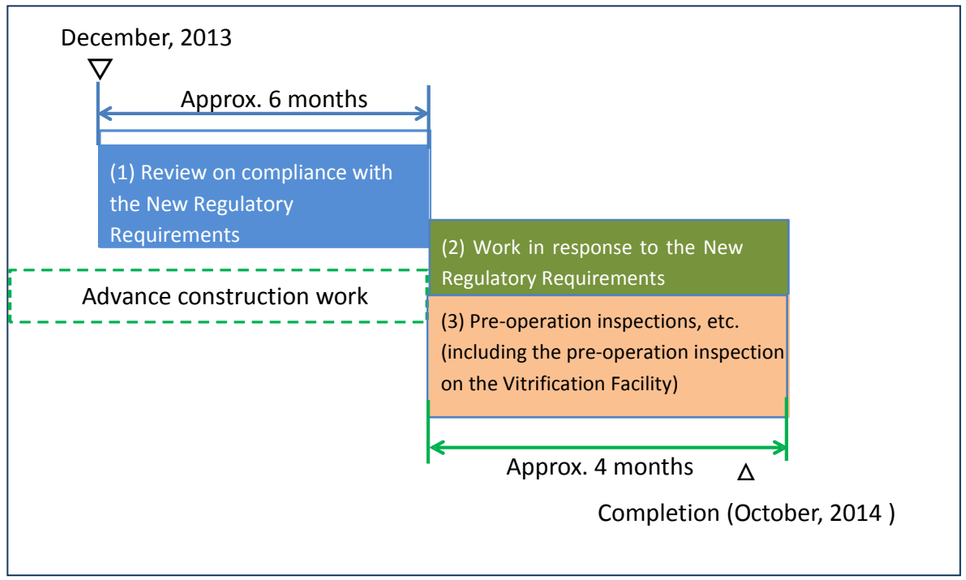
Response to the New Regulatory Requirements at the Rokkasho Nuclear Fuel Cycle Facilities

1. Reprocessing Plant

<1-1. Change of Plant construction plan>

The scheduled completion time, which was set as "TBA", is changed to "October, 2014" in view of the time required to conduct reviews and engineering work to ensure compliance with the New Regulatory Requirements, as the conformity to the New Regulatory Requirements is the condition of completion for Reprocessing Facilities under construction according to the "Approach to the implementation of the New Regulatory Requirements for Nuclear Fuel Facilities (adopted by the Nuclear Regulation Authority in its 30th meeting)".

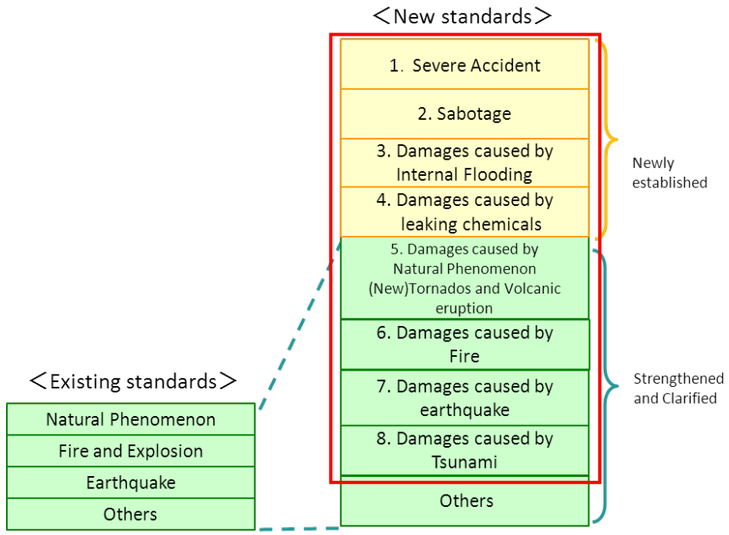
The three items shown in this diagram must be carried out before the completion of the construction. The periods shown below have been taken into account as a necessary timeframe.



- "(1) Review on conformity to the New Regulatory Requirements" is estimated to take 6 months, which is around the same amount of time as the review period anticipated in the application for commercial nuclear reactors. The following matters are addressed during this period:
  - Reflecting the findings of past review on assessment method, etc. concerning matters commonly applicable to both reprocessing and commercial nuclear reactor facilities, such as the approach to defining design-basis earthquake ground motion (DBGM Ss) and the approach to assessing tornadoes / volcanic eruptions
  - Making advance preparation of reference materials for review / briefing, to be held after the application concerning the New Regulatory Requirements

- "(2) Work in response to the New Regulatory Requirements" is estimated to take 4 months in view of the amount of time required for necessary engineering works such as "partially modifying existing facilities to set up connection ports with portable equipment", to be carried out after receiving approval for the application on the New Regulatory Requirements, based on the facts that preparation for works that can be commenced has already been started, and that the deployment of portable equipment is already in progress. "(3) Pre-operation inspections" are to be carried out during the period of (2). This includes the pre-operation inspections on the Vitrification Facility.

<1-2. Focuses of the New Regulatory Requirements >



<1-3. Main measures for compliance with the New Regulatory Requirements>

1. Countermeasures for severe accidents (responses to facilities for handling severe accidents, etc.)

- Seven events beyond the assumption of previous plant designs, such as "criticality accident in a fuel cell", are selected as severe accident. The following steps are taken to address hardware response requirements to prevent such accidents.
  - a. Deploying portable equipment such as firefighting pumps for direct coolant injection, in order to prevent high-level radioactive liquid waste from evaporating and solidifying in the event of loss of the cooling function (See the Table 1)
  - b. Partially modifying existing facilities to establish the connection ports of portable equipment to existing facilities
  - c. Assessing the effectiveness of trainings on the handling / procedures for facilities deployed in "a" in preparedness for severe accidents.

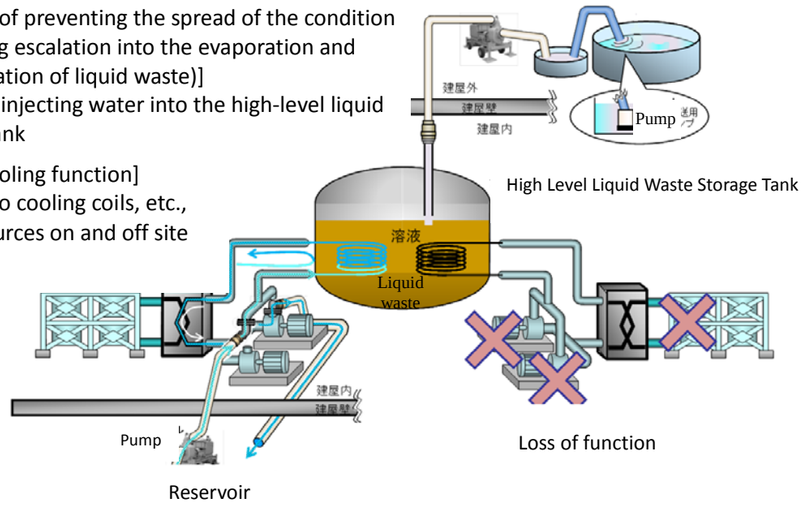
Table 1: Examples of portable equipment deployed in preparedness for severe accidents
("a" in the above list)

Requirements such as accident-prevention facilities (examples)	Measures (e.g. deployment of portable equipment)
Facilities for bringing criticality under control (bringing it to the state of sub-criticality)	Soluble neutron absorber feeder
Facilities for alleviating the effects of radioactive material discharge in the event of liquid waste evaporation and solidification	Portable filter unit, portable exhaust
Facilities for preventing an explosion with hydrogen, generated in radiolysis	Engine air compressor, etc.
Facilities for bringing fire or explosion, induced by organic solvent, etc., under control (e.g. extinguishing it)	Nitrogen and compressed air feeder, etc.
Facilities for cooling spent fuel when Spent Fuel Storage Pool inventory goes unusually low	Portable sprayers
Facilities for addressing leakage of radioactive materials	Medium-sized transport pumps
Facilities for suppressing the discharge of radioactive materials outside the plants	Large-capacity foam feeder
Water feeding facilities required to address a severe accident	Deployment of firefighting pumps

【Reference: Response to the loss of the cooling function at the high-level liquid waste tank】

[Means of preventing the spread of the condition (delaying escalation into the evaporation and solidification of liquid waste)]
Directly injecting water into the high-level liquid waste tank

[Means of restoring the cooling function]
Directly injecting water into cooling coils, etc., using alternative water sources on and off site



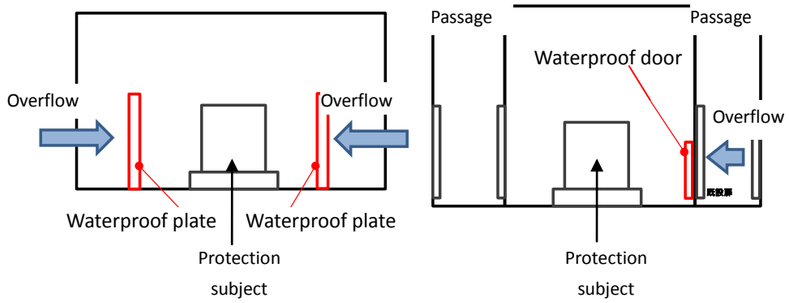
2. Prevention of illegal access to the Reprocessing Plant

- The New Regulatory Requirements demand that the Reprocessing Plant prevent illegal human access, keep out materials that could cause hazard to people or other materials, and block unauthorized access. This is achieved with existing measures such as invasion prevention fencing.

3. Prevention of damage from overflow

- Waterproof plates, waterproof doors and watertight doors are installed to protect facilities from water overflown as a result of equipment / pipe damage, Spent Fuel Storage Pool sloshing, etc.

【Reference: Outline of measures (waterproof plates and waterproof doors)】



4. Prevention of damage from chemical leakage

- The New Regulatory Requirements demand that facilities with safety functions maintain the safety functionality even in chemical leakage. Chemical feed pipes, etc. are to be wrapped with protective sheeting to protect the facilities from chemical leakage.

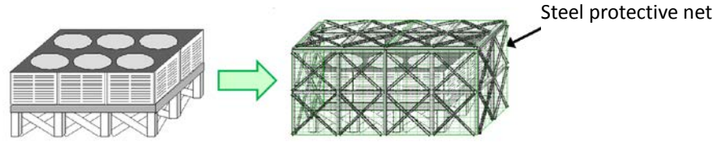
5. Prevention of damage from external impact (new requirements against tornadoes / volcanic eruptions)

- The New Regulatory Requirements have added tornadoes and volcanic eruptions to the list of anticipated natural phenomena in relation to the demand that safety functionality be maintained in the event of anticipated natural phenomena. The following actions are to be taken.

<Tornadoes>

- The impact of tornadoes, in addition to other natural phenomena, is assessed. Based on the findings, protective nets, etc. are to be installed to protect outdoor facilities with safety functions (e.g. Safety Coolant system's cooling tower) from tornadoes.

【Reference: Outline of tornado countermeasures】



<Volcanic eruptions>

- It has been determined that the likelihood of applicable volcanos (Towada Volcano, Hakkoda Volcano) affecting the facility during its operations is sufficiently small. Monitoring is possible on the basis of information from public organizations.

6. Prevention of damage from fires

- The New Regulatory Requirements demand that gloveboxes, etc. that handle nuclear fuel be designed with non-combustible or flame retardant materials. Current gloveboxes, which use acrylic panels, are to have flame-retardant sheeting applied to attain flame retardant property.

7. Prevention of damage from earthquakes

- The New Regulatory Requirements demand that latest scientific insight and other information be used to determine DBGM Ss for earthquakes at a specific hypocenter (interplate earthquake, inside inland earth's crust earthquake and slab earthquake) and earthquakes at non-specific hypocenters.

The results of latest studies on active faults around the site and latest seismic activity data have been reflected.

- More specifically, assessment has been made on the anticipation of a hypothetical interplate earthquake with a magnitude of 9 (M 9) on the Richter scale in view of the 2011 off the Pacific coast of Tohoku Earthquake, assuming that an inside oceanic plate earthquake of the scale similar to that of the 2011 Miyagi Offshore Earthquake (M 7.2) could occur on the site. As for earthquakes with a non-specific hypocenter, assessment has been made in line with the New Regulatory Requirements' approach to "gather seismic observation records from areas near hypocenters to define DBGM Ss for the site".
- The assessment pointed to ground motion of up to 450 Gal, which is DBGM Ss adopted in the 2006 Seismic Safety Assessment. Allowing some margin, it has been decided to set DBGM Ss at 600 Gal.
- Detailed impact assessment of existing facilities' seismic resistance based on the revised DBGM Ss, has confirmed seismic safety of Class S facilities, which are subject to the most stringent requirements in seismic design. This confirms their seismic safety, making it unnecessary to apply further seismic reinforcement.
- For the New Regulatory Requirements, equipment whose seismic resistant class is changed to Class S and existing facilities that are used in severe accident response in impact mitigation measures (severe accident response facilities), must be able to maintain their functionality even under DBGM Ss. Based on the abovementioned amendment of DBGM Ss, seismic reinforcement is applied to some of the facilities (Ventilation dampers at the Separation Building, Purification Building, etc.).

8. Prevention of damage from tsunami

- The New Regulatory Requirements demand in the review guide that tsunami assessment be carried out. Considering the siting of the Reprocessing Plant (55m above sea level, 5km from the coastline), it has been determined that there should be no effect from tsunami. Consequently, as before, there is no need for tsunami countermeasures.

2. Vitrified Waste Storage Center

<2-1. Focuses of the New Regulatory Requirements>

<2-2. Main measures for compliance with the New Regulatory Requirements>

No engineering work for compliance

1. Prevention of illegal access to the facility

- Similarly to the Reprocessing Plant, the existing invasion prevention fencing is sufficient to address this issue.

2. Prevention of nuclear fuel reaching criticality

- The content of nuclear fission materials in vitrified waste is low, posing no risk of criticality. Therefore there is no need for new measures.

3. Prevention of damage from external impact (tornadoes and volcanic eruptions)

- The New Regulatory Requirements have added tornadoes and volcanic eruptions to the list of anticipated natural phenomena in relation to the demand that safety functionality be maintained in the event of anticipated natural phenomena. The following actions are to be taken.

<Tornadoes>

・Assessment of impact from tornadoes in addition to other natural phenomena has concluded that no additional reinforcement is necessary.

<Volcanic eruptions>

・Similarly to the Reprocessing Plant, it has been determined that the likelihood of applicable volcanoes (Towada Volcano, Hakkoda Volcano) affecting the facilities during their operations is sufficiently small. Monitoring is possible, on the basis of information from public organizations.

4. Prevention of damage from earthquakes

- Similarly to the Reprocessing Plant, DBGM Ss is changed to 600 Gal. Assessment of the revision on existing facilities has concluded that no seismic reinforcement is required.

5. Prevention of damage from tsunami

- Similarly to the Reprocessing Plant, it has been concluded that there is no need for tsunami countermeasures, as before.

3. Uranium Enrichment Plant

<3-1. Focuses of the New Regulatory Requirements>

<3-2. Main measures for compliance with the New Regulatory Requirements>

No engineering work for compliance

1. Prevention of the spread of a severe accident, etc.

- The New Regulatory Requirements demand that these facilities have necessary measures in place to prevent an event that could lead to a severe accident from escalating into a severe accident, e.g. a measure to limit the effect of possible uranium hexafluoride leakage at a uranium processing facility handling uranium hexafluoride in particular. In view of the possibility of "damage to a device or building in pressure greater than the surrounding atmospheric pressure (homogenization tank, interim product container) leading UO_2F_2 (aerosol) and hydrogen fluoride (gas) into the building or outdoor environment", further enhancement is applied to the protective clothes, closing tools, etc. that are already deployed.

2. Prevention of damage from earthquakes

- Seismic safety has been re-assessed due to the revision of the overdesign factor for design-basis horizontal seismic force coefficient, which concluded that no seismic reinforcement is necessary as the result cleared the New Regulatory Requirements.

4. MOX Fuel Fabrication Plant

4-1. Focuses of the New Regulatory Requirements

<4-2. Main measures for compliance with the New Regulatory Requirements>

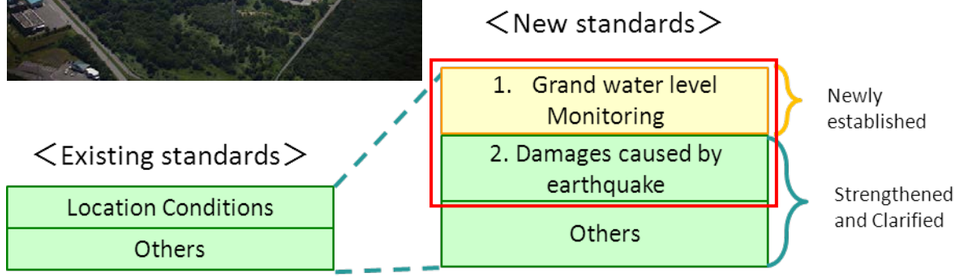
1. Severe accident countermeasures (response measures concerning severe accident response facilities, etc.)

- Assessment has been carried out on possible criticality in the homogenizer / mixer, hydrogen explosion at the sintering furnace, anticipating a "criticality accident" and "containment function loss", which may develop in conditions beyond those of design-basis accidents. It has concluded that there is no possibility of severe accident, with no necessity for severe accident countermeasures.

Actions in the level similar to those for the Reprocessing Plant are to be implemented for the requirements other than the above 1.

5. Low-Level Radioactive Disposal Center

<5-1. Focuses of the New Regulatory Requirements>



1. Monitoring of ground water level

- Requirement for "Ground water level monitoring system" has been newly introduced. However, it is not required to apply the New Regulatory Requirements to the facilities which are already licensed.
- Assessment of the current facilities and conditions shows that they generally clear newly-introduced requirements in the New Regulatory Requirements.

In addition to the abovementioned response to design requirements, the application for approval of Technical Specification Amendment is to be filed due to the requirement of "periodic assessment" in the amended Provisions on Category II Waste Disposal.

END

Earthquake response measures for the Reprocessing Plant (at DBGM Ss)

DBGM Ss in this application:　600 Gal
(Reference: DBGM Ss in the previous seismic safety assessment , reported in 2007:　450 Gal)

【Approach to defining DBGM Ss】

・ The New Regulatory Requirements demand that DBGM Ss be determined based on latest insight and results of geological surveys.

→ DBGM Ss reflects the results of latest active fault surveys around the site, data from the 2011 off the Pacific coast of Tohoku Earthquake (March 11 2011 earthquake) and most recent case studies by public research institutes.

【Ground motion at specific hypocenters】

・ Assessment of ground motion anticipating the earthquakes listed below, pointed to up to 450 Gal. Allowing for some margin, it has been decided to set DBGM Ss at 600 Gal.

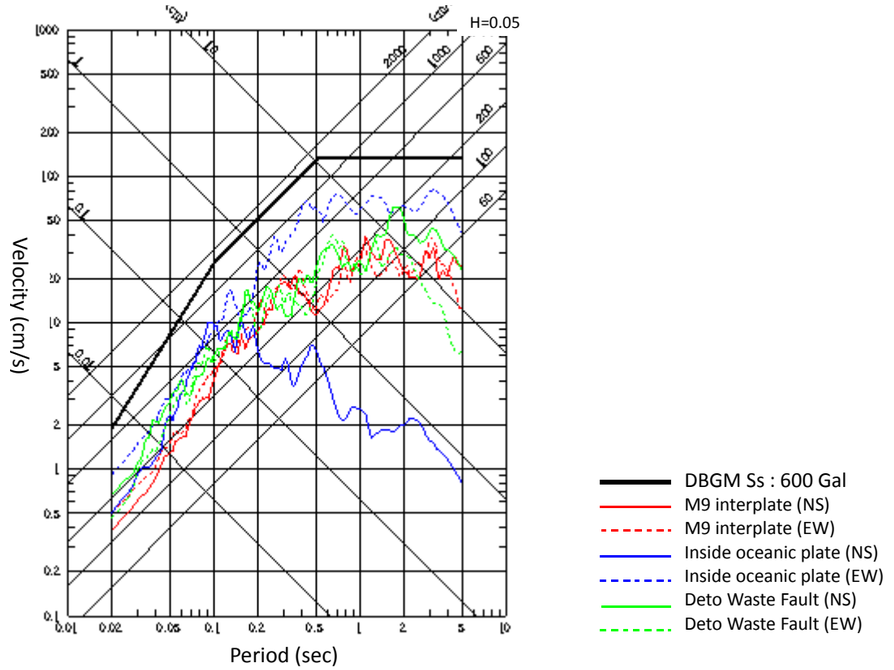
i. Interplate earthquake　: Earthquake hypothetically measuring M 9 in view of the 2011 off the Pacific coast of Tohoku Earthquake
ii. Inside oceanic plate earthquake : 2011 Miyagi Offshore Earthquake, which was the largest scale slab earthquake recorded in the Tohoku region (M 7.2)
iii. Inside inland earth's crust earthquake　: Earthquake caused by Deto West Fault (M 6.8)

【Ground motion with no hypocenter specified】

・ Assessment according to the New Regulatory Requirements' approach of "defining the site's ground motion by gathering seismic records of earthquakes in nearby areas" points to the ground motion of 450 Gal.　It is not adopted as this is below DBGM Ss of 600 Gal sought in this application.

・ The Central Research Institute of Electric Power Industry examined the 2004 Hokkaido Rumoi Nanbu Earthquake, and, based on the results of drilling surveys at Rumoi, estimated the bedrock wave on free surface of the base stratum in relation to the ground surface observation record (approx. 1,100 Gal) to be the maximum acceleration of 585 Gal, marginally topping 600 Gal at some frequencies.　However, the impact on the site facilities is no more than 600 Gal, used in this application.

Results of each earthquake's ground motion assessment and the DBGM Ss used in this application



【Impact on existing facilities】

・ Impact assessment of existing facilities' seismic resistance based on the revised DBGM Ss, has confirmed seismic safety of Class S facilities under the previous aseismic design category.　No seismic reinforcement work is required.

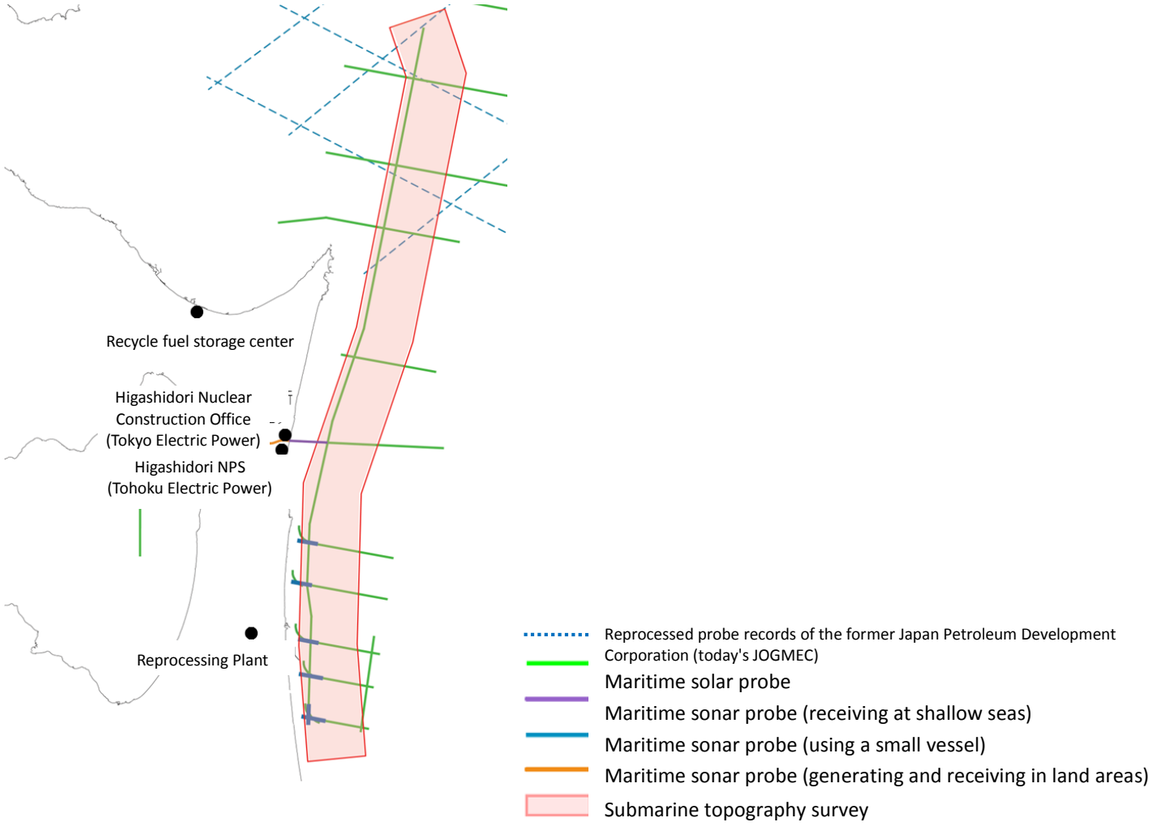
・ Since the New Regulatory Requirements demand that equipment whose seismic resistant class is changed to Class S maintain its functionality under DBGM Ss, some facilities require seismic reinforcement.

【Geological surveys and active fault investigations】

1) Geostructural survey of the eastern Shimokita Peninsula (continental shelf peripheral fault) (released on December 17, 2013)

・ Marine sonar probe, mud sampling survey, etc. provided geostructural interpretation of the site at deep subsurface.

・ The previous assessment that this fault is unlikely to become active in the future, remains valid. The latest findings were consistent with previous geostructural interpretation.



Investigated by four licensees* operating in Shimokita Peninsula
(*JNFL, Tohoku Electric Power Company, Tokyo Electric Power Company and RFS)

2) Fault investigation on site (released in December 19, 2013)

Trench surveys found no displacement or disfigurement in the basal layer of upper terrace deposits (approx. 200,000 years old), indicating that there have been no activity since at least the late Pleistocene (120,000 – 130,000 years old).

- It has been confirmed that this is not likely to become active in the future, and that there is no issue about the stability of the ground foundation.

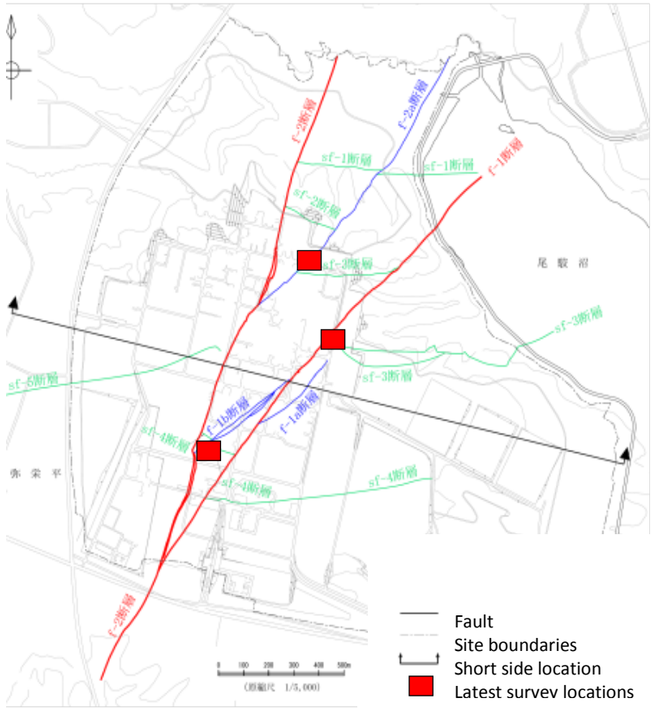


Figure 1: Layout of faults on the site

Table 1: Table of geological layers on the site

地質時代			地層名	記号	主な層相及び岩相
新生代	第四紀	完新世	崖錐堆積層	dt	礫，砂，粘土
			沖積低地堆積層	al	礫，砂，粘土，腐植土
		更新世 後期	火山灰層	lm	褐色の粘土質火山灰
			中位段丘堆積層	M2，M1	主に石英粒子からなる淘汰の良い中粒～粗粒砂
		更新世 中期	高位段丘堆積層	H3	主に石英粒子からなる淘汰の良い中粒～粗粒砂
		更新世 前期	砂子又層 上部層	S2	砂，シルト，礫
			砂子又層 下部層	S1	凝灰質砂岩
	新第三紀	鮮新世 後期	鷹架層 上部層(T2) 泥岩層	Tms	泥岩 一部に凝灰岩を挟む。
		中新世 中期	鷹架層 中部層(T2) 礫混り砂岩層	Tss	礫混り砂岩
			鷹架層 中部層(T2) 軽石混り砂岩層	Tps	砂岩・凝灰岩互層，礫混り砂岩，砂岩泥岩互層，軽石混り砂岩，砂質軽石凝岩
			鷹架層 中部層(T2) 軽石凝灰岩層	Tpt	凝灰岩，軽石凝灰岩，軽石質砂岩，礫
			鷹架層 中部層(T2) 粗粒砂岩層	Tcs	砂質軽石凝灰岩，粗粒砂岩
			鷹架層 下部層(T1) 細粒砂岩層	T1fs	細粒砂岩 一部に粗粒砂岩を挟む。
			鷹架層 下部層(T1) 泥岩層	Tms	泥岩 一部に凝灰質砂岩，砂質軽石凝灰岩を…

注）—— は，整合関係を示す。
〰 は，不整合関係を示す。

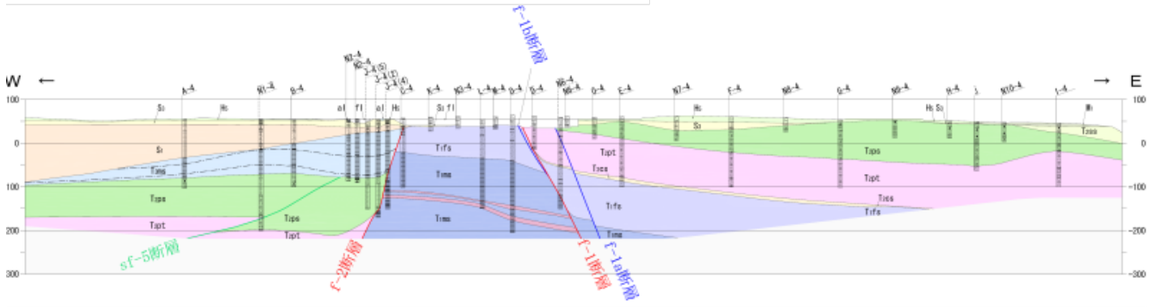
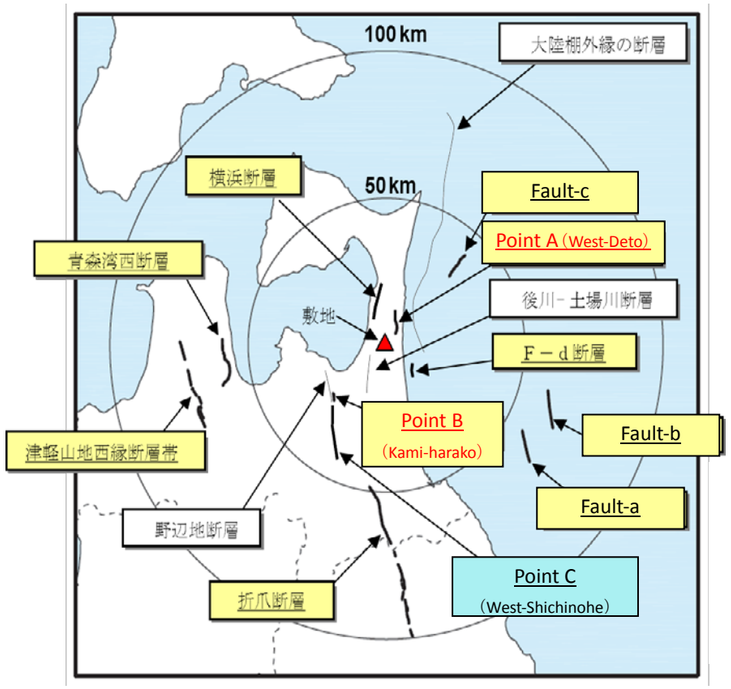


Figure 2: Cross-section view of geology on the site

3) Land area survey around the site (Released in December 19, 2013)

- Drilling surveys were carried out at two locations shown in the diagram Point A and Point C)
- Fault -a starts on the north edge at a northern stratum older than 400,000 years. Its fault length is changed (approx. 6km to approx. 10km)
- Fault -c (newly recognized as an active fault this time: approx. 22km) and Fault -b(approx. 5km) cannot have the possibility of activity ruled out, and had the possibility of simultaneous rupture assessed in relation to the assessment of ground motion (approx. 27km).
- Based on the results of the drilling surveys, these anticipated activities would come within the previous DBGM Ss (450 Gal), and therefore have no impact on the facilities' seismic safety.



Underlined Active faults newly added for this seismic design consideration

Underlined Active faults for seismic design considerations
Red text: Fault assessment revised this time

Faults not for seismic design considerations