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Report of the Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the "2011 off the Pacific coast of Tohoku Earthquake"

28 September 2011

Central Disaster Management Council

Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the "2011 off the Pacific coast of Tohoku Earthquake"

Notes

- **The 2011 off the Pacific coast of Tohoku Earthquake** refers to the earthquake hazard of magnitude 9.0 that occurred on 11 March 2011 and was named by the Japan Meteorological Agency based on a standard naming convention. **The Great East Japan Earthquake**, named subsequently by the Cabinet, refers to the earthquake and tsunami disaster and the accompanying nuclear accidents.
- **The Central Disaster Management Council** is one of the councils that deal with crucial policies of the Cabinet and is established in the Cabinet Office based on the Disaster Countermeasures Basic Act. The council consists of the Prime Minister, who is the chairperson Minister of State for Disaster Management, all ministers, heads of major public institutions and experts. The council promotes comprehensive disaster countermeasures including deliberating important issues on disaster reduction according to requests from the Prime Minister or Minister of State for Disaster Management.

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1. Introduction

Six months have now elapsed since the Great East Japan Earthquake which brought unprecedented damages in Japan. As the full picture and the dimensions of the damage gradually becomes revealed, local residents, communities, businesses, local governments and the national government are unifying their strength in a determined effort towards reconstruction.

However, the bitter experiences and tough lessons experienced in this disaster must be permanently passed on as a testament linking the past, the present and the future, and as wisdom for the building of disaster-resilient nation and communities.

”2011 off the Pacific coast of Tohoku Earthquake” generated a mega earthquake and tsunami that went far beyond any of the pre-disaster expectations. It incurred vast damage including the greatest loss of human life in a single disaster in Japan since the Second World War, and posed the nation with enormous challenges regarding the way earthquake and tsunami countermeasures have been developed so far. The Central Disaster Management Council therefore decided that it would establish the “Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the 2011 off the Pacific coast of Tohoku Earthquake” to investigate and analyze the recently experienced earthquakes and tsunamis and examine countermeasures for future earthquakes and tsunamis. The Committee carried on with the debate.

The magnitude of the earthquake, the height and strength of the tsunami, the extent of the inundated area, the occurrence of subsidence across a wide area, and the extensive human and material damage experienced in this disaster all vastly exceeded the levels of damage previously envisaged by the technical committees convened by the Central Disaster Management Council. While disaster management measures had been promoted according to various disaster management plans based on pre-disaster assumptions and their implementation, it is possible that in some districts these actually exacerbated the damage. We have to humbly concede the difficulty of predicting natural phenomena, and conduct a fundamental review of conceptualizing the earthquake and tsunami used for hazard assumption in the future. With regard to tsunami countermeasures in particular, we must urgently conduct across-the-board reviews, and thoroughly prepare for mega earthquakes and tsunamis in the Nankai Trough, which it is feared may occur in the near future.

According to the results of post-earthquake surveys in the disaster affected areas, it is clear that early evacuation is vital for safe evacuation from tsunamis, and that some people who

were not expecting a tsunami managed to evacuate as a result of having been verbally warned by those around them. How to make residents understand the importance of early evacuation is a crucial issue for the future in the regions that are expected to be hit by tsunamis.

Over 60% of the dead and missing in the Great East Japan Earthquake were aged 60 or over, and many volunteer fire fighters or police officers were among the victims, clearly revealing the issues on evacuation upon tsunami arrival.

The Committee compiled an interim report on 26th June based on the findings of its first four meetings, and in the subsequent eight meetings successively held concentrated discussions on the issues that have transpired in the period from the advent of the Great East Japan Earthquake up to the present day. In the future, there will be no end to the issues that have to be discussed as the verification of emergency response activities and recovery and reconstruction measures proceeds; this current report has been compiled with a mission of swiftly laying out the direction of future countermeasures against earthquakes and tsunamis.

2. Characteristics and verification of the damage caused by the earthquake and tsunami

(1) Characteristics of earthquake and tsunami damage

- The tsunami that occurred in this disaster was of a scale that vastly exceeded pre-disaster assumptions. The main reason was an enormous earthquake with a magnitude of 9.0, a size that could not be envisaged from the history of earthquakes in Japan that stretches back for several hundred years, erupted as an earthquake with a wide epicentral area that interlocked several regions. The reasons why such enormous tsunamis occurred include the fact that the mechanism causing the tsunami consisted not only of a slipping movement at the deep plate boundaries that lead to a normal ocean trench earthquake, but also a considerable simultaneous slipping movement at the shallow plate boundaries.
- Phenomena that particularly exceeded any pre-disaster assumptions included the enormous tsunami height and extensive inundation area, penetration of inundation area into a considerable distance inland, inundation caused by tsunami run-up along rivers overflowing the river banks, and the widespread occurrence of subsidence. It should be noted that the level of subsidence remains unchanged at the current time and secondary damage from this earthquake and tsunami disaster is occurring in the affected regions in the form of flooding due to storm surges and precipitation.
- As a result of this tsunami certain districts have suffered devastating region-wide damage, with vast numbers of dead or missing people, homes washed away, industrial stagnation and economic losses. Moreover, the destructive force of the tsunami washed away buildings, vehicles, ship and so on, leading to colossal amounts of floating debris in the seas. This also led to further damage such as tsunami fires due to oil leaking from oil storage tanks.
- In addition, it is conceivable that the circumstances of the announcement of tsunami warnings and the way that they were delivered, and the actions taken by the evacuating residents and others had a considerable impact on the expansion of the damage suffered. The possible reasons for the extensive damage also include the fact that evacuation sites were not all necessarily close to residents and the fact that the tsunami was greater than the hazard level considered in the pre-disaster damage estimate or described in hazard maps.
- Considering the size of the magnitude 9.0 quake, the damage to buildings resulting from the ground motion caused by the earthquake was relatively minor due to the periodic features of seismic movement. However, many buildings were destroyed, half destroyed or

partially destroyed across a wide area, including damage to homes arising from liquefaction under reclaimed land and former river channels in Tohoku to the Kanto district. There was also massive damage to lifeline services and transportation facilities. There were also damages due to long-period ground motion, though relatively minor considering the scale of the earthquake, as such incidents as falling of ceiling materials in high-rise buildings and damages to elevators were reported from districts a long way from the epicentre.

- Looking at previous earthquakes suggests that after a mega earthquake of such magnitude as the "2011 off the Pacific coast of Tohoku Earthquake" occurs, major aftershocks arise in the epicentral area, while induced earthquakes above a certain size erupt across a wide area around its periphery. It is therefore essential that people are widely warned about the possibility of aftershocks and induced earthquakes over a certain size.

(2) Pre-disaster principles in selecting earthquakes and tsunamis for hazard assumptions

- In addition to trench-type earthquakes in the vicinity of the Japan and Chishima Trenches that are expected to occur in regions that include the epicentral area of the "2011 off the Pacific coast of Tohoku Earthquake", the committees convened by the Central Disaster Management Council have conducted estimation of expected hazard levels of earthquakes and tsunamis for the Tokai Earthquake, Tonankai and Nankai Earthquakes, Tokyo Inland Earthquakes, and Chubu and Kinki Regions Inland Earthquakes. In doing so, aiming at replicating the earthquakes and tsunamis experienced over the past few hundred years in those regions, those earthquakes and tsunamis that have repeatedly occurred and are likely to occur in the near future were selected as impending earthquakes and tsunamis to be used for hazard assumption, and were considered for examinations of seismic movement and tsunami hazards.
- "2011 off the Pacific coast of Tohoku Earthquake" was a magnitude 9.0 earthquake caused by the interlocking of several epicentral areas in the Japan Trench, an earthquake that could not be found in the earthquake literature of Japan stretching back several hundred years. The fact that such an earthquake could not be envisaged is the result of basing assumptions about Japan Trench earthquakes and tsunamis on the earthquakes and tsunamis experienced over the past several hundred years, and means that there are limitations to the hazard assumption methods used prior to this disaster.

(3) Reflections on the differences between the pre-disaster assumptions and the actuality of this disaster

- We must gravely accept the fact that the results of the pre-disaster assumptions of earthquakes and tsunamis were far removed from the earthquake and tsunami that actually occurred, and must undertake a fundamental review of the principles regarding selection of earthquakes and tsunamis for future hazard assumptions.
- Up until now, the earthquakes considered to be impending from among the very largest earthquakes experienced in Japan over the past few hundred years have been used for replication of seismic intensities and tsunami heights recorded in the past using seismic source models, and these have been treated as the hazard assumptions for the next largest-scale earthquake to occur. As a result, if the seismic intensity or tsunami heights of an earthquake were not reproducible by the model, the earthquake was regarded as having a low probability of occurrence, even if such earthquake may have occurred in the past, and was disregarded from the hazard assumptions. With regard to this disaster, there is a need to deeply reflect on the fact that earthquakes that are considered to have occurred in the past, such as the Jogan Sanriku Earthquake of 869, the Keicho Sanriku Earthquake of 1611, and the Enpo Boso Earthquake of 1677, were all disregarded when developing the hazard assumption.
- These earthquakes were disregarded despite it being known that they had occurred in the past because of the difficulties in reproducing the complete picture of the earthquakes including their intensities and tsunami height, which are necessary as the basis for examining concrete disaster management measures. In the future, it will be essential that the use of these earthquakes in hazard assumption is examined, regardless of the inadequate understanding of their complete picture. Despite the probability of their occurrence being low, historic earthquakes in which earthquake and tsunami damage is considered to have been on an overwhelming scale must be adequately examined.
- Because the actualities of earthquake and tsunami differed from the pre-disaster hazard assumptions, the scope of the seismic movement, tsunami height and extent, and the inundation area all exceeded expected levels by far. In particular, while the estimated inundation area was used for preparing disaster management material including hazard maps, it cannot be denied that the fact that the tsunami inundation area and tsunami height were far greater than the estimated levels led to the proliferation of damage. It is possible

that the hazard maps that were prepared based on the pre-disaster hazard assumptions lead to providing false sense of security to people, and that the tsunami that exceeded these assumptions led to an expansion of the damage.

- Looking at the construction of coastal protection facilities suggests that while these are effective against tsunamis with tsunami heights within the scope of their design, the massive tsunami and colossal damage witnessed during this disaster exposed the limitations of disaster management measures that rely on coastal protection facilities to an excessive degree.
- The estimation of earthquake magnitude and the tsunami height predictions issued by the Japan Meteorological Agency immediately after the earthquake vastly underestimated their true scales, and the size of the earthquake and the tsunami warnings were subsequently repeatedly revised upwards over time. It is considered that the impact of the initial tsunami height prediction was particularly great, and it is possible that the evacuation actions of residents and volunteer fire fighters were blunted by the initial tsunami warning, leading to expansion of damage incurred.
- It is therefore necessary to explore countermeasures to prevent the reoccurrence of such an event and seek to make rapid improvements, including such measures as upgrading of warning systems in preparation for mega earthquakes and utilization of offshore observation data for tsunami warnings.
- While gravely acknowledging the fact that this disaster event caused damage greatly exceeding the pre-disaster damage estimate, the former principles for hazard assumption need to be fundamentally reviewed and thorough reviews be conducted for all procedures from selection of earthquakes and tsunamis for hazard assumption through to development of individual measures, so that the disaster management measures be rebuilt in their entirety.

3. Selection of earthquakes and tsunamis for development of disaster management measures

(1) Significance of earthquake and tsunami hazard assumptions

- Since before this disaster, earthquake and tsunami countermeasures have been developed by national and local governments by first selecting earthquake hazards to be assumed and then formulating and promoting various disaster management measures based on the results of hazard assumptions of seismic movement and tsunami. Though the earthquake and tsunami experienced in this disaster greatly exceeded the pre-disaster assumptions, it does not necessarily mean that the exercise of hazard assumptions for earthquakes and tsunamis is a pointless task. There is a need to carry out adequate investigation and analysis regarding the reason why phenomena far beyond the pre-disaster hazard assumption occurred, continue to revise as required the hazard assumptions for earthquakes and tsunamis, re-examine future damage scenarios and proceed with disaster management measures.
- Meanwhile, it is also essential that an adequate understanding is obtained of the fact that natural phenomena are inherently uncertain and there are certain limitations to hazard assumptions.

(2) Principles for conducting earthquake and tsunami hazard assumptions for the future in consideration of the Great East Japan Earthquake

- In order to select earthquakes and tsunamis to be used for hazard assumptions, it is necessary to accurately investigate the historic occurrence of the earthquakes and tsunamis going back as far as possible in time, and proceed with investigations based on scientific knowledge such as analysis of ancient documents and other historical material and surveys of tsunami deposits and coastal topography. In conducting these investigations it is essential that they are implemented with the continued collaboration of the Headquarters for Earthquake Research Promotion's Earthquake Research Committee, which has been undertaking a long-term evaluation of seismic movements.
- Bearing in mind the fact that forecasting earthquakes is difficult and the fact that there are uncertainties with long-period assessments, earthquakes and tsunamis must be examined while considering all possibilities including the possibility of actual damage exceeding the damage expected by the hazard assumption.

- In other words, when conducting earthquake and tsunami hazard assumptions in the future, the largest-possible mega earthquakes and tsunamis should be considered from every possible angle.
- Furthermore, even in cases in which it would be practically difficult to develop the facilities needed as disaster management measures against the earthquakes and tsunamis based on a hazard assumption, such an assumption must be adopted without hesitation.
- Research and analysis into the elucidation of the mechanisms triggering earthquakes and tsunamis will become even more essential. Among these, in order to verify the occurrence of mega tsunamis over a time scale of several thousand years it is vital that further enhancement be made not only to seismological research but also to the comprehensive geological, archaeological and historical research, including research into tsunami deposits on land and the ocean floor, geological research into coastal terraces, and research into biological fossils etc.
- In addition, in order to ascertain accurately the state of the vicinity of the ocean trench that is thought to have been the source of the mega tsunami experienced in this disaster event, there is a need to make direct observations of not only inland but also ocean bottom crustal movement to study interplate coupling, and make further effort to promote research to improve precision of earthquake and tsunami hazard assumption based on seismology.
- The mega tsunami generated by the magnitude 9.0 earthquake occurred because the so-called ‘interlocking of a normal ocean trench earthquake’ and a ‘tsunami earthquake’ simultaneously occurred. This kind of earthquake could occur not only in the Japan Trench where the “2011 off the Pacific coast of Tohoku Earthquake” erupted, but also in other regions such as the Nankai Trough. It is therefore vital that research and analysis of the tsunami earthquake mechanism and the multi-segment rupture of normal ocean trench earthquakes and tsunami earthquakes are further promoted so that the adequate elucidation of their generating mechanism is achieved in order to develop tsunami scenarios for future mega ocean trench earthquakes.
- In the event of “2011 off the Pacific coast of Tohoku Earthquake”, a massive tsunami was generated together with tremendous shaking. However, if a tsunami earthquake, not accompanied by a large quake, erupts by itself, there is a possibility that the tsunami reaches the coast before the residents become aware of the need to evacuate. In the light of the fact that tsunami earthquakes, including such disasters as the 1611 Keicho Sanriku Earthquake and the 1896 Meiji Sanriku Earthquake, have repeatedly caused extensive

damage in the past, special measures are needed with regard to warning and evacuation for tsunami earthquakes.

- Since the impact is enormous when damage is caused in regions where such facilities as nuclear power stations are located, the process for earthquake and tsunami hazard assumptions requires more elaborate research and analysis concerning epicentral areas and tsunami source areas from the point of view of ensuring safety.

4. Principles for future tsunami hazard assumptions and developing tsunami countermeasures

(1) Basic Principles

- Development of future tsunami countermeasures will basically require the assumption of two levels of tsunamis. On the first level are the largest-possible tsunamis envisaged on the basis of developing comprehensive disaster management measures, which focus on the evacuation of local residents as the main pillar. Such tsunamis would be set on the basis of ultra-long-term tsunami deposit research and crustal movement observations etc., and while the frequency of their occurrence is extremely low, when they do occur the damage would be enormous. The tsunami triggered by the "2011 off the Pacific coast of Tohoku Earthquake" can be considered to belong to this group.
- On the second level are tsunamis envisaged on the basis of constructing coastal protection facilities such as structures including breakwaters to prevent tsunamis from penetrating inland. These tsunamis occur more frequently than the above mentioned largest-possible tsunamis and cause major damage despite their relatively lower tsunami heights.

(2) Principles for countermeasures against largest-possible tsunamis

- The occurrence of a mega tsunami and the devastating damage experienced in this disaster revealed that there were problems with disaster management measures that depended too much on such measures as coastal protection facilities. It is essential that tsunami countermeasures be developed by accounting for the tsunamis experienced in the "2011 off the Pacific coast of Tohoku Earthquake" or the largest-possible tsunamis, and while placing protection of people's lives as the first priority, it is needed to ensure sustaining of minimum required social and economic functions such as governmental functions and hospitals regardless of what sort of disaster occurs. For this, it is necessary to establish comprehensive tsunami countermeasures embracing every possible instrument, which place evacuation as the core and combine land use planning, evacuation facilities and disaster management facilities.
- In order that various instruments are integrated and unified to effectively function as tsunami countermeasures, it is essential that mechanisms are established to secure organic collaboration between various related plans such as the local disaster management plans for municipalities and urban planning.

- In addition, since it is difficult to know what sort of tsunami will arrive when they occur, the requisite systems and measures should be developed and implemented in order to enable residents to evacuate in an appropriate manner according to the circumstances of their localities. This will necessitate tsunami observations and monitoring, the announcement of tsunami warnings, delivery of tsunami warnings, evacuation guidance, and construction of tsunami evacuation sites, tsunami evacuation buildings, and evacuation routes and stairs. It will also require investigation and analysis of issues identified in this tsunami disaster such as what sort of information the residents received during the disaster and how they acted upon it so that adequate countermeasures can be made.
- Damages experienced in this disaster occurred because the tsunami hazard extended beyond the 'damage prevention measures'. Thus 'damage mitigation measures' are needed in order to minimize the proliferation of damage. Efforts will be required to raise disaster awareness of residents and those in charge of disaster management through disaster education and disaster drills.
- In doing so, it is vital to consider what type of information is useful for residents at times of evacuation, how to utilize information delivery tools such as improved local disaster management radio communication systems or mobile phones, and carry out the requisite measures in collaboration with the relevant organizations.
- Furthermore, since destruction of nuclear power stations or facilities likely to serve as headquarters during a disaster such as municipal offices and police or fire stations result in serious impacts, every conceivable effort must be made in ensuring that tsunami countermeasures for these key facilities are thorough.

(3) Principles for countermeasures using coastal protection facilities against frequently occurring tsunamis

- The coastal protection facilities that have been constructed were based on a scenario of tsunamis that occur with relatively high frequency, and they have achieved certain results in preventing damage. However, since the tsunami height in this disaster far exceeded the tsunami height that these facilities were designed for, while they were effective to a certain extent in terms of lowering water levels, delaying the arrival of the tsunami and maintaining the coastline, most of the coastal protection facilities were damaged and the land behind these facilities suffered enormous tsunami damage.
- In preparing for largest-possible tsunamis, raising considerably the designed tsunami

height for the coastal protection facilities is not realistic from the standpoint of the financial requirements for construction of such facilities, and the potential impact on the coastal environment and its use. Therefore, coastal protection facilities must continued to be constructed for relatively frequent tsunamis with a certain level of tsunami height from the point of view of protecting human life and the assets of residents, stabilizing the regional economy and securing efficient industrial bases.

- With regard to coastal protection facilities, it is also essential that progress be made in the promotion of technical developments for, and instalment of structures that will rigorously withstand tsunamis that are higher than those for which they were designed.

5. Damage scenarios

(1) Significance of damage scenarios

- In promoting earthquake and tsunami countermeasures by the Central Disaster Management Council, first of all the seismic movement and tsunamis from the target earthquake have been envisaged, and having constructed damage scenarios based on these, the various disaster management measures that should be implemented by the government such as Policy Frameworks for Earthquakes, Earthquake Disaster Reduction Strategy, and Guidelines for Emergency Response Activities have been drafted, and necessary countermeasures have been promoted.
- Damage scenarios, by calculating damage estimates and making clear the whole picture of the damage, help to widely inform the society regarding the necessity for disaster management measures. At the same time, they serve as the foundation stones for formulating wide-area disaster management measures.
- Therefore, in response to the colossal damage caused by the Great East Japan Earthquake, there is a need to meticulously research and analyze the nature and state of the damage, and having reviewed the methods and content of scenarios, to continue working on creating future damage scenarios.

(2) Pre-disaster damage scenarios and the actual damage caused by the Great East Japan Earthquake

- The damage scenario regarding the damage anticipated from trench-type earthquakes in the vicinity of the Japan and Chishima Trenches, which was published in 2005 by a committee of the Central Disaster Management Council, contained quantitative estimates regarding physical damage (building damage, earthquake fires, disaster waste), human damage (deaths, people forced to live in evacuation centres etc.), lifeline damage (to electricity, communications, gas and water supplies etc.), transportation damage (to roads, railways and ports), and economic damage (both direct and indirect). However, the height of the tsunami, the inundation area and the human and material damage caused by the disaster far exceeded anything envisaged in pre-disaster damage scenarios.
- In addition, enormous damage was caused by factors for which qualitative but not quantitative scenarios had been created, such as tsunami fires, the advent of missing people, destruction caused by the shaking of the earthquake and the tsunami to substations

and power lines, water intakes, water purification and sewage treatment plants and oil storage tanks.

- On the other hand, while many buildings were damaged due to the shaking of the earthquake the damage was not as extensive as expected, and an examination is required of the suitability of the estimation methods used in pre-disaster damage scenarios. There is also a need for research and analysis regarding the relationship between the length of earthquake cycle and the damage caused, examples of which include the indoor damage such as ceiling collapses due to short-period seismic movement, and damage to high-rise buildings and other large structures caused by long-period ground motion –a cause for concern in the event of a mega ocean trench earthquake. Particular attention must be paid to the fact that the shaking resulting from long-period ground motion during a Tokai Earthquake that is expected in the future is estimated to be at least twice the size of what experienced in the Great East Japan Earthquake.

(3) Future damage scenarios

- In response to the fact that the majority of the damage witnessed in the Great East Japan Earthquake far exceeded any pre-disaster damage estimates, the causes of this must be adequately investigated and analyzed, and having clearly identified the issues in the scenario methods, the requisite improvements should be made. Furthermore, it is also essential that sufficient investigation and analysis is carried out regarding the phenomena for which the actual damage fell below the pre-disaster estimate, why this was the case, and what the relationships between regional characteristics and the shaking generated by the earthquake were.
- Disaster management measures must be examined and drafted on the basis of a more concrete damage scenario after minutely researching the matters that were only qualitatively considered in the damage estimation scenarios used prior to the disaster, the matters that have become apparent following the Great East Japan Earthquake but were not considered in pre-disaster scenarios, and the matters that should be considered in future damage scenarios.
- Since natural phenomena are inherently uncertain, it is essential to bear in mind that there are certain limitations to assumptions and scenarios.
- In the course of reviewing the methods used in developing damage scenarios, quantitative assessment of damage mitigation by future countermeasures, such as reduction of human

damage due to promotion of early evacuation of residents or earthquake resistant buildings, should be conducted.

- During the Great East Japan Earthquake regional differences in the evacuation distances and evacuation procedures became apparent for the lowland plains and rias costal area. It is therefore necessary that some means to enable due consideration of regional characteristics be devised when future scenarios are developed.
- The “2011 off the Pacific coast of Tohoku Earthquake” occurred during the daytime, and not in the middle of winter. Supposedly it had occurred under other seasonal conditions, or at a different time of day or under different meteorological circumstances, the damage could have been even greater. Therefore there is a need to examine multiple damage scenarios, including a worst-case scenario. In doing so, the fact that the nature of the damage differs greatly in the urban and rural districts and the knock-on impact upon areas outside the disaster zone must be borne in mind.
- Since there was a considerable discrepancy between the rapid damage estimates conducted by the Cabinet Office immediately after the earthquake and the state of the damage caused to people and buildings by the Great East Japan Earthquake, it is essential that improvements to the damage estimation system be sought along with review of damage scenarios in preparation for future mega ocean trench earthquakes.

6. Countermeasures to mitigate tsunami damage

(1) Basic Principles

- It is important to enact countermeasures against largest-possible tsunamis based on a 'disaster reduction' philosophy that focuses on minimizing damage. In order to do so, tsunami damage should be mitigated as much as possible not only through structural measures such as coastal protection facilities, but also through non-structural measures centring on evacuation, such as thorough disaster education and preparation of hazard maps, in order to prepare for tsunamis that exceed the protection levels of the structural facilities.
- Principles for construction of coastal protection facilities are expressed in section 4 (3).
- Easing tsunami evacuation requires, in addition to the construction of coastal protection facilities, a combination of such measures as construction of secondary barriers utilizing transportation infrastructure to prevent tsunami wave from penetrating further inland, land raising, construction of evacuation sites, tsunami evacuation buildings and evacuation routes and stairs, and land use and building regulations that account for the risks of inundation. These steps must be implemented in a manner appropriate to the various local circumstances. In order to achieve swift and assured evacuation from tsunamis, town planning should allow evacuation within the shortest possible timeframe, around five minutes in the case of communities where tsunamis arrive quickly, while placing evacuation on foot as the basic principle and in due response to local circumstances. In communities where topographical conditions or the state of land use make such responses difficult, it is essential that measures for tsunami evacuation are thoroughly examined with consideration to factors such as the tsunami arrival time.
- In other words, from the perspective of securing the safety of residents and mitigating damages to livelihood and industry, swift and assured evacuation of residents together with promotion of land use that mitigates inundation risks and construction of coastal protection facilities to prevent tsunami penetration into in-land are the basic and vital measures in the promotion of comprehensive tsunami countermeasures. There is a need to combine all of these non-structural and structural measures, and build systems and mechanisms for integrated efforts while taking into account local circumstances.
- The fundamental step in protecting human life from a tsunami is evacuating to higher ground without hesitation, swiftly and autonomously, as soon as a strong or extended shaking is felt. In order to raise disaster awareness of residents and encourage the

formation of local consensus regarding disaster management measures, it is essential that disaster management organizations including national and local government bodies regularly make publicly known all the latest developments and various data regarding disaster management in a readily understood manner.

(2) Preparation of a system and creation of rules for efficient evacuation

1) Basic Principles

- The evacuation actions taken by residents are the fundamentals of human damage mitigation measures against tsunamis. Residents need to be educated not to excessively rely on such measures as construction of coastal protection facilities and to be aware of the importance of taking evacuation actions swiftly and autonomously to higher ground with no hesitation as soon as a large earthquake erupts. The disaster awareness of residents needs to be raised and tied in with secure evacuation actions.
- If a tsunami occurs in the middle of the night or if a power outage occurs, the evacuation of residents could be severely hampered, setting certain limitations on the residents' ability to evacuate. Countermeasures need to be combined with land use planning including designation of areas with the lowest inundation risks as residential areas.
- Since tsunami warnings and evacuation instructions are the first pieces of information for governments and residents to base their evacuation actions on, and are information upon which lives of residents depend, the manner in which they are announced and delivered and the quality of the information are extremely important. Efforts need to be made to improve the content of the warnings and to reinforce the system for delivering information.
- In addition, community disaster management capabilities need to be enhanced as part of community development through such means as preparation of concrete and practical hazard maps, disaster education, improved disaster drills, and construction of evacuation sites, tsunami evacuation buildings, evacuation routes and evacuations stairs.
- In order to highlight the importance of evacuation actions in the advent of a tsunami and to improve and reinforce preparedness against mega ocean trench earthquakes in the Nankai Trough, which may occur in the near future, images of the tsunami arrival in the recent disaster should be widely collected, and further investigations and analyses should be conducted to exhaustively verify the damages, evacuation actions and state of evacuation in the Tohoku and Kanto regions where the damage was particularly devastating. It should be noted that such investigation needs to be conducted carefully and with due

consideration to the disaster victims.

2) Improvements to tsunami warning announcements

- Bearing in mind that there are limitations to announcing tsunami warnings with a certain degree of precision immediately after an earthquake, tsunami warnings should be issued quickly and in line with estimates that are on the safe side, and should be updated to more accurate figures when details become known subsequently.
- The fundamental of tsunami evacuation is swift and autonomous evacuation to higher ground when a strong or extended shaking is experienced. While raising awareness on this fundamental, the meanings and contents of tsunami warnings and evacuation instructions need to be adequately explained to the citizens.
- On the other hand, in order not to amplify a sense of distrust among the recipients of tsunami warnings, such as local governments and residents, by providing excessive warnings as a result of issuing tsunami warnings that are on the safe side, efforts need to be made to ensure that residents have a sufficient understanding of the features of tsunami warnings including their prediction accuracy. In doing so, it is vital that explanations are given concerning the features of tsunami warnings against tsunami earthquakes and distant tsunamis.
- As tsunami warnings are the trigger for governments and residents to conduct disaster management and evacuation actions, the very first warning is the piece of information that serves as the trigger for evacuation action, and it is therefore essential that the content to be conveyed as tsunami warnings be examined from the point of view of the warnings' recipients. Furthermore, disaster response activities and evacuation actions in accordance with the levels of tsunami warnings or expected tsunami height should be examined in more details in the future.
- When issuing tsunami warnings, it should not only inform the expected tsunami height but also deliver the information that enables people to easily imagine the magnitude of damage likely to be caused by the tsunami, including such information as damages caused by historical tsunami disasters etc.
- Even in cases where the evacuation instructions are automatically issued after tsunami warnings, there is a need to build mechanisms for delivering to the residents such information as tsunami magnitude and the districts for which evacuation instructions should be applied, from the perspective of smooth evacuation and securing of safety of the

residents. The understanding of residents regarding the intent of evacuation instructions should be promoted in advance.

- Since in the case of the recent "2011 off the Pacific coast of Tohoku Earthquake" the observation results of the leading wave issued in the tsunami information could have caused delays or adjourning of evacuation actions of residents, adequate attention should be paid to the way in which tsunami information is issued. It is also essential that residents be notified that the second, third, or subsequent tsunami waves could be larger than the leading wave.
- With regard to tsunami disasters causing wide-ranging and devastating damage, the disaster management systems must be examined in response to the recent tsunami disaster, including the entities to be responsible for issuing evacuation instructions.

3) Improvement and strengthening of tsunami warnings and information delivery systems

- As evacuation information when a tsunami is impending is information upon which lives depend, every possible tool including local disaster management radio communication systems, J-ALERT (a satellite based system that allows authorities to quickly broadcast alerts to local media and to citizens directly via system of speakers), television, radio, mobile phones, 1-Seg (a mobile terrestrial digital audio/video and data broadcasting service), etc should be utilized, and tsunami warnings must be delivered to governments and residents without fail.
- There is a need to examine responses based on the issues experienced in the recent disaster, such as power outages across wide areas, the damage caused by the quake and tsunami to local government buildings and the local disaster management radio communication systems themselves, and the difficulties experienced in hearing the content of the information delivered by the local disaster management radio communication systems.
- It is essential that, with the cooperation of telecommunications companies, more redundancies and diversification in information delivery systems are rapidly sought, including for example the delivery of tsunami warnings over widely-used mobile phones, and utilizing their capacity for simultaneously delivering emergency e-mails.
- Since it is necessary to ensure evacuation of not only the residents but also other people, there is also a need to examine ways of providing tsunami warning accurately at the

earliest possible stage to vehicles and trains in transit, ships, and people on beaches etc., and to reinforce measures to enable rapid evacuation.

4) Improvement and strengthening of earthquake and tsunami observation systems

- As it is now clear that the observation data from cable-type offshore hydraulic gauges and GPS wave gauges etc. is extremely effective in improving the precision of tsunami forecasts, it is highly probable that they will be useful in the updating of more accurate tsunami warnings.
- It is therefore essential that the earthquake and tsunami observation systems are improved and strengthened by improvements to maritime observations using ocean bottom seismographs, cable-type offshore hydraulic gauges and GPS wave gauges etc. Furthermore, in order to avoid the need for volunteer fire fighters to go to the coast directly to check the tsunami, improvements should be made to the coastal tsunami-monitoring systems to obtain information on the state of tsunamis.
- The mechanism to utilize the real-time tsunami observation data for announcements of tsunami warnings should be enhanced by strengthening direct observations in the seas where tsunamis are generated.
- The development of comprehensive tsunami forecasting technologies including the rapid ascertainment of the magnitude of earthquakes must be promoted for the establishment of more accurate tsunami forecasting technologies.
- In preparing for the future eruption of a mega ocean trench earthquake in the Nankai Trough, maintenance of data collection, processing and delivery functions is vital when efforts are made to improve and strengthen the observations system. It is therefore essential that measures such as preparation of alternative functions or backup systems for avoiding loss of function due to simultaneous damage are considered from the perspective of business continuity planning.

5) Appropriate selection of evacuation sites and evacuation routes

- The selection of evacuation sites and evacuation routes should be implemented in an integrated manner with the development of communities that are resilient to earthquakes and tsunamis as mentioned in Section (3) below.
- Since the expected height of tsunamis and inundation depth differ greatly according to the

topography of coastlines and shape of bays, appropriate consideration should be taken of these factors, and evacuation sites, tsunami evacuation buildings, evacuation routes and stairs should be developed in response to local circumstances, in order to enable evacuations to be completed within the shortest possible timeframe, around five minutes in communities where tsunamis arrive quickly. However, in communities where topographical conditions or the state of land use make such responses difficult, it is essential that measures for tsunami evacuation are thoroughly examined with consideration to factors such as the tsunami arrival time.

- With regard to evacuation sites, it is essential that they are developed in places where there is the lowest possible risk of inundation. Preferably their locations should be selected so that they will not become isolated after evacuation, and will enable further evacuation according to the circumstances surrounding the arrival of tsunamis. At the same time, in the event that there are no suitable locations for evacuation sites, and structures such as tsunami evacuation buildings have to be used as evacuation sites, structures with adequate high need to be selected to ensure safety of the evacuation site even in the case of the largest-possible tsunami.
- While the evacuation sites are used as the "destination for immediate evacuation from an earthquake or a tsunami" as mentioned above, they are also used as the "shelters where people live temporarily". Since these two functions are sometimes used in mixture it is important to thoroughly explain to residents about the differences in these two functions. It should be noted that in some cases evacuation sites actually continue to be used as places to temporarily live in after people have evacuated to them in an emergency immediately after an earthquake or tsunami once their safety from earthquake or tsunami damage is verified.
- In the event that the lifeline functions at the evacuation sites used as the "shelters where people live temporarily" are not readily restored and if the period of evacuation is expected to last for an extend period of time, or if the evacuation site is expected to be isolated due to disruption of roads, the living environment in such evacuation centres may deteriorate and the adequate support may not arrive. In such cases, having examined the suitability or otherwise of locating and maintaining an evacuation centre in the locality in question, evacuation to other areas where support from the government and volunteers can be received, or further wide-area evacuation will need to be considered.
- Tsunami evacuation buildings play an important role in ensuring protection of the lives of evacuees. In order to secure a requisite number of these buildings with a requisite strength

to withstand the largest-possible tsunami, the designation requirements, structural and location criteria for tsunami evacuation buildings etc. should be reviewed and their development promoted, with sufficient attention paid to the inundation depth and areas, and the state of damage caused to structures and tsunami evacuation buildings as a result of the tsunamis experienced in this disaster.

- In the event that private sector buildings are used as tsunami evacuation buildings, a system to enable complete evacuation in the event of an emergency need to be developed, including conclusion of prior agreements with the management of the building.
- Consideration should be paid to providing financial and other support measures when tsunami evacuation buildings are developed or designated.
- In order to ensure evacuation of residents to high ground on foot, efforts should be made to develop and also inspect safety of evacuation routes and stairs. Efforts should also be made regarding innovations and improvements aimed at reducing required time for evacuation. Furthermore, the development of evacuation routes needs to be conducted with adequate consideration of the occurrence of traffic jams and accidents resulting from vertical displacement of ground caused by ground motion, the increased number of cars carrying evacuees, and traffic light failure during power outages.
- In response to the fact that many fatalities were caused among volunteer fire fighters and police officers involved in the closure of flood gates and inland lock gates and directing residents for evacuation, it is essential that rules of conduct are stipulated concerning disaster management responses and evacuation guidance within the time that tsunamis arrive in order to avoid placing volunteer fire fighters and police officers in danger. There is also a need to thoroughly examine and decide in advance the evacuation support measures for the elderly, the handicapped and other people requiring assistance in disasters.
- Measures such as automated and remote-control closure of flood gates and inland lock gates should be promoted to mitigate as much as possible danger or injury to people such as volunteer fire fighters. It should be noted that in order to ensure that delayed evacuees can still escape even after the closure of inland lock gates, innovations such as installation of emergency evacuation slopes need to be introduced in construction of coastal protection facilities.
- Evacuation from earthquakes and tsunamis can be hampered by a variety of obstacles including collapsed buildings and turned over furniture due to ground motion, and the

liquefaction of bedrock or breakout of fires outside of buildings. Therefore, in response to the factors that obstructed evacuation during the Great East Japan Earthquake, it is essential that educational activities be conducted to encourage essential countermeasures such as making buildings earthquake-resistant and securely anchoring furniture.

(3) Development of communities that are resilient to earthquakes and tsunamis

1) Basic Principles

- With regard to the newly envisaged largest-possible tsunamis, it will be necessary to show the potential inundation risks for different communities, while referring to the assumptions of a worst-case scenario of impact from tide levels and damage to facilities etc. As well as securing the safety of residents while striving to obtain the creation of local consensus with reference to this scenario, there is also a need to proceed with community development efforts that aim to mitigate the scale of the damage caused to livelihood and industry.
- Having clearly identified the districts at risk from tsunami inundation in the community development process, it is essential that examinations be conducted of land use and the formats for facilities and equipment, including the sea-facing sides of coastal protection facilities. It is also essential that evacuation sites, tsunami evacuation buildings, evacuation routes and stairs be developed in a well-planned manner, and in collaboration with city planning efforts. In doing so, in order to achieve swift and assured evacuation from tsunamis, with evacuation on foot as the basic principle and in due response to local circumstances, community development should aim to enable evacuation within the shortest possible timeframe, around five minutes in the case of communities where tsunamis arrive quickly. In communities where topographical conditions or the state of land use make such responses difficult, it is essential that measures for tsunami evacuation are thoroughly examined with consideration to factors such as the tsunami arrival time.
- In order to protect the lives and assets of residents and stabilize regional economic activity, the construction of coastal protection facilities must seek to prevent in-land inundation from relatively frequent tsunamis with certain tsunami height, and the technical development of structural technologies should be promoted so that structural facilities can exercise a resilient effectiveness even in the event of tsunamis exceeding the tsunami height they were designed for.
- In the regions devastated by the recent disaster event that have often been exposed to tsunamis in the past, old inscriptions on stone monuments warned of the dangers of

tsunami damage, and history shows that when, over the years, houses were once again built on low-lying land they have repeatedly suffered damage. In the future, it is essential that these stone monuments are not only left standing but that their meaning is correctly passed down to future generations, in order to avoid the repetition of such calamities.

- When considering land use in the future, there will be a need to reflect to the greatest possible extent changing social conditions such as the advent of a fully-fledged aging society and a declining population, and measures for coexistence with the oceans that at the same time protect human life, lifestyles and industry, and tie in with community revitalization, will be necessary.
- By incorporating a perspective of gender equality, realistic and practical measures that reflect the diverse viewpoints of those living in the communities will be achieved, and it is also conceivable that their ability to manage disasters will be improved. Therefore, when concrete evacuation procedures and development of communities are explored, consideration will be made to incorporate female perspectives that have not been inadequately considered in the past, through such means as enthusiastically promoting the inclusion of female members in disaster management councils.

2) Countermeasures based on land use and facility development

- Measures combining land use planning, including designation of residential districts in the areas less prone to tsunami inundation risks, is necessary by widely promoting understanding of residents regarding the inundation risks arising from largest-possible tsunamis, and while seeking a local consensus.
- By adequately verifying the causes of the earthquake and tsunami devastation in the recent disaster and disaster management measures introduced prior to the disaster, and by utilizing the lessons learned, evacuation related facilities such as evacuation sites, tsunami evacuation buildings, evacuation routes and stairs should be developed or designated in a planned manner while accounting for local circumstances such as tsunami inundation risk and the time it takes for tsunamis to arrive. It is particularly important that the designation of tsunami evacuation buildings and development of evacuation sites, routes and stairs, are incorporated in the whole of community development in order to ensure complete evacuation. Besides attempting to make tsunami evacuation buildings earthquake and wave-resistant, there is also a need to examine responses in cases where the inundation height exceed the controlled height in local zoning regulations.

- In conjunction with this, steps should also be encouraged to signpost the position and direction of evacuation sites, tsunami evacuation buildings, evacuation routes and stairs in every corner of towns, in an easily understood manner.
- In order to mitigate tsunami inundation damage and extend the lead times for evacuation, highly resilient coastal protection facilities and multi-layer protection incorporating secondary barriers utilizing transportation infrastructure such as raised roads to prevent tsunami waves to penetrate further inland should be developed.
- When these facilities are developed, measures should be taken to enable rapid recovery in the event they are struck by earthquakes or tsunamis, and the facilities need to be appropriately managed and maintained so that they can adequately exercise their effectiveness.
- In order that governmental and social functions are maintained even in the event of a largest-possible tsunami, the government-related facilities, evacuation sites, facilities for assisting elderly people and others requiring support in the time of disasters and welfare facilities and hospitals must be located in areas where there is no risk of tsunami inundation or where the risk is at least minimal. The requisite measures for inducing appropriate land use should also be examined.
- It should be noted that since these facilities have stock of important information about residents, backup systems for such data should be developed. Moreover, existing facilities including those other than mentioned above should be aimed to be relocated in areas with low inundation risks over the medium to long term, according to their importance.
- If some of these facilities are currently located in inundation risk areas they should be made earthquake and wave resistant and attempts should be made to turn them into disaster management bases where, for example, emergency generators are located, telecommunications facilities are developed and emergency materials are stored. In previous tsunami disasters, there are numerous examples of residents who have relocated to higher ground or relocated en masse but returned to tsunami inundation risk areas after a certain period of time for the sake of lifestyle and work conveniences. In order that this does not occur again during the process of reconstruction following the recent disaster, not only in these areas but in other areas where there are fears that tsunami damage may occur, the inducement of appropriate land use and the placing of restrictions on land use or regulations on building structures through ordinances should be examined.
- The Great East Japan Earthquake generated vast quantities of disaster waste, and since this

waste proved to be an enormous obstacle to emergency response activities improvements should be made to ensure that buildings do not easily turn into disaster waste, by making them more earthquake and wave-resistant etc.

3) Coordination between local disaster management plans for municipalities and city planning

- According to the Disaster Countermeasures Basic Act, local disaster management plans for municipalities specifically stipulate the duties that municipal disaster management councils should perform in order to deal with disaster management. However, while some municipalities designate land use regulations and so on as tsunami disaster management measures in their plans, some do not, and their responses are not uniform.
- Furthermore, among tsunami countermeasures, though 'disaster management facilities' and 'disaster management systems' are illustrated as matters stipulated in the local disaster management plans for municipalities in the Disaster Countermeasures Basic Act, there is no mention of 'development of communities from a tsunami disaster management perspective.'
- From the perspective of city planning on the other hand, although there are municipalities that mention tsunami disaster management in the fundamental objectives and policies of city planning in the master plans for city planning formulated according to the City Planning Act, because of differences in the base laws and procedures for developing local disaster management plans for municipalities and master plans for city planning both of these are treated as independent plans, and it could hardly be said that an adequate attempt has been made to ensure consistency in their content.
- Therefore, since it is essential to organically coordinate local disaster management plans for municipalities and city planning in order to enhance the effectiveness of earthquake and tsunami countermeasures, it is essential to promote development of safe communities from a long-term perspective, responding to the risk of inundation from largest-possible tsunamis through the joint preparation of plans by the disaster management department and the city planning department. In conducting these tasks, where necessary the participation of experts in the field of disaster management should be sought.

(4) Raising disaster awareness about tsunamis

1) Basic Principles

- Although tsunami disasters occur only about once every ten to fifteen years, once they do occur the damage can be devastating. There is a need to adequately inform local residents that a tsunami can hit at any point along the coastline of Japan, to continuously promote disaster management measures, deepen our scientific understanding of earthquakes and tsunamis, and improve the disaster awareness of residents and others. Raising awareness with the cooperation of mass media such as television, radio and newspapers will be effective.
- Earthquakes and tsunamis are natural phenomena, and there should be an adequate understanding of the fact that it is quite possible they will exceed our assumptions. Examples were witnessed during the recent disaster where although the hazard level went far beyond the scope of scenarios envisaged appropriate evacuation actions helped to prevent or mitigate damage. Gaining a shared awareness of risk through disaster education – so-called 'risk communication' – is vital in order to try to encourage an understanding of the precise meaning of the numerical values used in tsunami scenarios etc., and enable people to evacuate flexibly according to rapidly changing circumstances, and in the midst of an impending tsunami whose scale and nature is unknown.
- Passing down disaster-related culture over generations based on the earthquake and tsunami damage that has occurred across history is very important. In response to the investigations conducted into the recent disaster, in order to improve the people's understanding of earthquake and tsunami disasters and their management, it is important that, in addition to school education, comprehensive educational programs at various scenes be examined with the participation of experts and practitioners on the ground, and that the development of such programs is promoted.

2) Improvements to hazard maps

- The results of post-earthquake survey in the damaged areas show that the residents' awareness levels of hazard maps were low and because the maps were prepared based on former scenarios they led to providing false sense of security to people. The problem has been identified that the hazard maps may well have exacerbated the damage caused by the tsunami. Continued investigations and analysis are necessary regarding the deficiencies of hazard maps, including the manner in which they are used.

- In order to ensure that hazard maps are effectively used by residents in evacuation, there is a need to examine the way that hazard maps are created, including clarifying the relationships between tsunami warnings and evacuation advisories and instructions, envisaging multiple hazard levels of tsunamis, and indicating ground elevations on hazard maps. Furthermore, since tsunamis are natural phenomena with a great deal of uncertainty surrounding them, it is essential that an emphasis is placed on risk communication, including the continuous and regular communication of the fact that the inundation areas for a largest-possible tsunami shown on the hazard maps may actually be exceeded.
- Since there are limits to raising the residents' awareness merely by handing out hazard maps to them, it is essential that systems and mechanisms are built to get across the message of hazard maps thoroughly, for example by including them in city planning books and using them in the explanation of important matters contained in the Building Lots and Buildings Transaction Business Act.
- In addition to map formats, the inundation areas and heights of historical tsunamis or tsunamis expected in the future, and the location of evacuation sites, tsunami evacuation buildings and evacuation routes and stairs should be indicated all over towns. With innovations such as using luminous stones and lights to make them easier to see at night, and sirens to guide people to evacuation sites for example, more rigorous steps must be taken to endow the public with a constant awareness of the dangers of tsunami damage in everyday life and enable them to evacuate smoothly. It should be noted that in the event that the 'height' of tsunamis etc. is indicated in towns, whether past levels or expected future levels should be shown, and whether the heights should be indicated in height above sea level or the inundation height of tsunamis themselves are factors requiring innovations making them readily understood by residents. At the same time, examinations should be made of integrated nationwide standards, with due respect to the steps being taken at the various local levels.

3) Thoroughness in the principle of evacuation on foot, and education about the importance of evacuation

- When earthquakes or tsunamis occur, the ground motion and accompanying liquefaction leads to all manner of issues such as the collapse of houses, falling objects, road damage and displacement of ground surfaces, and traffic jams and road accidents. Evacuation on foot has therefore been the principle method for tsunami evacuation, and it is appropriate

that this principle is maintained.

- However, taking into consideration the fact that a considerable number of the survivors of the Great East Japan Earthquake evacuated in automobiles it is essential that measures for safe and assured vehicular evacuation of evacuees are adequately examined in each community by accounting for the time it takes for the tsunami to arrive, distances to evacuation sites, the presence of people requiring assistance during disasters, and the circumstances of evacuation routes, in case they have no choice but to evacuate in cars, while upholding the principle of evacuation on foot.
- Having done so, concrete and practical tsunami evacuation plans should be drawn up according to local circumstances, and steps taken to thoroughly inform the local residents. It should be noted that when tsunami evacuation plans are created, efforts should be made to raise their efficacy as much as possible through concrete simulations and drills etc. conducted according to the population in the areas that will have to be evacuated, and the circumstances surrounding the establishment of the evacuation sites, tsunami evacuation buildings, evacuation routes and stairs.
- As there are many issues surrounding evacuation by automobiles in the event of an earthquake or tsunami, continual awareness raising on the issues to keep in mind when evacuating by automobiles should be conducted targeting such people as those who are acquiring or renewing driving licenses.
- A look at the evacuation actions taken during the Great East Japan Earthquake shows that a considerable number of residents failed to evacuate immediately after the shaking stopped, but it would be inappropriate to attribute this entirely to a low awareness of tsunami disasters. Other reasons for not evacuating immediately include people who were outside at the time of the quake returning home or checking on the safety of family members. In order to reduce the number of victims in future tsunamis, it is important that the reasons for not evacuating immediately are analyzed in details, and such reasons be eliminated as much as possible.
- This will require that routine checks are made by families and communities about evacuation procedures in the advent of a tsunami, and that thoroughness is sought in awareness of evacuating to higher ground as fast as possible in the event of a tsunami, regardless of the circumstances, in the spirit of “Tsunami tendenko”, the old saying along the Tohoku Pacific coast that teaches everyone to escape to higher ground swiftly and without concern for those around them.

4) Implementation of disaster education

- During the Great East Japan Earthquake there were examples of junior high school students helping elementary school children to evacuate, and nearby residents evacuating as a result of the evacuation actions of junior high school students, which kept the damage of the tsunami at a minimum; these once again show the necessity and importance of disaster education concerning earthquakes and tsunamis.
- Although largest-possible tsunami disasters occur only rarely, once they do occur there are fears that the damage can be devastating. It is therefore important that the lessons of the recent tsunami are passed on indefinitely to future generations in order to ensure the complete evacuation of residents regardless of the circumstances.
- It is essential that people are made aware that the first wave of a tsunami is not always a drawback wave, but can also be a run-up wave, and that the second, third or subsequent waves can in some cases be bigger than the initial wave.
- Therefore, from the earliest stages of school education, continuous and enhanced disaster education must be implemented throughout Japan. It would include the characteristics of communities where pupils live, the local risks with regard to earthquakes and tsunamis, the state of historical tsunami damages, and the lessons that have been learnt from tsunamis in the past. It should be noted that as there is no guarantee that people who live in inland areas not impacted by tsunamis will not encounter tsunamis when, for example, they are on holiday by the sea, it is also essential that they too are adequately educated about tsunamis through disaster education.

5) Improvements of community disaster management capability

- In response to the fact that calls by nearby residents to evacuate and initiative-led evacuations played major roles in promoting evacuation actions of people during the Great East Japan Earthquake, people must be made aware that autonomous evacuation leads to the evacuation of residents, and the importance of locally integrated evacuation –evacuation in which people call out to each other and swiftly evacuate – must be strongly advocated.
- When disaster drills are implemented, in the light of the fact that the arrival time of the tsunami was comparatively accurate, concrete and practical drills that reflect the arrival

time of a largest-possible tsunami should be implemented. And in order that the lessons of the Great East Japan Earthquake do not fade with the passage of time, innovations should be made such as conducting them on a continuous and regular basis.

- Since in order to respond swiftly and appropriately in the occurrence of a disaster it is essential that the special characteristics and circumstances of the regions in which residents reside are ascertained, and this information shared, steps must be taken to reinforce community disaster management capability, such as improving the regional community by preparing an environment in which people of any generation can play a regular part, and nurturing community disaster management leaders. In addition, measures to enable the appropriate evacuation of visitors unfamiliar with the area and foreigners unused to disaster responses need to be examined.
- In response to the fact that the Great East Japan Earthquake also led to many settlements and districts becoming isolated by tsunami, the deployment of satellite-based mobile phones to secure a communication system following earthquakes and tsunamis, and autonomous disaster management organizations fostered in tandem with the securing of local self-contained storage facilities and stockpiles should be promoted.

7. Measures to reduce damage caused by shaking

(1) Basic Principles

- With regard to buildings, transportation infrastructure, lifelines, etc., continuous efforts need to be made to systematically promote reinforcement of such structures to make them earthquake resistant and in addition steadily implement countermeasures against long-period ground motion and liquefaction.

(2) Making buildings resistant to earthquakes

- In addition to being the major cause of human deaths, the collapse of buildings can become the main cause of factors, such as the generation and spread of fire as well as the generation of evacuees and disaster waste, which lead to further expansion of damages and inhibition of emergency response activities. For this reason, in addition to continuing systematic efforts to make buildings resistant to earthquakes, awareness raising regarding the need for seismic reinforcement should be strengthened and consideration given to financial and other support measures.
- Following the Great East Japan Earthquake, there were also many reports of damage caused by the ceilings of buildings falling. For this reason, there is a need to continue the implementation of measures such as installing steady braces and ensuring clearance between ceilings and walls. Furthermore, since there were also reports of turned over furniture and collapsed brick walls causing damage and inhibiting evacuation, awareness raising to promote necessary measures such as measures to anchor furniture or prevent the collapse of brick walls should be carried out proactively and consideration given to financial and other support measures.
- Damage to lifelines in a disaster not only hinders safety confirmation, evacuation of residents, and emergency response activities such as relief and rescue, but also causes the deterioration of the living environment for evacuees. For this reason, it is necessary to promote earthquake reinforcement and redundancies of lifeline infrastructure to prevent them from being damaged or cut off in a disaster. Furthermore, damage to transportation infrastructure in a disaster not only disrupts the transportation system but also severely hinders the removal of disaster waste and restoration of lifelines. For this reason, systematically improving resistance to earthquakes and substitutability is necessary.

(3) Long-period ground motion and liquefaction countermeasures

- In the “2011 off the Pacific coast of Tohoku Earthquake”, long-period ground motion was relatively small considering the scale of the earthquake. However, since super-high-rise buildings incurred damage such as fallen ceilings and damage to interior materials, fire doors, and elevators, there is a need to implement necessary reinforcement measures. In addition, in considering long-period ground motion it is necessary to consider the effects of not only the intensities of the shaking caused by the earthquake but also the periodic features and duration of each earthquake.
- Furthermore, since there was widespread damage to houses caused by ground liquefaction on reclaimed land and former river beds, there is a need to steadily promote ground improvement in addition to enhancing shallow ground data collection and database creation. With regard to smaller buildings, such as individual houses, manuals on foundation structures that are effective liquefaction countermeasures are to be widely distributed. In addition, in considering liquefaction in the future, it is necessary to consider the effects of not only the intensities of the shaking caused by the earthquake but also the duration of the earthquake.

8. Preparations for a large-scale earthquake

(1) Characteristics of the damages caused by a mega ocean trench earthquake

- In addition to causing widespread power and water outages, the Great East Japan Earthquake exposed numerous problems, such as the isolation of many areas due to inundation, loss of disaster management headquarters and administration functions due to damage to municipal offices, and extreme shortages of supplies such as gasoline and other fuels.
- Furthermore, the earthquake caused phenomena and situations that could not have been sufficiently predicted previously—such as subsidence experienced over wide areas, liquefaction phenomena, and the overwhelming number of people who were stranded in the metropolitan area unable to return home—and the characteristics of the damage caused by a mega ocean trench earthquake—extensive and widespread—also became clear.
- For example, the municipalities expected to experience seismic intensity of 6- or greater in the Tokai Earthquake or Tonankai and Nankai Earthquakes that are recommended to strengthen and promote disaster management measures against earthquakes, are located in areas with extremely high concentration of population and industry. The area account for about one-third of Japan's total population and one-half of the national total shipment of manufactured goods. If a mega earthquake were to occur in the Nankai trough, it is highly probable that extensive human and economic damage would result. There is also a need to give especial consideration to the possibility of extensive damage also occurring in areas other than those mentioned above, such as, for example, fires in oil storage tanks in Tokyo Bay and damage to super-high-rise buildings due to liquefaction phenomena or long-period ground motion.
- Furthermore, as was also observed in the Great East Japan Earthquake, there is a high possibility of the damage inflicted by an earthquake spreading, being prolonged, and worsening, such as the effects of widespread electricity outages due to damage to power facilities; fuel shortages due to damage to refineries; disruption to the transportation of supplies and people and other emergency response activities due to damage to roads, railways, ports, and airports; and huge numbers of evacuees spread over a wide area.
- Although relatively small considering the scale of the earthquake, the Great East Japan Earthquake caused damage to many buildings over a wide area. Moreover, although the long-period ground motion that shook super-high-rise buildings was relatively small considering the scale of the earthquake, just as there were reports of damage to

super-high-rise buildings due to long-period ground motion in areas a long distance from the epicentre, in a huge ocean trench earthquake in the Nankai trough—which, it is feared, could occur in the near future—there is a high possibility and that strong long-period ground motion will be generated due to the periodic features and propagation of seismic movements, causing concern that extensive damage to super-high-rise buildings may arise.

- The Great East Japan Earthquake generated extensive damage and many disaster victims, requiring as enormous number of temporary housing to be built. However, it has been pointed out that it was not possible to sufficiently respond to the requirements of disaster victims from the view points of building time and location due to the difficulty of finding suitable sites for temporary housing. There is concern that similar problems would arise if a mega ocean trench earthquake in the Nankai trough or Tokyo Inland Earthquakes occur in the future.

(2) Preparations for the future

- Since earthquakes can occur anywhere in Japan, not only in the Nankai and Tokyo metropolitan areas—where strong concerns are held against mega ocean trench earthquake in the Nankai trough or Tokyo Inland Earthquakes, respectively—but in areas that have not yet experienced a major earthquake or tsunami full preparations also need to be made against the possibility of an earthquake or tsunami occurring.
- First of all, in accordance with the principles for conducting earthquake and tsunami hazard assumptions as described in 3(2) above, the seismic movements, tsunami, and subsidence that are to be expected should first be estimated and then estimation should be made for human and material damage based on the data on damage caused by the "2011 off the Pacific coast of Tohoku Earthquake" and newly available scientific and technological knowledge. Based on these estimates, all possible measures should be taken to improve future disaster management measures, such as formulating earthquake and tsunami countermeasures that fully reflect the lessons learned from the Great East Japan Earthquake.
- Since there are limits to the response that could be made by the disaster areas alone, in formulating earthquake and tsunami countermeasures for scenarios in which a mega ocean trench earthquake occurs in the Nankai trough, there is also a need for consideration of countermeasures from the view point of creating a national grand design, for example, constructing roads, railways and port facilities to enhance transportation network on the

Japan Sea side of the country.

- Since a worst-case scenario may not necessarily ensue if Tokai, Tonankai, and Nankai earthquakes all occurred at the same time, consideration must also be given to scenarios in which earthquakes occurred in these areas at different times. For example, if earthquakes occurred in these areas within a few minutes to a few hours of each other, the height of the ensuing tsunami would increase due to the overlapping of the tsunamis; accordingly, if the time until the next earthquake occurs is longer than this, there is the danger of facilities that have been recovered and reconstructed or are in the process of recovery and reconstruction being damaged, causing an aggravation of social anxiety. Moreover, it is also necessary to consider complex disasters that may occur if these coastal earthquakes occurred at the same time as an inland earthquake, typhoon, or other natural disaster.
- In the case of a mega ocean trench earthquake that affects multiple prefectures and communities, disaster victims are frequently forced to evacuate to areas that are a long distance away from their homes and spread over a broad area. In such cases, there is a high probability that they will receive support from a local government other than those in the disaster zone. However, since these local governments cannot provide evacuees with sufficient support due to constraints imposed by the current laws, a framework needs to be established so that local government other than those in the disaster zone will be able to proactively provide support to evacuees. There is also a need to construct and improve systems for disaster victims who have been forced to evacuate outside their local areas to easily and unfailingly receive information and support/services from the local government in the disaster area where they lived prior to the earthquake.
- It is known that in the Great East Japan Earthquake there were people vulnerable to disasters whose lives were threatened after evacuating from the tsunami, and it has been pointed out that this was especially striking amongst people living in isolated villages and areas. Consequently, in order to avoid such secondary disasters, concrete support measures involving coordination amongst the specialized areas of disaster management, medical care, health and welfare need to be considered as there are limits to the responses that local areas can provide alone.
- With regard to Tokyo Inland Earthquakes, based on the report of the Committee, consideration should also be given to mega earthquakes along the Sagami trough—a so-called “Great Kanto Earthquake-class” earthquake—which is not currently included in earthquakes used for hazard assumptions for Tokyo Inland Earthquakes.

- In the case of Tokyo Inland Earthquakes, the damage to the nation's capital and the economic impacts of the earthquake would be extensive. Thus, there is a need to strengthen measures for ensuring the continuity of the capital's central functions, establishing a wide-area support system, and handling people stranded in the metropolitan area unable to return home as well as enormous numbers of evacuees after first verifying their efficacy based on the lesson learned from the Great East Japan Earthquake.
- In the case that key Japanese industries are affected by a large-scale earthquake, recovery will require a substantial amount of time and domestic economic activity may stagnate; for these reasons, business continuity plans (BCP) for times of disaster are necessary from the view point of business continuity.
- There is a need to review aspects of Tokyo Inland Earthquakes such as magnitude, ground motion, and tsunami occurrence based on the latest scientific knowledge, and need to revise them as necessary.
- In addition to the above, investigation and research on earthquakes and tsunamis that could occur in Japan should be promoted based on the latest scientific knowledge in addition to making efforts to strengthen disaster management measures.

9. Future disaster management measures

- The Committee intensively analyzed the occurrence and damage brought by mega earthquakes and tsunamis in the "2011 off the Pacific coast of Tohoku Earthquake" and considered the future principles for earthquake and tsunami countermeasures. Amidst the need for the swift recovery and reconstruction of the areas devastated in the recent disaster and the enhancement of Japan's disaster preparedness, there is a need to immediately proceed with revisions of Japan's disaster management measures as a whole based on the report of the Committee.

(1) Revision of the Basic Disaster Management Plan

- The Basic Disaster Management Plan is a basic plan concerning disaster management in Japan and is amended as necessary in view of disaster situations that occur and the efficacy of the measures implemented in response to these disasters.
- The report by the Committee calls for drastic revision of earthquake and tsunami countermeasures, and the government needs to consider policies and measures to which the report's recommendations apply, broadly improving and expanding descriptions of tsunami countermeasures and in other ways revising the Basic Disaster Management Plan.
- With regard to revising the Basic Disaster Management Plan, tsunami countermeasures are currently positioned as one item within the "Second Volume: Earthquake Disaster Countermeasures", and revisions of the plan should also include revision of this structure.
- Furthermore, looking at one role of the Basic Disaster Management Plan—that of indicating which items should receive major emphasis in the Disaster Management Operation Plan and Local Disaster Management Plan—there is a need to clarify basic principles on earthquake and tsunami countermeasures that should be considered by national government ministries and agencies as well as local governments, such as principles on tsunami hazard assumptions upon the development of tsunami countermeasures.
- Since there is an urgent need for local governments nationwide to revise earthquake and tsunami countermeasures, there is a need for revisions to the Basic Disaster Management Plan to be carried out swiftly. In addition, there is a need for revisions of the Plan to continue to be carried out appropriately and at appropriate times based on the progress of recovery/reconstruction, the status of consideration of new disaster management measures,

and the opinion of those in the disaster affected areas.

(2) Review and revision of disaster management measures in various domains

- Based on the report by the Committee and views stated in the revised Basic Disaster Management Plan, national government ministries and agencies need to carry out reviews of their own policies and Disaster Management Operation Plans, revising these where necessary and amending guidelines and policies issued to local governments.
- In particular, based on the lessons learned from the Great East Japan Earthquake, thorough reviews of the content of documents compiled in the past by the relevant national government ministries and agencies—such as the "Guide for Strengthening Tsunami Countermeasures in Local Disaster Management Plans" (March 1998), the "Tsunami and Storm Surge Hazard Map Manual" (March 2004), the "Guidelines for Developing a Manual for a Decision and Delivery of Evacuation Advisories and Orders" (March 2005), and the "Guidelines Related to Tsunami Evacuation Buildings" (June 2005)—should be carried out and appropriate revisions made.

(3) Improvement of disaster management measures in communities

- Since the report of the Committee contains many items that need to be addressed, such as local disaster prevention measures and emergency response measures that are appropriate for the situation in different communities, local governments also need to consider their own disaster management measures, such as revising Local Disaster Management Plans for municipalities and formulating wide-area disaster management plans through the joint efforts of multiple local governments.

(4) Consideration of further issues

- Although these were not necessarily among the agenda of the Committee, many issues with the response to the Great East Japan Earthquake were indicated in the Committee's report, including wide-area support systems, relief supply provision/transportation systems, handling of wide-area/long-term evacuation, provision of information to evacuation centres and improvement of the evacuation environment.
- For this reason, emergency response measures such as the responses of the national and local governments and evacuation behaviour of local residents in the Great East Japan

Earthquake should be reviewed, and based on the lessons learned from these, necessary revisions of disaster management measures should be carried out.

- Furthermore, in order to improve preparedness for the next large-scale disaster, the countermeasures against a mega ocean trench earthquake in the Nankai trough and Tokyo Inland Earthquakes, as mentioned in Chapter 8, should also be reviewed and considered.
- On the other hand, based on the lesson gained through emergency response activities following the Great East Japan Earthquake, a legal system providing for future disasters needs to be prepared swiftly. To this end, the national and local governments must undertake reviews with an aim of revising the legal system for responding to disasters from such view points as unified responses to wide-area large-scale disasters between national and local governments, responses to loss of administrative functions of local governments, wide-area evacuation, and support for disaster victims from immediately following the disaster to recovery and reconstruction.
- Furthermore, reviews also need to be undertaken with an aim towards the implementation of necessary revisions with regard to risk management systems for when natural disasters strike, such as the establishment/operation of an Extreme Disaster Management Headquarters and the form of role-sharing between responsive organizations within the government.
- Moreover, the Committee considered a broad range of issues, from principles of future earthquake and tsunami hazard assumptions to specific measures for reducing damage, but the disaster affected areas are still in the process of recovery and reconstruction, and so by no means have all the lessons to be learned been learned. For example, there is a need to continue thorough discussion of forms of evacuation using automobiles, responses to people requiring assistance in disasters, forms of disaster education, and forms of disaster management -related terminology and to ensure that these are reflected in disaster management measures.
- In addition, issues that require future consideration and thorough discussion include the development of swift and appropriate emergency relief and recovery technologies and the easing of regulations when implementing tsunami disaster countermeasures.

10. Preservation of records of the Great East Japan Earthquake and information dissemination on future disaster management measures

(1) Preservation of records of the Great East Japan Earthquake

- In order to make good use of the lessons learned from the Great East Japan Earthquake - a disaster that took the greatest number of lives in a single event in Japan during the post-war period with extensive human and material damage - and strengthen countermeasures against earthquakes and/or tsunamis that may occur in Japan in the future, it is important that we firmly pass these lessons on to the next generation so that the experience and memories of the Great East Japan Earthquake do not fade or are forgotten with the passing of time.
- To this end, firm efforts are needed to pass these experiences on to the next generation, such as making a broad range of materials - the results of investigations and analyses conducted by relevant government ministries and agencies, universities, and private research institutions as well as the visual images taken by relevant government ministries and agencies and the mass media - available to the public as far as possible through the internet and other channels so they can be viewed in addition to storing such materials appropriately in the National Diet Library and National Archives of Japan.
- Furthermore, Japan also needs to make a collective effort to carry out an investigation and research of the mechanisms that generated the massive tsunami in the “2011 off the Pacific coast of Tohoku Earthquake” and summarize the results of this research so that they can be utilized in formulating earthquake and tsunami countermeasures for the future.

(2) Information dissemination regarding future disaster management measures

- Following the Great East Japan Earthquake, Japan received wide-ranging support from the international community, with many countries, regions, and international organizations sending rescue/specialists teams to Japan and/or providing food, water, blankets, and other relief supplies.
- Through the investigation and discussion process of the Committee new knowledge and valuable lessons regarding earthquake and tsunami countermeasures have been gained. It is believed that this knowledge and experience will contribute to the strengthening of disaster management measures not only in Japan but in other countries as well. For this reason, it is necessary that this information be widely disseminated to other countries through international conferences and other forums.

11. Conclusion

Due to the extensiveness of the damage brought by the mega tsunami in the Great East Japan Earthquake, the report of the Committee focuses on tsunami countermeasures. However, it is highly possible that a mega ocean trench earthquake in the Nankai trough—which it is feared will occur in the near future—would cause not only damage due to a mega tsunami but also extensive damage due to strong shaking by earthquakes. Accordingly, countermeasures against both earthquakes and tsunamis need to be strengthened than before.

For this reason, the lessons of the Great East Japan Earthquake need to be thoroughly reviewed. Accordingly, detailed investigation and analysis of the "2011 off the Pacific coast of Tohoku Earthquake", the mechanisms that generate mega tsunamis, and the status of damage caused by these events needs to continue, and a system established for compiling such materials as summaries of investigation and analysis results and visual images and presenting them for broad viewing by the general public as well as utilizing them in the formulation of disaster management measures for the future.

Furthermore, in order to also provide support for the recovery of the disaster-affected areas, there is a need to carry out surveys in real time of the process of recovery and reconstruction in the devastated areas so that the power to recuperate from disasters can be scientifically surveyed and analyzed.

We cannot simply stand around mourning the losses and damage inflicted by the Great East Japan Earthquake. While mourning the damage, we must stand and face whatever catastrophic disaster that may occur and do all that we can to protect human life. Based on this conviction, we must further strengthen earthquake and tsunami countermeasures while at the same time carrying through with the recovery and reconstruction of the devastated areas—systematically building a nation and cities that are even stronger against earthquakes and tsunamis in addition to educating and raising the awareness of the general public about earthquake and tsunami disasters. Moreover, there is a need for disaster management -related fields of science and engineering, humanities and social science, and life science to join forces in a collective effort to carry out scientific surveys examining the reasons for the occurrence of disasters and comparing local characteristics, such as whether or not damage was inflicted, as well as to strengthen the research system.

Based on the report of the Committee, the national government can be expected to perform necessary revisions of Japan's overall earthquake and tsunami countermeasures and pour

every effort into enhancing disaster management measures for the future, thus liberally fulfilling the fundamental government role of protecting the lives and property of the nation's citizens.

Reference Materials

- List of Committee Members
- Meeting Schedule

List of Members of the Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the "2011 off the Pacific coast of Tohoku Earthquake"

Chairman	KAWATA Yoshiaki	Professor, Dean of Faculty of Safety Science, Dean of Graduate School of Safety Science, Kansai University
Vice Chairman	ABE Katsuyuki	Professor Emeritus, The University of Tokyo
	IZUMIDA Hirohiko	Governor of Niigata Prefecture
	ISOBE Masahiko	Professor, Graduate School of Frontier Sciences, The University of Tokyo
	IMAMURA Fumihiko	Professor, Disaster Control Research Center, Graduate School of Engineering, Tohoku University
	OKAMURA Makoto	Professor, Graduate School of Integrated Arts and Sciences, Kochi University
	SHIMAZAKI Kunihiko	Professor Emeritus, The University of Tokyo
	SHIMIZU Hiroshi	Mayor of Yaizu City, Shizuoka Prefecture
	TAKAHASHI Shigeo	President, Port and Airport Research Institute
	TANAKA Atsushi	Professor and Director, Center for Integrated Disaster Information Research, Interfaculty Initiative in Information Studies, The University of Tokyo
	TAMURA Keiko	Professor, Risk Management Office / Research Center for Natural Hazards and Disaster Recovery, Niigata University
	NODA Takenori	Mayor of Kamaishi City, Iwate Prefecture
	HIRAHARA Kazuro	Professor, Graduate School of Science, Kyoto University
	FUKUWA Nobuo	Professor, Graduate School of Environmental Studies, Nagoya University
	FURUMURA Takashi	Professor, Center for Integrated Disaster Information Research, Interfaculty Initiative in Information Studies, The University of Tokyo
	MIDORIKAWA Saburoh	Professor, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology
	YAMAZAKI Noboru	Deputy Chief Commentator, Japan Broadcasting Corporation (NHK)

Total 17 members
(Honorifics omitted.)

Meeting Schedule

Date of meeting	Meeting number	Content of Discussion
May 28, 2011 (Sat.)	1st	・Analysis of the March 11, 2011 earthquake and tsunami
June 13, 2011 (Mon.)	2nd	・Principles on target earthquakes in large-scale earthquake countermeasures
June 19, 2011 (Sun.)	3rd	・Principles on target earthquakes in large-scale earthquake countermeasures ・Basic directions for preventing/mitigating tsunami damage ・Interim report (working draft)
June 26, 2011 (Sun.)	4th	・Basic directions for preventing/mitigating tsunami damage ・Basic principles on facility improvements to defend against tsunamis ・Interim report (draft)
June 26, 2011 (Sun.)		**Release of the Interim report: Basic Principles on Future Tsunami Countermeasures**
July 10, 2011 (Sun.)	5th	・Local efforts to prevent tsunami disasters
July 31, 2011 (Sun.)	6th	・Forms of land use for reducing tsunami damage ・Measures for evacuating from a tsunami during a disaster
August 16, 2011 (Tue.)	7th	・Measures for evacuating from a tsunami during a disaster ・Principles for damage estimates
August 25, 2011 (Thu.)	8th	・Measures for evacuating from a tsunami during a disaster ・Principles for damage estimates ・Responses to wide-area damage from a large-scale ocean trench earthquake
September 10, 2011 (Sat.)	9th	・Measures for evacuating from a tsunami during a disaster ・Responses to wide-area damage from a large-scale ocean trench earthquake
September 17, 2011 (Sat.)	10th	・Review of the Basic Disaster Management Plan ・Final report (preliminary draft)
September 24, 2011 (Sat.)	11th	・Final report (draft)
September 28, 2011 (Wed.)	12th	・Final report (draft)
September 28, 2011 (Wed.)		**Release of the report of the Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the "2011 off the Pacific coast of Tohoku Earthquake"**