Overview of Results of the Request for Information for Contaminated Water Issues

Yoji UEDA
Director for Management of Contaminated Water in Fukushima Daiichi,
Agency for Natural Resources and Energy, METI
12 November 2013

METI
Ministry of Economy, Trade and Industry

Identification of Risks of Contaminated Water and Examination of Countermeasures

1. Considerations at the Committee on Countermeasures for Contaminated Water Treatment

(1) "The Government of Japan will identify all of potential risks through the processes and will constantly consider concrete preventive measures and the way of emergency response utilizing such technical expertise as the Committee on Countermeasures for Contaminated Water Treatment."

("Basic Policy for the Contaminated Water Issue", Sep. 3, 2013, Nuclear Emergency Response Headquarters)

(2) "The Committee on Countermeasures for Contaminated Water Treatment, based on site considerations, will identify potential risks and add countermeasures when necessary. 【To be intensively carried out from the middle of this month, and provisionally summarized during this calendar year. Also in future as necessary】"

("Policies and Concrete Actions for Addressing the Contaminated Water and Decommissioning Issues", Sep. 10, 2013, Inter-Ministerial Council for Contaminated Water and Decommissioning Issues)

2. Position of the Latest Considerations

(1) Based on "Policies and Concrete Actions for Addressing the Contaminated Water and Decommissioning Issues" on Sep. 10, 2013, risk identification and countermeasure examination by the Committee on Countermeasures for Contaminated Water Treatment have started.

Sep. 13 (Fri.) The 6th Meeting of the Committee on Countermeasures for Contaminated Water Treatment

Sep. 27 (Fri.) The 7th Meeting of the Committee on Countermeasures for Contaminated Water Treatment

(2) It is considered to achieve fundamental settlement of contaminated water issue when the countermeasures taken and to be taken work effectively. In case when these countermeasures do not bring the expected results, the preventive and multi-layered measures will be taken on the basis of risk identification.

(3) Risk identification will be implemented by sources of contamination, and necessary countermeasures can be divided into the following two categories.

① Preventive and multi-layered measures to be taken in case when the current countermeasures do not bring the expected results
(Example: Measures for restraining underground-water inflow in case the current underground-water bypass does not function.)

② Identification of potential risks requiring future countermeasures and their implementation
(Example: Shielding water leakage from the penetration structure of the reactor building or from the gap between buildings)

3. Future Considerations

(1) For the potential risks with technical difficulties, technical proposals will be invited for collecting wisdom and expertise. The proposals will be examined in the following two months. The Committee on Countermeasures for Contaminated Water Treatment will conduct the site survey promptly.

(2) Taking into account of risk levels of contaminated sources and effectiveness of countermeasures taken, preventive and multi-layered countermeasures, in which priority, schedule and details of measures are identified, will be comprehensively developed.

Identifying potential risks and necessary preventive & multi-layered countermeasures

	Risks		Countermeasures taken or decided to be taken by September 3
Risks already being responded	Leakage of contaminated ground water into the sea	Contaminated water in the seaside trenches	• Remove the highly C/W in the trenches *[Removing]*
		Contaminated soil in the seaside turbine building	• Install underground wall by injecting sodium silicate. Pumping up C/W from contaminated area. *[Preventing leakage]* • Paving the contaminated area around the building with asphalt. *[Preventing leakage]* • Install sea-side impermeable walls in the port. *[Preventing leakage]*
		C/W in the storage tanks	• Enhance survey of leakage and patrols of tanks and pipes. *[Preventing leakage]* • Install water gauge and leakage detector. *[Preventing leakage]* • Move water to welded tanks, strengthen bolts of horizontal steel tanks. *[Preventing leakage]* • Accelerate replacement from bolted tanks to welded ones. *[Preventing leakage]* • Clean up C/W by ALPS.*[Removing]* • Clean up C/W by more efficient cleaning equipment.*[Removing]* • Remove contaminated soil around the tanks. *[Removing]*
	Contamination of ground water by leakage of secondary waste and its leakage into the sea (e.g., leakage of secondary waste stored in HIC)		• Reduce the volume of secondary waste by more efficient cleaning equipment. *[Preventing leakage]*
	Shortage of tanks due to contaminated water increase		• Pump up ground water on mountain side well (groundwater by-passing) *[Isolating]*
			• Pump up water from building side well (sub-drain) *[Isolating]*
			• Install frozen soil walls enclosing the reactor and turbine buildings*[Isolating]*
			• Install enough tanks to store increasing contaminated water. *[Preventing leakage]*

Additional preventive and multi-layered countermeasures
• Improve soil of north-side area of Unit 1 cooling water intake. *[Preventing leakage]* • Counter measures for contaminated substances in the plant port. *[Preventing leakage] [Removing]* →《Inviting technical proposals: Removal of radioactive materials from the seawater in the harbor》
• Increase height of the embankment, install the back-up embankment, and replace embankment and basement of the horizontal tanks to concrete. *[Preventing leakage]* • Prevent inflow of C/W by replacing trenches to culverts. *[Preventing leakage]* • Accelerate further replacement to welded tanks, and improving reliability of them. *[Preventing leakage]* →《Inviting technical proposals: Welded tank with longer integrity》 • Prevent leakage of groundwater contaminated by leaked tank water to the plant port (preventing spread of contamination by chemical agent injection) . *[Preventing leakage]* • Increase of ALPS to accelerate storage water decontamination. *[Removing]* • Detect small leakage from tank. *[Preventing leakage]* →《Inviting technical proposals: Technologies for detection of minor leaks》
• Prevent leakage from HIC (installing buildings enclosing temporary storages etc.) *[Preventing leakage]* • Reduce the volume of high radiation waste and secure better storing methods. *[Preventing leakage]*
• Stop groundwater inflow *[Isolating]* →《Inviting technical proposals: Construction technologies for impermeable walls, technique for covering surfaces 》
• Secure storage capacity for contaminated water *[Preventing leakage]* →《Inviting technical proposals: Technologies to store large amounts of contaminated water safely for a long period》 • Adequate treatment of tritiated water . →《Inviting technical proposals: tritium removal technologies》

Countermeasures written in red letters were decided on Inter-governmental council near Fukushima Daiichi NPS (9/9) and on the Prime Minister Abe 's site visit(9/19)

	Risks			Future countermeasures envisaged at this point, further assessment is needed for priority and schedule
Risks in need of assessment	Leakage from cooling system	Leakage of C/W in buildings	Leakage of C/W in buildings	• Shorten loops to remove C/W from each reactor building to the CW treatment equipment. *[Preventing leakage]* • Prevent C/W leakage to groundwater (sealing tunnels of the outer wall of the buildings., etc.). *[Preventing leakage]* →《Inviting technical proposals: technologies to block water inside the buildings》 • Control level of C/W and groundwater by installing pump in the lower floor of the reactor buildings. *[Preventing leakage]*
			Leakage of C/W in the buildings to the sea by an outer-rise tsunami	• Install tide embankment. *[Preventing leakage]* • Increase tank capacity. *[Preventing leakage]*
		Leakage C/W from pipes		• Replace pipes with radiation resistant, install back-up pipes. *[Preventing leakage]*
		Leakage C/W from cesium removal equipment		• Prevent C/W leakage from cesium removal equipment. *[Preventing leakage]*
	Radioactive waste generated after cesium removal			• Develop containment buildings. *[Preventing leakage]* • Develop measures for waste reduction and safety waste storage, *[Preventing leakage]*
	Natural disaster or other incidents (e.g. damage of tanks)			• Develop system to prevent C/W from leaking outside by quick transferring C/W to the buildings etc. *[Preventing leakage]*

Note1: Further risk studies are expected due to the shortage of sufficient information at present on risk assessment.
→《Inviting technical proposals: Understanding the groundwater flow 》
Note 2: Taking into account of risk levels of contaminated sources and effectiveness of countermeasures taken, preventive and multi-layered C/W countermeasures, in which priority, schedule and details of measures are identified, will be comprehensively developed.

C/W: contaminated water

Three Principles for Contaminated Water Issue

1. ISOLATING the contamination source

① Pumping up groundwater from the mountainside and near the reactor buildings

② Installation of the land-side impermeable wall using a soil freezing method

2. REMOVING the contamination source

③ Removing the highly contaminated water in the trenches

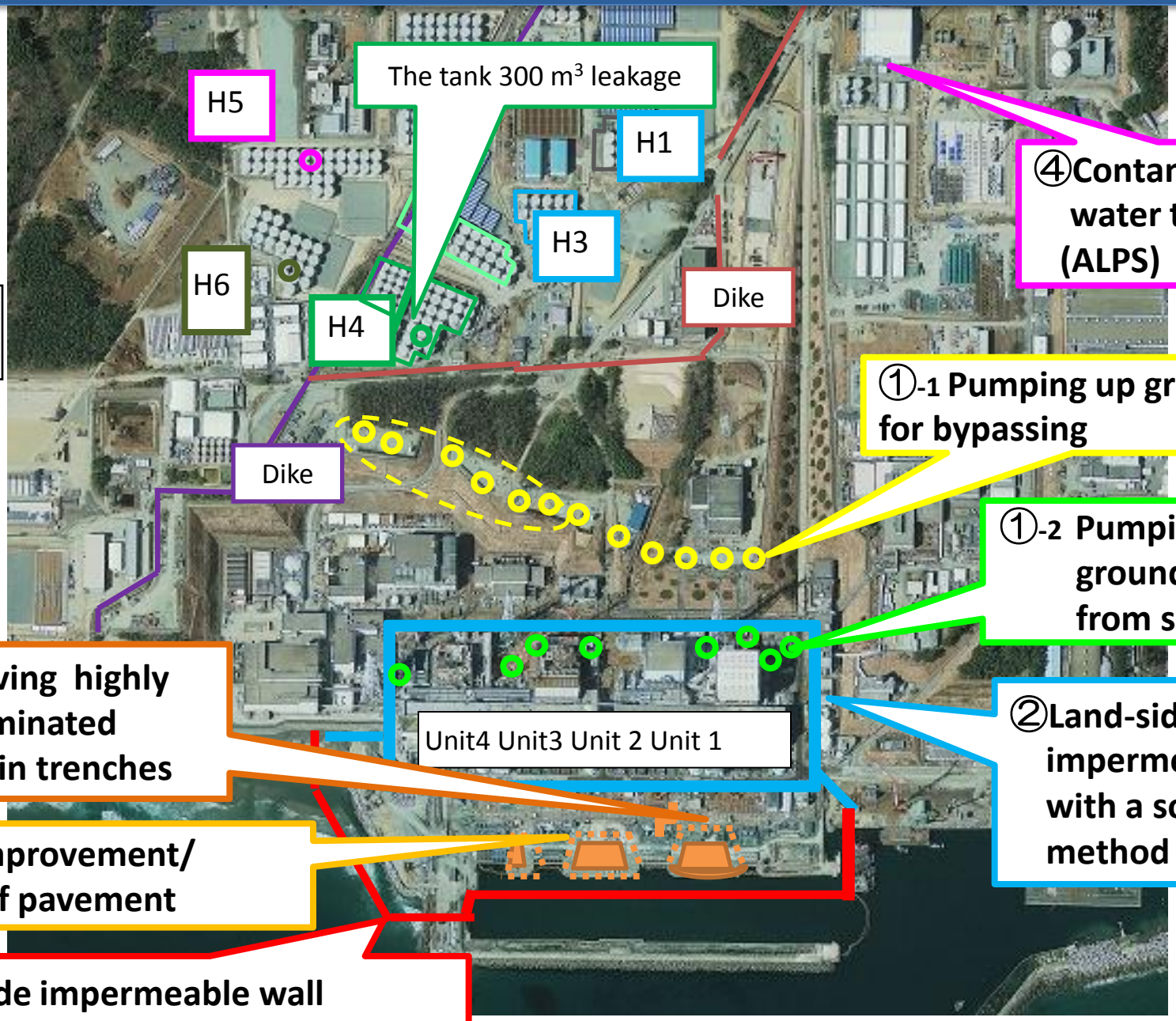
④ Contaminated water treatment(multi-nuclide removal equipment (named ALPS))

3. PREVENTING LEAKAGE

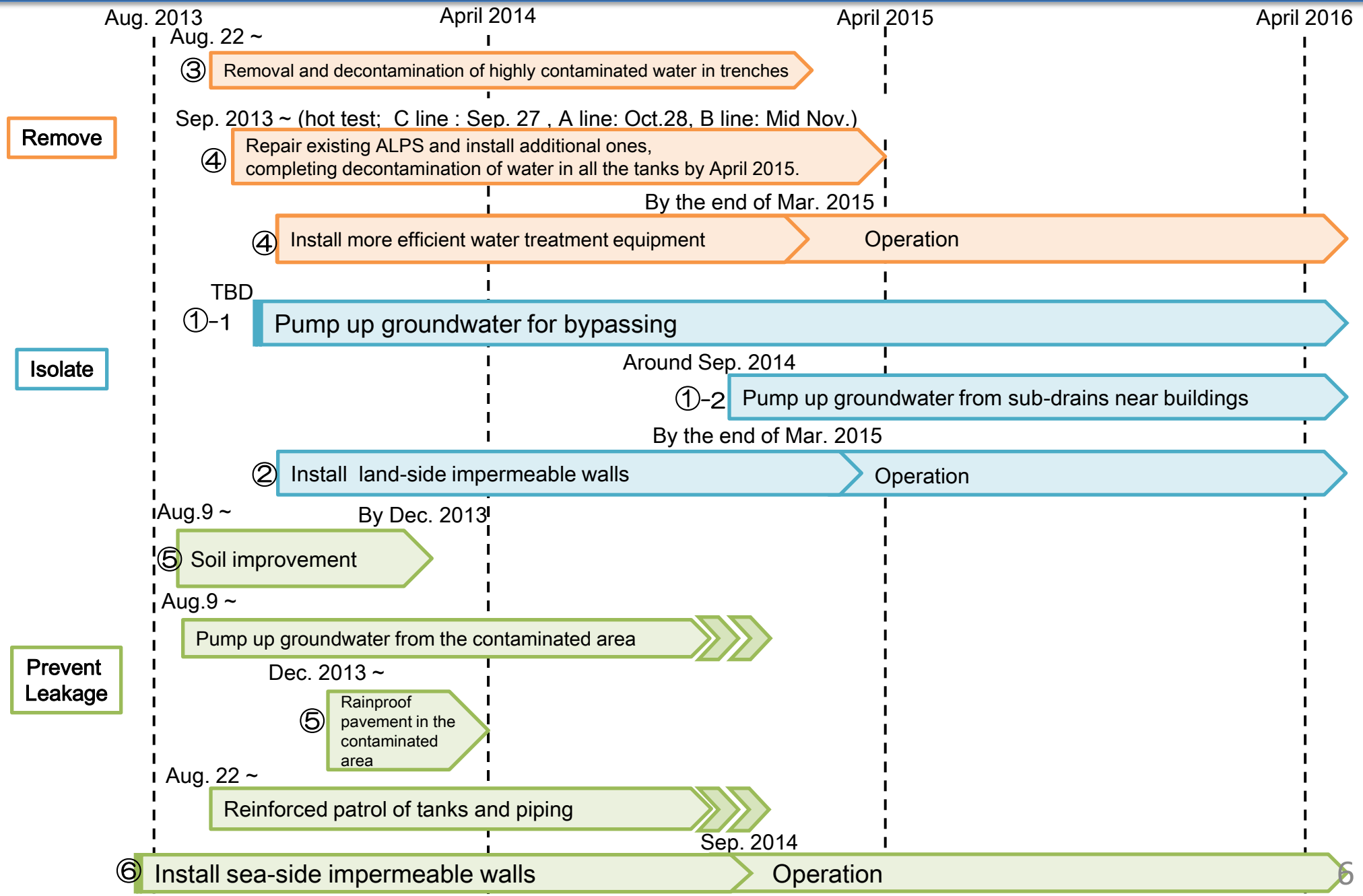
⑤ Soil improvement with sodium silicate (liquid glass) and rainproof pavement

⑥ Installation of the sea-side impermeable walls

Layout of Tank Area at Fukushima Daiichi



Schedules of Key Countermeasures



Inviting Intelligence for Contaminated Water Issue from Inside and Outside of Japan

1. Sequence of Events

(1)The Inter-Ministerial Council for Contaminated Water and Decommissioning Issues on Sep. 10, 2013 decided to establish a team to collect intelligence from inside and outside of Japan to broadly invite countermeasures against contaminated water in terms of potential risks with technical difficulties in particular, and to get a provisional summary in two months.

(2)In response, a team for collecting wisdom and technology, composed of experts of the International Research Institute for Nuclear Decommissioning (IRID), utilities, general contractors and manufacturers etc. was established on Sep. 20, 2013. The team started inviting technical proposals (through announcements on a website, briefing sessions, academic and international meetings in and out of Japan etc.)

2. Fields of Inviting Technical Proposals

Technical proposals for countermeasures to address the contaminated water issue are invited for the following six fields.

① Accumulated contaminated water (storage tanks, minor leakage detection technology etc.)
② Treatment of contaminated water (tritium removal technology, long-term stable storage methods of tritium etc.)
③ Decontamination of seawater in the port area (technology of removal of radioactive Cs & Sr from seawater)
④ Management of contaminated water inside buildings (technology of shielding water inside buildings and foundation improvement works etc.)
⑤ Site-wide management of groundwater inflow (technology of impermeable wall construction and wall facing etc.)
⑥ Understanding groundwater flow (geology & groundwater measurement system, water quality analysis technology etc.)

3. Future Schedule

(1)The above-mentioned team, in collaboration with knowledgeable people in and outside of Japan, will scrutinize the proposals submitted by Oct. 23, 2013.

(2)The results will be examined by the Committee on Countermeasures for Contaminated Water Treatment for compilation by around the mid Nov., and will be reflected to the overall picture of preventive and multi-layered countermeasures for contaminated water treatment to be finalized by the end of this year.

Summary of Results of RFI for Contaminated Water Issues

Particularly-Required Technologies	Proposals	Major Technical Items
1. Accumulation of contaminated water (Storage tanks, etc.)	205	• Welded tanks (shortening of delivery time, leak prevention, enlargement of tank) • Long-term and stable storing of large amount of contaminated water • Detection of minor leaks • Facilitating removal of the bolted type of tanks
2. Treatment of contaminated water (Tritium, etc.)	182	• Tritium removal technologies • Technologies in long term, stable storage of the tritiated water • Integrated risk assessment
3. Removal of radioactive materials from the seawater in the harbor	158	• Removal of radioactive Cs&Sr inside the seawater • Installation that absorbs radioactive materials (silt fence)
4. Management of contaminated water inside the buildings	107	• Water stoppage in the building • Water stoppage around the building
5. Management measures to block groundwater flow from flowing into the site	177	• Impermeable wall in addition to ice wall • Facing • Immobilization of radioactive Sr • Blocking or curbing groundwater at the mountain side
6. Understanding the groundwater Flow	116	• Methods for data acquisition • Rapid nuclide analysis method • Rapid and/or unmanned borehole drilling method • Groundwater flow and nuclide migration analysis
Other than the areas1 – 6 above	26	

Total submitted proposals: 779
Note 1: Invitation period was from 25 Sep to 23 Oct.
Note 2: Submitted information was categorized according to the proposers. Sum of the proposals of each area is larger than the total proposals (779) because some proposals are categorized into two or more.