

# **Chapter 3 Preparedness for Nankai Trough Major Earthquakes: Research on Disaster Risk Management for Anomalous Phenomena**

## **1-1 Research on Disaster Risk Management for Anomalous Phenomena along the Nankai Trough**

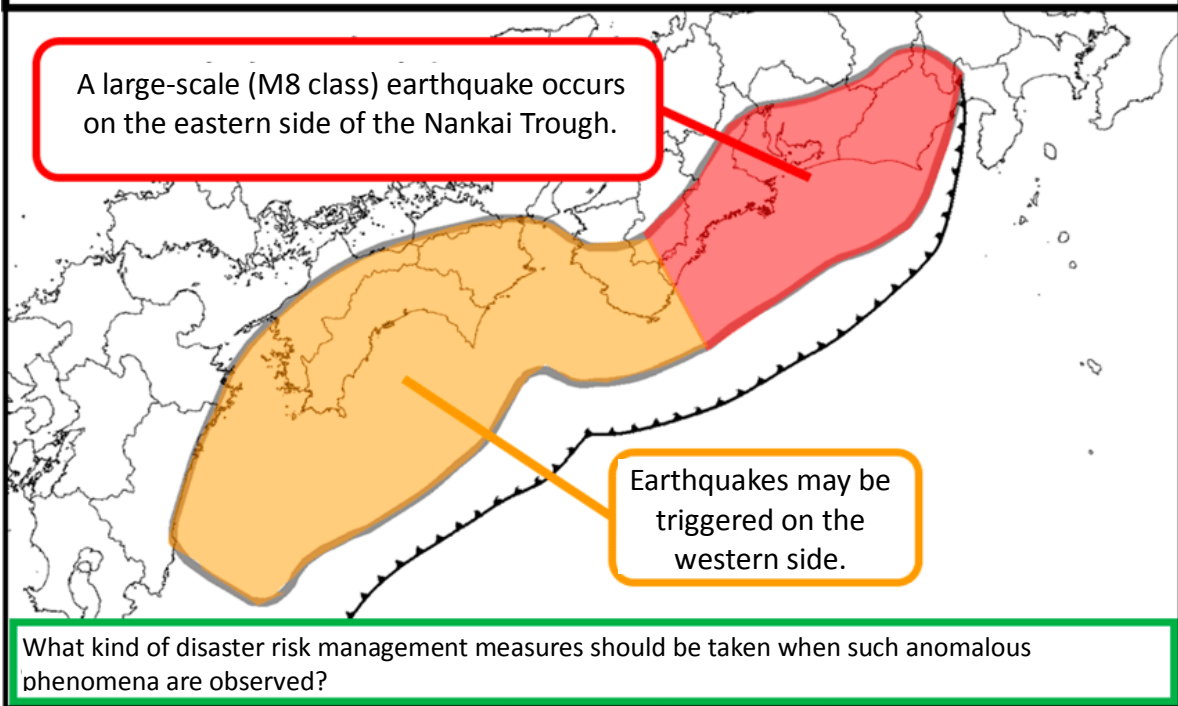
In March 2018, the Cabinet Office established the “Working Group on Disaster Risk Management for Anomalous Phenomena along the Nankai Trough” under the National Disaster Management Council’s Disaster Management Implementation Committee. The purpose of the establishment of the working group is to study desirable disaster risk management for anomalous phenomena observed along the Nankai Trough and social mechanisms to conduct disaster risk management. The study was based on the basic policy of disaster risk management for such phenomena that has been indicated in “Implementation of Disaster Management Based on the Observation and Evaluation of Earthquakes along the Nankai Trough (Report),” which was released in September 2017. The working group started its research in FY2018.

Reference: [http://www.bousai.go.jp/jishin/nankai/taio\\_wg/taio\\_wg\\_02.html](http://www.bousai.go.jp/jishin/nankai/taio_wg/taio_wg_02.html)

The working group held seven meetings in FY2018 while coordinating its study with the discussion at the Chubu Study Group on New Corporate Disaster Risk Management based on Earthquake Observation along the Nankai Trough, which has held a meeting every month in Nagoya City, Aichi Prefecture, since FY2017. At its meetings, the working group reviewed example cases of disaster management activities conducted by Shizuoka and Kochi Prefectures and the Chubu economic community in their model areas. The group then discussed and studied assumed cases of anomalous phenomena (three cases: a partial area rupture, a limited area rupture, and a slow slip) and the disaster management to be implemented in the event of each case of phenomenon. On December 25, 2018, “Regarding Desirable Disaster Risk Management for Anomalous Phenomena along the Nankai Trough (Report),” a report summarizing the working group’s discussion and study, was released on the Cabinet Office’s website.

Reference: [http://www.bousai.go.jp/jishin/nankai/taio\\_wg/taio\\_wg\\_02.html](http://www.bousai.go.jp/jishin/nankai/taio_wg/taio_wg_02.html)

### Example of Anomalous Phenomena That Might Occur along the Nankai Trough



Source: Implementation of Disaster Management Based on the Observation and Evaluation of Earthquakes along the Nankai Trough (Report) (Summary)  
(Reference: [http://www.bousai.go.jp/jishin/nankai/taio\\_wg/taio\\_wg\\_02.html](http://www.bousai.go.jp/jishin/nankai/taio_wg/taio_wg_02.html))

The report describes specifically how the national and local governments, companies and other organizations as well as residents should respond to each of the assumed three cases when the probability of the occurrence of an earthquake is assessed to have become relatively high. This is intended to mitigate damage by making use of information collected through the observation of anomalous phenomena in consideration of such factors as the severity of the estimated damage that could be caused by a large-scale earthquake along the Nankai Trough and the past earthquakes in the region. As it is impossible at present to precisely forecast when, where or on what scale an earthquake may occur, it has been decided to prescribe specifically how disaster management should be implemented and in which period in each case utmost caution is required.

### Systems for implementation of disaster management

#### o Planning of disaster management

In order to smoothly and appropriately implement disaster management, it is necessary for the national and local governments and other relevant organizations to formulate in advance plans for disaster management that should be implemented.

#### o Specifics of earthquake information concerning the observation of anomalous phenomena

With respect to earthquake information, it is necessary to conduct studies on labeling of information and alert level assessment so that disaster management suited to each case of phenomenon and the alert level can be implemented.

#### o A system for universal start of disaster management

It is necessary to make clear that it is essential for relevant organizations and residents to universally start implementing disaster management in accordance with the level of the required disaster management.

### Matters of consideration for the study and disaster management by residents and companies

#### o Promoting measures to deal with earthquakes that may occur without warning signs

Further promoting measures that should be implemented in preparation for earthquakes that may occur without warning signs would be most effective for dealing with a Nankai Trough Earthquake, which may take any of a great variety of forms.

#### o Preventing social chaos and providing appropriate information

It is necessary to carefully disseminate information related to the Nankai Trough Earthquake so that the people can have an accurate understanding.

#### o Guidelines for promoting the study of disaster management by residents and companies (tentative name)

The national government needs to compile guidelines that indicate the basic approach to disaster management, items that should be studied, procedures for the study, and points of attention, among other matters.

#### o Matters of consideration for the study of disaster management in specific sectors

Following consultations with relevant ministries and agencies, it is necessary to make clear the principles for disaster management that should be implemented by organizations in specific sectors, including schools and hospitals, as well as by designated public organizations in such sectors as communication and logistics while taking into consideration the principles of disaster management by residents and companies.

Source: Implementation of Disaster Management Based on the Observation and Evaluation of Earthquakes along the Nankai Trough (Report) (Summary)  
(Reference: [http://www.bousai.go.jp/jishin/nankai/taio\\_wg/taio\\_wg\\_02.html](http://www.bousai.go.jp/jishin/nankai/taio_wg/taio_wg_02.html))

## 1-2 Disaster Risk Management for the Case of a Partial Area Rupture

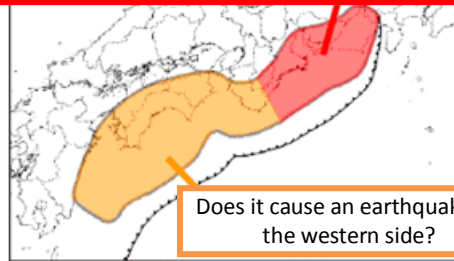
In the case of a partial area rupture (large-scale earthquake) causing serious damage (hereinafter referred to as the “partial area rupture case”), a large-scale earthquake occurs in a part of the expected epicentral area along the Nankai Trough, while the risk of multiple large-scale earthquakes occurring in the remaining area increases.

**A partial area rupture (a large-scale earthquake with a magnitude of 8.0 or higher) causing serious damage**

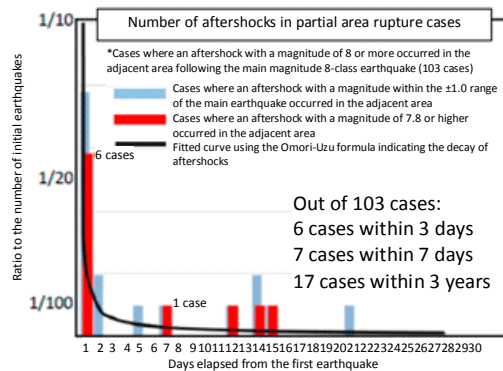
<Criteria>

- An earthquake with a magnitude of 8.0 occurs at a plate boundary in the epicentral area of the Nankai Trough

A large-scale (M8 class) earthquake occurs on the eastern side of the Nankai Trough.



Does it cause an earthquake on the western side?



The frequency of occurrence of an aftershock within seven days is once in 10+ cases.

(7 cases out of 103 cases)

The probability is nearly a hundred times the normal.

\*Normal probability  
 The probability of 70% to 80% in 30 years means that the probability of occurrence of an earthquake within 7 days is once in 1,000 times.

Source: Implementation of Disaster Management Based on the Observation and Evaluation of Earthquakes along the Nankai Trough (Report) (Summary)  
 (Reference: [http://www.bousai.go.jp/jishin/nankai/taio\\_wg/taio\\_wg\\_02.html](http://www.bousai.go.jp/jishin/nankai/taio_wg/taio_wg_02.html))

The frequency of occurrence of this case is once in 100 to 150 years. The scenario of this case was developed based on the most recent two cases where major earthquakes occurred in a row: one was the 1944 Tonankai Earthquake (Mw 8.2) and the 1946 Nankai Earthquake (Mw 8.4), and the other was the 1854 Tokai Earthquake (Mw 8.6) and the earthquake that occurred about 32 hours later, the 1854 Nankai Earthquake (Mw 8.6).

Note) The momentum magnitudes (Mw) are based on the Report of the Working Group on the Criteria of Anomalous Phenomena along the Nankai Trough for Disaster Risk Management (December 2018).

If a magnitude 8-class earthquake occurs along the Nankai Trough in this case, the following disaster risk management measures will be implemented over the following week to prepare for a subsequent earthquake that might occur in the area struck by the earthquake as well as in remaining areas.

The maximum alert will be maintained for a week in principle. In the following week, disaster management measures for the partial area rupture case will be carried out.

<Residents>

- Residents must evacuate if it is obvious that they would not be able to evacuate should an aftershock occur.
- Residents who need special care must evacuate if they might not have enough time for evacuation should an aftershock occur. Other residents should prepare for evacuation or voluntarily evacuate depending on the situation.
- Residents in other areas should stay alert and review earthquake preparedness

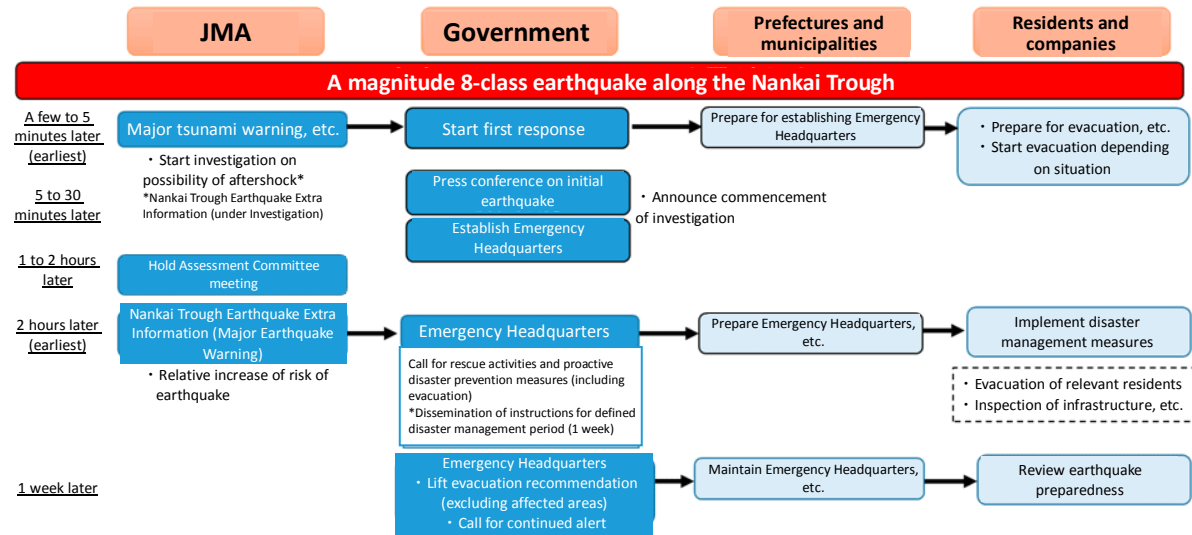
<Companies>

- Facilities used by many and unspecified people and facilities handling hazardous materials must make sure to carry out facility inspections and check fire control measures, etc.
- If there is an obvious risk of endangering employees' lives in the case of a large-scale earthquake, companies should take appropriate preventive measures.
- Other companies should also stay alert and review earthquake preparedness.
- Companies are encouraged to have a business continuity plan that would mitigate overall damage and allow them to recover as early as possible, even if it means that business activities would be temporarily limited and diminished.

Source: Implementation of Disaster Management Based on the Observation and Evaluation of Earthquakes along the Nankai Trough (Report) (Summary)  
 (Reference: [http://www.bousai.go.jp/jishin/nankai/taio\\_wg/taio\\_wg\\_02.html](http://www.bousai.go.jp/jishin/nankai/taio_wg/taio_wg_02.html))

## Disaster Response Process When a Major Earthquake Warning Is Issued

- The JMA reports to the government as early as two hours after the main earthquake when it judges that the risk of a subsequent earthquake is high.
- The government gives instructions to local governments on disaster risk management measures over the next week.
- If one week passes without a subsequent large earthquake, the government lifts evacuation recommendations, while encouraging residents to continue to stay alert



Source: Cited from the summary of the Guidelines for Formulating Disaster Risk Management Measures Based on Various Nankai Trough Earthquake Scenarios (1st Edition)  
 (Reference: <http://www.bousai.go.jp/jishin/nankai/index.html>)

### 1-3 Disaster Risk Management for the Case of a Limited Area Rupture or a Slow Slip

In the case of a limited area rupture causing limited damage (hereinafter referred to as the “limited area rupture case”), an earthquake that is one scale smaller than a major earthquake (*i.e.* a magnitude 7-class earthquake) occurs along the Nankai Trough.

The frequency of this case is once in 15 years. In the last seven cases, no major aftershock was observed (on a global level, the frequency that a magnitude 8-class earthquake occurs in the same area within a week following an earthquake with a magnitude of 7.0 or more is once in a few hundred times).

The slow slip case causing no damage (hereinafter referred to as the “slow slip case”) refers to the case where an anomalous slow slip is observed. A significant change is observed with a strainmeter and the state of fixation of plate boundaries obviously changes over a short period.

This case has never been observed before. While there is a way to conduct a qualitative assessment to see if the risk of a large-scale earthquake has increased, there is no established method or criteria to quantitatively assess the likeliness of occurrence of a large-scale earthquake.

Disaster risk management for these two cases will be centered on the review of earthquake preparedness.

**The case of a limited area rupture causing limited damage (possible foreshock with a magnitude between 7.0 and 8.0)**

An earthquake (M7 class) occurs along the Nankai Trough.

Is it a foreshock of the large-scale Nankai Trough Earthquake?

- ✓ Some residents start evacuation.
- ✓ No major damage has yet occurred in most regions.

**The case of a slow slip causing no damage**

- ✓ No shock or tsunamis. Transportation infrastructure operates as normal
- ✓ Attracting higher interest from the public as an unprecedented case

**Review earthquake preparedness, raising the alert level, etc.**

(Limited area rupture case) Disaster management measures are implemented over a week of maximum alert period in principle  
(Slow slip case) Disaster management measures will be continued until it is confirmed that no new change has occurred after the same amount of time as the period in which the change in the slip was observed.

**Example of items to review for earthquake preparedness**

[Residents]

- Check if the furniture is securely fixed
- Check means for confirming family members' safety
- Evacuation routes
- Check the inventory of household emergency supplies

[Companies]

- Check means for confirming employees' safety
- Check evacuation instructions for facility users and evacuation routes for employees
- Inspection of facilities and equipment
- Check if the furniture and equipment are securely fixed.

**Example of disaster management measures taken according to the situation**

[Residents]

- Be ready for evacuation (prepare emergency bags, etc.)
- Voluntary evacuation to houses of relatives or acquaintances
- Stay in a safe room with no objects with a risk of collapse or fall

[Companies]

- Traffic control along the coasts
- Increase parts inventory
- Restrict the use of rooms whose ceilings have objects that may fall
- Backup and storage of electronic data and important documents

Source: Disaster Risk Management for Anomalous Phenomena along the Nankai Trough (Report) (Summary)  
(Reference: [http://www.bousai.go.jp/jishin/nankai/taio\\_wg/taio\\_wg\\_02.html](http://www.bousai.go.jp/jishin/nankai/taio_wg/taio_wg_02.html))

## Disaster Response Process

	Earthquake with a magnitude of 8 or higher at a plate boundary*1	Earthquake with a magnitude of 7 or higher*2	Slow slip*3
Immediately after the earthquake <small>(Only when deemed necessary in the case of a slow slip)</small>	<ul style="list-style-type: none"> <li>● Prepare for or start disaster management measures (such as evacuation) depending on the situation</li> </ul>		<ul style="list-style-type: none"> <li>● Prepare for or start disaster management measures depending on the situation</li> </ul>
(Earliest) About 2 hours later	<p style="text-align: center;"><u>Major earthquake warning</u></p> <ul style="list-style-type: none"> <li>● Review earthquake preparedness, etc.</li> <li>● Residents who need special care must evacuate if they might not have enough time for evacuation should an aftershock occur. Other residents should prepare for evacuation or voluntarily evacuate depending on the situation.</li> <li>● Residents must evacuate if it is obvious that they would not be able to evacuate should an aftershock occur.</li> </ul>	<p style="text-align: center;"><u>Major earthquake advisory</u></p> <ul style="list-style-type: none"> <li>● Review earthquake preparedness, etc. (voluntary evacuation as needed)</li> </ul>	<p style="text-align: center;"><u>Major earthquake advisory</u></p> <ul style="list-style-type: none"> <li>● Review earthquake preparedness, etc.</li> </ul>
1 week later			
2 weeks later*4	<p style="text-align: center;"><u>Major earthquake advisory</u></p> <ul style="list-style-type: none"> <li>● Review earthquake preparedness, etc. (voluntary evacuation as needed)</li> </ul>	<ul style="list-style-type: none"> <li>● Return to normal life while staying alert for aftershocks and being aware that the risk of a large-scale earthquake has not been eliminated</li> </ul>	
Until it is confirmed that the slip has stopped	<ul style="list-style-type: none"> <li>● Return to normal life while staying alert for aftershocks and being aware that the risk of a large-scale earthquake has not been eliminated</li> </ul>		
Until the occurrence of a large-scale earthquake			<ul style="list-style-type: none"> <li>● Return to normal life while staying alert for aftershocks and being aware that the risk of a large-scale earthquake has not been eliminated</li> </ul>

- \*1 When an earthquake with a magnitude of 8.0 or higher has occurred on a plate boundary in the expected epicentral area of the Nankai Trough (the partial area rupture case)
- \*2 When an earthquake with a magnitude between 7.0 and 8.0 has occurred on a plate boundary in the expected epicentral area of the Nankai Trough or when an earthquake with a magnitude of 7.0 or higher has occurred in a spot other than plate boundaries in the expected epicentral area of the Nankai Trough or within the 50 km radius of the trench axis of the expected epicentral area (the partial area rupture case)
- \*3 When an anomalous slow slip has been observed, during which a significant change was observed with a strainmeter and the state of fixation of plate boundaries has obviously changed over a short period (the slow slip case)
- \*4 The two weeks comprise of one week of the aftershock warning period and one week of aftershock advisory period.

The measures in the above table are mere guidelines. Actual response measures would vary depending on the situation.

Source: Cited from the summary of the Guidelines for Formulating Disaster Risk Management Measures Based on Various Nankai Trough Earthquake Scenarios (1st Edition)  
(Reference: <http://www.bousai.go.jp/jishin/nankai/index.html>)

#### 1-4 Announcement of Information

The JMA started to release Nankai Trough Earthquake-related Information in November 2017 as a transitional means until a new disaster risk management scheme is established. Based on the report of the Working Group on Disaster Risk Management for Anomalous Phenomena along the Nankai Trough published in December 2018, the JMA decided to release observation and analysis results of anomalous phenomena that occurred along the Nankai Trough under the titles of “Nankai Trough Earthquake Extra Information” and “Nankai Trough Earthquake Information”.

Reference: [http://www.jma.go.jp/jma/press/1903/29a/20190329\\_nankaijoho\\_name.html](http://www.jma.go.jp/jma/press/1903/29a/20190329_nankaijoho_name.html)

Titles and Conditions of Announcement of Nankai Trough Earthquake-Related Information

Information issued by JMA	Conditions of announcement
Nankai Trough Earthquake Extra Information	<ul style="list-style-type: none"> <li>○ When an anomalous phenomenon is observed along the Nankai Trough and investigation is started or continued to check the correlation of the phenomenon with large-scale earthquakes in this region.</li> <li>○ When announcing investigation results on observed anomalous phenomena</li> </ul>
Nankai Trough Earthquake Information	<ul style="list-style-type: none"> <li>○ When announcing information on the situation after the announcement of investigation results on observed anomalous phenomena</li> <li>○ When announcing investigation results shared at a regular meeting of the Nankai Trough Earthquake Assessment Committee (except when a Nankai Trough Earthquake Extra Information is to be made)</li> </ul>

Source: Japan Meteorological Agency website

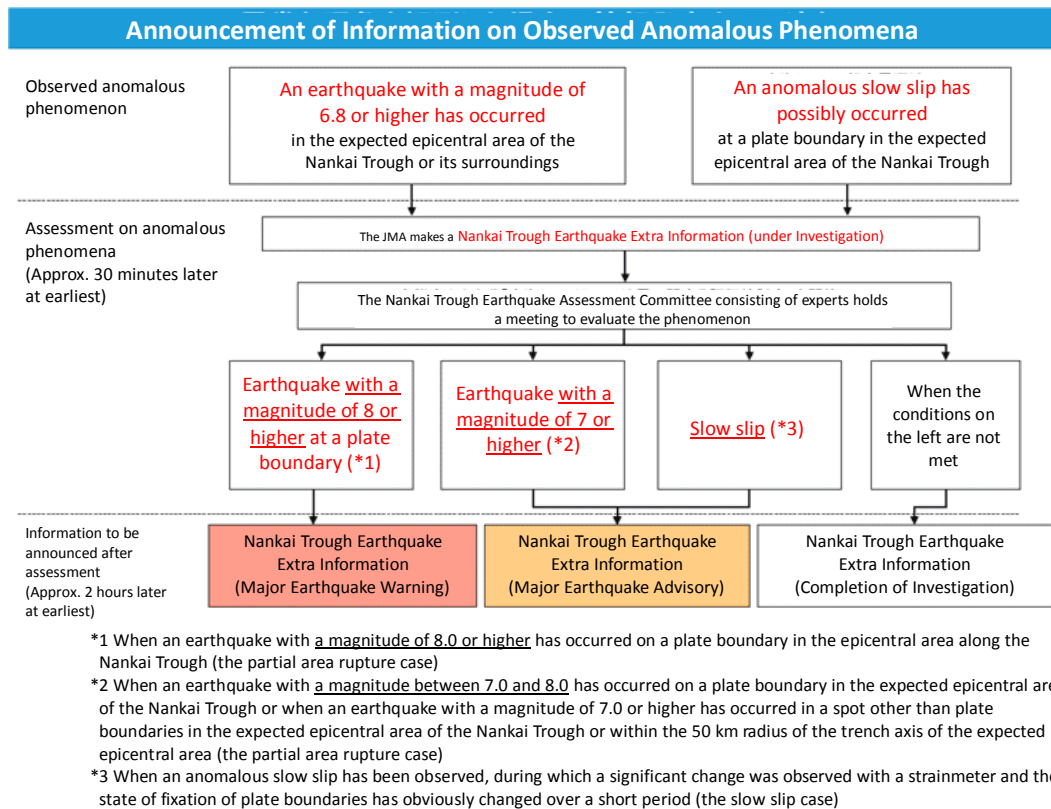
(Reference: [http://www.jma.go.jp/jma/press/1903/29a/20190329\\_nankaijoho\\_name.html](http://www.jma.go.jp/jma/press/1903/29a/20190329_nankaijoho_name.html))

In the partial area rupture case, the JMA will make a Nankai Trough Earthquake Extra Information (Major Earthquake Warning), while the government calls for alert and evacuation, when the occurrence of the following phenomenon is confirmed:

- An earthquake of Mw 8.0 or higher has occurred at a plate boundary in the expected epicentral area of the Nankai Trough

In the limited area rupture case or the slow slip case, the JMA will make a Nankai Trough Earthquake Extra Information (Major Earthquake Advisory), while the government calls for caution and the review of earthquake preparedness, when the occurrence of one of the following phenomena is confirmed:

- An earthquake of Mw 7.0-8.0 has occurred at a plate boundary in the expected epicentral area of the Nankai Trough
- An earthquake of Mw7.0 or higher has occurred in a spot other than plate boundaries in the expected epicentral area of the Nankai Trough or within the 50 km radius of the trench axis in the expected epicentral area
- An anomalous slow slip has been observed, during which a significant change was observed with a strainmeter and the state of fixation of plate boundaries has obviously changed over a short period



Source: Cited from the summary of the Guidelines for Formulating Disaster Risk Management Measures Based on Various Nankai Trough Earthquake Scenarios (1st Edition)  
 (Reference: <http://www.bousai.go.jp/jishin/nankai/index.html>)

### 1-5 Guidelines and Future Steps

The abovementioned disaster risk management processes for the three cases are basic guidelines. Residents, communities, and companies need to take the best disaster risk management measures possible according to the situation.

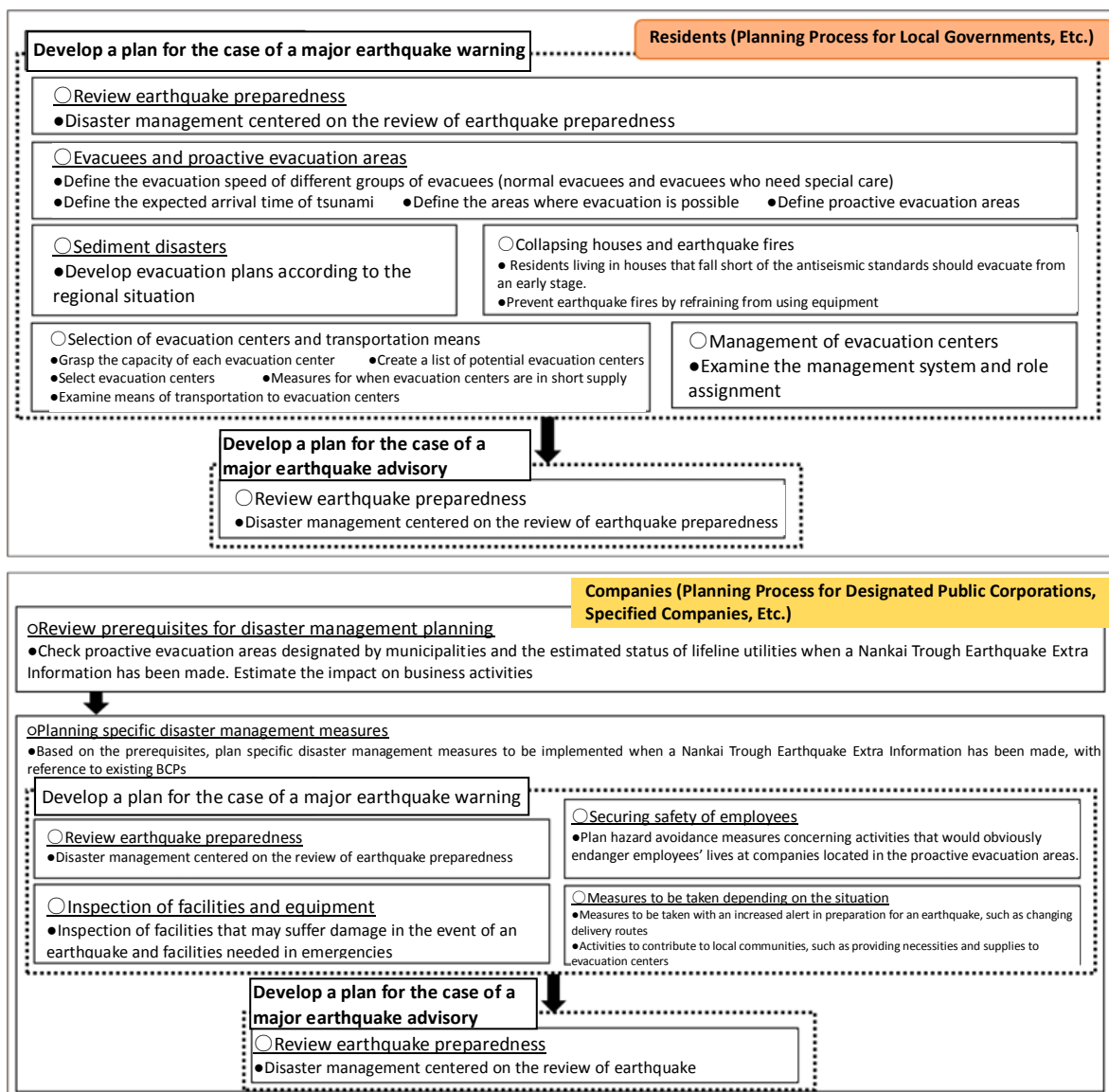
The Cabinet Office and relevant ministries and agencies examined disaster risk management policies for each sector and published the Guidelines for Formulating Disaster Risk Management Measures Based on Various Nankai Trough Earthquake Scenarios (1st Edition) on March 29, 2019.

Reference: <http://www.bousai.go.jp/jishin/nankai/index.html>

The above Guidelines are intended to help local governments, designated public corporations, and companies with examining and formulating disaster risk management plans for cases in which the risk of a Nankai Trough large-scale earthquake is increasing. The Guidelines consist of three sections titled “General,” “Residents,” and “Companies” respectively. These are intended for use by local governments, designated public corporations, facilities used by many and unspecified people, and facilities handling hazardous materials that are located in the Nankai Trough earthquake measures promotion area. The Guidelines show the planning process for these entities based on the following basic ideas:

- It is important to choose safer disaster prevention actions, keeping in mind (1) the balance between the risk of an earthquake and the impact of disaster risk management measures on day-to-day life and business activities, and (2) the fact that it is difficult to accurately predict the timing of an earthquake and it is practically impossible to completely guarantee safety with disaster risk management measures.
- It is important to implement preparedness measures for a sudden earthquake in order to mitigate its impact on day-to-day life and enhance safety.





Source: Cited from the summary of the Guidelines for Formulating Disaster Risk Management Measures Based on Various Nankai Trough Earthquake Scenarios (1st Edition)  
 Reference: <http://www.bousai.go.jp/jishin/nankai/index.html>

Preparedness for a sudden earthquake is still important because anomalous phenomena are not necessarily always observed before a large-scale earthquake in the Nankai Trough. Since appropriate disaster risk management varies among regions, each community needs to find what kind of disaster risk management policies and solutions would work for it, while referring to the Guidelines and coordinating disaster risk management measures for individuals, households, communities, and organizations on a regional or district level. The disaster risk reduction capabilities of communities and companies can be improved by continuing to promote preparedness for a sudden earthquake and proactively formulating disaster risk reduction measures based on the Guidelines for the time at which the risk of a large-scale earthquake increases. The Guidelines are based on the current best knowledge and will be revised as needed to incorporate new insights.