

Review of IAEA Transport Safety Standards in Light of 28 Lessons Learned from Fukushima Daiichi Nuclear Power Stations Accident

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ABSTRACT

After the nuclear accidents in Fukushima Daiichi Nuclear Power Station, the IAEA Director General requested in July 2011 that the Commission of Safety Standards (CSS) review all IAEA Safety Standards within 12 months. The CSS established an Action Plan to review the Safety Standards, including the transport safety standard, i.e. the Regulations for the Safe Transport of Radioactive Material (SSR-6), through gap analysis methodology.

The Transport Safety Standards Committee (TRANSSC) accepted the methodology in its 23rd meeting (TRANSSC 23) in November 2011, and discussed the effects of the accident on the transport safety standard, which was based on the report from the Japanese government. This included 28 lessons learned from the accident. Following the TRANSSC 23 decision to provide a list of possible transport actions identified from the lessons, the Secretariat in cooperation with Japanese colleagues distributed the list of identified items with discussion starters to the Member States in the end of December 2011.

In March 2012, experts convened at the Consultancy Meeting on the Technical Basis Document and discussed the list alongside comments from the Member States and the Preliminary Gap Analysis provided by Japan. They made following recommendations, which were generally accepted by TRANSSC 24 held in June 2012.

- The Transport Regulations, SSR-6:
 - No issues requiring urgent revision have been identified,
 - The need to enhance emergency response provisions should be considered, and
 - The test conditions that could arise from very unlikely, but possible natural events should be evaluated by a Working Group.
- The Advisory Material, TS-G-1.1:
 - Additional guidance for hydrogen generation etc. should be reviewed.
- The Guidance for Planning and Preparing for Emergency Response, TS-G-1.2:
 - The planned revision should be expedited and incorporated the results of gap analysis.

Consequently, the 2012 Edition of SSR-6 was issued as scheduled in October 2012, and any impact on the Regulations, if identified, would be proposed in the next review/revision cycle. Consideration of possible natural events would be discussed in the Technical Meeting on Transport Environment in July 2013. The revision work on TS-G-1.2 is underway.

In this paper, an outline of gap analysis and discussions are presented.

INTRODUCTION

At 14:46 JST on 11th March 2011, the Great Tohoku Earthquake and tsunami caused by the earthquake attacked the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Co., and a nuclear accident followed at an unprecedented scale and over a lengthy period.

The Government of Japan submitted a report^[1] to the IAEA Ministerial Conference on Nuclear Safety held between 20th-24th June 2011 at IAEA Headquarters in Vienna, consisting of a summary of the evaluation of the accident and the lessons learned. The report presented 28 lessons learned in five groups as shown below:

(Lessons in group 1) Strengthen preventive measures against a severe accident

1. Strengthen measures against earthquakes and tsunamis
2. Ensure power supplies
3. Ensure reliable cooling function of reactors and PCVs
4. Ensure reliable cooling functions of spent fuel pools (SFPs)
5. Thorough accident management (AM) measures
6. Responses to multi-site issues
7. Consideration of NPS arrangement in basic design
8. Ensuring the water tightness of essential equipment and facilities

(Lessons in group 2) Enhancement of measures against severe accidents

9. Enhancement of measures to prevent hydrogen explosions
10. Enhancement of containment venting systems
11. Improvement of the accident response environment
12. Enhancement of the accident radiation exposure management system
13. Enhancement of training for responding to severe accidents
14. Enhancement of instrumentation for reactors and PCVs
15. Central control of emergency supplies and setting up of rescue teams

(Lessons in group 3) Enhancement of nuclear emergency response

16. Response to a combined situation of massive natural disaster and nuclear emergency
17. Reinforcement of environmental monitoring
18. Clarification of the allotment of roles between central and local organizations
19. Enhancement of communication regarding the accident
20. Enhancement of response to assistants from other countries and communication to the international community
21. Accurate understanding and prediction of the effect of released radioactive materials
22. Clear definition of the criteria for wide-area evacuations and radiological protection standards in nuclear emergencies

(Lessons in group 4) Reinforcement of safety infrastructure

23. Enhancement of safety regulatory and administrative systems
24. Establishment and reinforcement of legal framework, standards and guidelines
25. Human resources for nuclear safety and nuclear emergency preparedness and responses
26. Ensuring the independence and diversity of safety systems
27. Effective use of probabilistic safety assessments (PSA) in risk management

(Lesson in group 5) Raising awareness of safety culture

28. Thorough grounding of safety culture

As part of the thorough review of IAEA safety standards, the Transport Safety Standards Committee (TRANSSC) is conducting a review of its transport safety standard, the IAEA Regulations for the Safe Transport of Radioactive Material (SSR-6), based on the abovementioned 28 lessons learned from the Fukushima Accident.

REVIEW OF THE IAEA SAFETY STANDARDS

In the IAEA Ministerial Conference on Nuclear Safety, the Director General (DG) asked the IAEA's Commission of Safety Standards (CSS) to review the relevant standards. In the letter dated 7th July, the DG officially made a request to the CSS Chair that "The Commission would review the standards and report back within the next 12 months with recommendations for strengthening the standards, where gaps would be identified to further promote their universal application."

The CSS responded immediately, firstly by establishing a Safety Standards Action Plan to review the Safety Standards with a gap analysis methodology. Then, four Safety Standards Committees (the Nuclear Safety Standards Committee (NUSSC), the Radiation Safety Standards Committee (RASSC), the Waste Safety Standards Committee (WASSC) and the Transport Safety Standards Committee (TRANSSC)) conducted review of their safety standards in accordance with the Action Plan. The action was also addressed by the IAEA Action Plan on Nuclear Safety (GOV/2011/59-GC(55)/14); "to review and strengthen IAEA Safety Standards and improve their implementation using the existing process in a more efficient manner."

In the letter dated 31st May 2012 attached to the first Progress Report, the Chair of CSS reported the following initial progress to the DG:

- 1) 106 lessons analyzed through 64 main topical areas, and no gaps or deficiencies have been identified in the 450 overarching requirements. However, the addition of 31 associated requirements and the strengthening of 20 existing ones are proposed.
- 2) Some of the most significant issues that require focus:
 - The further strengthening of defense-in-depth by better taking into account extreme natural hazards that may exceed the levels foreseen in the current design and in the current safety requirements.
 - The importance of measures to maintain containment integrity, which is critical as the last barrier to protect people and the environment.
 - The importance of harmonized approaches to support international trade, including for commodities and foodstuffs.
 - The need for a justification process and optimization criteria for remediation and rehabilitation as well as advice on the transition from an emergency to a post-emergency phase.

As an outcome of the first review, the revision of five major safety requirements documents, i.e. GSR Part 1 "Governmental, Legal and Regulatory Framework for Safety", NS-R-3 "Site Evaluation for Nuclear Installations", SSR-2/1 "Safety of Nuclear Power Plants: Design", SSR-2/2 "Safety of Nuclear Power Plants: Commissioning and Operation" and GSR Part 4 "Safety Assessment for Facilities and Activities" is underway in an efficient manner.

Review of other safety requirements documents and safety guide documents is also underway in a prioritized manner, and several proposals of revision to documents have been made.

REVIEW OF THE TRANSPORT SAFETY STANDARDS

Initiation of the Review

The Safety Standard Action Plan was presented and explained by the CSS Secretariat in the 23rd Meeting of the Transport Safety Standards Committee (TRANSSC 23, October 2012), and TRANSSC accepted the methodology of the review (i.e. gap analysis). Following the presentation from the TRANSSC Member of Japan on the Fukushima Accident, TRANSSC discussed the impact of the accident on the transport safety standard, based on the 28 lessons learned reported from the Japanese government. The Secretariat selected the following 16 transport issues raised for initial consideration for safety standard action plan:

- 1) Encountering environments beyond regulations
- 2) Package cooling in an accident (cf. Type C burial)
- 3) Water tightness
- 4) Hydrogen generation
- 5) Assessment for release significance
- 6) Radiation protection standards for transport – including emergencies
- 7) Use of risk informed basis for design
- 8) Risk based accident management
- 9) Working in a transport accident environment
- 10) Training for accidents / training courses related to transport accidents
- 11) Combined natural disasters and radioactive material transport emergencies
- 12) Monitoring following a transport accident (e.g. multi-state release)
- 13) Who to inform and how to inform them
- 14) Contamination - Contamination levels on non-radioactive goods
- 15) Non-transport emergency - Emergency response requirements - should these be extended and should they include transport of radioactive material from a non-transport emergency
- 16) Large volumes of waste - Guidance on transport of large volumes of contaminated material

TRANSSC 23 concluded that the Secretariat would provide list of possible transport actions identified from the lessons learned from the Fukushima accident to TRANSSC Members by the end of December 2011, and TRANSSC members would provide comments and recommendations on the list to the Secretariat by 31st January 2012.

Gap Review

Mid-December 2012, Japanese experts provided the “Draft list of issues for TRANSSC consideration on IAEA Transport Safety Standard from the viewpoint of 28 lessons learned in the Japanese Report to the IAEA”. The list consisted of 16 lessons identified to be potentially related to transport safety, gap review of each lesson, relevant IAEA Safety Standards (requirements TS-R-1, guides TS-G-1.1, TS-G-1.2, etc., and IAEA overarching requirements) and their relation to the 16 items proposed in TRANSSC 23.

Then the Secretariat added 29 “Discussion starters” to the list and distributed the list to the Member States in the end of December 2012 with a request that this be discussed at the TRANSSC 24 meeting in June 2012. The discussion starters included questions such as:

- Are issues such as natural forces fully considered in the hypothetical tests?
- How does the severe accident frequency in the regulations compare to the actual frequency of severe natural events?
- Is there a need for secondary power supplies for some equipment used in transport?
- Is water ingress sufficiently covered in the regulations?

- In the event of a non-transport emergency, should there be conditional exemptions to transport requirements?
- Has the concept of safety culture been adequately considered in transport requirements?

Table 1. Excerpt from “Draft list of issues for TRANSSC consideration on IAEA Transport Safety Standard from the point of 28 lessons learned in the Japanese Report to the IAEA”

Lessons learned from the accident ⁴²			Relevant IAEA Safety Standards ⁴²		No of IAEA ⁴² OARs* ⁴²	16 items proposed in TRANSSC 23 ⁴²	Secretariat ⁴²
No ⁴²	28 lessons learned ⁴²	Gap review ⁴²	Requirements ⁴²	Guides ⁴²			Discussion starters ⁴²
(Lessons in Category 1) Preventions of severe accidents⁴²							
1 ⁴²	Strengthen measures against earthquakes and tsunamis ⁴²	It should be reviewed whether the impact loads act to packages are covered by the regulatory test conditions, and whether there is any condition not being postulated in the regulatory design conditions to be assessed. ⁴² E.g. Impact load by seismic force or tsunami force to packages; ⁴² Collision to surrounding structures at the time of earthquake during lifting of the package; ⁴² Collision of collapsed structure (e.g. gantry crane) onto the package; ⁴² Burial into landslide soil due to the earthquake; ⁴² Burial into debris brought by tsunami. ⁴² Stacking load to the package (currently 5 times); ⁴² Combined situation of incidents ⁴²	TS-R-1 (Sections VI and VII) ⁴²	TS-G-1.1 (Sections VI and VII) ⁴²	(8), (9), 10, 11, 12, 19 ⁴²	Encountering environment beyond regulations ⁴²	Are issues such as natural forces fully considered in the hypothetical tests and in the Q system? ⁴² Is building collapse (or perhaps collapse of a crane) covered by the requirements, and should it be? ⁴² Is burial a situation that should be considered? ⁴² Is the stacking load in the regulations sufficient? ⁴² Are there accident combinations resulting from natural events that are not included in the hypothetical accident scenarios? ⁴²

The Secretariat arranged a one day discussion among the experts on the review of the IAEA Transport Standard during the consultancy meeting CS-26 on the Technical Basis Document held in March 2012. Responding to the request from the Secretariat in advance, around 40 comments from 6 Member States were collected. Excerpts were:

- Guidance document TS-G-1.2 (Emergency Preparedness) should be improved (7 comments).
- “Natural disaster condition of transport” may be considered.
- It is important to evaluate carefully cost-benefit analysis before a decision being taken.
- Paragraphs 104 and 304 of TS-R-1 could be strengthened to enhance emergency response.
- Package test conditions (burial test, dynamic crush test, immersion test) should be discussed.
- Power supply for some equipment and measures to prevent hydrogen explosion should be discussed.
- No gap which would rise to additional or new design or test requirements for packages is identified except the potential for burial in a severe accident environment.
- Situations where accident environments may exceed the package capability can be avoided using operational controls.
- An option to require a shipment approval for Type B packages with very high heat release may be discussed.
- The current deterministic approach in the Regulations should be kept as it is, but the need to use a risk based accident management should be checked.
- Enhancement of training and responding to severe transport accidents is important.

- Collapse of a building onto a package in a nuclear facility will be assessed as part of the safety evaluation of the facility.
- Revision of TS-G-1.4 (Management System) and TS-G-1.5 (Compliance Assurance) should be considered to develop guidance about safety culture.
- The regulatory test conditions were never intended to cover the hypothetical maximum transport accidents, and to consider unlikely scenarios means to modify the current approach to the Regulations, and may seriously affect the transport field.
- Auxiliary equipment is outside of the scope of the Regulations. It may be considered in the modal regulations under the general umbrella of dangerous goods.
- An analysis should be done to introduce new provisions in TS-R-1 to manage urgent need to transport waste or another radioactive material.

To enhance discussion in CS-26 and TRANSSC 24, Japanese experts submitted a preliminary view on the gap analysis and proposed actions as a document titled “Relationship of 28 lessons learned from Fukushima Daiichi Accident with IAEA Transport Safety Standard – Preliminary View from Japan”. The document consisted of responses to 29 discussion starters and proposed actions. Major actions proposed were:

- Accidents caused by severe natural phenomena which are not included in the regulatory test conditions: Though it is not classified as an urgent item, a working group to discuss on transport incidents should be set up.
- Do the Regulations cover all the transport incidents? How can we consider less frequent but severe accidents?: There is a need for transport risk assessment, which can be considered as an idea to handle such unlike events.
- Hydrogen explosion, water ingress: To be addressed in the Advisory Material (TS-G-1.1).

Table 2. Excerpt from “Relationship of 28 lessons learned from Fukushima Daiichi Accident with IAEA Transport Safety Standard - Preliminary View from Japan”

Lessons learned from the accident [Ⓢ]			Secretariat [Ⓢ]	Japan [Ⓢ]	Proposed action [Ⓢ]
No [Ⓢ]	28 lessons learned [Ⓢ]	Gap review [Ⓢ]	Discussion starters [Ⓢ]	Preliminary view [Ⓢ]	
(Lessons in Category 1) Preventions of severe accidents[Ⓢ]			[Ⓢ]	[Ⓢ]	[Ⓢ]
1 [Ⓢ]	Strengthen measures against earthquakes and tsunamis [Ⓢ]	<p>It should be reviewed whether the impact loads act to packages are covered by the regulatory test conditions, and whether there is any condition not being postulated in the regulatory design conditions to be assessed.[Ⓢ]</p> <p>E.g. Impact load by seismic force or tsunami force to packages;[Ⓢ] Collision to surrounding structures at the time of earthquake during lifting of the package;[Ⓢ] Collision of collapsed structure (e.g. gantry crane) onto the package;[Ⓢ] Burial into landslide soil due to the earthquake;[Ⓢ] Burial into debris brought by tsunami.[Ⓢ] Stacking load to the package (currently 5 times);[Ⓢ] Combined situation of incidents[Ⓢ]</p>	<p>Are issues such as natural forces fully considered in the hypothetical tests and in the Q system?[Ⓢ]</p> <p>Is building collapse (or perhaps collapse of a crane) covered by the requirements, and should it be?[Ⓢ]</p>	<p>Requirements in the Transport Regulations are not based on full consideration of natural environmental conditions or forces (environmental conditions such as an ambient temperature, insolation or mechanical impact conditions induce by natural forces).[Ⓢ]</p> <p>Requirements have been established to include almost of consequences from natural forces and man-induced events based on experiences in dangerous goods transport.[Ⓢ]</p> <p>As requirements derived to cover very unlikely events may disturb efficient transport, they should be selected with considerations to occurrence frequency and consequence of events and contribution to promote total safety of transport.[Ⓢ]</p> <p>No natural phenomenon is considered in the Q system, which is based on an assumption with single event occurred on single package.[Ⓢ]</p> <p>Not all the collapse of buildings or cranes is not covered by the Regulations, and it is almost impossible to cover all collapse conditions by the requirements of the Regulations. But, the possibility that a package encounters such collapse during transport seems very low.[Ⓢ]</p>	<p>As one of ideas to consider events beyond expectations, a need for transport risk assessment may be discussed.[Ⓢ]</p> <p>No action[Ⓢ]</p>

- Emergency response (interactions, work under accident conditions, dose limits, notification, etc.): To be incorporated in the emergency preparedness guidance document TS-G-1.2 under the current revision process.
- Do we need swift revision of the Regulations to cover radiological impact estimation, emergency transport, contamination levels, etc.?: Studies by experts will be recommended through inter-agency meeting, coordinated research project, etc.

In consideration of comments by Member States and the preliminary review, CS-26 concluded that the following items would be recommended to TRANSSC:

- The Transport Regulations, SSR-6:
 - No issues requiring urgent revision have been identified.
 - In the framework of the next review and revision cycle, the need to enhance the provision regarding emergency response should be considered.
 - It is recognized that the tests in the Regulations address very challenging accident conditions, but conditions that could arise from very unlikely but possible natural events have not been considered. A Working Group should be set up to review the tests and to evaluate the need for additional tests, such as burial. Any outcome should be available before the next review cycle. This Working Group should draw maximum benefit from and coordinate with the on-going “Technical Basis” effort.
- The Advisory Material, TS-G-1.1:
 - Additional guidance should be developed regarding hydrogen generation and explosion, multiple high standard water barriers (paragraph 677 in the 2009 Edition of TS-R-1), transport mode and conveyance specific items.
 - Guidance on special arrangement for emergency transport should also be developed.
- The Guidance for Planning and Preparing for Emergency Response, TS-G-1.2:
 - The Document Preparation Profile (DPP) for the revision of TS-G-1.2 should be finalized as early as possible and take into account lessons 5, 6, 11 to 13, 15 to 25 and the corresponding gap analyses.
 - When revising TS-G-1.2, all the IAEA documents recently published dealing with emergency preparedness and response should be taken into account.
 - Guidance on communication in case of a transport related accident involving multiple countries and mutual assistance (including the IEC of IAEA) should be improved in TS-G-1.2 (e.g., the IMO and ICAO search and rescue conventions could be considered).
- Safety culture:
 - Safety culture should be specifically addressed in TS-R-1 and sections dealing with safety culture in guidance documents should take into account all IAEA requirements which were recently published, including the latest edition of the BSS.

Discussion in TRANSSC Meetings

In the 24th Meeting of TRANSSC (TRANSSC 24, July 2012) the Secretariat explained the course of review and the list of issues with discussion starters, which resulted in lively debate among the Member States. The preliminary review and proposed actions calmed down the arguments, and TRANSSC generally accepted the recommendations from CS-26. Conclusions from the meeting were as follows, and major items were incorporated to the “TRANSSC 3Year Plan”:

- No issues requiring urgent revision were identified.
 - The draft of the 2012 Edition of the Regulations (TS-R-1, which was renumbered as SSR-6 later) should proceed to the publication process as scheduled.

- Considerations for possible natural events which may impact the Regulations will be discussed in the Technical Meeting on Transport Environment.
 - The review of impact from the lessons learned from the Fukushima Accident will be added to the terms of reference of the Technical Meeting.
- TS-G-1.2 should be revised.
 - The Document Preparation Profile (DPP) to revise TS-G-1.2 should be revised to incorporate relevant results from the gap review.
- Other items would be dealt in review cycles, if necessary.
 - Any impact on the Regulations, if identified, will be proposed in the next review/revision cycle.

The 25th meeting of TRANSSC (TRANSSC 25, October 2012) confirmed that necessary actions from the lessons learned from the Fukushima Accident were properly reflected in the TRANSSC 3 Year Plan.

- The terms of reference for the Technical Meeting on Transport Environment were discussed, and the following items for consideration were selected:
 - Item 1: Strengthen measures against earthquakes and tsunamis (including Item 27: Effective use of probabilistic safety assessment (PSA) in risk management).
 - Item 2: Ensure power supplies
 - Item 3: Ensure reliable cooling function of reactors and PCVs
 - Item 4: Ensure reliable cooling function of spent fuel pool
 - Item 8: Ensure the water tightness of essential equipment and facilities.
- Revised DPP for TS-G-1.2 revision was approved.

TM on Transport Environment

The Technical Meeting (TM) on Transport Environment was originally planned to discuss the effects caused by climate change and transport infrastructure change on the Transport Regulations, then its scope extended to cover the lessons learned from the Fukushima Accident. TM was held in July 2013, and several case studies were presented to demonstrate the robustness of transport packages even under the hypothetical accident conditions beyond the regulatory environment. A Japanese expert presented a methodology to identify and classify natural events potentially affect the safety of transport packages. Applying the methodology to the domestic spent fuel transport, several incidents requiring special attention (i.e., further survey) were pointed out as listed in Table 3.

Though it was not mentioned in detail in the presentation, package safety would be expected to be maintained in the case of these potential incidents.

Table 3. Example of potential incidents for the case of domestic spent fuel transport

Situation	Initial event	Potential incident/ scenario	Load type	Evaluation by further detailed survey
cargo work	tsunami	hit by fallen crane itself	impact	no influence on package safety
	tsunami	piled up by a grounded vessel	impact	no influence on package safety
	volcano	fired by pyroclastic flow or ashes	fire	no influence on package safety
	volcano	covered by pyroclastic flow or ashes	burial	no influence on package safety
land transport	volcano	fired by pyroclastic flow or ashes	fire	no influence on package safety
	volcano	covered by pyroclastic flow or ashes	burial	no influence on package safety
site storage	tsunami	fired by outflow oil from nearby tank	fire	no influence on package safety
	volcano	fired by pyroclastic flow or ashes	fire	no influence on package safety
	volcano	covered by pyroclastic flow or ashes	burial	no influence on package safety

Further survey is underway, and so far the package integrity under the conditions of crane falling and vessel pile-up has been demonstrated through structural analyses. The transport routes are out of the reach of pyroclastic flows from volcanos, but a small part is within the range of ash fall. There are no oil tanks near the transport routes.

Total burial of a package is expected, but only partially, from observations of aftereffects of the tsunamis caused by the Great Tohoku Earthquake. Results of Computational Flow Dynamics (CFD) calculation on the package temperatures in the cargo hold of grounded vessel under the condition of loss of cooling mechanism are expected to come out by the end of this year.

From the viewpoint of the lessons learned from the Fukushima Accident, consequently, the TM recommended no change on regulatory test conditions, but some changes to the Regulations to enhance emergency response such as:

- For emergency response, the consignee, carrier and government shall establish an emergency response plan prior to shipment, and the consignee and carrier shall submit this to the competent authorities if required.
- To evaluate the cooling function loss from the viewpoint of emergency in the case of using a mechanical cooling system during stowage of high heat packages, conveyance using this cooling system will also be subject to shipment approval.

The periods of 0.9 m and 15 m depth immersion tests are proposed to be extended to one week, however these proposals are based on criticality safety considerations.

As these change proposals have already been filed as items to be considered in the current review cycle of the Regulations (the 2012 Edition of SSR-6), they will be forwarded to the revision cycle if TRANSSC decide to revise the Regulations in the next meeting in November 2013.

CONCLUSIONS

As part of thorough review of the IAEA Safety Standards, TRANSSC reviewed its Transport Safety Standard, i.e., the Regulations for the Safe Transport of Radioactive Material SSR-6 (former TS-R-1) from the viewpoint of the 28 lessons learned from Fukushima Accident. The conclusions reached by TRANSSC are as follows:

- No issues requiring urgent revision of the Regulations were identified. Any impact on the Regulations, if identified, would be proposed in the next review/revision cycle.
- The need for additional tests was evaluated and it was concluded it would improve emergency preparedness. Relevant proposals to change the Regulations will be discussed in the current review cycle of the Regulations.
- Guidance document TS-G-1.2 “Planning and Preparing for Emergency Response to Transport Events involving Radioactive Material” should be revised to incorporate the results of the gap analyses. The Document Preparation Profile (DPP) to revise TS-G-1.2 was already approved, and the revision work has started.

ACKNOWLEDGMENTS

The authors thank Mr. James Torrens Stewart, the former head of the Transport Safety Unit, NSRW-RIT, IAEA, for providing suggestive discussion starters to enhance TRANSSC discussion and arranging the proper agenda for meetings to conclude the review.

REFERENCE

- [1] Nuclear Emergency Response Headquarters, Government of Japan, “Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety – The Accident at TEPCO’s Fukushima Power Stations –”, June 2011.