory decision, have their deadline in 2016 or later and still have no defined deadlines for the licensees.

Tier 2 activities still need regulatory input and have no licensee schedule. Tier 3 activities still need to be decided and therefore have no licensee actions scheduled either.

As far as plans on coping with the loss of electrical power and beyond design basis external events are concerned, each licensee will assess the capabilities and limitations of their installed equipment, modify the systems as needed to address hazards and desired capacities, and ensure that portable equipment can be brought into service before installed systems exhaust available resources. Installed systems and portable equipment will need to draw from several potential sources of water in case the normal heat sinks are rendered unavailable by the event.

CONCLUSION [2]
The IRRS Team concludes that most of the NTTF recommendations have been incorporated into the action plan of the NRC. However, certain issues are subject to further consideration or are dependent on the results of ongoing actions. The IRRS Team encourages the NRC to set clear timelines for resolution of all actions.

12.4. CONCLUSIONS BY REVIEWED AREAS

Module 1: Responsibilities and Functions of the Government

The review carried out in light of the Fukushima accident has not identified specific vulnerabilities in the area of responsibilities and functions of the government.

Responsibilities are clearly embedded in the governmental legal and regulatory framework for safety, also in emergency/accident situations. In the event of an emergency/accident situation, several authorities are involved, and their respective responsibilities and functions are clearly specified within the governmental, legal and regulatory framework for safety, including emergency/accident situations. The role of the authorized party is clearly specified. All aspects of regulatory independence are adequately considered and ensured to be met. Provisions are made in the safety framework to ensure that the regulatory body is effectively independent, also in emergency/accident situations.

CONCLUSION [3]
The IRRS Team concludes that the existing status in the area of responsibilities and functions of the government is appropriate and no concern has been raised.

Module 2: Global Nuclear Safety Regime

The review carried out in light of the Fukushima accident has not identified specific vulnerabilities in the area of the global safety regime. Provisions are in place to implement the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in Case of a Nuclear Accident. Mechanisms are in place to effectively communicate at the international level in case of crisis situations. (The NRC has specific agreements with Canada and Mexico, and commitments to IAEA related to sharing information on emergency preparedness.) The US is fulfilling its obligations towards the Convention on Nuclear Safety, including continued participation in the activities and mechanisms of the Convention. The US demonstrates sufficient openness for, and a strong involvement in international peer review missions.

CONCLUSION [4]
In the area of the global safety regime no concern has been raised and the IRRS Team concludes that the existing status is appropriate.

Module 3: Responsibilities and Functions of the Regulatory Body

The NRC as an independent nuclear regulatory body has sufficient legal power and ability to perform its functions in licensing and regulation of civilian use of nuclear energy and materials. It has authority to intervene in facilities and activities under its responsibility that may present a risk to the public health or safety. Such interventions, however, are not independent from the possible cost to the authorized party. Therefore, when evaluating potential safety improvements for protection against beyond design basis events, the NRC completes a cost-benefit analysis.

The NRC has the authority to take timely actions in the case of an emergency or an accident situation, including, in exceptional cases, entering the plant and operating or ordering the operation of the facility.

The NRC reacted promptly and effectively on the TEPCO Fukushima Daiichi accident by creating the NTTF. The NTTF provided valuable and important results in a very short period of time. Although most of the recommendations by the NTTF relate to the licensees activities, all need input and work from the NRC by at least collecting information on deliberations and decisions and often performing rule-making. Two of the recommendations by the NTTF directly address the regulatory framework and the working method of the NRC.

The NRC established a dedicated Project Directorate to utilize the lessons learned from the accident and to initiate the actions stemming from the NTTF recommendations, staff's proposals and decisions by the Commission. The actions have been grouped into three tiers depending on their urgency and underlying conditions. The deadline for the actions related to the licensees and stemming from the lessons learned is in 2016 or later, however, many of the actions do not yet have deadlines as they are dependent on other actions or decisions to

be taken beforehand. Issues related to the accident, such as extended SBO, loss of ultimate heat sink or severe accident management, have not yet been unanimously included into the Status Summary of Japan Lessons Learned Activities of the NRC.

The implementation of recommendations by the NTTF related directly to NRC activities has not yet been decided.

CONCLUSION [5]
The IRRS Team considers that the NRC acted in a timely manner and is also committed to act in the light of lessons learned from the accident. The IRRS Team considers that the implementation period of actions identified so far should be clearly defined, taking into account the urgency of the topics. Consideration should also be given to expanding the scope of these actions as necessary.

Module 4: Management System of the Regulatory Body

The NRC management system allowed for a powerful response to the Fukushima accident, the respective actions are described in Sections 12.1 and 12.2 above.

The NRC has a management system that is established, implemented, assessed, and continually improved and it covers the entire organization. Resources are devoted to the development of an overarching document that describes the relationship of each component of the NRC's management system to ensure clear NRC staff understanding of how the agency's policies, instructions, and guidance relate to each other to support quality in NRC activities. The management system takes full account of the need to provide sufficient competent resources, promote an effective safety culture, and work in an open and transparent manner. The activities identified and implemented by the NRC in response to the Fukushima activities are achieved in accordance with the established management system.

CONCLUSION [6]
The IRRS Team considers that no further action is needed with regard to the management system as a result of the Fukushima accident.

Module 5: Authorization

In the authorization process, NRC reviews and assesses the hazards associated to the siting. The methods used to assess external hazards for new plants are much more sophisticated than the methods used for the earliest nuclear plants licensed in the US and are considered sufficiently robust in the light of the Fukushima accident. For plants that are already licensed, licensees were asked to perform re-evaluations of seismic and flooding hazards at their sites using present day information and guidance. The results will determine whether additional regulatory actions are necessary (e.g. ordering plant modifications). The re-assessment of other external hazards and a combination of them has been included in Tier 2 tasks and shall be scheduled in the future.

Furthermore, all the other safety features of the plant are being reviewed in the authorization process: design provisions to ensure removal of heat from the reactor and from the spent fuel, the confinement of radioactive material, a selected set of design extension conditions, the means of cooling the reactor core, the systems aimed at transferring the residual heat from

items important to safety to the ultimate heat sink, the emergency power supply and the fuel handling and storage. For more details on the conclusions of the re-assessment carried out after the Fukushima accident, see the conclusions of Module 6, Review and Assessment.

CONCLUSION [7]
The IRRS Team concludes that appropriate actions have been taken even though further actions should be considered in relation to the re-assessment of the current operating reactors against external hazards other than earthquakes and flooding and combinations of them.

Module 6: Review and Assessment

The TEPCO Fukushima Daiichi accident initiated the creation of the NTTF which also comprehensively reviewed and assessed the likelihood and progression of similar events in US NPPs as discussed in Section 12.2 above. The report by NTTF was used as a source of inspiration for many regulatory bodies worldwide. Assessment of preventive capabilities focused on seismic and flooding hazards (planned but not yet scheduled also on other hazards and their combinations); assessment of mitigative provisions addressed the issues of containment venting, spent fuel pool cooling, emergency preparedness, staffing and communication. Although the review concluded that the occurrence of such events is very unlikely, a number of actions leading both to enhancing safety of NPPs as well as to strengthening the regulatory regime were proposed, prioritized according to their urgency of implementation.

Implementation of the proposed actions is ongoing. Some of the actions led to rulemaking, including station black-out mitigation strategies, on-site emergency response capabilities, and filtering and confinement strategies. Implementation of the actions will lead not only to safety upgrading of the plants, but also to the enhancement of the regulatory processes, in particular those dealing with obligatory implementation of effective accident management procedures in existing NPPs.

At present, the NRC continues to review licensees' applications, which are aimed at amending the licenses in order to respond to lessons learned from the Fukushima accident.

NRC actions following the Fukushima accident demonstrated that the regulatory body has significant resources as well as capabilities for performing review and assessment of precursors as well as of progression of such type of accidents. Nevertheless, it was also revealed that there is a need for implementation of more stringent requirements on consideration of design extension conditions in the analysis of such conditions as well as in the requirements on implementation of adequate mitigative provisions in operating US NPPs. For example, Level 1 PSA for existing NPPs covered only internal initiating events and a supplementary control room is not part of the US authorization process. Before the accident, mitigation of design extension conditions in existing plants was addressed by voluntary actions of the licensees. Some of these issues are being considered in the proposed accident management rule which is to be approved by the Commission in 2016, other still remain for future NRC considerations.

CONCLUSION [8]
The IRRS Team considers that appropriate actions have been taken by the NRC to assess implications of the Fukushima accident for US plants and necessary further actions have been initiated.

Module 7: Inspection

In the framework of immediate actions taken by the NRC following the Fukushima-Daiichi accident, specific inspections were among the most significant. On 23 March 2011, resident inspectors using Temporary Instruction 2514/183 began re-examining emergency equipment and on 29 April 2011, using Temporary Instruction 2515/184, examining severe accident management procedures and associated training in NPPs. Later on, in September 2011, also fuel cycle facilities were inspected. The inspections were focused on the adequacy of seismic and flooding protection of nuclear facilities. In addition to imposing the NPPs to perform their own detailed inspections or walk-downs of their seismic and flooding protection features (completed in November 2012), the NRC inspectors have also performed their follow-up inspections.

Using the existing Reactor Oversight Process and Temporary Instructions, NRC inspectors continue to inspect emergency AC power, mitigating systems, containment integrity and spent fuel pool heat removal, as well as ongoing Fukushima-related plant modifications including the use of FLEX (mobile and portable) equipment. In the next step the inspectors will conduct on-site audits to verify implementation of the Overall Integrated Plans submitted by the licensees.

In spite of the conclusion made based on the post-Fukushima assessment and stating that a similar sequence of events is unlikely to occur in the US NPPs, the lessons learned led to the extension of previous inspection activities. The change of the NRC policy outlined in a new severe accident management rule, provided its successful implementation scheduled for the beginning of 2016, will allow the NRC to incorporate inspections of the accident management procedures into the comprehensive Reactor Oversight Process.

It can be concluded that the existing integrated Reactor Oversight Process provided sufficient means for identification of potential harmful external hazards and for continued inspections of preventive means against progression of the hazards into severe accidents, as well as arrangements between the operator's headquarters and the plant management. Implementation of the proposed severe accident management rule will allow the integration into the Reactor Oversight Process, also including mitigative features of accident management. Compensatory measures are in place before adoption of the final rule.

CONCLUSION [9]
The IRRS Team considers that the actions related to inspection taken by the regulatory body were exemplary and necessary further actions have been initiated.

Module 9: Regulations and Guides

The TEPCO Fukushima Daiichi severe accident became a challenge for US regulations, especially when dealing with beyond design basis events, multiple events and events affecting several reactors on the same site. Three orders were issued to modify the licensing basis of the US reactors. One order required licensees and CP holders to develop, implement and maintain guidance and strategies to restore or maintain core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event. A second order required that all operating BWR facilities with Mark I and Mark II containments have a reliable hardened venting capability for events that can lead to core damage. This order was subsequently modified to include venting after core damage. The third order required that all power reactor Licensees and CP holders have reliable means to remotely monitoring wide-range spent fuel pool levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis external event.

A number of other rulemaking activities are considered by the Japan Lessons Learned Directorate. Issues currently considered for rulemaking are station blackout mitigation strategies, onsite emergency response capabilities, filtering and confinement strategies. Another consideration is to require integration of emergency operating procedures, mitigation guidelines, extensive damage mitigating guidelines and severe accident management guidelines (SAMG, which have been a voluntary industry initiative).

Several other rulemaking activities are considered to improve the defence in depth. So far, no new Regulations or Regulatory Guides have been issued as a result of the Fukushima accident. The first substantial safety enhancements ordered are expected to be implemented before the end of 2016.

CONCLUSION [10]
The IRRS Team concludes that more work remains to be done in order to adjust the US Regulations and Guides to fully account for the Fukushima accident.

Module 10: Emergency Preparedness and Response

Existing NRC regulations require that its licensees maintain an emergency preparedness capability that is routinely exercised with participation from offsite authorities to ensure a coordinated, timely and effective response in line with international standards.

To ensure that the lessons learned from Fukushima are captured, short term regulatory actions were initiated, i.e. an order, issued by the NRC in 2012, to require mitigation strategies for beyond design basis external events as well as rulemaking is under way for Station Blackout Mitigation Strategies and also for Filtering and Confinement Strategies. The NTTF recommended that facility emergency plans should include prolonged station blackout and multi-unit events. The rulemaking addressing this recommendation is currently in progress. In addition, the NPP industry has developed a program, known as “FLEX”, designed to address the main safety challenges of Fukushima; the loss of cooling capability and electrical power resulting from a severe natural event. The strategy is “flexible” as it relies on portable equipment to protect against events that go beyond design basis events.

CONCLUSION [11]
The IRRS Team considers that the Fukushima lessons learned were thoroughly analysed, the necessary short term actions have been recognised and implemented. Further long term actions are under consideration.

APPENDIX I - LIST OF PARTICIPANTS

INTERNATIONAL EXPERTS:		
1. **PATCHETT,** Colin	Office of Nuclear Regulation (ONR)	colin.patchett@hse.gsi.gov.uk
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4. **JENDE,** Erik	Swedish Radiation Safety Authority (SSM)	erik.jende@telia.com
5. **MISAK,** Jozef	Nuclear Research Centre Řež (ÚJV)	mis@ujv.cz
IAEA STAFF MEMBERS		
1. **NICIC,** Adriana	Division of Nuclear Installation Safety	a.nicic@iaea.org
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3. **DANI,** Mario	Division of Nuclear Installation Safety	m.dani@iaea.org
LIAISON OFFICERS		
1. **HOPKINS,** Jon	US Nuclear Regulatory Commission (NRC)	jon.hopkins@nrc.gov

APPENDIX II - MISSION PROGRAMME

Time	Sat, 1 Feb	Sun, 2 Feb	Mon, 3 Feb	Tue, 4 Feb	Wed, 5 Feb	Thu, 6 Feb	Fri, 7 Feb	Sat, 8 Feb	Sun, 9 Feb	Mon, 10 Feb	Tue, 11 Feb
9:00-10:00	Arrival of Team Members	Arrival of team members	Entrance Meeting	Interviews	Interviews / Site-Visits	TM write report / Visit / Interviews	Discussion of findings by the Team / Team writes report	Individual Team Review	**Submission of the Draft to the Host**	**IAEA Admin prepares Final Draft Report to Host**	**Exit meeting**
10:00-11:00								Detailed Group Review	Host reads report / TL prepares presentation		
11:00-12:00											
12:00-13:00				Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Press conference
13:00-15:00			Lunch	Interviews + in-group discussions	TM formulate findings / Site-Visits	Sources and waste findings formulated / Visit	Discussion of findings with counterparts	Detailed Group Review	Host reads report / TL prepares presentation	**Presenting and handing over Final Draft to the Host**	Lunch
15:00-16:00		Initial Team Meeting: • IRRS process • Main objectives • Report writing • Schedule • First observations	Interviews				Team writes report	TC drafts Executive Summary / TM finalise the Draft Report	**Written comments by the Host**	Briefing DIR-NSNI, finalization of press release	Departure of Team Members
16:00-17:00					**Written prelimi-nary findings delivered**	**Final findings with texts delivered**	**Draft report text to TL**		Comments presented by the host		
17:00-18:00			Daily Team Meeting	Daily Team Meeting	Daily Team Meeting: Discussion of findings **Submission to IRRS Admin**	Daily Team Meeting: Discussion of findings **Submission to IRRS Admin**	Daily Team Meeting: outcomes of discussion with counterparts **Submission to IRRS Admin**	Discussion of Executive Summary **Submission of Report to IRRS Admin**	Daily Team Meeting: Host's comments	Free	
20:00-24:00			Writing of the report	Writing of the report	IRRS Admin compiles/distributes Report	IRRS Admin compiles/distributes Report	IRRS Admin compiles/distributes Report	IRRS Admin finalizes Draft Report	IRRS Admin finalizes Draft Report		

APPENDIX III - MISSION COUNTERPARTS

	IRRS EXPERTS	NRC Lead Counterpart
1.	**RESPONSIBILITIES AND FUNCTIONS OF THE GOVERNMENT**	
	MELLADO, Isabel	SCOTT, Catherine, KOKAJKO, Lawrence
2.	**GLOBAL NUCLEAR SAFETY REGIME**	
	MELLADO, Isabel	KOKAJKO, Lawrence
4.	**MANAGEMENT SYSTEM OF THE REGULATORY BODY**	
	JENDE, Erik	LUBINSKI, John
5.	**AUTHORIZATION**	
	MELLADO, Isabel	EVANS, Michele
6.	**REVIEW AND ASSESSMENT**	
	MISAK, Jozef	GIITER, Joe
7.	**INSPECTION**	
	MISAK, Jozef	NIEH, Ho, LEW, Dave
9.	**REGULATIONS AND GUIDES**	
	JENDE, Erik	CASE, Mike, BAHADUR, Sher

	IRRS EXPERTS	NRC Lead Counterpart
10.	**EMERGENCY PREPAREDNESS AND RESPONSE**	
	GRLICAREV, Igor	LEWIS, Robert
11.	**INTERFACE WITH NUCLEAR SECURITY**	
	MELLADO, Isabel	HOLAHAN, Patricia
12.	**REGULATORY IMPLICATIONS OF THE TEPCO FUKUSHIMA DAIICI ACCIDENT**	
	LUX, Ivan and IRRS Team	SKEEN, David

APPENDIX IV - RECOMMENDATIONS (R) AND SUGGESTIONS (S) FROM THE INITIAL 2010 IRRS MISSION THAT REMAIN OPEN

Module	R/S	Recommendations/Suggestions
4	**R2**	The NRC should develop a methodology and implement a holistic Management System Review at planned intervals to ensure the continuing effectiveness of the management system.
6	**S7**	The NRC should consider proper ways aimed at more direct implementation of ALARA principle in setting up the radiological acceptance criteria for design basis accidents as well as in assessment of acceptability of the results of relevant safety analysis.

APPENDIX V - RECOMMENDATIONS (RF), SUGGESTIONS (SF) AND GOOD PRACTICES (GPF) FROM THE 2014 IRRS FOLLOW-UP MISSION

Module	RF/SF/GPF	Recommendations, Suggestions or Good Practices
5	**SF1**	The NRC should consider developing a consolidated rulemaking and corresponding guidance in order to facilitate the orderly transition from operation to decommissioning and ensure that current staff knowledge and experience on this subject remain imbedded in the processes and the regulation.
11	**GPF1**	The systematic analysis of significant non-nuclear events not only in the safety/security interface but in the entire operating experience program, the coordination and communication of the operating experience analysis through the new Operating Experience Center of Expertise and the diversity of products offered by the Operating Experience Branch (IOEB) to make them suitable for different uses and applications inside the NRC is considered a Good Practice.

APPENDIX VI - REFERENCE MATERIAL PROVIDED BY USNRC

NUREGs

NUREG-0090, "Report to Congress on Abnormal Occurrences: Fiscal Year 2012," Volume 35, Revision 1, issued August 2013
NUREG/BR-0500, "Safety Culture Policy Statement," Revision 1, issued December 2012 (ADAMS Accession Number ML12355A122)
NUREG-0654/FEMA-REP-1, "Criteria for the Preparation and Evacuation of Radiological Emergency Response Plans Preparedness in Support of Nuclear Power Plants,"
NUREG-0728, "NRC Incident Response Plan," Revision 4, issued April 14, 2005
NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition."
NUREG-1122, "Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Pressurized Water Reactors," Revision 2, Supplement 1, issued October 2007 (ADAMS Accession Number ML072970334)
NUREG-1123, "Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Boiling Water Reactors," Revision 2, Supplement 1, issued October 2007 (ADAMS Accession Number ML13086A115)
NUREG-1650, "The United States of America National Report for the 2012 Convention on Nuclear Safety Extraordinary Meeting, July 2012," Revision 4, issued July 2012 (ADAMS Accession Number ML12221A013)
NUREG-1650, "The United States of America National Report for the Convention on Nuclear Safety: Sixth National Report, October 2013," Revision 5, issued October 2013 (ADAMS Accession Number ML13303B021)
NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 2, issued December 2010
NUREG-2150, "A Proposed Risk Management Regulatory Framework," issued April 2013 (ADAMS Accession Number ML12109A277)

COMMISSION PAPERS

SECY-11-0084, "Staff Action Plan to Address the Integrated Regulatory Review Service Mission," dated June 27, 2011 (ADAMS Accession Number ML1106030400)
SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 (ADAMS Accession Number ML11269A204)
SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following The Events in Japan," dated July 12, 2011
SECY-11-0117, "Proposed Charter for the Longer-Term Review of Lessons Learned from the March 11, 2011, Japanese Earthquake and Tsunami," dated August 26, 2011
Staff Requirements Memorandum SECY-11-0117, "Proposed Charter for the Longer-Term Review of Lessons Learned from the March 11, 2011, Japanese Earthquake and Tsunami," dated October 19, 2011
SECY-11-0124, "Recommended Actions to be taken Without Delay From The Near-Term Task Force Report," dated September 9, 2011

Staff Requirements Memorandum SECY-11-0124, “Recommended Actions to be taken Without Delay From The Near-Term Task Force Report,” dated October 18, 2011
Staff Requirements Memorandum SECY-11-0137, “Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned,” dated December 15, 2011
SECY-12-0010, “Engagement of Stakeholders Regarding the Events in Japan,” dated January 23, 2012
SECY-12-0025, “Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami,” dated February 17, 2012
Staff Requirements Memorandum SECY-12-0025, “Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami,” dated March 9, 2012
Staff Requirements Memorandum SECY-12-0064, “Recommendations for Policy and Technical Direction to Revise Radiation Protection Regulations and Guidance,” dated December 17, 2012
Staff Requirements Memorandum SECY-12-0076, “Plan for retrospective Analysis of Existing Rules,” dated May 29, 2012
SECY-12-0095, “Tier 3 Program Plans and 6-Month Status Update in Response to Lessons Learned from Japan’s March 11, 2011, Great Tohoku Earthquake and Subsequent Tsunami,” dated July 13, 2012
SECY-12-0110, “Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission’s Regulatory Framework,” dated August 14, 2012
Staff Requirements Memorandum SECY-12-0110, “Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission’s Regulatory Framework,” dated March 20, 2013
SECY-12-0157, “Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments (REDACTED VERSION),” dated November 26, 2012
Staff Requirements Memorandum SECY-12-0157, “Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments (REDACTED VERSION),” dated March 19, 2013
SECY-13-0020, “Third 6-Month Status Update On Response To Lessons Learned From Japan’s March 11, 2011, Great Tohoku Earthquake And Subsequent Tsunami,” dated February 14, 2013
SECY-13-0038, “Fiscal Year 2012 Results of the Industry Trends Program for Operating Power Reactors,” dated April 8, 2013
SECY-13-0080, “Final Plan for Retrospective Analysis of Existing Rules,” dated July 29, 2013
SECY-13-0095, “Fourth 6-Month Status Update on Response to Lessons Learned from Japan’s March 11, 2011, Great Tohoku Earthquake and Subsequent Tsunami,” dated September 6, 2013
Staff Requirements Memorandum SECY-13-0095, “Fourth 6-Month Status Update on Response to Lessons Learned from Japan’s March 11, 2011, Great Tohoku Earthquake and Subsequent Tsunami,” dated November 13, 2013
SECY-13-0112, “Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling-Water Reactor,” dated October 9, 2013

SECY-13-0132, “Recommendations for Enhancing Reactor Safety in the 21st Century – The Near-Term Task Force Review of Insights from the Fukushima DaiIchi Accident,” Revision 0, dated July 12, 2011 (ADAMS Accession Number ML111861807)
COMSECY-13-0002, “Consolidation of Japan Lessons Learned Near-Term Task Force Recommendations 4 and 7 Regulatory Activities,” dated January 25, 2013
Staff Requirements Memorandum COMSECY-13-0002, “Consolidation of Japan Lessons Learned Near-Term Task Force Recommendations 4 and 7 Regulatory Activities,” dated March 4, 2013
COMSECY-13-0030, “Staff Evaluation and Recommendation for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel,” dated November 12, 2013

ORDERS

Order EA-02-026, “Order for Interim Safeguards and Security Compensatory Measures,” dated February 25, 2002
Order EA-12-049, “Order Modifying Licenses with Regards to Requirements for Strategies for Beyond Design-Basis External Events,” (ADAMS Accession Number ML12054A735)
Order EA-12-050, “Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents,” dated March 12, 2012
Order EA-12-051, “Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation.”
Order EA-12-157, “Confirmatory Order to Honeywell International Inc.,” dated October 15, 2012
Order EA-13-109, “Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions.”
“Request for Information Pursuant To Title 10 of The Code Of Federal Regulations 50.54(F) Regarding Recommendations 2.1, 2.3, And 9.3, Of The Near-Term Task Force Review Of Insights From The Fukushima DaiIchi Accident,” dated March 12, 2012

OTHER

“NRC Management System: A Framework for Accomplishing NRC Objectives for the Operating Reactor Program,” Draft
“Fiscal Year 2013 Office of the Executive Director for Operations (OEDO) Reasonable Assurance Justification Template,” dated October 3. 2013
“Fiscal Year 2013 Office of Nuclear Reactor Regulation (NRR) Reasonable Assurance Justification Template," dated October 4, 2013
“Memorandum of Understanding Between Acquisitions and Product Line and Partner Offices,” dated August 15, 2013
“Fiscal Year 2013 Reasonable Assurance Certifications,” dated October 7, 2013
Technical Letter Report (TLR) ANL-13/18, “Evaluation and Analysis of a Few International Periodic Safety Review Summary Reports,” issued December 2013 (ADAMS Accession Number ML13317B646)
“Japan Incident Response After Action Report for the Fukishima Dai-Ichi Accident,” issued December 2011 (ADAMS Accession Number ML112580203)
United States Country Report for the December 2012 Committee on Nuclear Regulatory Activities Meeting

United States Country Report for the December 2013 Committee on Nuclear Regulatory Activities Meeting

INDUSTRY DOCUMENTS

Nuclear Energy Institute (NEI)-12-06, "Diverse And Flexible Coping Strategies (Flex) Implementation Guide," issued August 2012
NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Protection Features," issued May 2012
NEI-13-02, "Industry Guidance For Compliance With Order EA-13-109: BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," issued November 2013
NEI 13-06, "Guidance for Closure of Tier 2 Emergency Preparedness Enhancements from the NRC Near-Term Task Force Report," Draft Revision D
Letter to the NRC from the NEI "Response to NRC Letter, Request for Submission of Industry Guidance Related to Emergency," dated December 17, 2013 (ML13352A355)
"Procedure Guidelines and Severe Accident Guidelines," Letter from Bahadur to Pietrangelo, Dated November 26, 2013
Electric Power Research Institute (EPRI) 1025286, "Seismic Walkdown Guidance for Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic," approved May 31, 2012
EPRI 1025295, "Severe Accident Management Guidance Technical Basis Report," dated October 2012

MANAGEMENT DIRECTIVES

Management Directive 6.3, "The Rulemaking Process," dated July 22, 2013 (ADAMS Accession Number ML13205A400)
Management Directive 6.6, "Regulatory Guides," dated April 12, 2011 (ADAMS Accession Number ML110330475)
Management Directive 8.8, "Management of Allegations," dated November 15, 2010 (ADAMS Accession Number ML102110541)
Management Directive 10.50, "Pension Offset Waiver," Dated July 8, 2013
Management Directive 10.77, "Employee Training and Development," dated February 8, 2005
Management Directive 10.158, "NRC Non-Concurrence Process," interim policy as of November 29, 2006 (ADAMS Accession Number ML070660506)
Management Directive 10.159, "The NRC Differing Professional Opinions Program," dated May 16, 2004 (ADAMS Accession Number ML041770431)
Management Directive 10.160, "Open Door Policy," Dated August 28, 1997 (ADAMS Accession Number ML041490186)

LAWS, STATUTES, AND REGULATIONS

Atomic Energy Act of 1954, as Amended
Energy Reorganization Act of 1974

5 United States Code (USC) 552, Freedom of Information Act
5 USC 552(b), Government in the Sunshine Act
10 CFR 2.801, “Initiation of rulemaking.”
10 CFR 2.802, “Petitions for rulemaking.”
10 CFR 20.2202, Notification of Incidents.”
10 CFR Part 21, “Reporting of Defects and Noncompliance.”
10 CFR 50.2, “Definitions.”
10 CFR 50.34, “Contents of applications; technical information.”
10 CFR 50.44, “Combustible Gas Control for Nuclear Power Reactors”
10 CFR 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors.”
10 CFR 50.47, “Emergency Plans,” Appendix E, “Emergency Planning and Preparedness for Production and Utilization Facilities,”
10 CFR 50.54, “Conditions of Licenses.”
10 CFR 50.59, “Changes, tests and experiments.”
10 CFR 50.62, “Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants”
10 CFR 50.63, “Loss of all alternating current power.”
10 CFR 50.67, “Accident Source Term.”
10 CFR 50.69, “Risk-informed Categorization and Treatment of Structures, Systems and Components for Nuclear Power Reactors,”
10 CFR 50.72, “Immediate Notification Requirements for Operating Nuclear Power Reactors.”
10 CFR 50.73, “License event report system.”
10 CFR 50.90, “Application for amendment of license, construction permit, or early site permit.”
10 CFR 50.92, “Issuance of amendment.”
10 CFR 50.100, “Revocation, Suspension, Modification of Licenses, Permits, and Approvals for Cause.”
10 CFR 50.109, “Backfitting.”
10 CFR 50.150, “Aircraft Impact Assessment.”
10 CFR 50, Appendix A, “General Design Criteria for Nuclear Power Plants”
10 CFR 50 Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.”
10 CFR 50, Appendix R, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979.”
10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.”
10 CFR 73.58, “Safety/Security Interface Requirements for Nuclear Power Reactors.”
10 CFR 73.71, “Reporting of safeguards events.”
10 CFR 50.559(c)(7), “Security Implementing Procedures.”
10 CFR 73.55(m), “Security Program Reviews.”
10 CFR Part 100, “Reactor Site Criteria,”
10 CFR 100.11, “Determination of exclusion area, low population zone, and population center distance.”

44 CFR Part 350, “Review and Approval of State and Local Radiological Emergency Plans and Preparedness.”
Homeland Security Presidential Directive 5 (HSPD-5), “Management of Domestic Incidents,” dated February 28, 2003
Presidential Policy Directive / PPD-8, “National Preparedness,” dated March 30, 2011
Article 1, “The Legislative Branch,” Section 7, “Revenue Bills, Legislative Process, Presidential Veto,” of the US Constitution
Section 402 of Public Law 112-74, “Consolidated Appropriations Act 2012.”

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Office of Nuclear Reactor Regulation (NRR) Office Instruction (OI) LIC-101, “License Amendment Review Procedures,” issued May 2012 (ADAMS Accession Number ML113200053)
Office of Nuclear Reactor Regulation Office Instruction LIC-109, “Acceptance Review Procedures,” Revision 1, dated July 16, 2009 (ADAMS Accession Number ML091810088)
Office of Nuclear Regulatory Research Office Instruction TEC-004, “Regulatory Guide Review, Development, Revision, and Withdrawal Process,” Revision 0, dated Mary 20, 2013 (ADAMS Accession Number ML101750587)
NSIR Incident Response Procedure (IRP) 057006, “Liaison Team International Liaison,” dated May 10, 2012
LIC-401, “NRR Reactor Operating Experience Program,” Revision 2, dated December 27, 2010 (ADAMS Accession Number ML081910741)
Office Instructions NRR COM-111/NSIR COM-218/NRO COM-107, “Managing Interfaces among Safety, Security, and Emergency Preparedness,” Revision 1, dated September 27, 2010 (ADAMS Accession Number ML101400470)

OIG REPORTS

Inspector General Report OIG-11-A-17, “Audit of NRC’s Management of Licensee Commitments,” dated September 19, 2011 (ADAMS Accession Number ML112620529)

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Regulatory Guide 1.70, “Standard Format and Content of Safety Analysis Report for Nuclear Power Plants (LWR Edition),” Revision 3, issued November 1978
Regulatory Guide 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Revision 2, dated May 2011 (ADAMS Accession Number ML100910006)
Regulatory Guide 1.73, “Qualification Tests for Safety-Related Actuators in Nuclear Power Plants,” Revision 1, issued October 2013 (ADAMS Accession Number ML13210A463)
Regulatory Guide 1.184, “Decommissioning of Nuclear Power Reactors,” Revision 1, issued October 2013 (ADAMS Accession Number ML13144A840)
Regulatory Guide 1.207, “Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Light-Water Reactor Environment for New Reactors,” issued March 2007

Regulatory Guide (RG) 5.74, "Managing the Safety/Security Interface," Revision 0, issued June 2009 (ADAMS Accession Number ML091690036)
Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated August 29, 2012
Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions," Revision 0 dated November 14, 2013

INSPECTION AND ENFORCEMENT DOCUMENTS

"Vendor Inspection Program Plan," Revision 7, issued August 2013 (ADAMS Accession Number ML13239A500)
"Vendor Inspection Program Plan Annual Self-Assessment of Metrics for Fiscal Year 2012," dated December 7, 2012 (ADAMS Accession Number ML12293A344)
IMC 0617, "Vendor and Quality Assurance Implementation Inspection Reports," dated October 3, 2013 (ADAMS Accession Number ML13246A450)
IMC 1245, "Qualification Program for Operating Reactor Programs," dated December 29, 2011 (ADAMS Accession Number ML11105A153)
Inspection Manual Chapter (IMC) 2507, Vendor Inspections," dated October 3, 2013 (ADAMS Accession Number ML13247A725)
IMC 2515 Appendix D, "Plant Status," dated February 24, 2012
Inspection Procedure (IP) 43003, "Reactive Inspections of Nuclear Vendors," dated October 3, 2013 (ADAMS Accession Number ML110871957)
IP 43005, NRC Oversight of Third-Party Organizations Implementing Quality Assurance Requirements," dated April 25, 2011
Inspection Procedure 71153, "Followup of Events and Notices of Enforcement Discretion," Appendix B, "Limiting NRC Impact during Events," dated December 5, 2011 (ADAMS Accession Number ML102810102)
NRC Enforcement Policy, Revision 5, dated July 9, 2013 (ADAMS Accession Number ML13228A199)
NRC Enforcement Manual, Revision 9, dated September 9, 2013 (ADAMS Accession Number ML102630150)
"Completion Of Temporary Instruction (TI)-184, "Availability And Readiness Inspection of Severe Accident Mitigation Guidelines (SAMGs)" At Region Ii Facilities – Revision," dated June 2, 2011
Temporary Instruction (TI) 2515/183, "Followup to the Fukushima Daiichi Nuclear Station Fuel Damage Event," dated March 23, 2011
TI 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)," dated April 29, 2011
TI-2515/186, "Inspection of Procedures and Processes for Responding to Potential Aircraft Threats," dated August 30, 2012 (ML12170B026)
TI-2515/187, "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns," dated June 27, 2012
TI-2515/188, "Inspection of Near-Term Task Force Recommendation 2.3 Seismic Walkdowns," dated July 6, 2012

TI 2515/190, “Inspection of the Licensee’s Proposed Interim Actions as a Result of the Near-Term Task Force Recommendation 2.1 Flooding Reevaluation,” dated August 30, 2013
TI 2600/0015, “Evaluation of Licensee Strategies for The Prevention and/or Mitigation Of Emergencies at Fuel Facilities,” issued September 30, 2011
IP 71111.18, “Plant Modifications,” dated December 21, 2010
IP 71111.05T, “Fire Protection (Triennial),” dated January 31, 2013
NRC Travel Trip Report, “Nuclear Procurement Issues Committee (NUPIC) Observation at MPR Associates, Inc.,” dated April 22, 2013
“Browns Ferry Nuclear Plant NRC Integrated Inspection Report 05000259/2013002, 05000260/2013002, and 05000296/2013002, and Assessment Follow-up,” dated May 14, 2013

LICENSING ACTIONS

“Oconee Nuclear Station, Units 1, 2, and 3, Issuance of Amendments Regarding Acceptance of the Reactor Protective System and Engineering Safeguard Protective System (RPS/ESPS) Digital Upgrade (TAC NOS. MD7999, MD8000, AND MD8001),” dated January 28, 2010
Monticello Nuclear Generating Plant – Issuance of Amendment No. 176 to Renewed Facility Operating License Regarding Extended Power Uprate (TAC No. MD9990),” dated December 9, 2013

RULEMAKING

Advance Notice Of Proposed Rulemaking, “Onsite Emergency Response Capabilities,” dated April 18, 2012 (Federal Register Notice (FRN) 2012-09336)
Draft Regulatory Basis, “Onsite Emergency Response Capabilities,” dated January 8, 2013 (Federal Register Notice (FRN) 2013-31706)
Regulatory Basis, “Onsite Emergency Response Capabilities,” dated October 25, 2013 (Federal Register Notice (FRN) 2013-24879)
Proposed Rule Initial Plan, “Retrospective Review Under Executive Order 13579,” dated November 16, 2011 (Federal Register Notice (FRN) 2011-29418)
Proposed Rule Request for Comment, “Retrospective Review Under Executive Order 13579,” dated November 23, 2012 (Federal Register Notice (FRN) 2012-28436)
Advance Notice Of Proposed Rulemaking, “Station Blackout,” dated March 20, 2012 (FRN 2012-6665)
Semiannual Regulatory Agenda, “Unified Agenda of Federal Regulatory and deregulatory Actions,” dated January 7, 2014 (FRN 2013-29648)
“Regulatory Analysis and Backfitting for the Consideration of Additional Requirements for Containment Vending Systems for Boiling Water Reactors with Mark I and Mark II Containments,” (ADAMS Accession Number ML12312A456)

GENERIC COMMUNICATIONS

Information Notice 2011-08, “Tohoku-Taiheiyou-Oki Earthquake Effects On Japanese Nuclear Power Plants – For Fuel Cycle Facilities,” dated March 31, 2011
Bulletin 2011-01, “Mitigating Strategies,” dated May 11, 2011

Generic Letter 88-20, "Individual Plant Examination [IPE] for Severe Accident Vulnerabilities," dated November 23, 1988

CODES AND STANDARDS

ANS 51.1, "Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor [PWR] Plants 1983."
ANSI/ANS-52.1-1978, "Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants, 1978."

PRESS RELEASES

"NRC Authorizes Honeywell Metropolis Facility to Resume Operations," dated July 2, 2013

APPENDIX VII - IAEA REFERENCE MATERIAL USED FOR THE REVIEW

1. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Governmental, Legal and Regulatory Framework for Safety, General Safety Requirements Part 1, No. GSR Part 1, IAEA, Vienna (2010).
2. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Management System for Facilities and Activities. Safety Requirement Series No. GS-R-3, IAEA, Vienna (2006).
3. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Preparedness and Response for Nuclear and Radiological Emergencies, Safety Requirement Series No. GS-R-2, IAEA, Vienna (2002).
4. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, General Safety Requirements Part 3, No. GSR Part 3 (Interim Edition), IAEA, Vienna (2011).
5. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Safety assessment for facilities and activities, General Safety Requirements Part 4, No. GSR Part 4, IAEA, Vienna (2009)
6. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Predisposal Management of Radioactive Waste, General Safety Requirement Part 5, No. GSR Part 5, IAEA, Vienna (2009).
7. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Decommissioning of Facilities Using Radioactive Material Safety, , Safety Requirement Series No. WS-R-5, IAEA, Vienna (2006).
8. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Safety of Nuclear Power Plants: Design, Specific Safety Requirements No. SSR-2/1, IAEA, Vienna (2012).
9. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Safety of Nuclear Power Plants: Commissioning and Operation, Specific Safety Requirements Series No. SSR-2/2, IAEA, Vienna (2011).
10. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Site Evaluation for Nuclear Installations, Safety Requirement Series No. NS-R-3, IAEA, Vienna (2003).
11. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Safety of Nuclear Fuel Cycle Facilities, Safety Requirement Series No. NS-R-5, IAEA, Vienna (2008)
12. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Disposal of Radioactive Waste, Specific Safety Requirements No. SSR-5, IAEA, Vienna (2011)
13. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Organization and Staffing of the Regulatory Body for Nuclear Facilities, Safety Guide Series No. GS-G-1.1, IAEA, Vienna (2002).
14. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Review and Assessment of Nuclear Facilities by the Regulatory Body, Safety Guide Series No. GS-G-1.2, IAEA, Vienna (2002).
15. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body, Safety Guide Series No. GS-G-1.3, IAEA, Vienna (2002).
16. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Documentation Used in Regulating Nuclear Facilities, Safety Guide Series No. GS-G-1.4, IAEA, Vienna (2002).
17. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Arrangements for Preparedness for a Nuclear or Radiological Emergency, Safety Guide Series No. GS-G-2.1, IAEA, Vienna (2007)

18. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Guide Series No. GSG-2, IAEA, Vienna 2011)

19. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Commissioning for Nuclear Power Plants, Safety Guide Series No. NS-G-2.9, IAEA, Vienna (2003)

20. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Periodic Safety Review of Nuclear Power Plants, Safety Guide Series No. NS-G-2.10, IAEA, Vienna (2003)

21. **INTERNATIONAL ATOMIC ENERGY AGENCY** - A System for the Feedback of Experience from Events in Nuclear Installations, Safety Guide Series No. NS-G-2.11, IAEA, Vienna (2006)

22. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Occupational Radiation Protection, Safety Guide Series No. RS-G-1.1, IAEA, Vienna (1999)

23. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Assessment of Occupational Exposure Due to Intakes of Radionuclides, Safety Guide Series No. RS-G-1.2, IAEA, Vienna (1999)

24. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Assessment of Occupational Exposure Due to External Sources of Radiation, Safety Guide Series No. RS-G-1.3, IAEA, Vienna (1999)

25. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Environmental and Source Monitoring for Purposes of Radiation Protection, Safety Guide Series No. RS-G-1.8, IAEA, Vienna (2005)

26. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Deterministic Safety Analysis for Nuclear Power Plants, Specific Safety Guides Series No. SSG-2, IAEA, Vienna (2010)

27. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants, Specific Safety Guide Series No. SSG-3, IAEA, Vienna (2010)

28. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants, Specific Safety Guide Series No. SSG-4, IAEA, Vienna (2010)

29. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Licensing Process for Nuclear Installations, Specific Safety Guide Series No. SSG-12, IAEA, Vienna (2010)

30. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Classification of Radioactive Waste, General Safety Guide No. GSG-1, IAEA, Vienna (2009)

31. **INTERNATIONAL ATOMIC ENERGY AGENCY -** Decommissioning of Nuclear Power Plants and Research Reactors, Safety Guide Series No.WS-G-2.1, IAEA, Vienna (1999)

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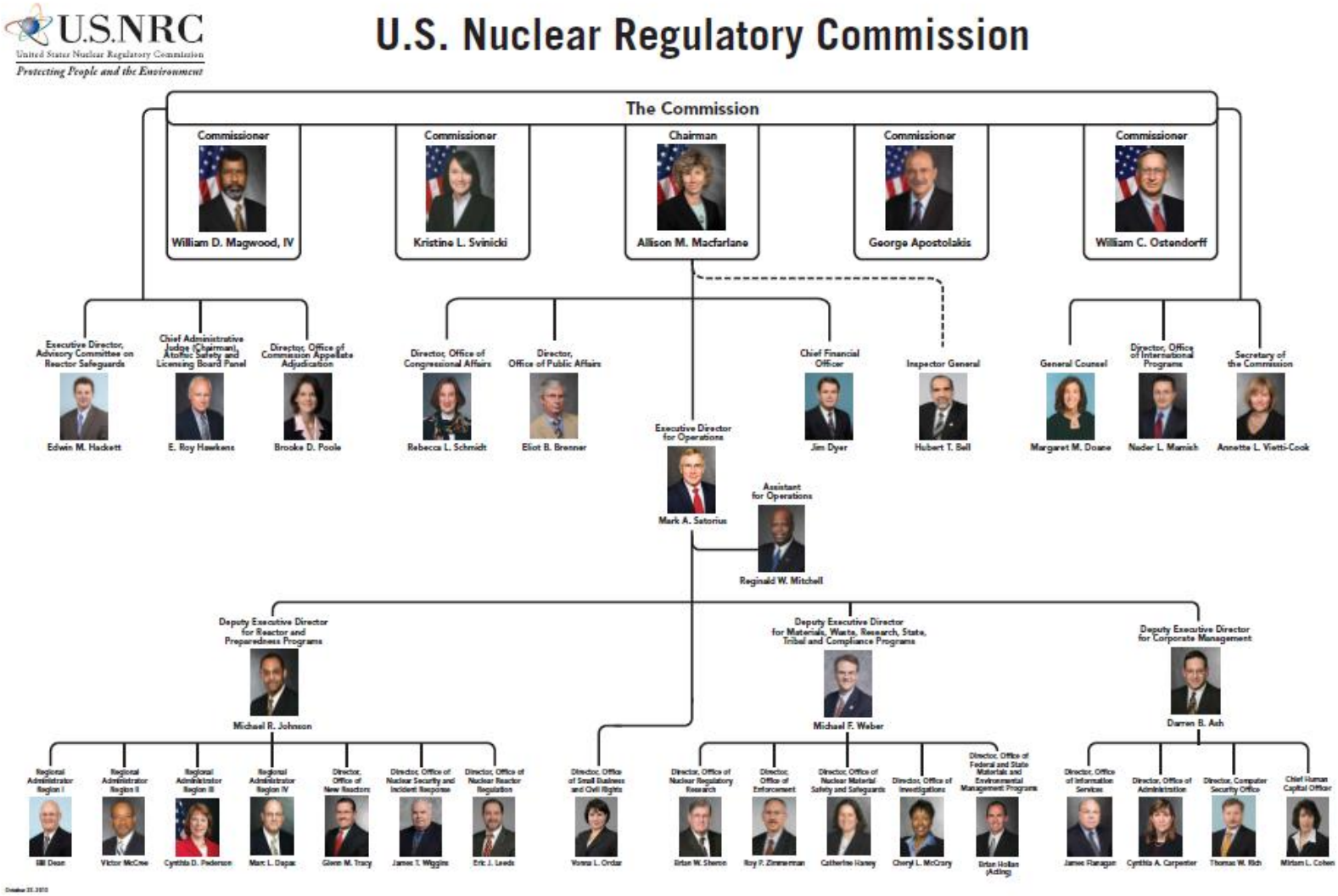
33. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Decommissioning of Nuclear Fuel Cycle Facilities, Safety Guide Series No.WS-G-2.4, IAEA, Vienna (2001)

34. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Predisposal Management of Low and Intermediate Level Radioactive Waste, Safety Guide Series No.WS-G-2.5, IAEA, Vienna (2003)

35. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Predisposal Management of High Level Radioactive Waste, Safety Guide Series No.WS-G-2.6, IAEA, Vienna (2003)

36. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Safety Assessment for the Decommissioning of Facilities Using Radioactive Material, Safety Guide Series No.WS-G-5.2, IAEA, Vienna (2009)

37. **INTERNATIONAL ATOMIC ENERGY AGENCY** - Storage of Radioactive Waste, Safety Guide Series No. WS-G-6.1, IAEA, Vienna (2006)

APPENDIX VIII - USNRC ORGANIZATIONAL CHART