On September 12, 2011, the Japan Meteorological Agency announced the direction of improvements in the issuance of tsunami warnings in light of the tsunami damage caused by the 2011 off the Pacific coast of Tohoku Earthquake. The direction pointed out especially the problem in the first tsunami warning announced three minutes after the occurrence of the earthquake, where the predicted height was far below the actual one. In more detail:

- The scale of the earthquake was underestimated in the first tsunami warning, and the possibility of the underestimated evaluation was not recognized.
- The Japan Meteorological Agency could not release the succeeding tsunami warnings promptly. The Japan Meteorological Agency was expected to have predicted the tsunami highly accurately by using the moment magnitude (Mw)[1] of the earthquake calculated approximately 15 minutes after the earthquake, and release a series of succeeding tsunami warnings, because the seismic waves exceeded the measuring range of the seismometer to obtain the Mw value. Furthermore, the Japan Meteorological Agency had insufficient means of providing updated tsunami warnings that reflect the data of the cable-type ocean bottom pressure gauge located offshore.

The tsunami warning was updated with the announcement of the second tsunami warning (at 15:14) approximately 28 minutes after the earthquake and the third warning (at 15:30) 44 minutes after the earthquake. However, many residents in some areas could not get the announcement of the second tsunami warning due to the influence of a power outage.[2] Moreover, a tsunami wave with a height exceeding of 10 m may have hit some areas before the issuance of the third tsunami warning.[3] In addition to the technical problem of underestimating the tsunami in the first warning, an information transmission problem was revealed, because the important updated information affecting the evacuation of the residents did not reach them.

At the same time, this earthquake caused enormous damage to the telecommunication infrastructure around Tohoku and Kanto districts. This is because communications line disrupted by disaster-stricken base stations and relay stations, communications traffic got heavy congestion, because of a great increase in communications traffic, and operation of the information communications equipment was interrupted.. It is indispensable for saving people's lives, property, and functioning of the country to keep smooth communication of fundamental importance including emergency, safety, security, and damage minimizing

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1 The Japan Meteorological Agency uses the Japan Meteorological Agency magnitude scale (Mj) and moment magnitude scale (Mw) to calculate the magnitude of an earthquake to show the scale of the earthquake.
The Japan Meteorological Agency magnitude scale (Mj) uses the maximum amplitude of the waveform recorded in a strong-motion seismograph that observes strong shakes at a maximum of approximately five seconds. This method is excellent in the speed of calculation, which takes only three minutes or so after the occurrence of the earthquake. A massive earthquake with a magnitude of more than 8.0, however, involves greater seismic waves at longer periods, but the levels of seismic waves at cycles of up to five seconds are almost the same. Therefore, the Japan Meteorological Agency magnitude scale (Mj) estimates the scale of the earthquake smaller than it actually is, and the precise estimation of the scale is not possible.
On the other hand, the moment magnitude scale (Mw) system analysis and calculates seismic waves including those at cycles as long as several tens of seconds recorded in a wide-band seismometer (capable of observing seismic waves at much longer periods), thus making it possible to estimate the scales of great earthquakes precisely. Furthermore, it has a merit of making it possible to estimate the mechanism of quake generation (whether a reverse fault or strike-slip fault).It, however, requires approximately 10 minutes to process the seismic waveform data. Therefore, it takes approximately 15 minutes to estimate the moment magnitude (Mw) of the earthquake after the earthquake takes place.

2 The Crisis & Environment Management Policy Institute and staff members of the laboratory of Associate Professor Naoya Sekiya of Media Communications Studies at the Department of Sociology, Toyo University visited safe shelters located in Kamaishi, Iwate Prefecture and Natori, Miyagi Prefecture to interview residents evacuated there. According to the preliminary analysis of their questionnaire survey on the 2011 off the Pacific coast of Tohoku Earthquake, approximately 80% of Kamaishi's residents and 96% of Natori's residents saw or heard a warning of the large-scale tsunami. Kamaishi residents and Natori residents who were informed of a tsunami height of 3 m and that of 6 m, respectively, by the warning were large in number. It is highly possible that the second warning (i.e., the height of the tsunami was revised to 6 m from 3 m in Iwate Prefecture and 10 m or over from 6 m in Miyagi) was not transmitted to a large number of Kamaishi and Natori's residents evacuated.

3 The first tsunami warning for the coastal area of Iwate Prefecture announced a tsunami height of 3 m, the second tsunami warning announced a height of 6 m, and the third tsunami warning revised the height to 10 m or over. According to the tsunami observation facilities of Iwate Prefecture, the maximum height of the tsunami wave was 8.5 m or over in Miyako at 15:26 and 8.0 m or over in Ofunato at 15:18 (according to the emergency earthquake and tsunami bulletin of 2011 for the 2011 off the Pacific coast of Tohoku Earthquake complied by the Japan Meteorological Agency).

communication. Therefore, it can be said that the construction of disaster-tolerant information infrastructure including a network with excellent disaster resistance is a great issue imposed on Japan.

On the other hand, social media services[1] were effective for safety confirmation and sharing of earthquake-related information as long as internet and mobile phone access was possible. It is important to have a variety of communication means in case of emergency. In the future, it is necessary to study the effective use of such means of communication in combination with conventional communication tools, with consideration of characteristics of social media services, in which anyone can be a sender of information, prevention of spoofing, and disparity of information literacy.

(Issues on disaster prevention measures)

It was revealed that the Japanese government or local governments had not considered Japan's preparedness for large-scale disasters beyond presumption or wide-area complex disasters including the accident at the Fukushima NPSs.

Furthermore, it was revealed that Japan's conventional disaster prevention measures, which overly depended on facility hardware including shore protection facilities (e.g., embankments and breakwaters), had limitations in preventing damage caused by earthquakes and tsunamis beyond presumption. This fact poses a question to the state of conventional research in the field of disaster prevention, which focused on measures to mitigate hardware-oriented disaster damage, such as safety measures for residential areas and the construction of embankments and levees. In addition, a problem has been pointed out that there was a possibility that damage was expanded by hazard maps[2], which had been prepared on the basis of the conventional presumption that gave people a false sense of security.

There were areas where shore protection facilities alleviated tsunami damage (e.g., Taneichi Beach (Hiranai) in Hirono-cho, Iwate Prefecture and Yamamoto Coast in Yamamoto-cho, Miyagi Prefecture). On the other hand, there were areas that sustained enormous damage in spite of large seawalls, such as Taro District in Miyako, Iwate Prefecture (place of the 2-km-long, 10-m-high large seawall, the so-called "Great Wall of Taro"). These cases were reported at a meeting of the Committee for Technical Investigation under the Central Disaster Prevention Council and other occasions. Moreover, the predicted flooding ranges in conventional tsunami hazard maps were very different from the actual flooding ranges in many cases because the scale of the tsunami was beyond presumption (refer to Figure 1-1-5). This was reported along with the fact that the recognition rate of the hazard maps was not high in the disaster-stricken areas (i.e., about 20%) and there were cases that put people off guard because they were outside the flooding areas.

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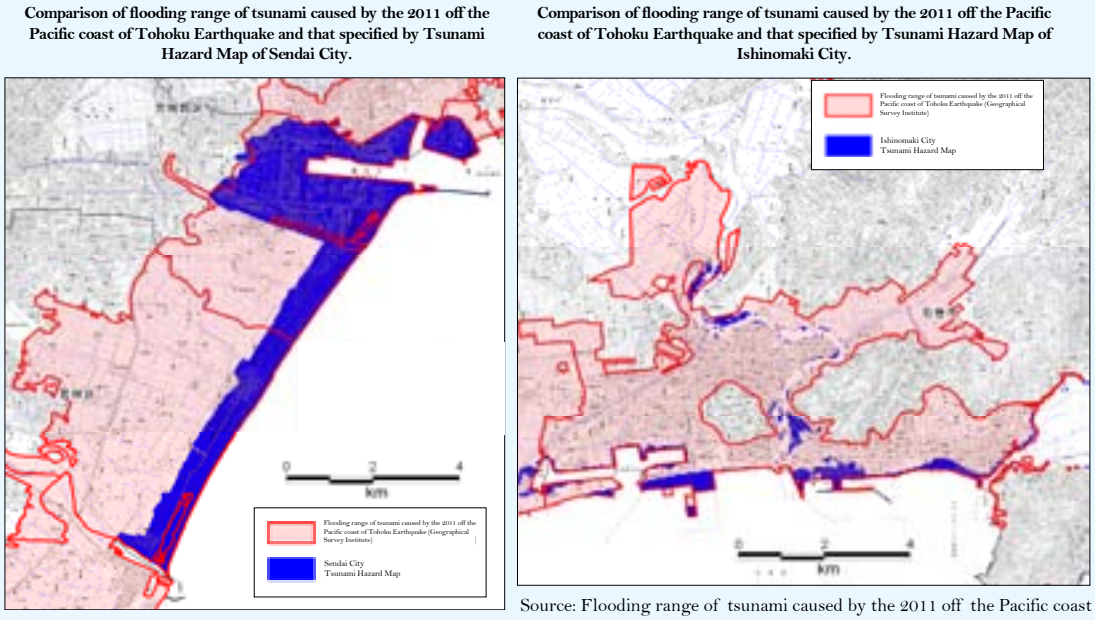
1 Social media services are bidirectional media communities in which a large number of users participate, and the participants share text and image contents transmitted by each individual. For example, Twitter, Facebook, and Mixi are social media services.

2 Hazard maps, which provide information on areas where natural disaster damage is presumed with the extent of the damage and sheltering places, are prepared in accordance with relevant acts, such as Article 14 of the Act Concerning the Special Fiscal Measures for the Urgent Earthquake Countermeasures Improvement Project to be Implemented in the Areas where Measures against Earthquake Disaster are Intensified, Article 14 of the Flood Prevention Act (Act No. 193 of 1949), and Article 6 of the Sediment Disaster Countermeasures for Sediment Disaster Prone Areas Act (Act No. 57 of 2000).

Figure 1-1-5 / Predicted Flooding Areas in Tsunami Hazard Maps and Actual Flooded Areas



Data: White Paper on Disaster Management, FY 2011

Source: Flooding range of tsunami caused by the 2011 off the Pacific coast of Tohoku Earthquake
Created from data of Geographical Survey Institute
Hazard Map: Tsunami Hazard Map of Sendai City
Tsunami Hazard Map of Ishinomaki City

(Issues on social communication about risks and issues related to the cultivation of awareness of disaster prevention)

The most important issue raised by the GEJE, is that a large number of human life could have been saved, if they had taken evacuation action immediately. As previously mentioned, this earthquake revealed the limitations of hardware, and that both proper decision in a critical moment and preparedness of residents during peacetime could make the difference between life and death. The earthquake disaster exactly reminded us of the importance of sharing a sense of risks through disaster prevention education and risk communication[1] during peacetime.

Japan is surrounded by the sea, and people enjoy four seasons and the beauty of mountains and rivers. On the other hand, Japan is one of the world's major earthquake countries. Since ancient times, people have lived with risks[2] of earthquake and tsunami disasters, learning lessons from their past disaster experiences and making efforts with their wisdom and ingenuity to alleviate disaster damage. The people may have forgotten the awe of nature and the lessons of the past, due to overestimating S&T. Furthermore, they may have neglected preparedness to various risks and crises. It can be said that the people, who saw the uncertainties and limitations of S&T with their own eyes, were forced to reaffirm the importance of preparations for risks and crises during peacetime.

As described, the GEJE raised issues concerning social communication about risks and issues related to the cultivation of awareness of disaster prevention in addition to the disaster prevention measures of the

1 Risk communication refers to a process attempting smooth communication, deepening mutual understanding, and consensus formation while residents, industries, and administrations properly share correct information related to risks and uncertainties (including potential risk and uncertainties).

2 A risk is usually defined as a hazard caused by the event of the risk multiplied by the probability of the occurrence of the risk event, but a different definition may be used depending on the field.

country, local governments and local communities.

b) Direction for and issues to be considered in future counter-earthquake and tsunami measures

Based on the verification of the earthquake disaster, relevant ministries including the Committee for Technical Investigation for the Central Disaster Prevention Council discussed the direction of countermeasures for earthquake and tsunami and action assignments for the realization.

(The concept of earthquakes and tsunamis as the target of disaster preventive measures)

The Committee for Technical Investigation of the Central Disaster Management Council showed its policy that target disaster should include enormous earthquakes and tsunamis of the largest class with consideration of all possibilities in preparation for disaster prevention in the future, and pointed out the necessity for the following items.

- Research for the mechanisms of earthquakes and tsunamis
- Completeness and reinforcement of the observation system for earthquakes and tsunamis toward the sophistication of prediction accuracy
- Development of tsunami prediction techniques

The massive tsunami induced by the earthquake with a scale of M9.0, occurred as a result of the concurrent occurrence of a usual ocean-trench earthquake linked with a tsunami earthquake.[1] This kind of earthquake can occur not only in the Japan Trench, where the 2011 off the Pacific coast of Tohoku Earthquake occurred, but also in other areas, such as the Nankai Trough.[2]

For this reason, the Committee for Technical Investigation states that the sufficient clarification of the generation mechanism of tsunami earthquakes, and the linkage between usual ocean-trench earthquakes and tsunami earthquakes is essential in the future, by the advancement of research and analysis, which will make it possible to predict tsunamis induced by massive ocean-trench earthquakes then prepare necessary measures to prevent the spread of disasters. Thus, the following items are considered important.

- In order to presume target earthquakes and tsunamis, it is necessary to investigate in detail the past earthquakes and tsunamis as much as possible and advance investigations including the analysis of historic documents, tsunami deposit investigation, and coastal topographic investigation based on scientific knowledge.
- When concrete disaster prevention measures are considered, presumed earthquakes and tsunamis should be set without hesitation even if the construction of necessary facilities to prevent damage from the presumed earthquakes and tsunamis are practically difficult.
- Integrated research should be promoted among various fields including the fields of humanities and social sciences (e.g., sociology, archeology, and history) as well as Earth sciences (e.g., seismology and geology).

Because it is difficult for current scientific knowledge to predict and elucidate natural phenomena

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1 A tsunami earthquake is an earthquake the magnitude (M) or seismic intensity of which is comparatively small but powerful enough to cause a large tsunami. The Meiji Sanriku Earthquake of 1896 is a typical example of a tsunami earthquake.

2 A trough is a long and rather wide groove that runs in the seabed with a maximum depth not exceeding 6,000 m. The Nankai Trough is a 700-km-long, narrow groove that runs almost east to west approximately 100 km off the south of the Tokai area, Kii Peninsula, and Shikoku.

exactly, full consideration should be given to the great uncertainty and limits of predicting natural phenomena. That is, a research of enormous earthquakes and tsunamis of the largest class is required with consideration of all possibilities based on the fact that it is difficult to predict earthquakes and that the long-term evaluation of such earthquakes involves uncertainties, thus setting certain limitations on the presumption of such earthquakes. For example, the Cabinet Office established the Nankai Trough Giant Earthquake Model Study Committee to research great earthquakes that may occur along the Nankai Trough based on the latest scientific knowledge and with consideration of lessons learned from the 2011 off the Pacific coast of Tohoku Earthquake. The Committee is discussing earthquakes and tsunamis of the largest class that should be presumed at the time of considering measures for such great earthquakes.[1] As for tsunami warnings, the Japan Meteorological Agency is enhancing technical arrangements including the techniques that can promptly recognize the possibility of underestimation. The Japan Meteorological Agency is also discussing certain arrangements from a safety viewpoint, such as the issuance of tsunami warnings based on safety-oriented presumption, in the case there is any uncertainty regarding tsunami warnings.

(Measures to mitigate damage caused by tsunamis and earthquake jolts)

In order to establish tsunami countermeasures in the future, it is necessary to presume two levels of tsunamis, i.e., an extremely large tsunami but with extremely low frequency that will cause extensive damage and a tsunami with a high frequent but low height that will cause heavy damage. It is necessary to consider damage mitigating measures for these tsunamis. The former (i.e., the tsunami of the largest class) requires disaster mitigation measures centered on the evacuation of residents. The latter (i.e., the tsunami with a comparatively high occurrence probability) requires measures centered on the maintenance of coastal maintenance facilities. That is, it is indispensable to mitigate disaster damage with combination of hardware measures and software measures; such as coastal maintenance facilities, and maintenance of hazard maps, disaster prevention education, and thoroughgoing risk communication during peacetime. As for hardware measures, it can be said that it is necessary to advance the technological development of structure that can demonstrate the effect of costal maintenance and similar facilities, even when a tsunami over the designed height would hit the area.

In addition, in order to ensure the smooth evacuation of residents, it is necessary to enhance communication and information transmission systems so that disaster information including tsunami warnings will accurately reach those in need of such warnings. Therefore, it can be said that it is necessary to implement R&D of technologies (e.g., technology to ensure smooth communication using all communication networks available in case of a disaster, and technology to accumulate a large volume of

[1] Based on the lessons of the Tohoku-Pacific Ocean Earthquake, the Cabinet Office established the Nankai Trough Giant Earthquake Model Study Committee in August 2011 to research great earthquakes and tsunamis of the largest class that may occur along the Nankai Trough. On December 27 the same year, the Cabinet Office released an interim report on the concept of setting a presumed focal area of a great earthquake in the Nankai Trough and the source area of a tsunami involved. The Committee in response to the report prepared an initial report on the intensity distribution of the great earthquake in the Nankai Trough and tsunami height on March 31, 2012. The initial report was prepared on the presumption that the scale of the earthquake used to estimate the intensity distribution and tsunami height would be M9 (the same as that of the 2011 off the Pacific coast of Tohoku Earthquake) in accordance with the guideline in a report of the Committee for Technical Investigation of the Central Disaster Management Council. That is, enormous earthquakes and tsunamis of the largest class with consideration of all possibilities should be presumed. By collecting the maximum values of a number of presumed patterns, the intensity distribution and tsunami height of the largest class were obtained. As explained, the results of the presumption do not predict the next earthquake and tsunami that are likely to occur along the Nankai Trough. Furthermore, it should be kept in mind that the report does not presume the occurrence of earthquakes and tsunamis with consideration of any occurrence probability in percentage within a limited period of years.

data) to realize a congestion-free information network. It is also necessary to implement R&D of technologies (i.e., the construction of cloud-to-cloud[1] infrastructure that promptly transfers important data from the cloud computer in a disaster-stricken area to that in a remote safe area in case of wide-range disaster) improving resistance to disasters.

In addition, there was a research on long-term ground motion,[2] which may have an adverse influence on skyscrapers. In the case of the GEJE, there was little long-period motion, due to which, the earthquake did not cause so serious damage to high-rise buildings. However, future earthquakes may generate long-term ground motion depending on the period and propagation characteristics of the ground motion. For this reason, it will be necessary to study long-term ground motion with consideration of the period characteristics and duration of each earthquake in addition to the seismic intensity and reinforce the earthquake resistance of skyscrapers.

(Towards improvements in regional disaster prevention capabilities with public assistance, mutual assistance, and self-assistance)

In addition to these, it is necessary for municipalities and regional communities to work together to make regional disaster prevention plans[3] and city plans linked organically with one another, and promote the construction of disaster-resistant towns. At that time, software measures (e.g., emergency drills) for improvements in regional disaster prevention capabilities will be indispensable in addition to the maintenance of hardware, such as disaster prevention facilities. Furthermore, it is necessary to raise the self-assist consciousness of residents (people) so that they can evacuate themselves to higher places without hesitation when they feel a strong or long jolt. In Kamaishi, Iwate Prefecture, approximately 3,000 junior high school students and elementary schoolchildren escaped from the enormous tsunami caused by the GEJE. They had been continuously given tsunami disaster prevention education centered on three evacuation principles, i.e., "Do not be restricted by presumption," "Do your best under given circumstances," "Be an evacuee taking the initiative," under the guidance of Graduate School Professor Toshitaka Katada at Gunma University, the Kamaishi Municipal Governments. As explained, nothing is more important than to raise residents' awareness of disaster prevention through disaster prevention education and drills while deepening the scientific understanding of residents (people) to earthquakes and tsunamis. Therefore, it is essential to advance research on improvements in humans' risk evading capabilities with consideration of the perspectives of humanities and social sciences including human behaviors and psychology. Then people would be able to take appropriate evacuation activities in case of disaster. Furthermore, it is essential to promote disaster prevention education and risk communication during peacetime.

In addition, in order to prevent the weathering of disaster memories and lessons, it is necessary to record electronically the results of the scientific verification and analysis of this earthquake and tsunami

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1 The cloud is a server group on a network.

2 Ground motion consists of shakes is various periods, such as shakes of in short periods and repetitive shakes for long periods. A long-period ground motion refers to repetitive shakes for long periods.
Long and large structures, such as high-rise buildings, oil tanks, and bridges, shakes for a natural period of several seconds to several tens of seconds. Long-period ground motion generated by a great earthquake may cause great shakes. Unlike short-term seismic waves, long-term ground motion travels a long distance without being weakened, and may be amplified depending on the configuration of plains and basins. Therefore, a long and large structure in an area far away from the epicenter may jolt unexpectedly.

3 A regional disaster prevention plan is created by the prefectural disaster prevention council and municipal disaster prevention council in accordance with Article 40 and Article 42 of the Disaster Countermeasures Basic Act (Act No. 223 of 1961).

and the history of reconstruction and hand down the records to the following generations as global common property.[1]

(ii) Discussion at Domestic and Overseas S&T Communities

a) Movements of Japan's S&T Communities, such as the Science Council of Japan and Related Societies

It is not only the government who are reflecting on their response to this disaster and drastically reviewing the direction of science technology and academic research. The Science Council of Japan and other academic associations related to earthquake and disaster prevention are jointly conducting a variety of discussions.

For example, the Committee on Comprehensive Measures against the Great East Japan Earthquake (hereinafter "the Committee on Comprehensive Measures") of the Science Council of Japan is one of such organizations. The Committee on Comprehensive Measures was established as a liaison organization by academic associations in a wide range of fields, such as the fields of science and engineering, agriculture, fisheries science and humanities. On May 27, 2011, the Committee on Comprehensive Measures summarized challenges that should be worked on for improvements in the earthquake and tsunami disaster prevention and mitigation capabilities of Japan as a country that experienced the 2011 off the Pacific coast of Tohoku Earthquake. Since then the Committee on Civil Engineering/Architecture and the Committee on Comprehensive Measures of the Science Council of Japan have been holding a continuous symposium "Protecting Life and Land from Great Disaster - Transmission from 24 Academic Societies" for the purpose of realizing more appropriate arrangements and measures for disasters, such as the 2011 off the Pacific coast of Tohoku Earthquake and others that Japan may experience in the future, based on information exchange and discussions of a large number of parties concerned beyond the conventional framework.

On June 30, 2011, the Committee on the Earth and Planetary Science of the Science Council of Japan and Japan Earth and Planetary Science Joint Meeting issued a joint statement "Rebuilding a Strong Japanese Society to Face Natural Disaster," about what they can do now, under sincere remorse on their insufficient awareness of the tsunami and earthquake that caused enormous damage. The joint statement reflects on the problematical points of the conventional long-term evaluation of earthquake occurrence, the importance of establishing a disaster prevention system and social infrastructure on the premise of limitations on the prediction of earthquake occurrence and uncertainty, the insufficient emergency warning system, and the necessity for the response of the cross-field team of academic societies in a wide range to multiple and chain disasters. Then the statement indicates the direction of improvements under the cooperation of the Joint Meeting. On February 11, 2012, the academic symposium "A Way to the Mitigation of Great Disaster and the Realization of a Sustainable Society Based on Lessons learned from the Great East Japan Earthquake" was held under the cooperation of the Executive Committee of

[1] Disaster victims, the local governments in the disaster-stricken areas, national research institutions, universities, nonprofit organizations, volunteers, and private sectors cooperated and launched the Great East Japan Earthquake□Disaster Recovery Marugoto Digital Archives (311 Marugoto Archives Project) in June 2011. The project was launched with the aim of digitally recovering past memories of the devastated area as well as digitally archiving images and materials showing the present and those related to reconstruction plans for the future under the recognition that it is the responsibility of the current generation to hand down the experience and lessons of the Great East Japan Earthquake for the next 1,000 years and construct a safe society. Digital contents in the Archives are in principle posted on the Internet after clearing up personal information, image rights and copyrights issues, so as to be available at libraries, museums, universities and research institutes both locally and globally, as reference materials for reconstruction plans of the region and disaster prevention studies.

Science Council of Japan in planning the symposium. The symposium was planned for the purpose of sincerely accepting lessons learned from the GEJE from various perspectives, mitigating future great disasters and ensuring Japan's steps toward a sustainable society, face to this issue from the viewpoint of earth and planetary sciences, and thinking of the way that Japan and the world should proceed.

The Seismological Society of Japan held a special symposium "Current Questions about Seismology - the 2011 off the Pacific coast of Tohoku Earthquake" in its 2011 Fall Meeting (October 12 to 15, 2011) . The members of the Seismological Society deeply regretted that their contribution to society in the aspect of disaster science was insufficient, and they discussed the problematical points of earthquake research in the past, the direction of next research and how it contributes to society. In particular, Session 1 discussed the theme "Why the 2011 off the Pacific coast of Tohoku Earthquake was not predicted - Identification of problems in Seismology for future research-, and they stated that it was a major defeat of seismology (omitted) that it could not predict or even point out the occurrence of the M9.0 earthquake in the Tohoku area. They explained that it is necessary to think of what should be done after thoroughly discussing the problems in the direction of the research and research structure in the past (omitted) in order to regain the people's trust in seismology.

Similarly, the proposition of the Geological Society of Japan (on April 5, 2011) pointed out directly that the occurrence of a massive earthquake like the GEJE should have been presumed based on the fact that massive earthquakes occurred in the world for the last few decades and with consideration of the results of recent research.

b) Trends in Overseas S&T Communities and Holding of International Symposiums

The 2011 off the Pacific coast of Tohoku Earthquake with a scale of M9.0 had great impact on overseas S&T communities as well. Immediately after the earthquake, a large number of domestic and overseas researchers and research institutions used Japan's conventional seismic land network, data on tsunami recorders and wave recorders meters in the Japanese waters, and observational data on the crustal deformation of the ocean floor and analyzed the generation process of the earthquake. As a result, the characteristics of the slippage in the plate boundary became clear. They found the process of the slippage in the plate boundary off the Pacific coast of the Tohoku region and it was certain that the slippage was rapid with a maximum distance of 50 m or more. The results of the research, which will be very important knowledge to measures for earthquake and tsunami disaster prevention in the future, are transmitted internationally through academic journals.[1]

At the same time, various agencies held international symposium aiming at worldwide share of experiences of the GEJE. For example, International Cooperation Agency, the Japan Science and Technology Agency, and the National Research Institute for Earth Science and Disaster Prevention jointly held the "International Symposium on Earthquake & Tsunami Disaster Reduction -Learning from the Great East Japan Earthquake-" in Sendai, a disaster-stricken areas, on May 14 to 15, 2012. The symposium was held for the purpose of sharing the valuable experiences of the 2011 0ff the Pacific coast of Tohoku Earthquake in Japan and earthquakes in other countries, such as Indonesia, the Philippines,

[1] These academic journals include: The June 17, 2011 issue of Science, an international comprehensive science magazine (the 2011 Magnitude 9.0 Tohoku-Oki Earthquake: Mosaicking the Megathrust from Seconds to Centuries) and the December 2, 2011 issue of the same magazine (the 2011 Tohoku-Oki Earthquake: Displacement Reaching the Trench Axis).

Peru and Chile, and lessons that people learned from these disasters and utilizing them for the earthquake and tsunami disaster prevention in each country. The participants discussed measures to reinforce the disaster prevention capabilities of each country against the earthquakes and tsunamis of the world.

UNESCO[1] and United Nations University jointly held an international symposium "The Great East Japan Tsunami and Tsunami Warning Systems: Policy Perspectives" on February 16 and 17, 2012. A tsunami was observed on the Pacific coast side of each country in the world, and the participants reconfirmed that cross-border initiatives are necessary for tsunami disaster prevention. Researchers and members in charge of disaster prevention from all countries gathered and confirmed that it is necessary for each country to share Japan's experiences and lessons. Furthermore, they emphasized the importance of the development of tsunami warning systems, and the reinforcement of disaster prevention hardware based on S&T and the importance of software measures including disaster prevention education.

(2) Response to the TEPCO Fukushima Nuclear Power Stations Accident

1) Accident Overview and Development

The TEPCO Fukushima Daiichi Nuclear Power Station (NPS) had six nuclear reactor units; Unit 1 through Unit 3 were under operation, and Unit 4 to Unit 6 were under periodic inspection when the 2011 off the Pacific coast of Tohoku Earthquake occurred at 14:46 on March 11, 2011. All the reactors under operation stopped automatically when the earthquake hit. At the same time, however, the external power supply sources were lost. Furthermore, the emergency diesel power generators that automatically started up were stopped by the tsunami strike except for the generator for Unit 6. The NPS lost all AC power supplies approximately one hour after the earthquake. Furthermore, Units 1, 2 and 3 lost an emergency core cooling function that does not use AC power supplies as a countermeasure to situations like this. Fire pumps were then employed to cool the cores with the injection of freshwater or seawater. It took a certain time, however, for the recovery of the reactor cooling function. Therefore, the nuclear fuel in the reactor cores was exposed and led to core melt.

Meanwhile, hydrogen was generated from the reactors, and on and after March 12, the reactor buildings exploded, the cause of which was considered to be the hydrogen. The above accident and other events caused the dispersion of radioactive materials over a wide range from the nuclear reactors of TEPCO Fukushima Daiichi NPS, which greatly affected the lives and environment of the residents in the area and the natural environment, people's lives, society, and economic activities of Japan.

Furthermore, the residual heat removal system of TEPCO Fukushima Daini NPS was damaged. On March 15, however, Units 1 through 4 all reached cold shutdown status.

The government tentatively estimated the accident as level 7 as the most serious accident on the International Nuclear Event Scale (INES) on April 12 based on the trial calculation of the total amount of radioactive material accidentally discharged into the air from TEPCO Fukushima Daiichi NPS. This level was as serious as the level of a catastrophic nuclear accident that occurred at the Chernobyl Nuclear Power Plant in 1986.

Table 1-1-6 shows the progress of the accident and the responses of the government and TEPCO.

[1] A specialized agency of the United Nations established on November 4, 1946 based on the Charter of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Table 1-1-6 / Progress of TEPCO Fukushima NPSs accident and history of responses of the Government and TEPCO to the accident

Date & Time	Event
March 11 14:46	• The 2011 off the Pacific coast of Tohoku Earthquake occurred.
to 14:48	• 1), 2), and 3): automatically shutdown; external power supply lost; and emergency diesel generator automatically started.
14:49	• The Japan Meteorological Agency announced a tsunami (great tsunami) alert in Iwate, Miyagi, and Fukushima Prefectures.
15:14	• The Prime Minister set up the headquarters for extraordinary disaster control (HEDC).
15:27	• TEPCO Fukushima Daiichi Nuclear Power Station (NPS) was hit by tsunami (TEPCO Fukushima Daini NPS hit by tsunami at 15:23 on the same day)
15:42	• 1), 2), and 3): The event (total loss of AC power) prescribed in Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereinafter referred to as "Nuclear Disaster Act") occurred.
16:36	• 1) and 2): The event (functional loss of ECCS disabled) prescribed in Article 15 of Nuclear Disaster Act occurred.
16:40	• MEXT instructed Nuclear Safety Technology Center (Nustec) which manages the System for Prediction of Environmental Emergency Dose Information (SPEEDI) to switch over to the emergency mode of the SPEEDI system. According to an instruction of the said Ministry, Nustec started to deliver the prediction results of the regular calculation assuming a unit emission to MEXT, the Nuclear and Industrial Safety Agency, the Nuclear Safety Commission, etc.
19:03	• The Prime Minister issued a "declaration of a nuclear emergency situation" of TEPCO Fukushima Daiichi NPS. The Prime Minister also established "Nuclear Emergency Response Headquarters related to the accident at TEPCO Fukushima Daiichi Nuclear Power Station (2011)", appointing himself as the general manager (in response to the declaration of a nuclear emergency situation of TEPCO Fukushima Daini NPS dated March 12, the name was changed into "Nuclear Emergency Response Headquarters related to the accidents at TEPCO Fukushima Daiichi Nuclear Power Station and TEPCO Fukushima Daini Nuclear Power Station (2011). Hereinafter called NERH").
21:23	• The general manager of the NERH instructed residents living within 3km radius from TEPCO Fukushima Daiichi NPS to evacuate the area and residents living within 3km to 10km radius from the Plant to take shelter indoors.
March 12 5:44	• The general manager of the NERH instructed residents living within a 10km radius from TEPCO Fukushima Daiichi NPS to evacuate the area.
7:45	• The Prime Minister issued a "declaration of a nuclear emergency situation" with respect to TEPCO Fukushima Daini NPS. • The general manager of the NERH instructed the residents living within 3km radius from TEPCO Fukushima Daini NPS to evacuate the area and residents living within a 10km radius from the Plant to take shelter indoors.
15:36	• 1): Hydrogen explosion occurred in the reactor building.
17:39	• The general manager of the NERH instructed residents living within a 10km radius from TEPCO Fukushima Daini NPS to evacuate the area.
18:25	• The NERH instructed residents living within a 20km radius from TEPCO Fukushima Daiichi NPS to evacuate the area.
March 13 5:10	• 3): The event prescribed in Article 15 of the Nuclear Disaster Act (loss of reactor cooling function) occurred.
17:58	• The Japan Meteorological Agency canceled all tsunami warnings.
March 14 11:01	• 3): Hydrogen explosion occurred in the nuclear reactor building.
	• The Ministry of Health, Labour and Welfare (MHLW) and the Ministry of Economy, Trade and Industry (METI) consulted the Radiation Council of MEXT about raising the radiation level limit at emergency from 100mSv to 250mSv for workers engaged in emergency work, and then received a report from the Council on the same day of consultation, stating that these values were appropriate (as for public workers engaged in emergency work, the National Personnel Authority consulted the Advisory Council on March 16 and then received a report stating that these values were appropriate on the same day.)
March 15 5:30	• The Government and TEPCO established the "the Government – TEPCO Integrated Headquarters for Response to the Incident at the Fukushima Nuclear Power Stations" (General manager: the Prime Minister) (The name was changed into the "Government/TEPCO Integrated Emergency Office" on May 6, and then into the "Government and TEPCO's Mid-to-Long Term Countermeasure Meeting on December 16.).
6:10	• 2): Abnormal sound was heard in the vicinity of the pressure suppression chamber.
6:14	• 4): Hydrogen explosion occurred in the nuclear reactor building.
7:15	• Cold shutdown of Unit 1-4 of TEPCO Fukushima Daini NPS was completed.
11:00	• The general manager of NERH instructed residents living within a 20km to 30km radius from TEPCO Fukushima Daiichi NPS to take shelter indoors.
March 16	• Determination of roles to be taken within the Government on the environmental monitoring of the areas beyond 20km from TEPCO Fukushima Daiichi NPS. (MEXT: Compilation and publication of acquired monitoring data; Nuclear Safety Commission: Assessment of the monitoring data; and NERH: Taking measures according to the assessment made by the Nuclear Safety Commission)
March 17	• MHLW set up provisional regulation values related to limits on food and drink ingestion. • The Ground Self-Defense Force sprinkled water over the spent fuel pool of Unit 3 of TEPCO Fukushima Daiichi NPS from helicopters (since then, cooling of the spent fuel pool of TEPCO Fukushima Daiichi NPS had been continued.).
March 18	• MEXT established a "health counseling hotline."
March 19	• MHLW set the index related to the radioactive substance in tap water.

March 20	• The quantity of radioactive substance exceeding the index value on food and drink intake limit from the tap water in Iitate Village in Fukushima Prefecture was detected.
March 21	• NERH related prefectural governments to put shipping restrictions on food and drink (spinach, *kakina*, and raw milk) (since then, NERH instructed each prefectural government to put shipping restrictions on their outputs.). • MHLW set the index for intake by infants on the limit of quantity of radioactive substance included in tap water (since then, quantities of radioactive substance in excess of the index value for infants from the tap water in cities, towns, and villages in Fukushima Prefecture and Kanto region had been detected.).
March 23	• Since March 16, the Nuclear Safety Commission had made use of the SPEEDI to calculate and estimate the amount released based on the measured values monitored in the past, and then, reentered the estimated values to make a trial calculation of the integrated dose for the period from March 11 till March 24. The volumes were then published.
March 26	• With the help of experts such as those of the National Institute of Radiological Sciences, the local Nuclear Emergency Headquarters conducted an investigation of thyroid exposure of children (1,080 persons) in the area, which required taking shelter indoors or in the area in which thyroid equivalent dose was estimated higher in a test calculation using SPEEDI (issued on March 23) (which had been carried out until March 30).
March 29	• NHRH established "Nuclear Sufferers Life Support Team" under its supervision.
April 4	• TEPCO released into ocean the water retained within TEPCO Fukushima Daiichi NPS (continued until April 10).
April 11	• Dispute Reconciliation Committee for Nuclear Damage Compensation was established.
April 12	• METI provisionally evaluated the present incident as that of level 7 (severe accident) in the International Nuclear and Radiological Event Scale (INES).
April 17	• TEPCO determined a "Roadmap towards Restoration from the Accidents at Fukushima Daiichi Nuclear Power Station" (hereinafter referred to as "roadmap").
April 19	NERH decided to implement "Provisional view regarding the judgment of the use of schoolyards and educational facilities in Fukushima Prefecture." Based on this, MEXT issued the notification to the Fukushima Prefecture Board of Education, etc.
April 21	• The general manager of NERH determined to set the area within a 20km radius from TEPCO Fukushima Daiichi NPS as a restricted area. Further, the evacuation area was changed from within a 10km radius to a 8km radius from TEPCO Fukushima Daini NPS.
April 22	• The general manager of NERH canceled the instruction of taking shelter indoors shelter given to residents living within a 20km to 30km radius from TEPCO Fukushima Daiichi NPS and newly set up deliberate evacuation areas and areas prepared for emergency evacuation. • The general manager of NERH instructed residents in Fukushima Prefecture to refrain from rice planting in zones from which evacuation was forced.
April 26	• MEXT started to publish the results of trial calculations by SPEEDI under the assumption that the 1 Beq of radioactive substance had been released from TEPCO Fukushima Daiichi NPS, which had been carried out from March 11.
April 28	• The Dispute Reconciliation Committee for Nuclear Damage Compensation formulated the "first guideline concerning the determination of the scope of nuclear damage caused by the accidents at TEPCO Fukushima Daiichi NPS and TEPCO Fukushima Daini NPS." (Afterwards, the second guideline (May 31), supplement to the second guideline (June 20), intermediary guideline (August 5), supplement to the intermediary guideline (December 6), and 2nd supplement to the intermediary guideline (March 16, 2012) were sequentially formulated.)
May 3 and 4	• The Nuclear Safety Commission, MEXT and NISA started to publish the results of trial calculations by SPEEDI under the assumption that varying amounts of radioactive substance had been released from TEPCO Fukushima Daiichi NPS.
May 10	• The Prime Minister announced a review of the Basic Energy Plan from the very beginning.
May 17	NERH laid down "Roadmap for Immediate Actions for the Verification of and Restoration from the Accident at Fukushima Daiichi Nuclear Power Station," "Immediate Actions for the Assistance of Nuclear Sufferers," and "Roadmap for Immediate Actions for the Assistance of Nuclear Sufferers."
May 19	• The governor of Fukushima Prefecture announced an implementation of "The Fukushima Health Management Survey" (The distribution of a basic survey questionnaire to all the prefectural residents started at the end of August).
May 24	• The Cabinet decided to hold "the Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company" (Committee chairman: Yotaro Hatamura, Professor Emeritus, the University of Tokyo and Professor of Kogakuin University).
June 7	• NERH decided on the "Report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety." (The additional report was decided on September 11.)

June 27	• Fukushima Prefectural Government started to check for internal exposure to radiation.
June 30	• NERH set 104 points of place in Date City as "specific spots recommended for evacuation" (Afterwards, 57 spots in Minamisoma City on July 21, 65 spots in Minamisoma City on August 3, 1 spot in Kawauchi City on the same day, 13 spots in Date City on November 25, and 20 spots in Minamioma City on the same day have been set.).
July 4	• Relevant ministries and agencies jointly held a "Monitoring Coordination Meeting."
July 19	• NERH confirmed the achievement of Progress Schedule Step 1.
July 29	• "Act on Emergency Measures for damages caused by the nuclear accident in 2011" was established
August 2	• The Monitoring Coordination Meeting established the "Comprehensive Monitoring Plan" (revised on March 15, 2012). • MEXT prepared a "radiation dose of distribution map" (dosimetry map) (Afterwards, soil concentration map etc. had been continuously prepared.).
August 3	• The "Law on Nuclear Damage Liability Facilitation Fund" was established.
August 9	• NERH established a "basic concept for rearranging the areas of evacuation."
August 15	• The Cabinet determined a "Basic Policy on the Reform of an Organization in charge of Nuclear Safety Regulation."
August 26	NERH determined a "Basic Concept for Pushing Ahead with Decontamination Works," a "Policy for Emergency Response on Decontamination Work ," and a "guideline for implementation of decontamination by municipalities." The "Act on Special Measures concerning the Handling of Environment Pollution by Radioactive Materials emitted by NPS related to the 2011 Off the Pacific coast of Tohoku Earthquake that occurred on March 11, 2011" was established.
August 29	• The "The Center for Dispute Resolution for Compensating Damages" was opened under The Dispute Reconciliation Committee for Nuclear Damage Compensation. (Registration was started for mediation of settlement from September 1; Fukushima Office (Koriyama) was opened on September 13)
September 12	• The Nuclear Damage Liability Facilitation Fund was established.
September 21	• Reception of applications for provisional payments by the Japanese Government was started.
September 30	• The general manager of NERH canceled the designation of areas prepared for emergency evacuation.
November 11	• The Cabinet determined a "Basic Policy on Act on Special Measures concerning the Handling of Environment Pollution by Radioactive Materials emitted by NPS related to the 2011 Off the Pacific coast of Tohoku Earthquake that occurred on March 11, 2011."
November 22	• The Nuclear Victims Life Support Team determined a "catalog on decontamination technology."
December 8	• "Fukushima Nuclear Accident Independent Investigation Commission" was established within the National Diet.
December 14	• The Ministry of the Environment established a "decontamination guideline."
December 16	• NERH confirmed the completion of Progress Schedule Step 2 (realization of cold shutdown status, etc.).
December 21	• Government and TEPCO's Mid-to-Long Term Countermeasure Meeting determined a "Mid-and-Long-Term Roadmap towards the Decommissioning of Fukushima Daiichi Nuclear Power Station Unit 1-4, TEPCO."
December 22	• The Cabinet Office's "Working Group on risk management of low dose radiation exposure" compiled a report. • MHLW determined a "guideline for the prevention of radiation hazards for workers engaged in decontamination operations, etc."
December 26	• The Prime Minister issued a "declaration of the cancellation of nuclear emergency situation" for TEPCO Fukushima Daini NPS. NERH determined "Basic concept and issues to be challenged for rearranging the restricted areas and areas to which evacuation orders have been issued where step 2 has been completed." • The TEPCO Fukushima Nuclear Power Station Accident Investigation and Verification Committee compiled an interim report. • MHLW consulted with the Radiation Council for a review of the indexes related to radioactive substances in tap water (those for food on December 27). (Reported on February 16, 2010 to the effect that it is reasonable for both.)

The following events are those which occurred in 2012	
January 26	• The Ministry of the Environment determined a "Plan for decontamination of special area" (Roadmap for decontamination).
March 5	• MHLW set the target values for management on radioactive substances in tap water (to be applied from April 1).
March 15	• MHLW set the standard limits of radioactive substances in food (for some items (apply transitional measures enacted April 1).
March 30	• NERH determined a review of restricted areas and areas to which evacuation orders have been issued in Kawauchi Village, Tamura City, and Minamisoma City (The Headquarters newly established areas to which evacuation orders have been issued in Kawauchi Village and Minamisoma City on April 1, and in Tamura City on April 16).

Notes: 1. If time is not specified in the columns before March 16, it indicates that a described item of work had been implemented by the end of the specified date.
2. Items marked with any one of "1)" through "6)" indicate that they describe the corresponding Unit No. 1 through 6 of the TEPCO Fukushima Daiichi Nuclear Power Station, respectively

Materials: Created by MEXT.

2) Issues Raised through Responses to the Accident and Investigation and Verification

(i) Indications of accident investigation and verification activities

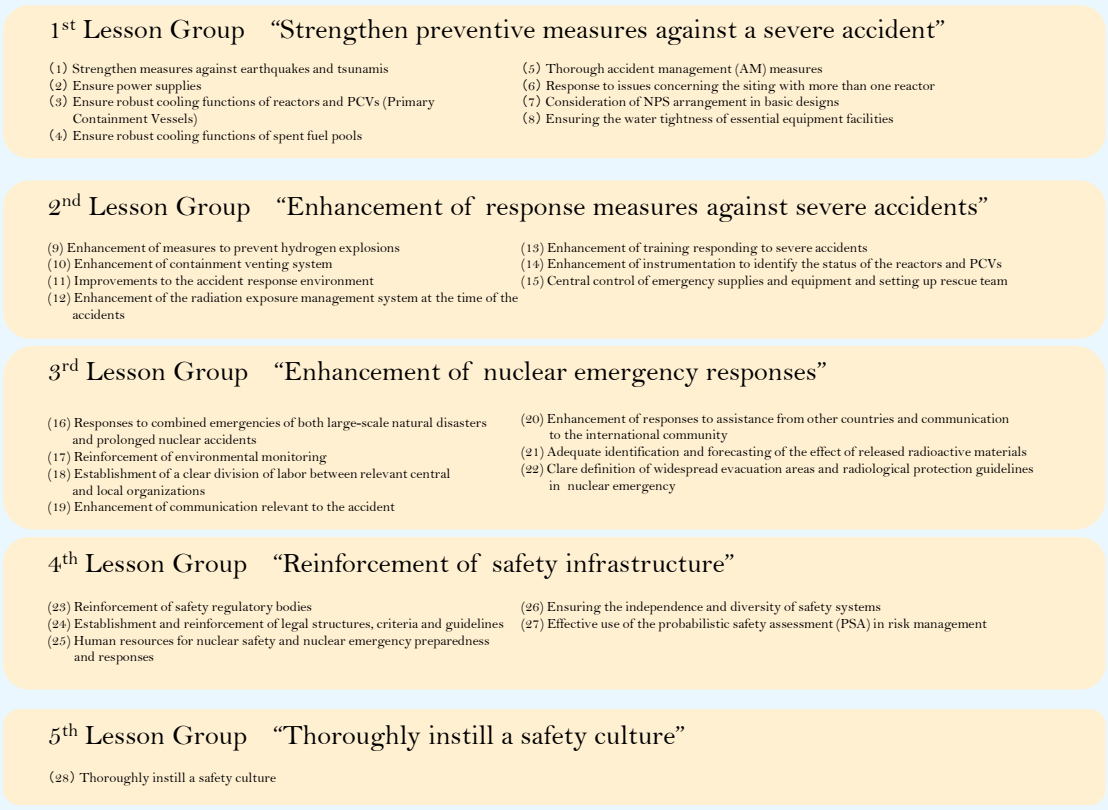
No other accidents have not only had a more impact on the life of the Japanese people but also attracted more attention from the international society than those at the TEPCO Fukushima NPS. Currently, in parallel to responding to the accidents, accident investigation and verification initiatives have been carried out, out of which the following items of lessons and issues have come out for us to remember.

a) Report of the Japanese Government to the IAEA

Towards the IAEA ministerial conference on nuclear safety held in June 2011, the Nuclear Emergency Response Headquarters (NERH) had prepared a June report to the IAEA (Figure 1-1-7). In this report, after having said, "The fact that this accident has raised concerns around the world about the safety of nuclear power generation is a matter which Japan takes with the utmost seriousness and remorse. Above all, Japan sincerely regrets causing anxiety for people all over the world about the release of radioactive materials," it is stated that 28 lessons learned so far through the occurrence and progress of nuclear accidents and the measures taken to deal with the nuclear disaster were lined up, such as strengthening preventive measures against a severe accident including measures against tsunamis exceeding the ones assumed in design and securing of emergency power supply sources and the cooling robust function of nuclear reactors; and improvement of measures to be taken to prevent hydrogen explosion.

In addition, in the declaration and the Chairman's summary in the concluding session of the IAEA ministerial conference, it has been mentioned that continuous provision of information from Japan is demanded for, and from the viewpoint that it is Japan's responsibility to continuously provide the international society with accurate information concerning the nuclear accidents, including lessons learnt from them, the Japanese Government prepared an additional report on the situation from the date of the June report onward (the September report to the IAEA) and submitted it to the of the IAEA Board of Governors and the IAEA General Meeting in September .

Figure 1-1-7 / 28 item of lessons pointed out in the June report to the IAEA



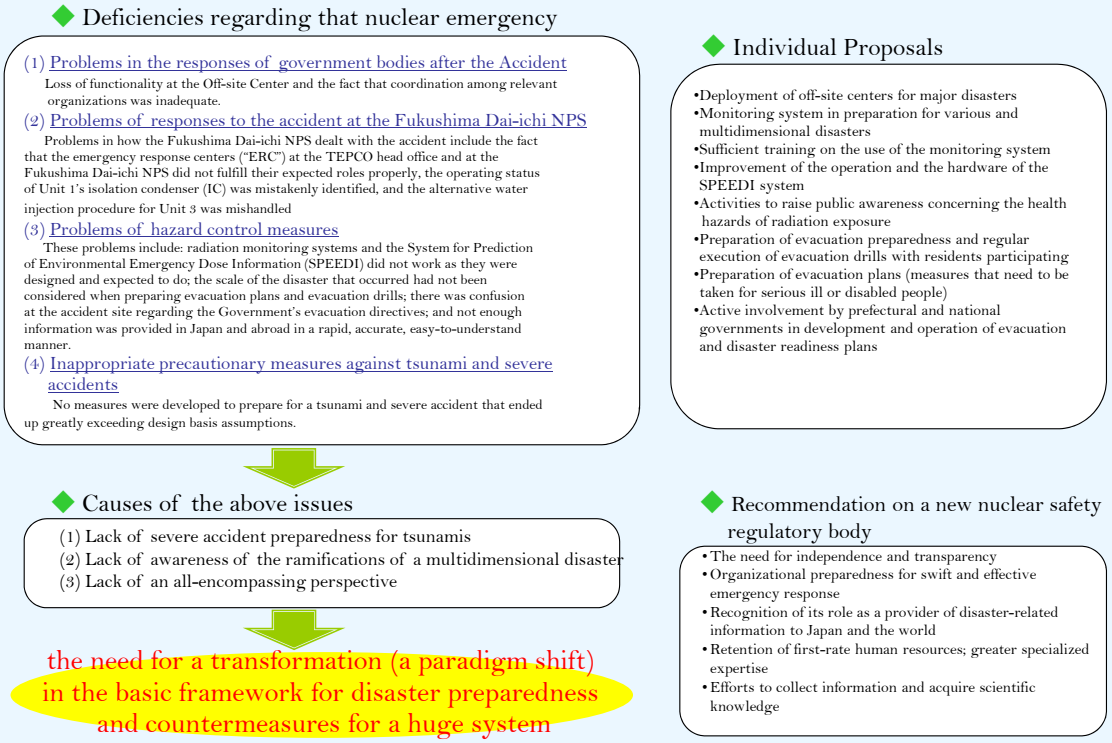
Materials: Created by MEXT based on the "Japanese Government's report to the IAEA Ministerial Conference on nuclear safety—about the accidents at the TEPCO Fukushima Nuclear Power Stations (NERH, in June 2011).

b) Interim report of the Government's Accident Investigation Committee

Establishment of the Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company (chaired by Yotaro Hatamura, professor emeritus of the University of Tokyo; hereinafter referred to as "Government's Accident Investigation Committee"), for the following purpose: "Its objectives are: to conduct investigation for finding out the causes of accidents at the Fukushima Daiichi Nuclear Power Station (Fukushima Daiichi NPS) and Fukushima Daini Nuclear Power Station (Fukushima Daini NPS) of TEPCO as well as the causes of accident damage; and to make policy recommendations for limiting the expansion of damage and preventing reoccurrence of similar accidents,". Since the first Committee meeting held on June 7, the Committee had gone ahead with their investigation and verification activities through their direct visits of its members to the sites and their interviews with more than 400 people concerned, and had prepared an interim report on December 26. This report refers to problem in the responses of government bodies after the accident, problems of hazard control measures, and inappropriate precautionary measures against tsunami and severe accidents, etc. It also includes proposals to recommendations on a new nuclear safety regulatory body (Figure 1-1-8). Some of the points to be remembered will be mentioned below.

The said Committee has an intention to proceed further with its investigation and verification activities and to compile a final report in summer of 2012.

Figure 1-1-8 / Key points of Accident Investigation and Verification Committee's interim report on the accidents at the TEPCO Fukushima Nuclear Power Station



Materials: Created by MEXT based on the "interim report (compiled on December 26, 2011 by Accident Investigation and Verification Committee on the accidents at the TEPCO Fukushima Nuclear Power Stations).

c) Other Investigation and Verification Activities

Apart from the investigation and verification activities conducted by the Government's Accident Investigation and Verification Committee, MEXT established a verification team within the Ministry in October 2011, which not only compiled and verified initiatives, issues and lessons in various areas of competent authorities but also publicized 10 proposals including revision of the Manual on Response to Nuclear Accidents and Disasters (the summary of the intermediate results of verification of recovery and reconstruction initiatives after the GEJE (First report), prepared on December 22, 2011 and is now working on continued compilation of the second report.

Non-governmental organizations have been also making efforts to investigate and/or verify the accidents. In the National Diet, the Fukushima Nuclear Accident Independent Investigation Commission (Chairman: Kiyoshi Kurokawa, Professor Emeritus, The University of Tokyo, former president of the Science Council of Japan) was established on October 30 to start their activities as an investigation commission independent from the Government to carry out investigation and verification of the accidents. The said Commission was assigned not only to conduct investigations to clarify the causes of the TEPCO Fukushima NPS accidents and the damages caused by them, to clarify and verify the contents, processes, and effects of measures taken by administrative organizations concerned, and to investigate the so-far made decisions or agreements on nuclear policies and their details, but also to propose policies or measures to prevent accidents at NPS and to mitigate damages caused by their occurrences (including

reviews of basic policies on nuclear energy and administrative organizations).

The "Independent Investigation Commission on the Fukushima Nuclear Accident" of the Rebuild Japan Initiative Foundation as a private organization, standing on the side of citizens independent of the Government and corporations, conducted their own investigations and verifications of the accidents through interviews with government officials and many others engaged in responding to the accidents.

Among communities of scientists, the Great East Japan Earthquake Taskforce of the Science Council of Japan publicized the recommendation on September 30 entitled "Towards a Reconstruction of the Areas Affected by the GEJE—Reconstruction Targets and Seven Principles (Second recommendation)." In this recommendation, the Task Force presented concrete proposals especially on decontamination of radioactive materials, establishment of the right to existence, early determination of reconstruction plan, development of renewable energy, and continuance and regeneration of cultural landscapes, and securement of financial resources, and then stated the determination of the Science Council of Japan to continue to work out more concrete plans and proposals towards the reconstruction of the affected areas and to promote its activities for early convergence of the nuclear accidents and prevention of the expansion of damages caused by nuclear radiation. Further, the Council, recognizing the gravity of academic responsibility for securement of the safety of people's lives, also determined to probe the causes concerned with the earthquake and accidents, and to critically verify from within the so-far made academic activities for securing safety of people's lives. In addition, on April 9, 2012, the Committee on Supporting Reconstruction after the Great East Japan Earthquake of the Science Council of Japan summarized various proposals by the "Sub-Committee on Building Disaster-Resilient Communities," the "Sub-Committee on the Promotion of Industry and Employment," and the "Sub-Committee on Counter-measures for Radiation" established under the Committee into the comprehensive proposals entitled "Recommendations from Science Council of Japan (SCJ) – with Confident Steps towards Reconstruction –" and handed it to the Prime Minister on April 10, 2012.

The Atomic Energy Society of Japan publicized a "Statement about the investigation of the accidents at the TEPCO Fukushima Daiichi Nuclear Power Station" on August 15, 2011. The statement says it is regrettable that the nuclear accidents in question have inflicted heavy damage on people and local communities and seriously undermined their confidence in peaceful use of nuclear energy. The Society states that it should humbly reflect on what has to be reviewed, recognizes it is most urgent to seek after the convergence of the accidents, mending of the environment inside and outside the site, and to play as a group of experts the role of exercising what needs to be done to secure nuclear safety. The Japan Federation of Engineering Societies also submitted its proposals to the Prime Minister on May 6, 2011," which states that "society's confidence in technology as the pillar of sustainable development of Japan and engineering as its academic system is facing a crisis," therefore "in order to restore society's confidence, it is essential to clearly find out the cause of and the facts regarding development of the nuclear disaster, and to make them visible to the society."

(ii) Various issues that occurred after the accident

Since the occurrence of accidents at the TEPCO Fukushima NPS, the Japanese Government has taken various measures as the situation progressed. In the meantime, various issues had come to the fore, the Government's Accident Investigation and Verification Committee and the Diet's TEPCO Nuclear Power