(9 Documents)

Group FI

(Records Released In Their Entirety)

Fukushima Water Update

September 17, 2013

ALPS under construction

Advanced Liquid Processing System - over 1 year behind schedule

FI/1

Briefing Sheet to Support Inter-Agency Discussions

Contaminated Water at Fukushima Daiichi Nuclear Facility

Introduction

This document is intended to provide an overview of the recent issues concerning contaminated ground water and leaking contaminated water storage tanks at the Fukushima Daiichi site. Ever since the March 2011 accident that caused significant damage to the reactor cores and plant structures, the utility (TEPCO) has been forced to generate thousands of tons of contaminated water as it continues to cool the cores and core debris within the damaged reactor buildings.

The Government of Japan has identified Three Principles for the countermeasures against the Fukushima Daiichi contaminated water issue. These Three Principles are:

Principle 1: Removing the source of the contamination

Principle 2: Isolating ground water from the contamination source

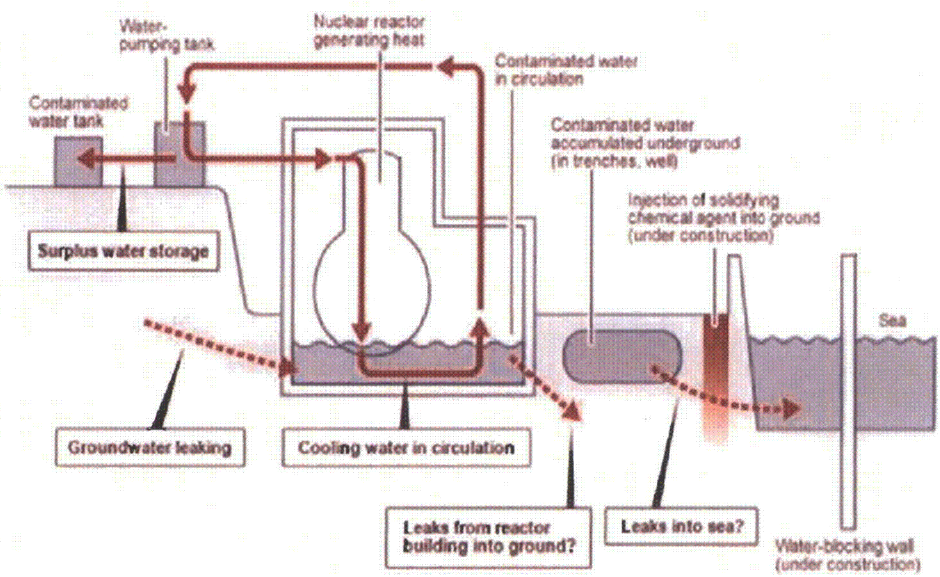
Principle 3: Preventing leakage of the contaminated water

Many factors contribute to the water situation at Fukushima Daiichi. These include:

- Circulating water to cool the reactors
- Ground water flow into NPP basements and leaking out
- Accident water left in trenches
- Leaking storage tanks containing highly contaminated water

Circulating water to cool the reactors

Flow Of Contaminated Water At Fukushima Daiichi Nuclear Power Plant

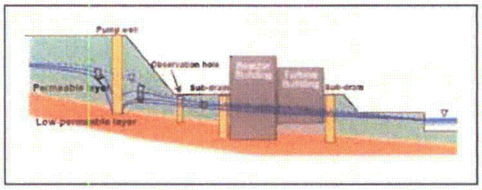


TEPCO pumps approximately 800 tons/day of highly contaminated waste water out of the reactor building/turbine building basements. This water is desalinated and run through a filtering system to remove radioactive cesium. About 400 tons/day is pumped back to cool the reactors, becoming contaminated again as it flows through reactor core debris, before flowing back to the reactor building/turbine building basements. The rest of the water, 400 tons/day, containing high concentrations of Sr-90 and tritium, is pumped to the ever growing storage tank farm.

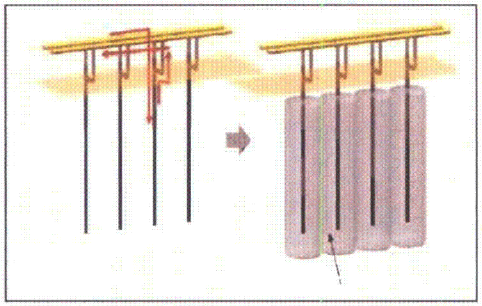
Ground water flow into NPP basements and leaking out

The water level in the reactor building/turbine building basements is maintained lower than the water table on the uphill side of the plant so that ground water flows into the basement. This leads to an estimated 400 tons/day of ground water leaking into the basements where it mixes with contaminated water. Some water may leak from the basements to the soil and groundwater underneath. The movement of radioactive cesium in the groundwater will be slowed as it absorbs on the soil but radioactive strontium and tritium remain with the ground water as it flows towards the harbor.

TEPCO is trying to limit the flow of water to the ocean. They are completing a steel wall at the edge of the harbor to block ground water. They are also injecting sodium silicate (liquid glass) into the soil, making a low permeability wall that also blocks flow of groundwater. Water trapped behind these walls will be pumped out and treated to limit the amount of radioactive contamination reaching the ocean. TEPCO plans to start operation of a ground water bypass system to pump up ground water before it reaches the reactor buildings/turbine buildings and pump it directly to the ocean. TEPCO plans to restart a sub drain system to pump and treat ground water from directly below the turbine buildings. There are also plans to construct, with Japanese Government support, a subterranean frozen soil wall around Units 1 through 4 to prevent ground water from mixing with highly contaminated water in the reactor building/turbine building basements.



Groundwater Bypass and Sub-drain Systems



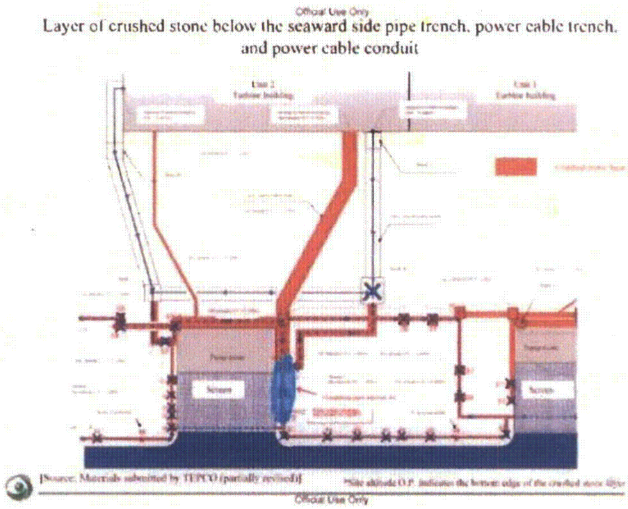
Subterranean Frozen Wall

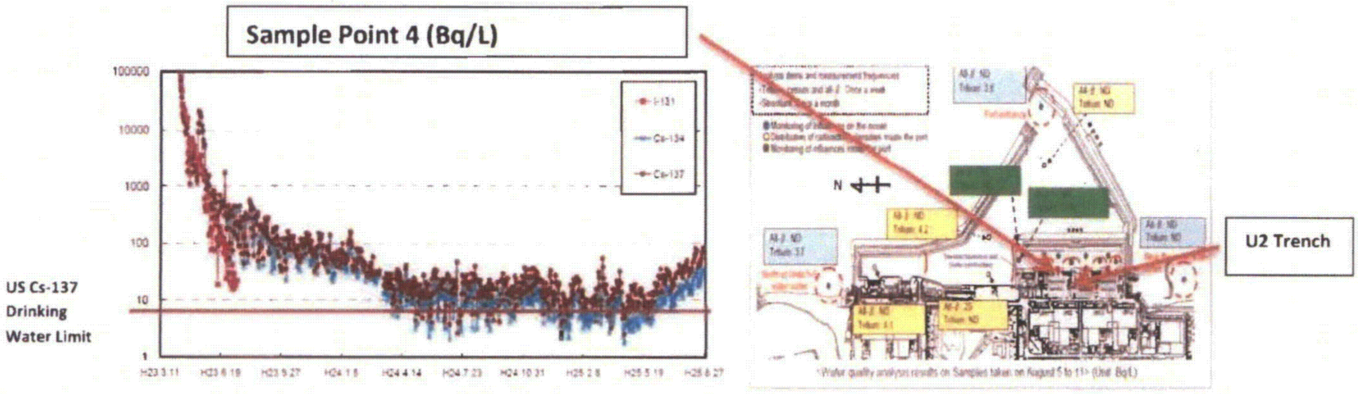
DRAFT: September 6, 2013

Briefing Sheet to Support Inter-Agency Discussions

Accident water left in trenches

A second source of ocean contamination may be the trenches, U shaped concrete tunnels, that house the pipes and electrical cable runs between the sea water pumps and the turbine buildings. These trenches flooded during the accident on March 11, 2011. The unit one trench was flooded with tsunami water and contains very little radioactivity. The unit 2 trench however, was flooded with highly contaminated accident water. TEPCO believed the water in the unit 2 trench was contained and so left it until a recent radioactivity uptick was observed at a harbor sample point near the trench. (See below) On Friday August 30, 2013 TEPCO pumped the unit 2 trench water to the turbine building basement and will continue monitoring to determine if this arrests the increasing release of radioactive materials to the Fukushima harbor.



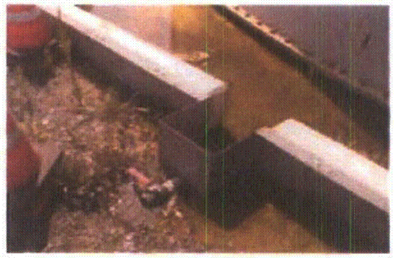


H23.3.11 = March 11, 2011 H25.8.27 = August 27, 2013

Leaking storage tanks containing highly contaminated water

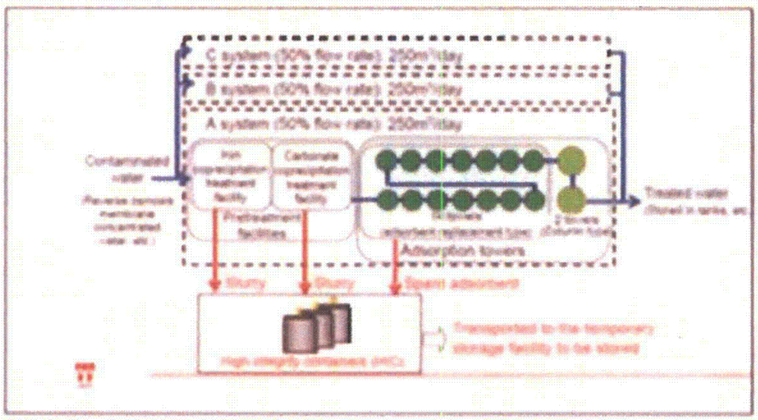
Another concern at the Fukushima Daiichi site is the roughly 300 tons of highly contaminated water that leaked from Tank No. 5 in the storage tank farm and passed through open berm drain valve to the surrounding soil in August 2013. TEPCO is digging up soil to determine the extent of water migration and inspecting other tanks to determine if there are other leaks. The Japanese Nuclear Regulatory Authority (JNRA) declared this event a level 3, serious incident, on the International Nuclear and Radiological Event Scale based on the amount of radioactive material released from the storage tank. The Japan Nuclear Regulation Authority released a public report on September 5, 2013, in which they describe the current situation of contaminated water leakage and possible issues with the storage tanks.

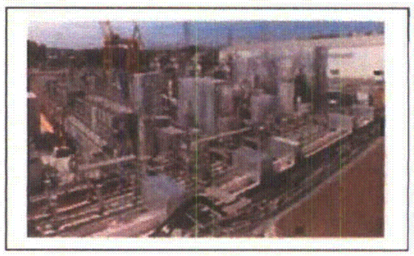
No. 5 Tank



Berm Drain

The amount of radioactive strontium stored in the tank farm, if not contained, has the potential to release more radioactivity to the ocean than was released in the days initially following the March 2011 accident. Removing the radioactivity from this stored water is considered by many to be a priority. However, the Advanced Liquid Processing System (ALPS) designed to remove all radioactivity with the exception of tritium is over a year behind schedule. When operational, ALPS can process up to 750T/day of the highly contaminated water. TEPCO hopes to receive permission to pump this tritium contaminated water to the ocean.



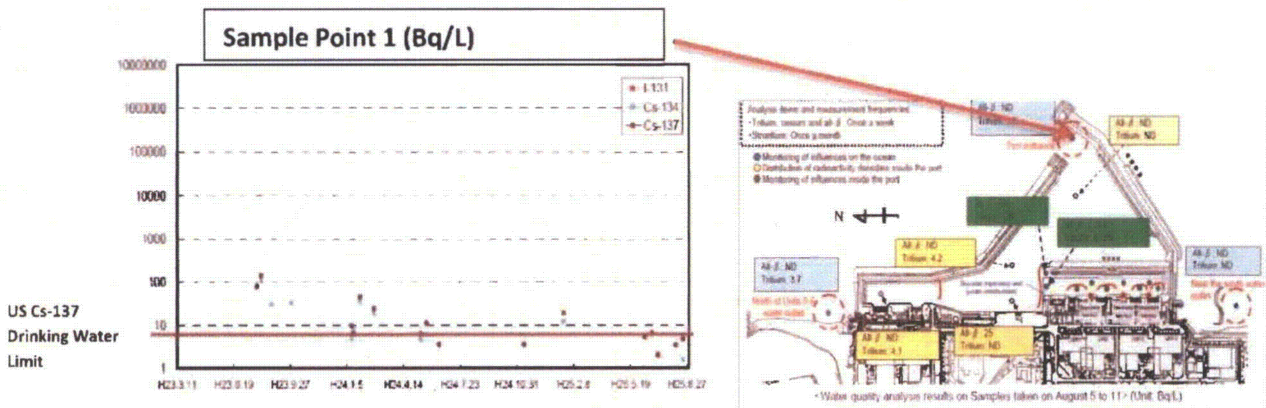


Advanced Liquid Processing System

Briefing Sheet to Support Inter-Agency Discussions

Overall Effect on the Environment

The effect of Fukushima water contamination on the U. S. is very low. For the last six months, Cs-137 activity measured at the harbor interface with the ocean is less than 10 Bq/L. This is below the World Health Organization drinking water standard (10Bq/L). The U.S. EPA standard for drinking water is 7.41Bq/L.



Seawater sampling at points 30 to 200 km from the facility indicate very low Cs-137 concentrations; typically below 0.004 Bq/L, compared to pre-accident concentrations around 0.003 Bq/L. However, concentrations nearer the coast tend to be somewhat higher (about 0.01- 0.02 Bq/L, which is well below US EPA drinking water standards).

Coordination with Other Federal Agencies and US Nuclear Industry

The NRC does not currently have an active role in responding to this situation. NRC will continue to communicate with JNRA and TEPCO, and stands ready to support JNRA if asked. In addition, the NRC is communicating routinely with other federal and state agencies, including with the White House Office of Science and Technology Policy. The activities of other federal agencies include:

- FDA is responsible for the safety of fish and other food products imported from Japan. FDA works with NOAA, as needed, to test seafood caught in US harvesting areas
- NOAA is responsible for ocean modeling and monitoring the movement of marine debris related to the tsunami in Japan
- EPA continues to monitor the situation and interface with other federal agencies

DOE and the US nuclear industry may be better suited to assist with decommissioning and cleanup of the Fukushima Daiichi site.

F1 (Fukushima Daiichi Nuclear Power Station) Issues

As of 5 September, 2013
Nuclear Regulation Authority (NRA), Japan

Menu:
- Current situation of contaminated water leakage
- Current information on radioactivity in seawater
- Further supervision by the NRA
- Further facilitation of international communication

I. Current situation of contaminated water leakage

There are 305 bolted-joint storage tanks for contaminated water at the Fukushima Daiichi Nuclear Power Station. According to the TEPCO's reports to the NRA, one of 305 bolted-joint storage tanks had an incident of water leakage, four storage tanks have the high possibility of water leakage, and one connection pipe between bolted-joint storage tanks had an incident of water leakage. [**Attachments 1 and 2**]

Contaminated water leakage (approximately 300 tons) in H4 Tank Area was found by TEPCO on 19 August, and falling-down of drops of contaminated water from the connection pipe between storage tanks in H5 Tank Area was found by TEPCO. [**Attachment 3**]

Four storage tanks (two tanks in H3 Tank Area [**Attachment 4**], one tank in H6 Tank Area [**Attachment 5**] and one tank in H4 Tank Area [**Attachment 6**]) have the high possibility of water leakage. In addition, other two storage tanks in H4 Tank Area have the possibility of contaminated water leakage. [**Attachment 6**]

At this moment, any contaminated water leakage from storage tanks other than the tank in H4 Tank Area has not been found definitely, and falling-down of drops of contaminated water from the connection pipe between storage tanks in H5 Tank Area has been stopped by TEPCO's countermeasures. Any out-flow of contaminated water beyond the dike installed surrounding the storage tanks other than the storage tank in H4 Tank Area has not found by TEPCO so far.

Regarding contaminated water leakage from the tank in the H4 Tank Area that was found by TEPCO on 19 August, the radioactivity (sampling date: 19 August) of some water retained in the dike installed surrounding the tank was as follows:

FI/2

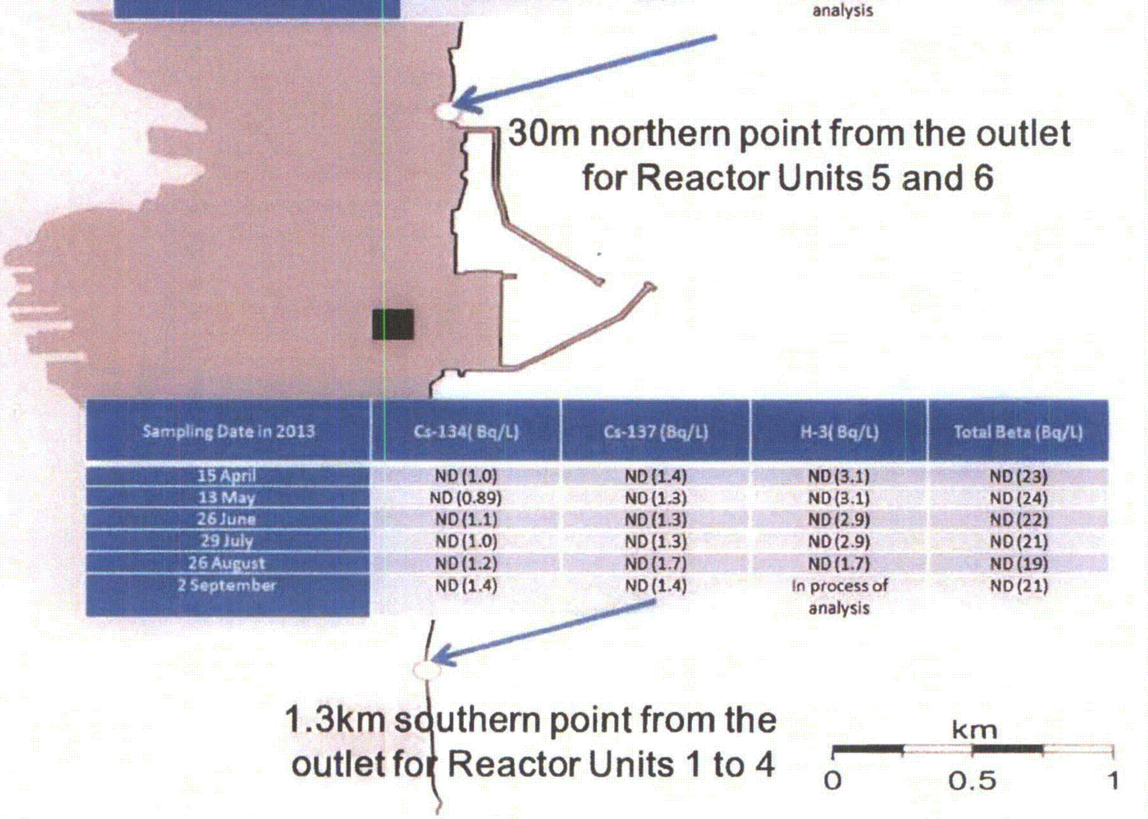
Cesium-134: 4.6×10^{1} Bq/cm^3
Cesium-137: 1.0×10^{2} Bq/cm^3
Total Beta: 8.0×10^{4} Bq/cm^3

II. **Current information on radioactivity in seawater**

Monitoring results of seawater near Fukushima Daiichi Nuclear Power Station show that the concentration for Cs-137 and H-3 are less than 3.3 Bq/L and 8.6 Bq/L respectively, and the concentration for Cs-134 and total Beta are ND (under the limit of detection) for the past six months.

Current information on radioactivity in seawater

Sampling Date in 2013	Cs-134 (Bq/L)	Cs-137 (Bq/L)	H-3 (Bq/L)	Total Beta (Bq/L)
15 April	ND (1.0)	ND (1.4)	3.8	ND (23)
13 May	ND (0.89)	ND (1.3)	ND (3.1)	ND (24)
26 June	ND (1.9)	3.3	8.6	ND (22)
29 July	ND (0.92)	ND (1.4)	ND (2.9)	ND (19)
26 August	ND (1.2)	ND (1.7)	8.3	ND (19)
2 September	ND (1.4)	ND (1.4)	In process of analysis	ND (16)



Sampling Date in 2013	Cs-134(Bq/L)	Cs-137 (Bq/L)	H-3(Bq/L)	Total Beta (Bq/L)
15 April	ND (1.0)	ND (1.4)	ND (3.1)	ND (23)
13 May	ND (0.89)	ND (1.3)	ND (3.1)	ND (24)
26 June	ND (1.1)	ND (1.3)	ND (2.9)	ND (22)
29 July	ND (1.0)	ND (1.3)	ND (2.9)	ND (21)
26 August	ND (1.2)	ND (1.7)	ND (1.7)	ND (19)
2 September	ND (1.4)	ND (1.4)	In process of analysis	ND (21)

III. Further supervision by the NRA

The Working Group on Countermeasures to Contaminated Water Leakage at Fukushima Daiichi Nuclear Power Station has been organized by the NRA to find out a possible solution to the serious issue of contaminated water leakage. In addition, supervision by the NRA including the NRA's Local Office for the site of Fukushima Daiichi Nuclear Power Station has been further enhanced as follows:

(a) Technical supports for TEPCO's radiation measurement

Technical advisors employed by the NRA have been working on teaching TEPCO the way of radiation monitoring and advising TEPCO to map an on-site radiation distribution.

(b) Enhancement of safety inspection

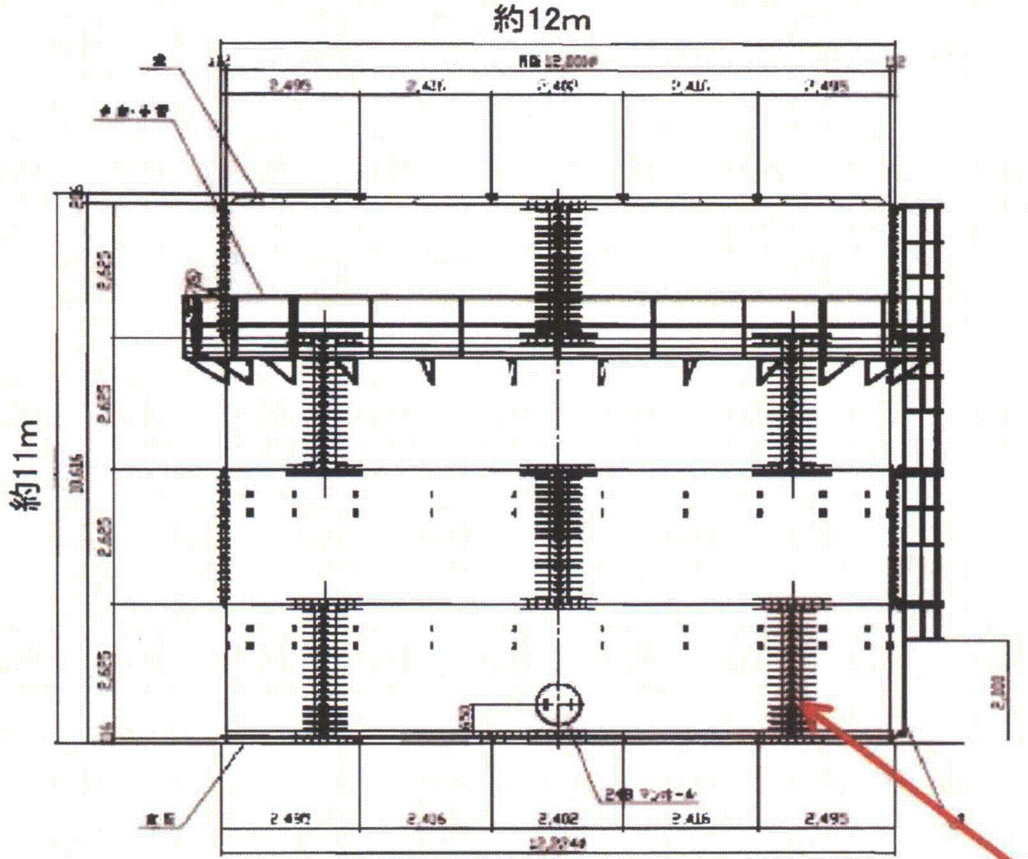
Safety inspection started to be enhanced by the NRA and JNES (a technical support organization to the NRA) on 4 September 2013.

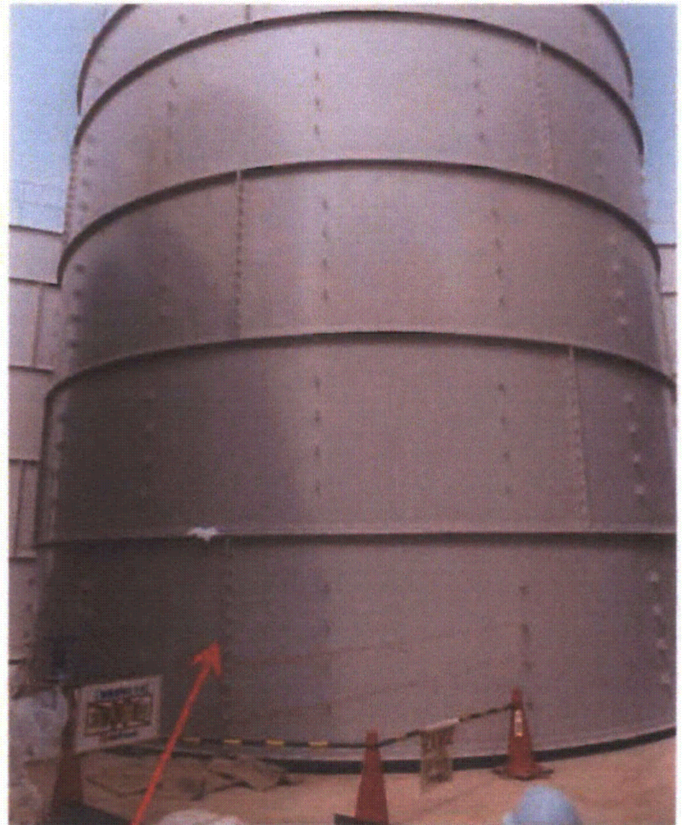
IV. Further facilitation of international communication

Information related to Fukushima Daiichi Nuclear Power Station such as regulatory activities of the NRA, radiation monitoring and incidents will be more available at the NRA's website. The NRA will provide the above-described information to the foreign press club in Japan and the international society including International Atomic Energy Agency (IAEA) in a proactive and prompt manner.

-END-

<Attachment 1>



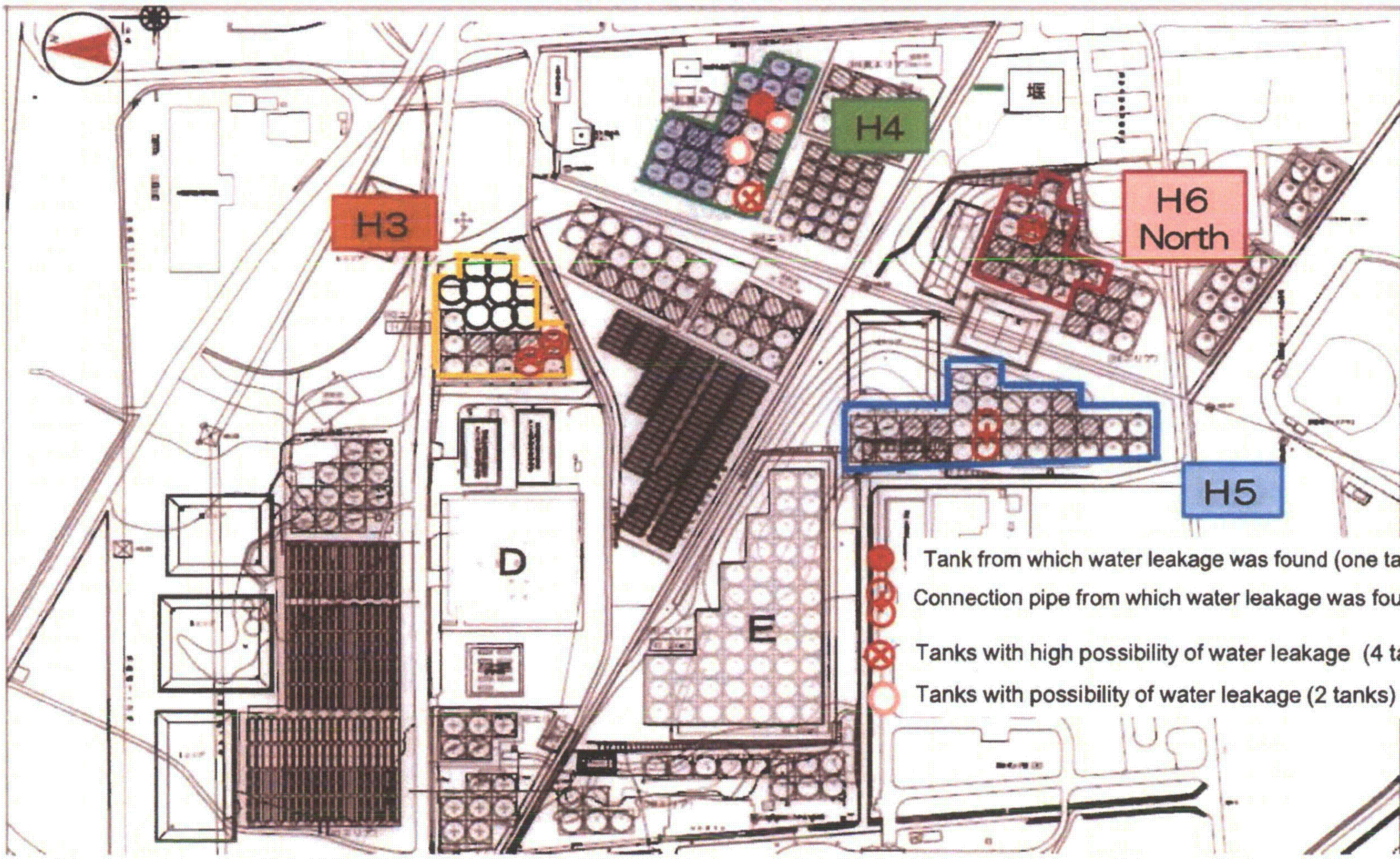


Bolted-joint storage tank

cf. Weld-bonding storage tank

<Attachment 2>

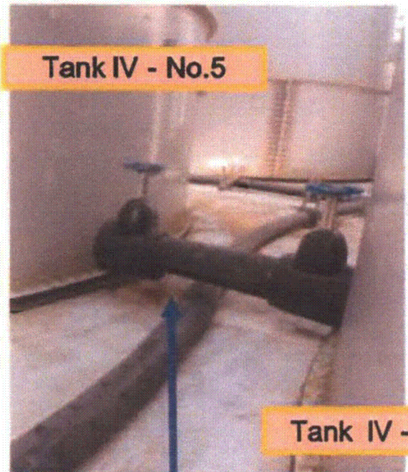
Location of Storage Tanks

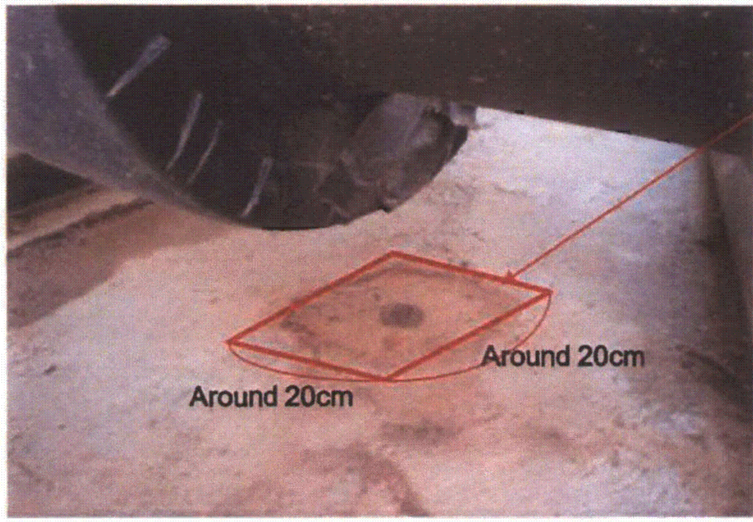


Modified by the NRA, Original illustrated by TEPCO

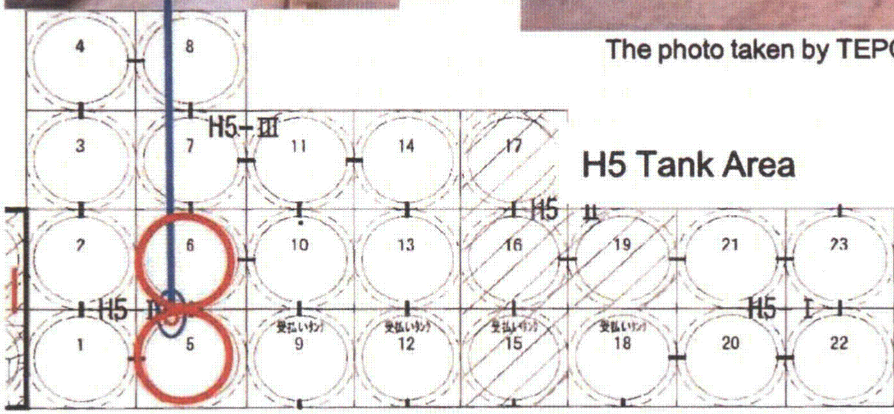
<Attachment 3>

Water Leakage from Connection Pipe between Storage Tanks (H5 Tank Area)





The photo taken by TEPCO on 31 August



Puddle trace (20 cm x 20 cm)

At the point 5cm from the surface of the puddle trace 230 mSv/h * of β rays was detected by TEPCO on 31 August.

It was found by TEPCO that one drop of contaminated water fell every 90 seconds after the cover stuff of the flange was removed, and then this water drop has stopped by TEPCO's tightening up the bolts of flange on 1 September.

* This value is not guaranteed by the NRA.

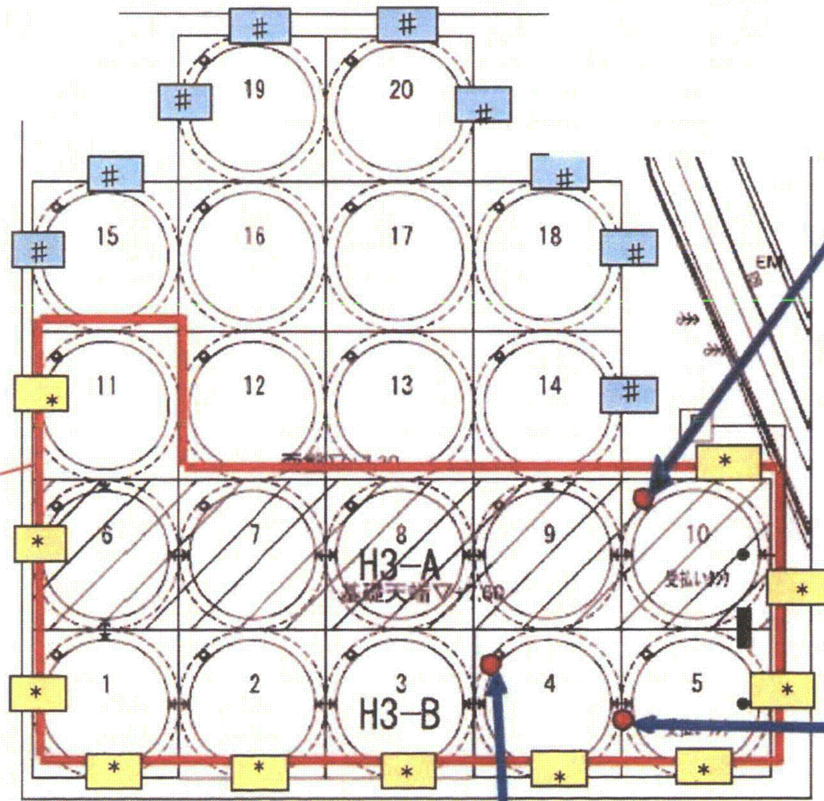
Radioactivity (Sampling date: 31 August 2013)

Nuclide	Concentration (Bq/cm^3)
Cs-134	25
Cs-137	61
Total Beta	3.0×10^5

Modified by the NRA, Original illustrated by TEPCO

<Attachment 4>

H3 Tank Area



Dike

Valve opened: #

Valve closed: *

Tank A-No.10

At the point 5cm from the flange, 220m Sv/h * of β rays was detected by TEPCO on 31 August. No water leakage was found around here.

Tank B-No.4(South)

At the point 5cm from the flange, 1800 mSv/h * of β rays was detected by TEPCO on 31 August. No water leakage was found around here.

Tank B-No.4 (North)

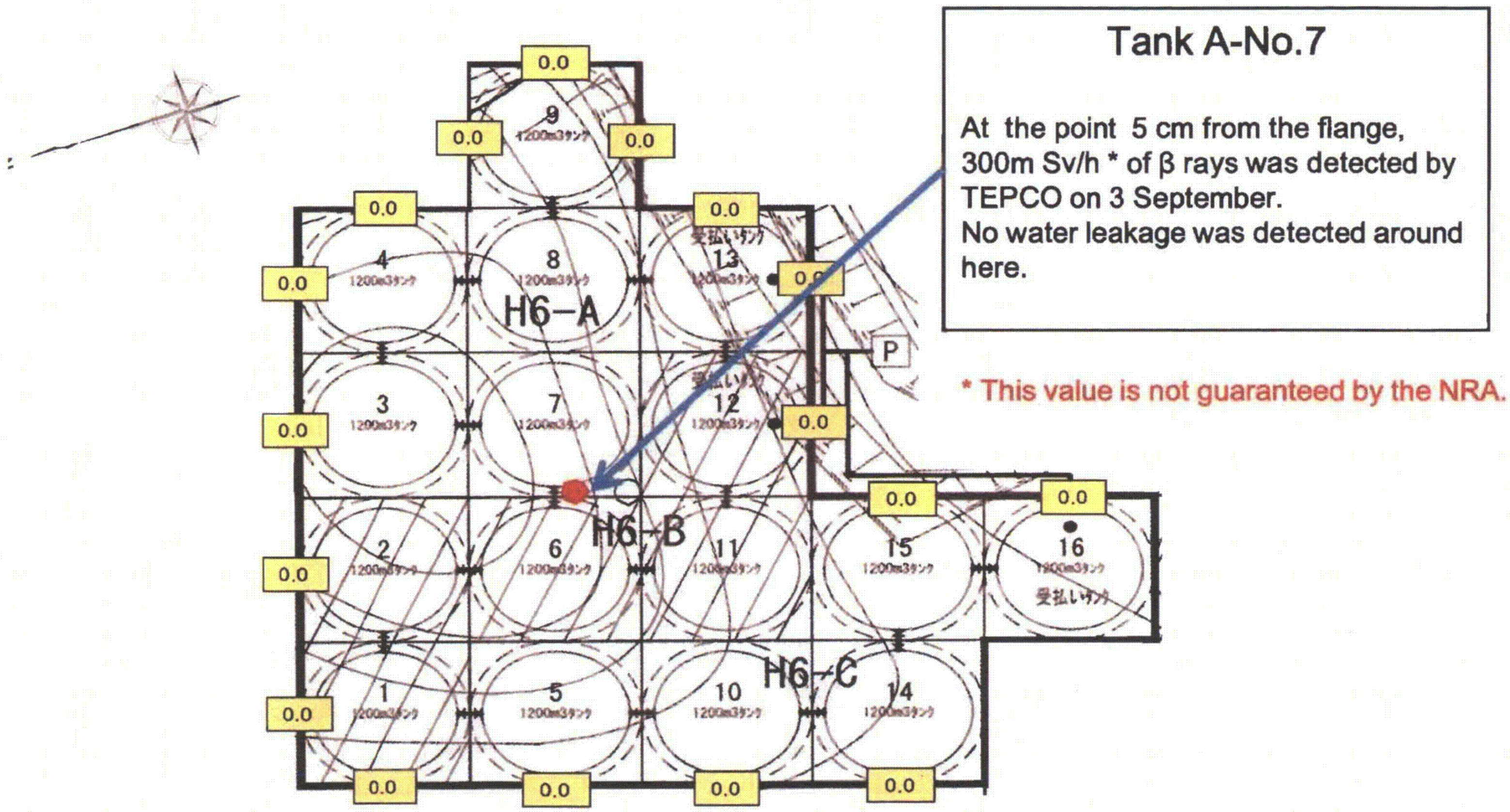
At the point 5cm from the flange, 2200 mS/h * of β rays was detected by TEPCO on 3 September. No water leakage was found around here.

* These values are not guaranteed by the NRA.

Modified by the NRA, Original illustrated by TEPCO

<Attachment 5>

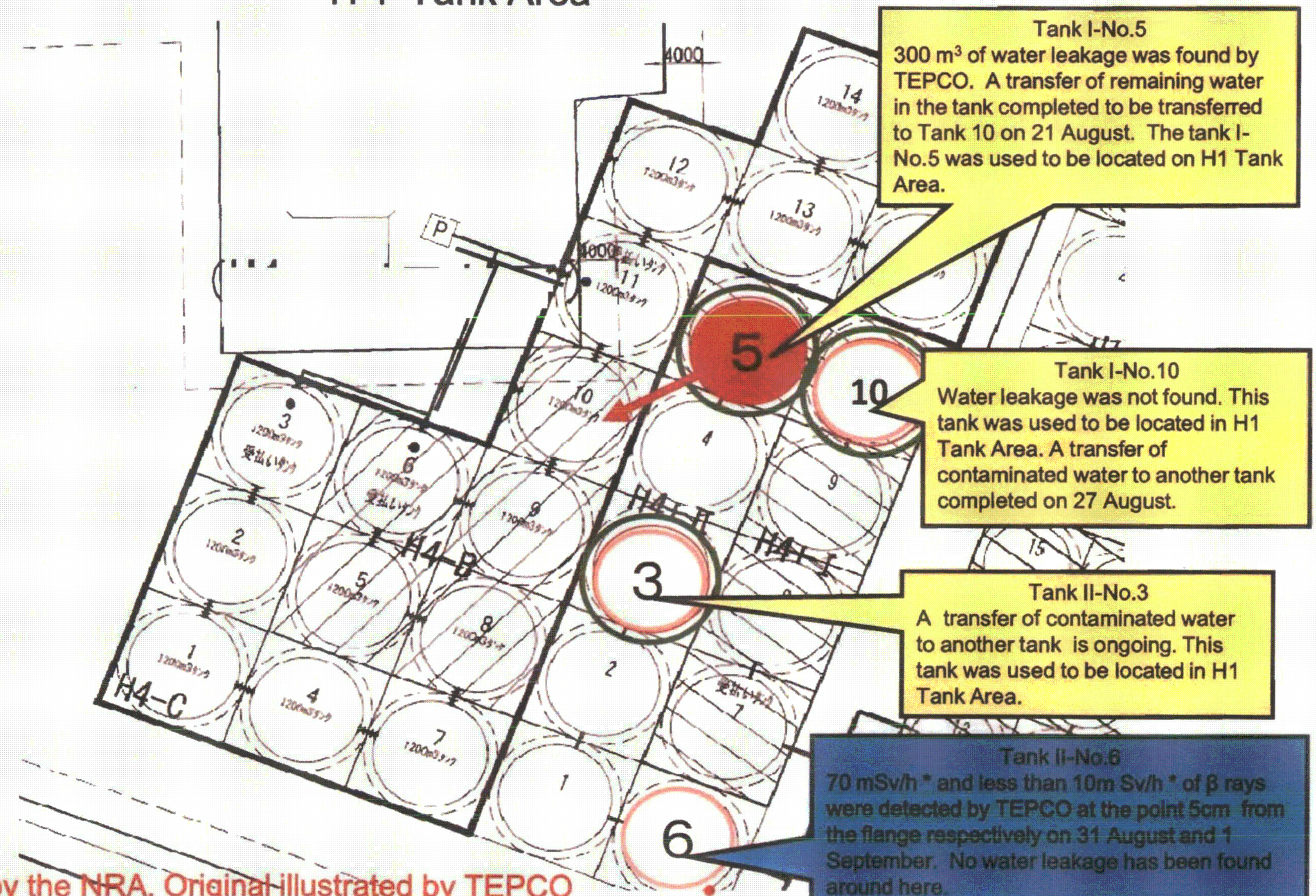
H 6 North Tank Area



Modified by the NRA, Original illustrated by TEPCO

<Attachment 6>

H 4 Tank Area

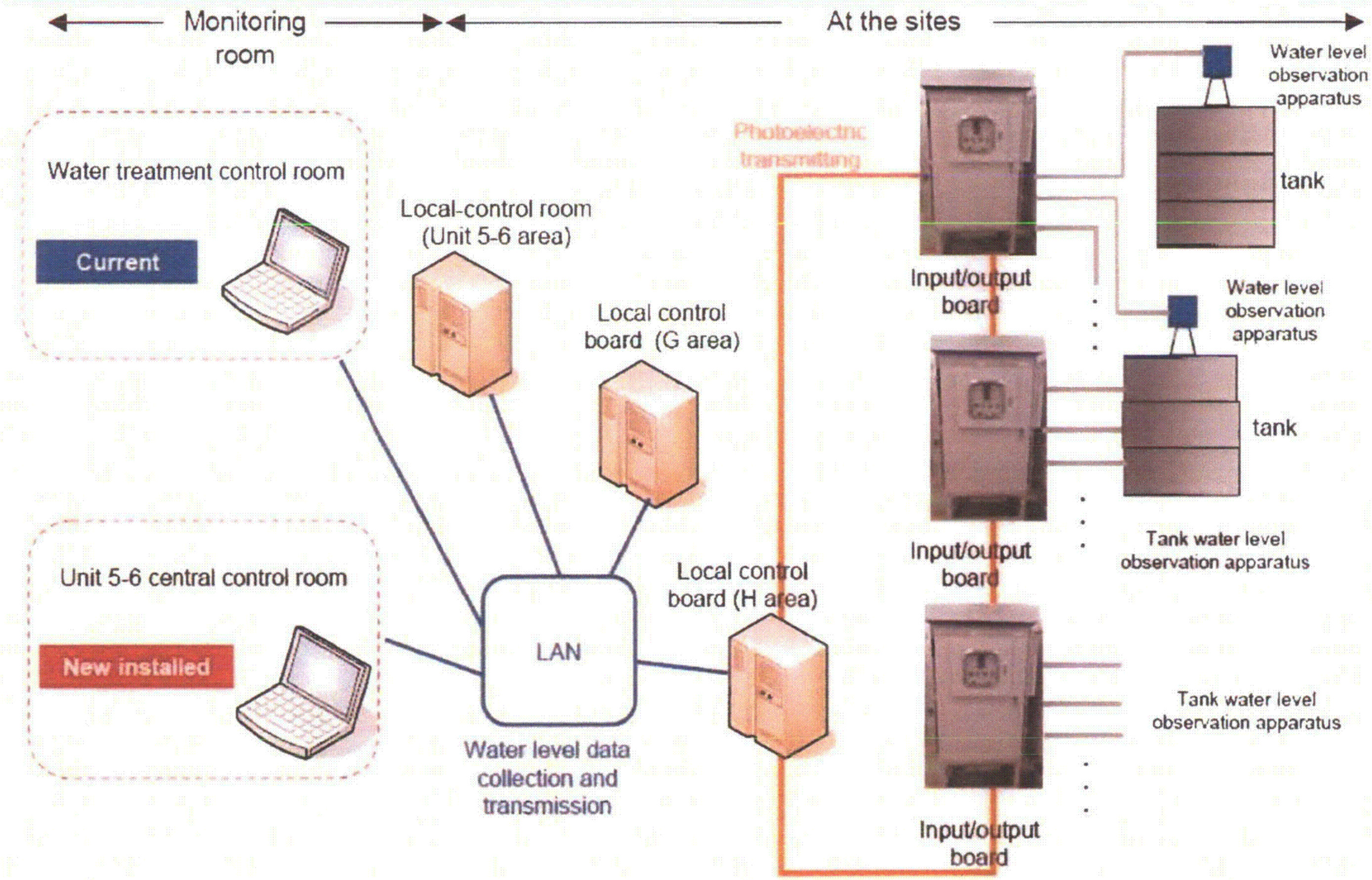


Modified by the NRA, Original illustrated by TEPCO

* These values are not guaranteed by the NRA.

Leaking Tank and Bypass System

Tank Level Monitoring System installation complete by 11/30/2013



Accumulated Water Inside the Dike in Each Tank Area at Fukushima Daiichi Nuclear Power Station

<Reference>
September 17, 2013
Tokyo Electric Power Company

Name of the area	Samped on Sep 15 (Unit: Bq/L)	Work	Period of work (Sep 16)	Amount of discharge or pump-up	Change of water level inside the dike* (As of 10:00 AM on Sep 16 → After the work)
H1	200	Pump-up	7:25 AM - 8:42 PM	-	Approx. 13cm → Approx. 2cm
H2 (North)	140	Pump-up	2:17 AM - 8:48 PM	-	Approx. 5cm → Approx. 3cm
N2 (South)	3,700	Pump-up	2:11 AM - 8:51 PM	-	Approx. 5cm → Approx. 4cm
H3	4,600	Pump-up	9:30 AM - 8:45 PM	-	Approx. 16cm → Approx. 4cm
H4 (North)	170,000	Pump-up	3:04 AM - 8:57 PM	-	Approx. 11cm → Approx. 3cm
H4 (South)	2,400	Pump-up	3:04 AM - 9:02 PM	-	Approx. 6cm → Approx. 4cm
H4	110	Pump-up	3:04 AM - 8:54 PM	-	Approx. 6cm → Approx. 4cm
H5	430	Pump-up	7:34 AM - 4:13 PM	-	Approx. 15cm → Approx. 14cm
H6	160	Pump-up	7:46 AM - 8:36 PM	-	Approx. 15cm → Approx. 5cm
H9	9	Discharge	1:50 PM - 3:38 PM	Approx. 60 t	Approx. 16cm → Approx. 4cm
H9 (West)	8	Discharge	1:50 PM - 3:38 PM	Approx. 80 t	Approx. 16cm → Approx. 3cm
B (North)	23	Pump-up	2:20 PM - 8:31 PM	-	Approx. 20cm → Approx. 5cm
B (South)	37	Pump-up	12:07 PM - 8:28 PM	-	Approx. 25cm → Approx. 6cm
C (East)	24	Discharge	1:50 PM - 3:26 PM	Approx. 70 t	Approx. 25cm → Approx. 9cm
C (West)	8	Discharge	12:42 PM - 3:51 PM	Approx. 160 t	Approx. 25cm → Approx. 2cm
E	6	Discharge	1:30 PM - 4:14 PM	Approx. 460 t	Approx. 16cm → Approx. 6cm
G4 (South)	3	Discharge	2:20 PM - 4:33 PM	Approx. 90t	Approx. 20cm → Approx. 14cm
G6 (North)	8	Discharge	1:20 PM - 4:26 PM	Approx. 210t	Approx. 20cm → Approx. 3cm
G6 (South)	34	Pump-up	12:18 PM - 8:24 PM	-	Approx. 20cm → Approx. 5cm

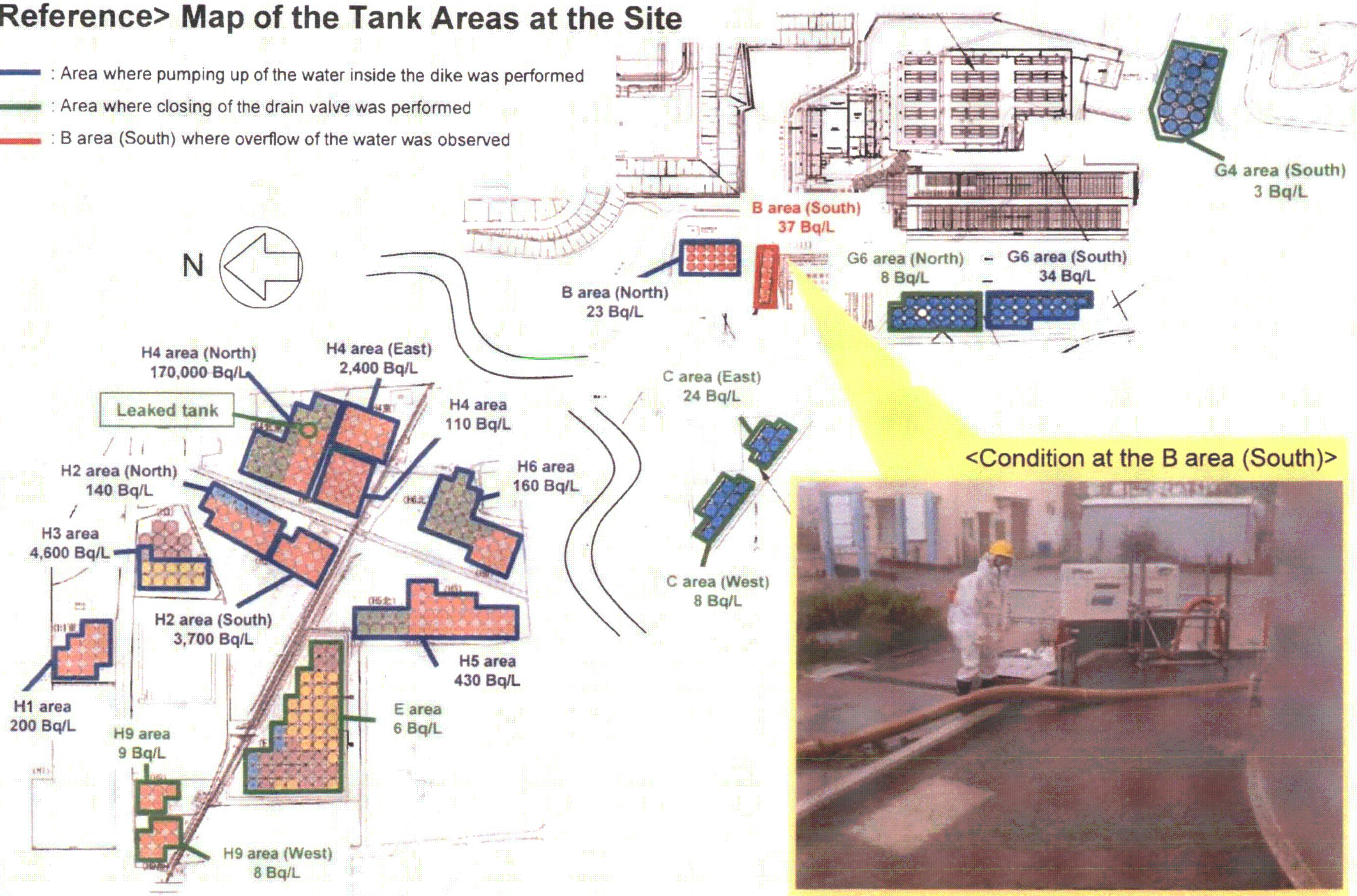
* The fluctuation ranges are different in each area, since the rain has been fallen continuously since Sep. 15 and the starting times of water discharge/pump-up in each area were different.

<Reference> Map of the Tank Areas at the Site

: Area where pumping up of the water inside the dike was performed

: Area where closing of the drain valve was performed

: B area (South) where overflow of the water was observed



<Condition at the B area (South)>

(Photo taken by TEPCO on September 15, 2013)

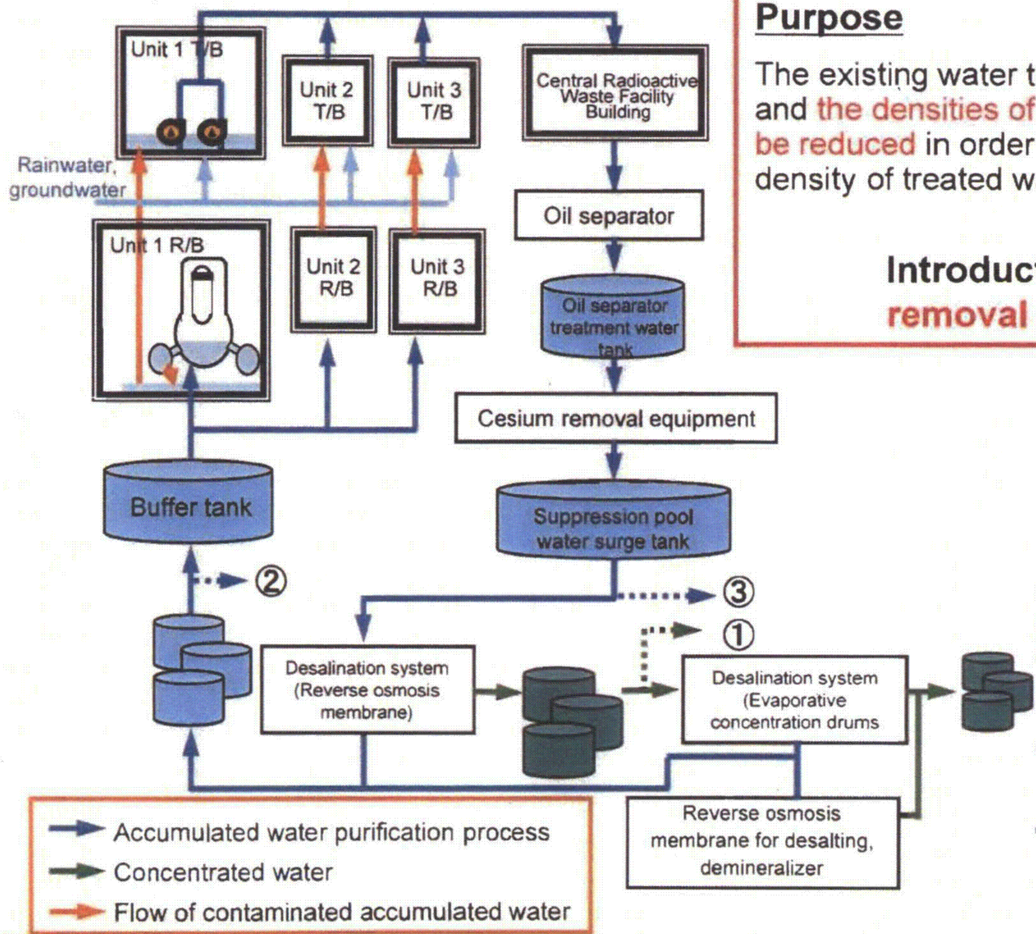
Purpose of Installing the Multi-nuclide Removal Equipment

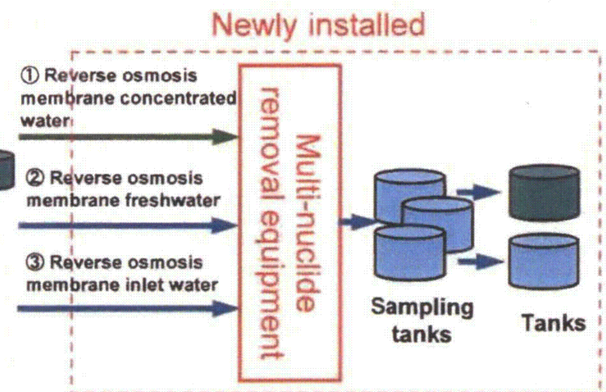
Installation of the multi-nuclide removal equipment

Purpose

The existing water treatment facility removes mainly cesium and the densities of other radioactive nuclides also need to be reduced in order to further reduce the radioactivity density of treated water.

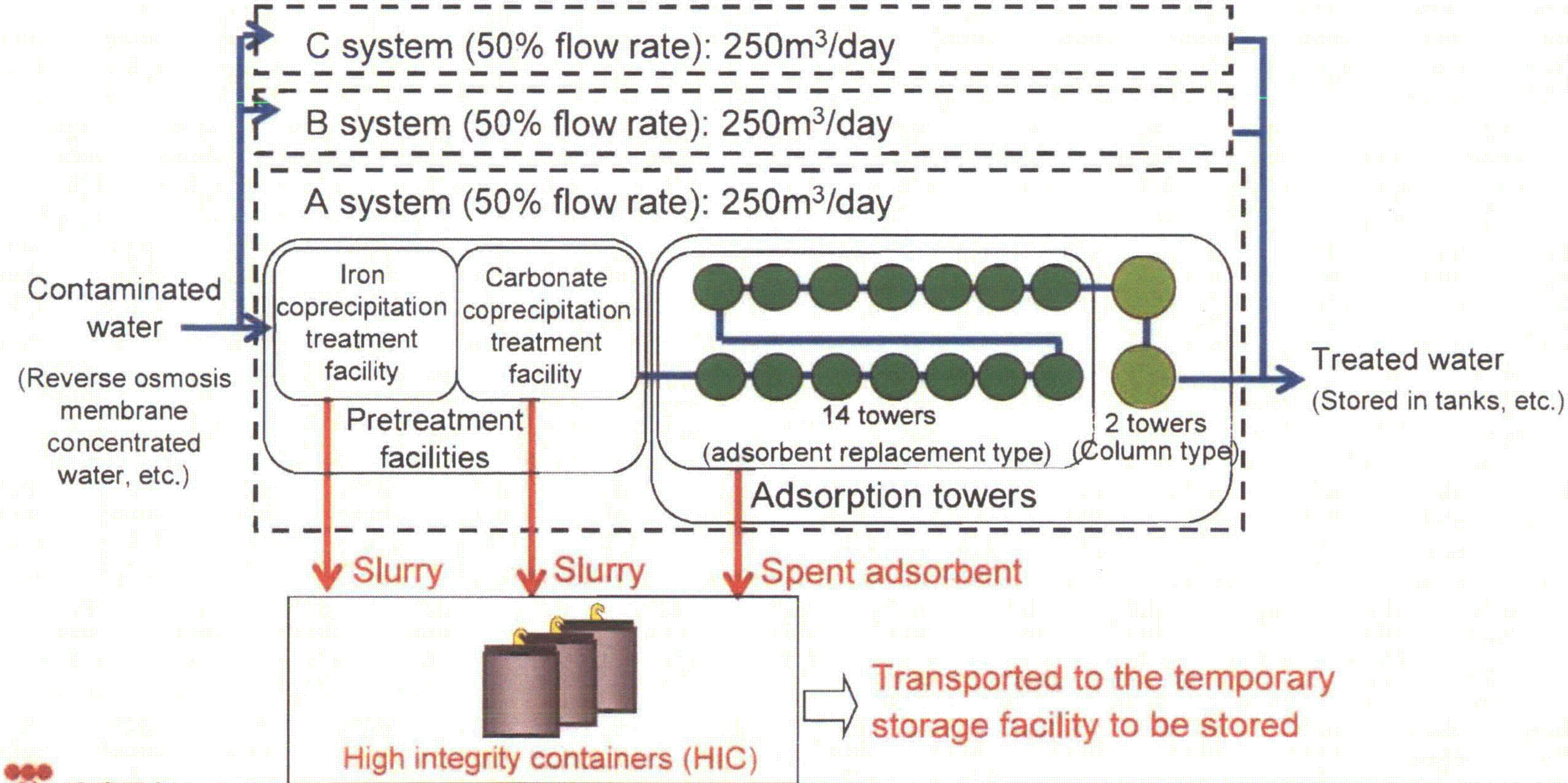
Introduction of the "multi-nuclide removal equipment"



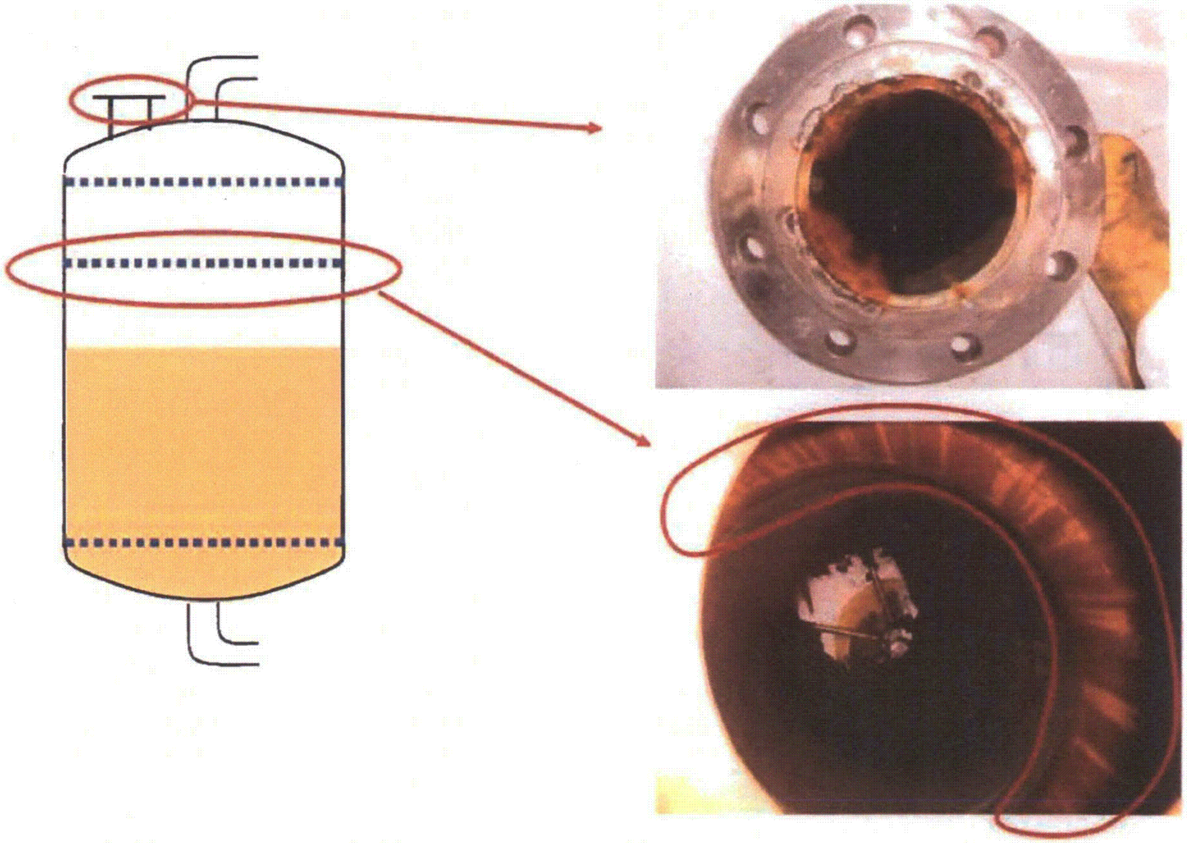


Overview of the Multi-nuclide Removal Equipment

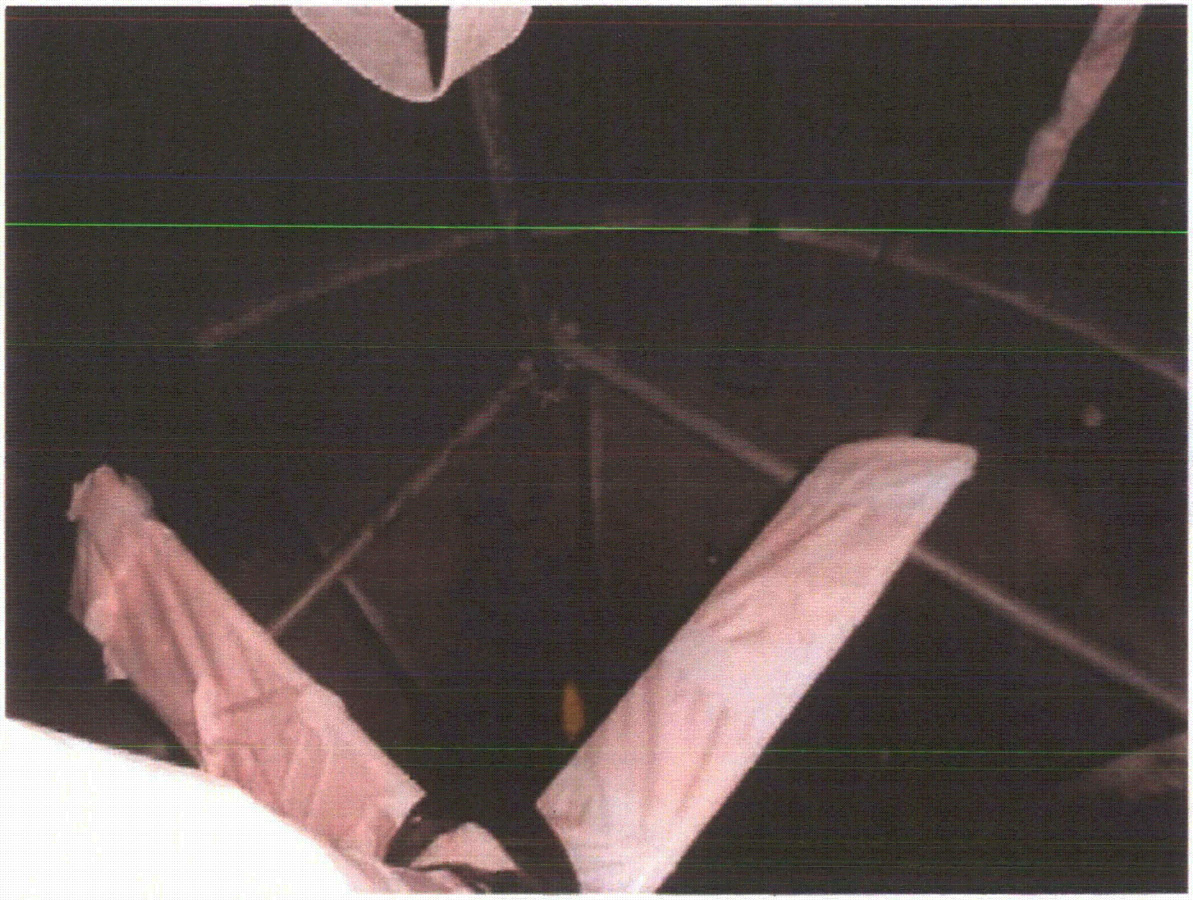
- Radioactive materials are removed by passing radioactive contaminated water through the pretreatment facilities and adsorption towers.
- The waste materials (slurry, spent adsorbent) are transferred into high integrity containers (HIC). HICs which store a specified amount of waste are transported to the temporary storage facility to be stored.



Areas of Pitted Corrosion Found in ALPS Resin Columns



Propylene Rubber Liner



Current Status (1/2)

Progress of building construction for the multi-nuclide removal equipment
(Photos taken on March 27, 2013)

Photo taken from the south side

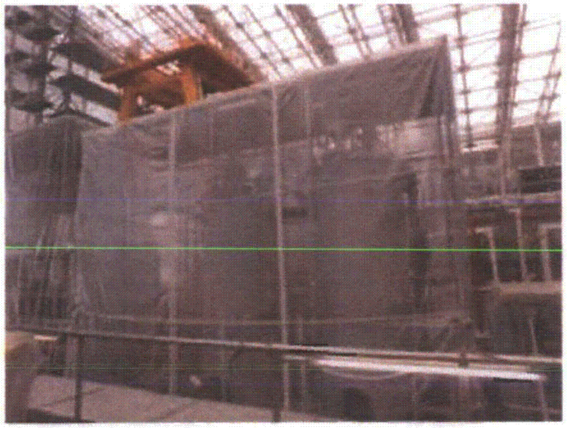
Photo taken from the northeast side

Photo taken from the north side

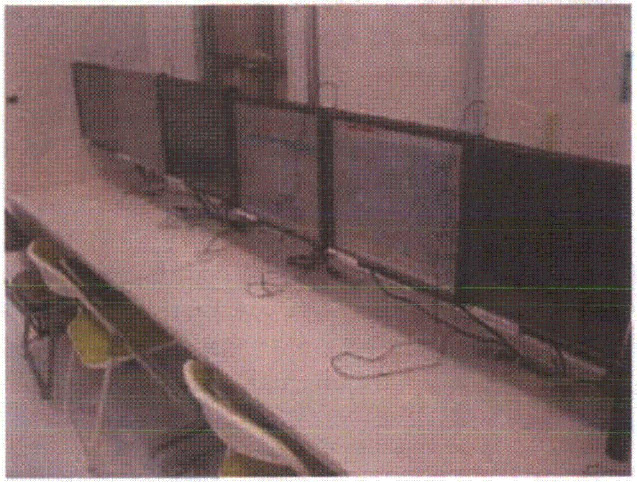
Current Status (2/2)

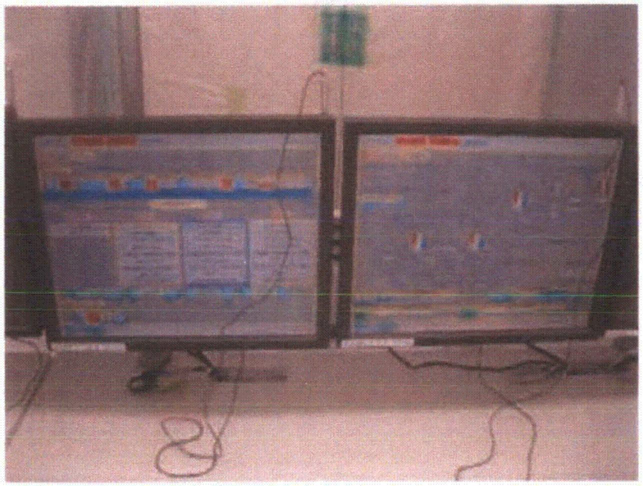
Progress of multi-nuclide removal equipment installation
(Photo taken on September 16, 2012)

Adsorption tower (Treatment column)
(Photo taken on March 27, 2013)



Control panels (Photos taken on March 27, 2013)





Notes on Ice Barrier Technology

M. Fuhrmann RES/DRA/ETB

Fukushima plan: 1.4 km in length; as deep as 30 m, vertical pipes, 1 m apart, anticipate 6-8 weeks for ice columns to merge. The ice-wall is not the only means of relieving water flow to basements; upgradient pumps and subdrain pumps may be used.

Ice Barrier technology applications are quite common:
Invented in 1863; first application was in coal mines in Wales in the 1880s.

Arctic: Stabilize foundations in permafrost areas; arctic pipelines use it.

Construction: Big Dig in Boston[1], Rotterdam: 40 m depth stabilize soil during subway station construction with large buildings nearby.

Mining: Cameco U mine in Canada[2], ore 600 m deep in fractured rock, freezing excludes water under high pressure and reduces radon exposure. Aquarius Gold Mine ice wall 2 miles long was planned, Oil Sands mine ice wall 5 miles long[3].

Remediation: ORNL contaminated pond[4], ice barrier established in January 1998 and was in place for 6 years. Depth 30 feet, Length 300 feet, ice thickness about 12 feet, barrier established after 18 weeks. Cost \$15-20/ ft^2.

Heat exchange fluids: Concentrated $CaCl_2$, CO_2, ammonia, other less corrosive fluids.

Groundwater flow rates are a concern. About 1 m/day or less is OK. Greater than that water brings a lot of heat to the ice wall area. Also the local groundwater velocity increases as the ice columns develop.

Frost heave is sometimes a concern. At Fukushima there is a free surface so it may not be much of an issue but heave needs to be monitored.

Monitoring of wall progress by subsurface temperature and water levels in wells is critical; especially on ocean side where salt water will likely be encountered.

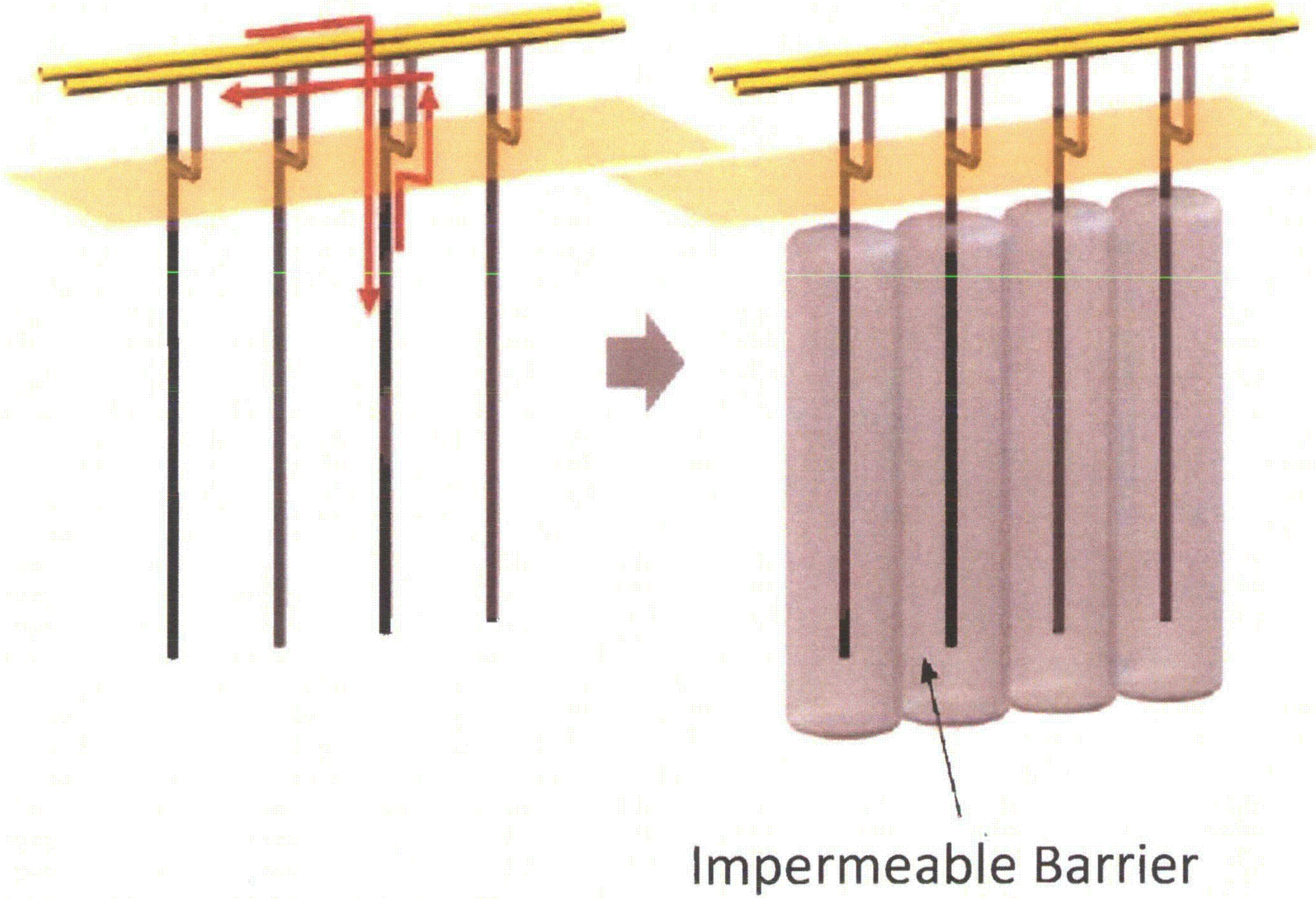
Ref. 1, Dijk, P. and Bos, J. (2001) Large Scale Application of Artificial Ground Freezing. Soft Ground Technology: pp. 315-330. American Society of Civil Engineers doi: 10.1061/40552(301)25

Ref 2. Newman et al., 2011, Artificial Ground Freezing: An Environmental Best Practice at Cameco's Uranium Mining Operations in Northern Saskatchewan, Canada, In; Mine Water- Managing the Challenges, pp 113-117, International Mine Water Association.

Ref 3. P. Fairley, 2013, MIT Technology Review, How the Fukushima Ice Barrier will Block Radioactive groundwater. www.technologyreview.com

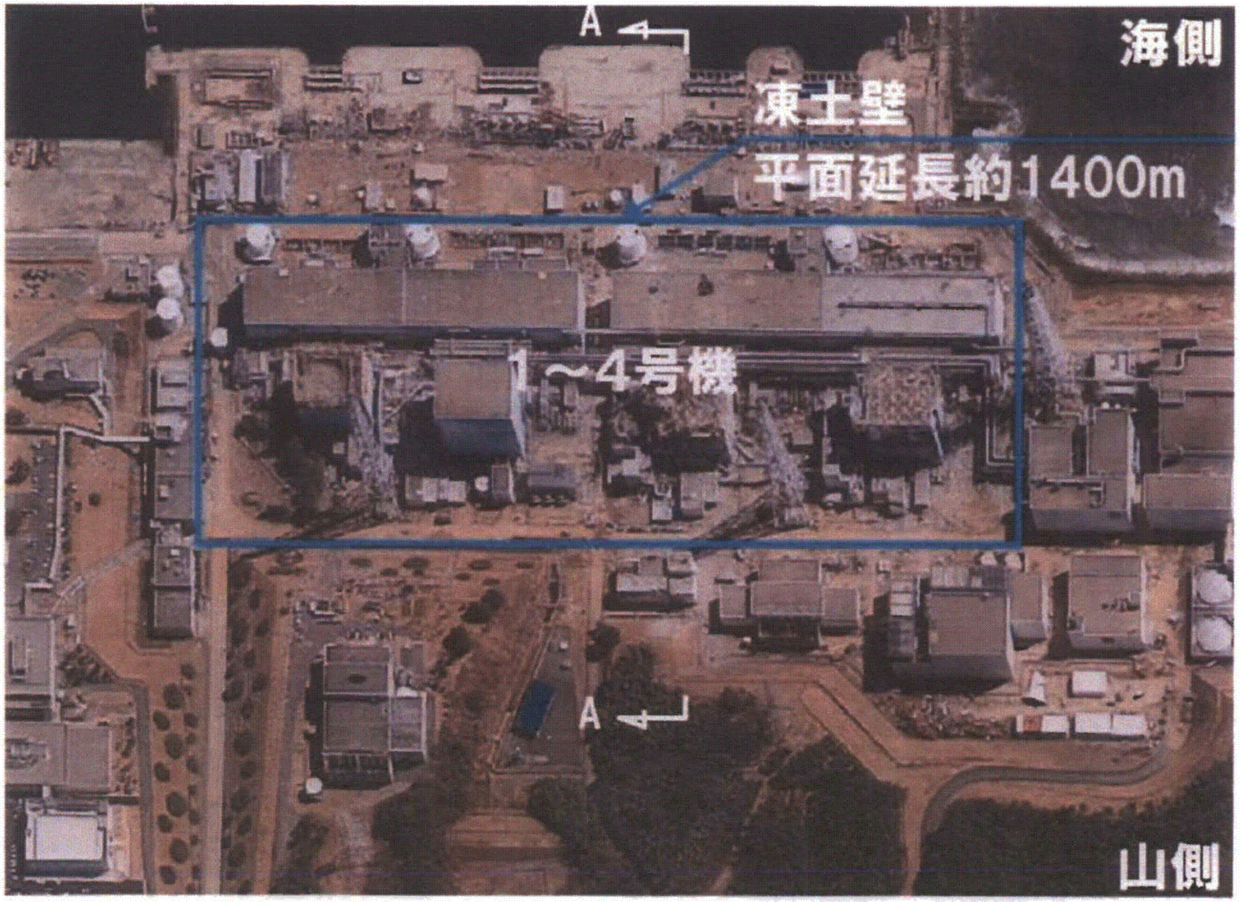
Ref 4. U.S. Department of Energy, 1999, DOE/EM-0483, Innovative Technology Summary Report, Frozen Soil Barrier.

Frozen Wall



Japan Lessons Learned

Frozen wall Perimeter



Notes on Oceanic Concentrations and Distributions of Radionuclides

Mark Fuhrmann RES/DRA/ETB

Inputs to Pacific from Fukushima (Povinec et al, 2013 and Refs therein): PBq = 10^{15} Bq
Airborne: Cs-137: 13 - 15 PBq (Cline et al), 23- 50 PBq (Stohl et al), 80% into N. Pacific.
Sr-90: 0.14 PBq (Povinec, et al.,2012)
Waterborne: Cs-137: 3.5-4.0 PBq (Tsumune et al, 2012), 11-16 PBq (Charette et al, 2013), 27 +/- 15 PBq (Bailly du Bois et al, 2012). Sr-90: 0.1 – 1 PBq (Povinec et al, 2012), 0.09 – 0.9 Pbq (Casacuberta et al, 2013) These estimates are based on Sr/Cs ratios in seawater.

Immediately following the accident: peak Cs-137 at harbor was 47 kBq/L (3/30/11) and 68 kBq /L (4/6/11). Adjacent to harbor (4/18/11) (Povinec et al, 2012) Cs-137 = 0.74kBq/L, Sr-90 = 0.062 Bq/L. Hundreds of km SE of the plant; e.g. in June, 2011, concentrations up to 3.9 Bq/L were measured (Buesseler et al, 2012). Elevated Cs-137 concentrations covered an area of about 150,000 km^2 (Povinec et al 2013).

Activity in Pacific more recently; Cs-137 distributions in coastal ocean **see NRA Map of May 16 – June 2, 2013**; surface activities about 50 km offshore range from 0.0010 – 0.0023 Bq/L. Closer to shore (20 km) concentrations are higher, 0.004 to 0.016 Bq/L, even when more than 200 km from Fukushima. This suggests to me effects of runoff from land. Further offshore, about 200 km, Cs-137 concentrations are essentially at background.

Background: Duran et al (2004) give background in N. Pacific as 0.003 Bq/L. Hirose and Aoyama, 2003, give range across the Pacific as 0.0017 to 0.0028 Bq/L. In comparison; based on 4 mRem/yr, MCL for Cs-137 is 7.4 Bq/L and for Sr-90 it is 0.3 Bq/L.

Distribution: Mixing has resulted in detectable concentrations of Cs-137 and 134 to at least 200m depth (Povinec et al, 2013). The eastern-most extent of the contamination was between Japan and Hawaii; at 180° E (June of 2011) and at 174° W (2012) (Kamenik, 2013). The Kuroshio Current acts as a southern boundary for transport of Fukushima radioactivity, keeping contamination to the north. Cs-137 in surface seawater around Hawaii showed a very slight elevation around March to May, 2011(Kamenik et al, 2013) and then maintained a steady concentration through October 2012 with an average of about 0.00146 +/- 0.00006 Bq/L which is within the range of background published elsewhere.

Pacific Bluefin Tuna (n= 50) were sampled off California in 2012 (Madigan et al, 2013). Cs-137 and Cs-134 were detected in all small tuna (n=28, recent migrants from Japan) at average Cs-134 concentrations of 0.7 +/- 0.2 Bq/kg dry wt, and Cs-137 concentrations of 2.0 +/- 0.5 Bq/kg. Large resident Tuna had no Cs-134 and only background levels of Cs-137. The most stringent government regulations limit Cs-137 to 400 Bq/kg (dry wt).

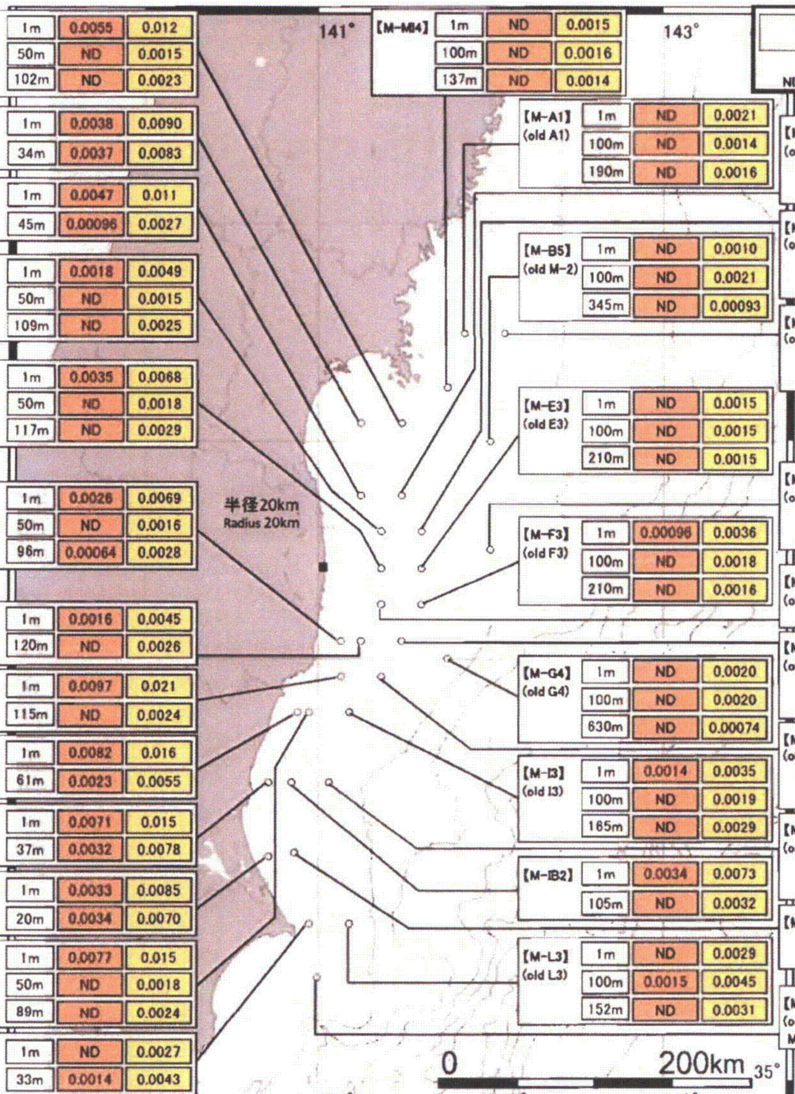
宮城県・福島県・茨城県・千葉県沖における海域モニタリング結果（海水）

Readings of Sea Area Monitoring at offshore of Miyagi, Fukushima, Ibaraki and Chiba Prefecture (Seawater)

試料採取日：平成25年5月16日～6月2日
（Sampling Date：May 16-Jun 2, 2013）

公表日：平成25年8月7日
（Published: Aug 7, 2013）

原子力規制委員会
Nuclear Regulation Authority (NRA)



採取深度	Cs-134	Cs-137

単位：Bq/L (Unit：Bq/L)
ND※1：不検出 (ND※1：Not Detectable)

Station	採取深度	Cs-134	Cs-137
【M-B3】(old B3)	1m	0.0055	0.012
	50m	ND	0.0015
	102m	ND	0.0023
【M-B1】(old B1)	1m	0.0038	0.0090
	34m	0.0037	0.0083
【M-C1】(old C1)	1m	0.0047	0.011
	45m	0.00096	0.0027
【M-D1】(old D1)	1m	0.0018	0.0049
	50m	ND	0.0015
	109m	ND	0.0025
【M-E1】(old E1)	1m	0.0035	0.0068
	50m	ND	0.0018
	117m	ND	0.0029
【M-G0】(old G0)	1m	0.0026	0.0069
	50m	ND	0.0016
	96m	0.00064	0.0028
【M-G1】(old G1)	1m	0.0016	0.0045
	120m	ND	0.0026
【M-H1】(old H1)	1m	0.0097	0.021
	115m	ND	0.0024
【M-I0】(old I0)	1m	0.0082	0.016
	61m	0.0023	0.0055
【M-J1】(old J1)	1m	0.0071	0.015
	37m	0.0032	0.0078
【M-K1】(old K1)	1m	0.0033	0.0085
	20m	0.0034	0.0070
【M-I1】(old I1)	1m	0.0077	0.015
	50m	ND	0.0018
	89m	ND	0.0024
【M-L1】(old L1)	1m	ND	0.0027
	33m	0.0014	0.0043
【M-MI4】	1m	ND	0.0015
	100m	ND	0.0016
	137m	ND	0.0014
【M-A1】(old A1)	1m	ND	0.0021
	100m	ND	0.0014
	190m	ND	0.0016
【M-B5】(old M-2)	1m	ND	0.0010
	100m	ND	0.0021
	345m	ND	0.00093
【M-E3】(old E3)	1m	ND	0.0015
	100m	ND	0.0015
	210m	ND	0.0015
【M-F3】(old F3)	1m	0.00096	0.0036
	100m	ND	0.0018
	210m	ND	0.0016
【M-G4】(old G4)	1m	ND	0.0020
	100m	ND	0.0020
	630m	ND	0.00074
【M-I3】(old I3)	1m	0.0014	0.0035
	100m	ND	0.0019
	165m	ND	0.0029
【M-IB2】	1m	0.0034	0.0073
	105m	ND	0.0032
【M-L3】(old L3)	1m	ND	0.0029
	100m	0.0015	0.0045
	152m	ND	0.0031
【M-C3】(old C3)	1m	ND	0.0028
	50m	ND	0.0016
	115m	ND	0.0017
【M-D3】(old D3)	1m	ND	0.0018
	100m	ND	0.0017
	200m	ND	0.0013
【M-A3】(old A3)	1m	ND	0.0014
	100m	ND	0.0014
	460m	ND	0.00082
【M-E5】(old E5)	1m	ND	0.0016
	100m	ND	0.0020
	515m	ND	0.00061
【M-F1】(old F1)	1m	0.0011	0.0044
	125m	0.00082	0.0033
【M-G3】(old G3)	1m	ND	0.0020
	100m	ND	0.0019
	190m	ND	0.0026
【M-H3】(old H3)	1m	ND	0.0023
	100m	ND	0.0019
	210m	ND	0.0027
【M-J3】(old J3)	1m	0.0018	0.0047
	100m	ND	0.0014
	536m	ND	0.0011
【M-IB4】	1m	0.0025	0.0065
	109m	0.0013	0.0037
【M-MI】(old M-24)	1m	ND	0.0029
	100m	ND	0.0022

※1 NDの記載は、海水の放射能濃度の検出値が検出目標値 0.001Bq/L を下回る場合。
※1 ND indicates the case that the detected radioactivity concentration in seawater was lower than the minimum detectable activity 0.001Bq/L

* 図中の■は東京電力(株)福島第一原子力発電所を示す。
* The legend ■ indicates the location of TEPCO Fukushima Dai-ichi NPP.
* 原子力規制委員会の委託事業により、(公財)海洋生物環境研究所が採取した試料を(公財)日本分析センターが分析。
* The samples of seawater collected by Marine Ecology Research Institute (MERI) were analyzed by Japan Chemical Analysis Center on the request of Nuclear Regulation Authority (NRA).
* 「水浴場の放射性物質に関する指針について(改訂版)」(環境省)において、自治体等が水浴場開設の判断を行う際に考慮する、水浴場の放射性物質に係る水質の目安は、以下のとおり。
  －放射性セシウム(放射性セシウム134及び放射性セシウム137の合計)が10Bq／L以下
* "Guidelines for Radioactive Substances in Bathing Areas" released by Ministry of Environment gives an indication of the water quality for municipalities to open bathing areas as follows
  － The concentration of radioactive Cs (Cs-134 and Cs-137) is lower than or equal to 10 Bq/L.

(参考)

平成20-22年度「海洋環境放射能総合評価事業」の宮城海域、福島第一海域(福島第一発電所から約25km付近)及び茨城海域の表層海水の環境放射能調査の結果：

(宮城海域) Cs-137: 0.0012～0.0017Bq/L、(福島第一海域) Cs-137: 0.0011～0.0019Bq/L、(茨城海域) Cs-137: 0.0011～0.0020Bq/L

(Reference)

The results of the environmental radioactivity measurement in the outer layer of the seawater in the sea area around Miyagi, Fukushima Dai-ichi NPP (around 25km distance from Fukushima Dai-ichi NPP) and Ibaraki shown in the report "Oceanic Environmental Radioactivity Synthesis Evaluation Business" FY 2008-2010 :

(The sea area of Miyagi) Cs-137: 0.0012～0.0017Bq/L (The sea area around Fukushima Dai-ichi NPP) Cs-137: 0.0011～0.0019Bq/L (The sea area of Ibaraki) Cs-137: 0.0011～0.0020Bq/L

宮城県・福島県・茨城県・千葉県沖外洋における海域モニタリング結果（海水）

Readings of Sea Area Monitoring at the Outer Sea of Miyagi, Fukushima, Ibaraki and Chiba Prefecture(Seawater)

試料採取日：平成25年5月14日～19日

(Sampling Date: May 14-19, 2013)

公表日：平成25年9月4日

(Published: Sep 4, 2013)

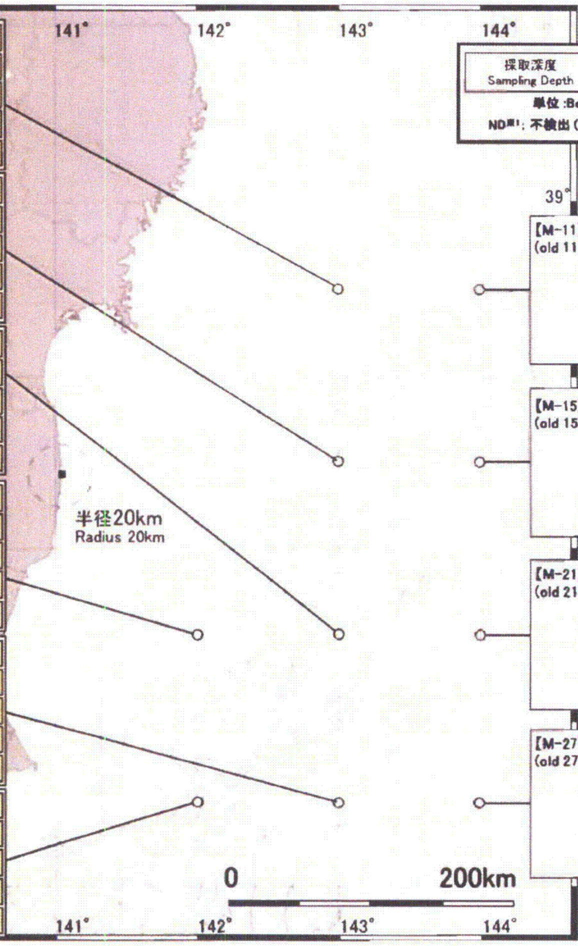
原子力規制委員会

Nuclear Regulation Authority (NRA)

採取深度 Sampling Depth	Cs-134	Cs-137

単位：Bq/L (Unit: Bq/L)

ND※1：不検出 (ND※1: Not Detectable)



Station	Depth	Cs-134	Cs-137
【M-10】 (old 10)	1m	0.0011	0.0029
	100m	ND(0.00068)	0.0021
	200m	ND(0.00064)	0.0022
	300m	ND(0.00065)	0.0019
	500m	ND(0.00061)	0.00091
【M-14】 (old 14)	1m	ND(0.00079)	0.0026
	100m	ND(0.00074)	0.0021
	200m	ND(0.00074)	0.0015
	300m	ND(0.00066)	0.0015
	500m	ND(0.00068)	0.00090
【M-20】 (old 20)	1m	ND(0.00082)	0.0025
	100m	ND(0.00095)	0.0019
	200m	ND(0.00092)	0.0018
	300m	ND(0.00096)	0.0014
	500m	ND(0.00084)	0.00080
【M-19】 (old 19)	1m	0.0010	0.0028
	100m	ND(0.00061)	0.0014
	200m	ND(0.00059)	0.0017
	300m	ND(0.00069)	0.0014
	500m	ND(0.00059)	0.0010
【M-26】 (old 26)	1m	ND(0.00069)	0.0020
	100m	ND(0.00065)	0.0025
	200m	0.0011	0.0036
	300m	0.0011	0.0034
	500m	ND(0.00085)	0.0015
【M-25】 (old 25)	1m	ND(0.0010)	0.0016
	100m	ND(0.00092)	0.0022
	200m	0.0020	0.0044
	300m	ND(0.00094)	0.0031
	500m	ND(0.00087)	0.0012
【M-11】 (old 11)	1m	ND(0.00096)	0.0025
	100m	ND(0.00095)	0.0023
	200m	0.0010	0.0018
	300m	ND(0.00092)	0.00095
	500m	ND(0.00097)	0.00068
【M-15】 (old 15)	1m	ND(0.00095)	0.0023
	100m	ND(0.00088)	0.0018
	200m	ND(0.00097)	0.0020
	300m	ND(0.00096)	0.0016
	500m	ND(0.00085)	0.00084
【M-21】 (old 21)	1m	ND(0.00068)	0.0019
	100m	ND(0.00069)	0.0026
	200m	0.0026	0.0056
	300m	0.0013	0.0043
	500m	ND(0.00064)	0.0015
【M-27】 (old 27)	1m	ND(0.00094)	0.0022
	100m	ND(0.00096)	0.0030
	200m	0.0012	0.0044
	300m	ND(0.0010)	0.0027
	500m	ND(0.00089)	0.0021

※1 NDの記載は、海水の放射能濃度の検出値が検出下限値を下回る場合。

※1 ND indicates the case that the detected radioactivity concentration in seawater was lower than the detection limits.

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  - The concentration of radioactive Cs (Cs-134 and Cs-137) is lower than or equal to 10 Bq/L.

(参考) 平成20-22年度「海洋環境放射能総合評価事業」の福島第一海域(福島第一発電所から約25km付近)の環境放射能調査の結果　Cs-137:0.0012～0.0019Bq/L

(Reference) The result of the environmental radioactivity measurement in the seawater around Fukushima Dai-ichi NPP (around 25km distance from Fukushima Dai-ichi NPP) shown in the report "Oceanic Environmental Radioactivity Synthesis Evaluation Business" FY 2008-2010:　Cs-137:0.0012～0.0019 Bq/L

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DOE-EM Activities on Fukushima

- DOE conducted three information exchange workshops
  - National Labs providing overviews of their experience with clean-up technologies.
- No direct technical exchanges, yet.
- U.S. Embassy Science Fellows support to the Japanese Ministry of the Environment. Report SRNL-RP-2013-00303 http://srnl.doe.gov/pubs/embassy_fellows_report.htm
- DOE-EM contacts:

  Steve Schneider (Director for Waste Processing)

  Kurt Gerdes (Director for Soil and Groundwater Remediation)

U.S. Department of Energy
Office of Environmental Management
Support to Japan Following the Fukushima Accident

After the accident at Fukushima in March 2011, Japan requested technical assistance from the United States (U.S.) Department of Energy (DOE), recognizing the environmental cleanup experience and expertise within the Office of Environmental Management (EM). In response, EM provided support in the following areas:

1. Technical Assistance and Information Exchange
   - Led three workshops to exchange technical information:
     - The first workshop, held in Tokyo in October 2011, discussed cleanup of the Fukushima reactor site and described U.S. experiences in radioactive waste cleanup.
     - The second workshop, held in Hanford, Washington, in February 2012, discussed offsite cleanup and included a tour of the Hanford site.
     - The third workshop, held in Tokyo in July 2013 provided U.S. experience (U.S. DOE with the U.S. Environmental Protection Agency (U.S. EPA)) on cesium behavior in the environment, stakeholder interactions, and environmental monitoring, which were identified by Japan's Ministry of Economy, Trade and Industry (METI) and Ministry of Environment (MOE) as priorities.

   - Answered technical questions submitted by Japan and discussed these in teleconferences shortly after the accident. These concerned:
     - waste storage, treatment and disposal;
     - soil and groundwater cleanup in agricultural areas;
     - corrosion and heat buildup during interim storage of water before treatment;
     - decontamination and decommissioning; monitoring/surveillance.

   - Developed a report on options for retrieval, storage, treatment and disposal;

   - Provided lessons learned about U.S. experience at Three Mile Island.

2. Decommissioning and Environmental Management Working Group
   - Established the group to address the long-term consequences of the Fukushima accident, including facility decommissioning, spent fuel storage, decontamination, and remediating contaminated areas.

   - Led by the U.S. (U.S. DOE-EM and the U.S. EPA); and Japan (METI and MOE).

   - Met in Tokyo in December 2012 and in July 2013 (in conjunction with the third workshop).

3. Partnership between the U.S. DOE National Laboratories and Japan
   - In September 2012, the Savannah River National Laboratory (SRNL), and the Pacific Northwest National Laboratory (PNNL) executed a Work For Others (WFO) contract with the Tokyo Electric Power Company (TEPCO) to produce a Feasibility Study describing how national laboratory expertise and capabilities could assist TEPCO in

six broad technical challenges associated with the cleanup at the Fukushima Daiichi Nuclear Power Station. The six technical areas spanned: 1) prevention of groundwater contamination, 2) grouting techniques, 3) laboratory analysis and design, 4) waste treatment and disposal, 5) fuel debris, and 6) water treatment.

- In developing the Feasibility Study, the laboratory technical teams described expertise and capabilities in each of the areas and proposed additional technical tasks that could be performed in subsequent contract scope. That report was issued in March 2013.

- TEPCO expressed interest in further work with the laboratories and an expanded WFO contract is nearing completion that would fund the laboratories to provide technical approaches on many of Fukushima's critical cleanup issues, including prevention of groundwater contamination.

4. Technical Staff Detailed to Japan
   - U.S. DOE, U.S. EPA, and Japan agreed to conduct technical staff details under the Department of State Embassy Science Fellows program. Three scientists (PNNL, SRNL, and U.S. EPA) spent two months in Japan in early 2013 supporting MOE. Their final report was issued in July 2013 and is available at http://srnl.doe.gov/pubs/embassy_fellows_report.htm.

   - National laboratory personnel have consulted with Japan on specific technical topics.

5. Opportunities for U.S. Companies Experienced in Remediation and Decommissioning to Assist in Cleanup
   - Issued a Request for Information in 2012 from U.S. companies with cleanup experience; 33 firms responded.

   - DOE collaborated with the Department of Commerce (DOC) to hold a June 2012 meeting between the U.S. companies and Japanese government officials and companies in Tokyo and included a trip to Fukushima.

   - Currently working with DOC to establish a second meeting between Japan and U.S. firms in late 2013 or early 2014.

6. Proposed Future Work; Japan is considering these proposals:
   - Continue technical exchanges using the Decommissioning and Environmental Management Working Group. The U.S. could address Japan's technical issues and Japan could present progress on Fukushima cleanup.

   - A demonstration project in the Fukushima exclusion zone. Details are still to be determined.

Sea Area Monitoring

November 12, 2013

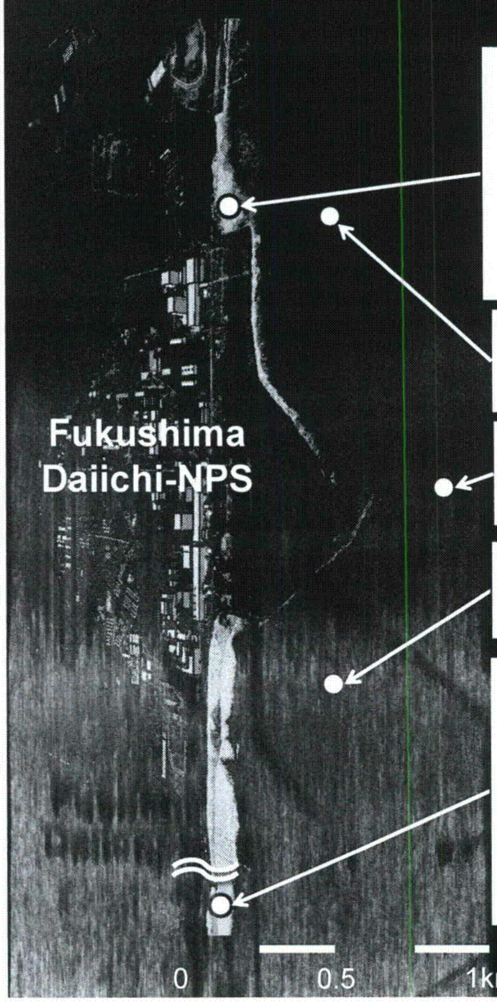
Nuclear Regulation Authority (NRA), Japan

FI/3

Sea area within 2km radius from the NPS

Sea water radioacitivity (Bq/L):
ND: under detection limits; Numbers in parentheses: detection limits

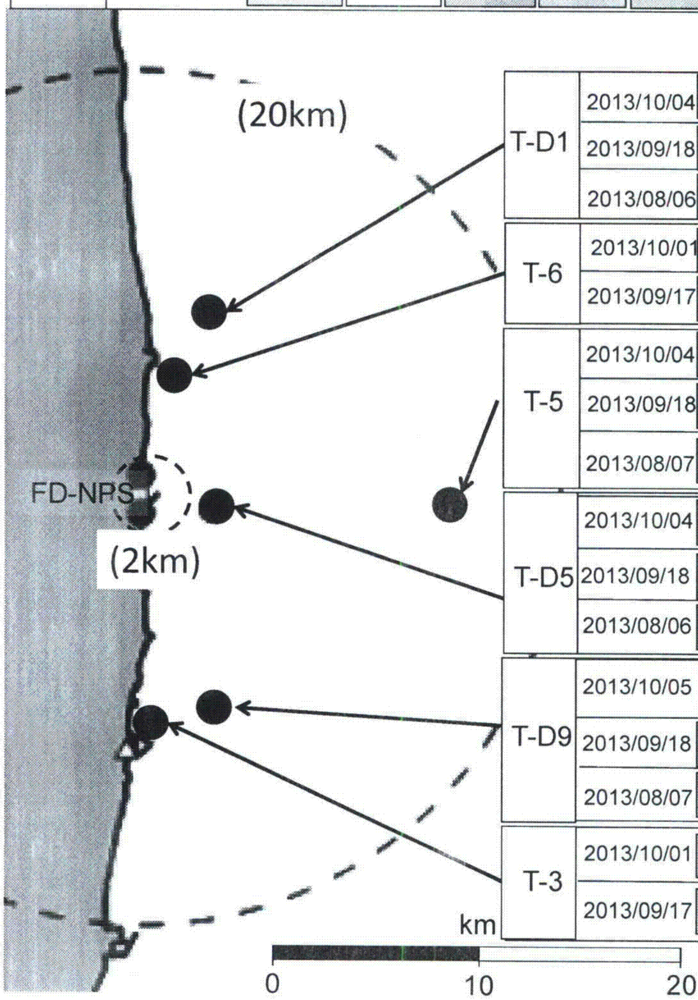
Sampling Point	Sampling Date	Cs-134	Cs-137	total β	H-3	Sr-90	total α	Pu-238	Pu-239+ Pu-240
T-1	2013/10/28	ND (1.3)	ND (1.3)	ND (15)	In progress				
	2013/10/21	ND (1.3)	ND (1.3)	ND (16)	ND (1.7)				
	2013/09/23	ND (1.2)	ND (1.4)	ND (17)	ND (1.8)	In progress	ND (0.13)		
	2013/08/12	ND (1.2)	1.4	ND (19)	4.7	In progress	ND (0.12)		
	2013/08/06	ND (1.4)	1.7					ND(6.6×10^{-6})	$(7.5\pm2.1)\times10^{-6}$
T-0-1	2013/10/28	ND (0.60)	ND (0.59)	ND (15)	In progress				
	2013/10/18	ND (0.81)	ND (0.64)	ND (16)	ND(1.8)				
T-0-2	2013/10/28	ND (0.54)	ND (0.70)	ND (15)	In progress				
	2013/10/18	ND (1.2)	1.6	ND (16)	2.9				
T-0-3	2013/10/28	ND (0.63)	ND (0.69)	ND (15)	In progress				
	2013/10/18	ND (0.70)	ND (0.76)	ND (16)	ND(1.8)				
T-2-1	2013/10/28	ND (1.3)	2.9	ND (18)	In progress				
	2013/10/21	ND (1.3)	ND(1.3)	ND (17)	ND(1.7)				
	2013/09/23	ND (1.2)	ND(1.4)	ND (17)	ND(1.8)	In progress	ND (0.13)		
	2013/08/12	ND (1.2)	ND(1.4)	ND (19)	ND(2.9)	In progress	ND (0.12)		
	2013/08/06	ND (1.4)	ND(1.3)	ND(21)				ND(7.6×10^{-6})	$(1.1\pm0.29)\times10^{-5}$



Sea area between 2-20km radius from the NPS (1)

S: 2m below sea level

Sea water radioacitivity (Bq/L):
ND: under detection limits; Numbers in parentheses: detection limits



Sampling Point	Sampling Date	Cs-134	Cs-137	total β	H-3	Sr-90	total α	Pu-238	Pu-239+ Pu-240	S
T-D1	2013/10/04	0.0050	0.0099	ND(17)	ND (0.34)	ND(0.02)	ND(1.7)	In progress	In progress	S
	2013/09/18	0.014	0.029	ND(15)	1.6					S
	2013/08/06	0.0053	0.011	ND(17)	ND (0.37)	ND(0.01)	ND(1.7)	ND(4.8×10^{-6})	ND(4.7×10^{-6})	S
T-6	2013/10/01	0.074	0.20	ND(17)	0.58					S
	2013/09/17	0.12	0.26	ND(15)	ND (0.34)					S
T-5	2013/10/04	In progress	In progress	ND(17)	ND (0.34)	ND(0.02)	ND(1.7)	In progress	In progress	S
	2013/09/18	ND (0.00091)	0.0029	ND(15)	ND (0.34)					S
	2013/08/07	ND (0.0015)	0.0049	ND(17)	ND (0.37)	ND(0.01)	ND(1.7)	ND(5.9×10^{-6})	ND(6.3×10^{-6})	S
T-D5	2013/10/04	0.0063	0.013	ND(17)	0.38	ND(0.02)	ND(1.7)	In progress	In progress	S
	2013/09/18	0.023	0.052	ND(15)	1.3					S
	2013/08/06	0.0057	0.019	ND(17)	ND (0.37)	ND(0.01)	ND(1.7)	ND(6.9×10^{-6})	ND(6.1×10^{-6})	S
T-D9	2013/10/05	0.0056	0.016	ND(17)	ND (0.34)	ND(0.02)	ND(1.7)	In progress	In progress	S
	2013/09/18	0.022	0.046	ND(15)	1.3					S
	2013/08/07	0.0058	0.013	ND(17)	ND (0.37)	ND(0.01)	ND(1.7)	ND(5.2×10^{-6})	ND(5.5×10^{-6})	S
T-3	2013/10/01	0.19	0.40	ND(17)	ND (0.32)					S
	2013/09/17	0.11	0.24	ND(15)	ND (0.34)					S

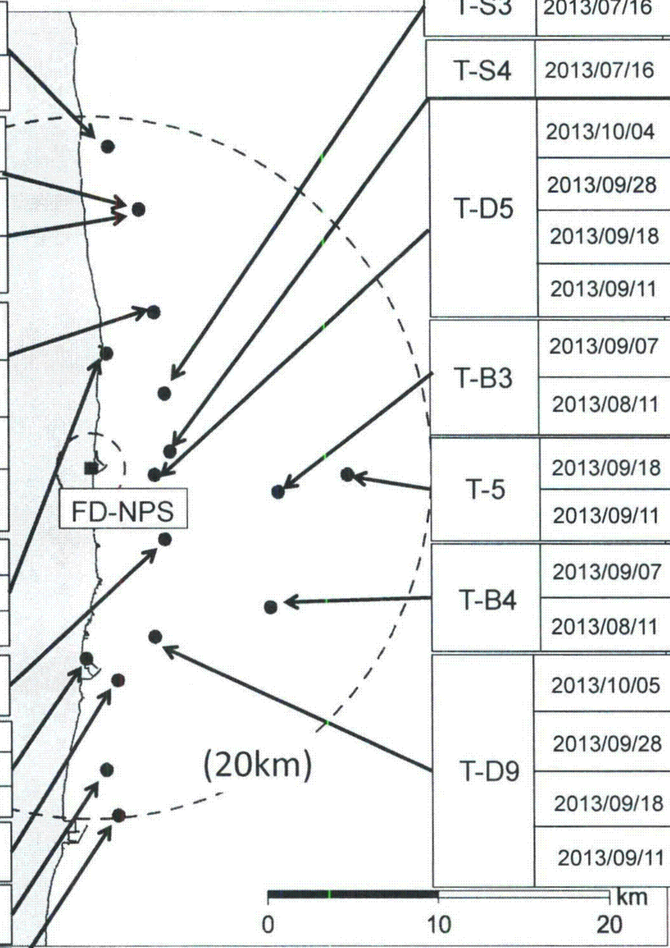
Sea area between 2-20km radius from the NPS (2)

Sampling Point	Sampling Date	Cs-134	Cs-137	S / B

S: 2m below sea level
B: 2-3m above sea bottom

Sea water radioacitivity (Bq/L):
ND: under detection limits; Numbers in parentheses: detection limits

Sampling Point	Sampling Date	Cs-134	Cs-137	S / B
T-S1	2013/09/05	0.0063	0.015	S
		0.0055	0.016	B
	2013/08/08	0.016	0.033	S
		0.016	0.032	B
T-14	2013/08/27	0.0027	0.0093	S
		0.0036	0.0090	B
T-S2	2013/09/05	0.0055	0.013	S
		0.0044	0.012	B
	2013/08/08	0.0084	0.018	S
		0.013	0.026	B
T-D1	2013/10/04	0.0050	0.0099	S
		0.0094	0.024	B
	2013/09/28	0.013	0.033	S
		0.017	0.040	B
	2013/09/18	0.014	0.029	S
		0.020	0.047	B
	2013/09/11	0.0035	0.0084	S
		0.0066	0.016	B
T-6	2013/10/01	0.074	0.20	S
	2013/09/24	0.13	0.29	S
	2013/09/17	0.12	0.26	S
T-S8	2013/07/18	0.011	0.024	S
		0.010	0.024	B
T-3	2013/10/01	0.19	0.40	S
	2013/09/24	0.074	0.20	S
	2013/09/17	0.11	0.24	S
T-S7	2013/07/12	0.025	0.051	S
		0.022	0.043	B
T-S5	2013/07/12	0.012	0.029	S
		0.029	0.056	B
T-11	2013/09/06	0.0040	0.0093	S
		0.015	0.033	B
T-S3	2013/07/16	0.0083	0.018	S
		0.0097	0.018	B
T-S4	2013/07/16	0.0095	0.022	S
		0.0056	0.013	B
T-D5	2013/10/04	0.0063	0.013	S
		0.0091	0.023	B
	2013/09/28	0.011	0.021	S
		0.038	0.078	B
	2013/09/18	0.023	0.052	S
		0.022	0.043	B
	2013/09/11	0.016	0.035	S
		0.010	0.022	B
T-B3	2013/09/07	0.0021	0.0061	S
		0.0043	0.012	B
	2013/08/11	0.011	0.023	S
		0.0060	0.013	B
T-5	2013/09/18	ND(0.00091)	0.0029	S
		0.0049	0.010	B
	2013/09/11	ND(0.0015)	0.0034	S
		0.0028	0.0069	B
T-B4	2013/09/07	ND(0.0014)	0.0044	S
		0.0028	0.0077	B
	2013/08/11	0.016	0.033	S
		0.012	0.027	B
T-D9	2013/10/05	0.0056	0.016	S
		0.0047	0.016	B
	2013/09/28	0.013	0.028	S
		0.023	0.050	B
	2013/09/18	0.022	0.046	S
		0.026	0.059	B
	2013/09/11	0.010	0.023	S
		0.0042	0.0067	B

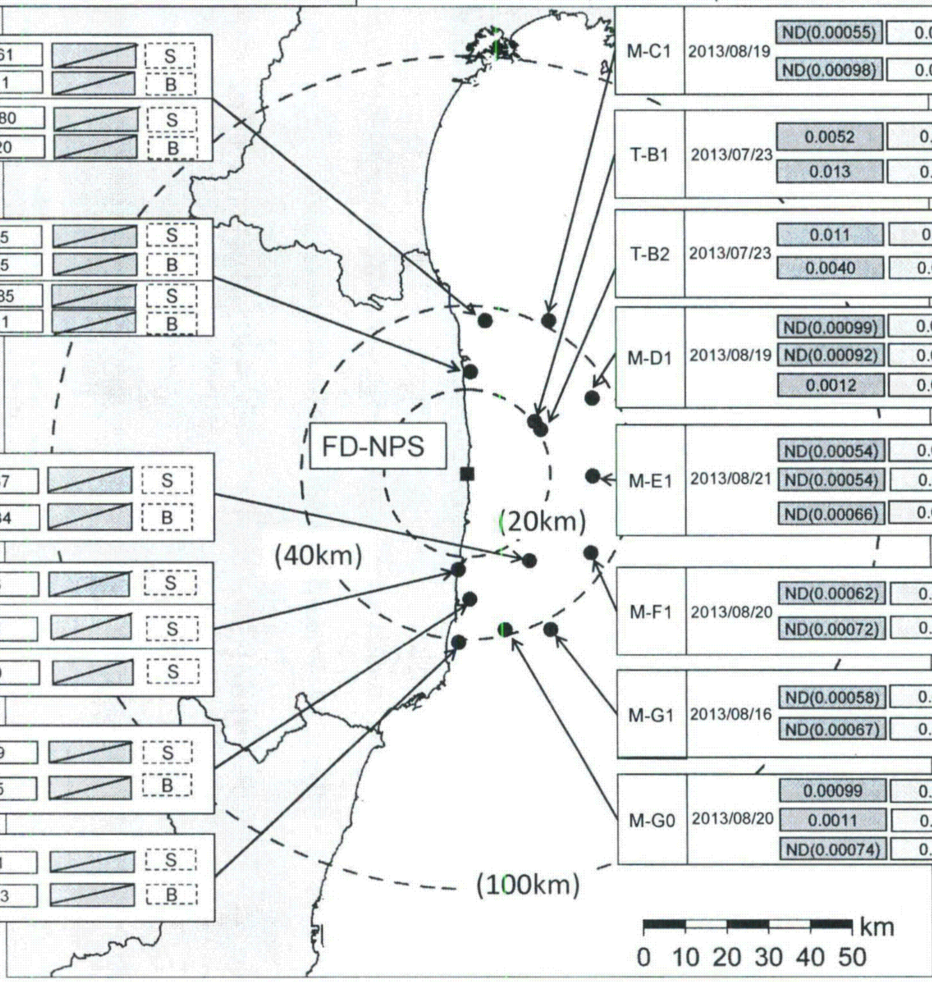


Sea area between 20-100km radius from the NPS(1)

Sampling Point	Sampling Date	Cs-134	Cs-137	Sr-90	S/B Depth (m) from sea level

S: 2m below sea level
B: 2-3m above sea bottom

Sea water radioacitivity (Bq/L):
ND: under detection limits; Numbers in parentheses: detection limits



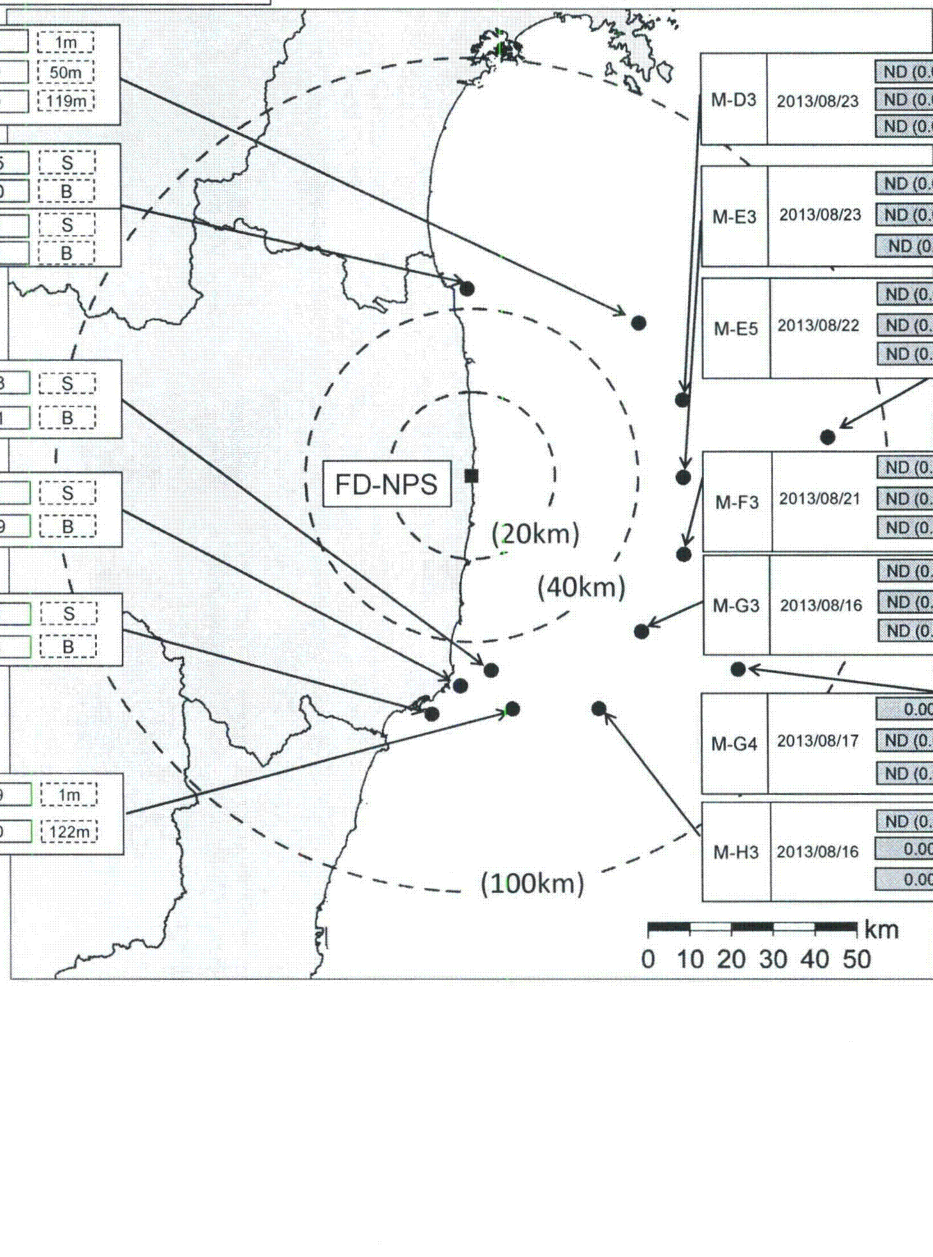
Sampling Point	Sampling Date	Cs-134	Cs-137	Sr-90	S/B / Depth
T-MA	2013/09/04	0.0016	0.0061		S
		0.0047	0.011		B
	2013/08/05	0.0024	0.0080		S
		0.0086	0.020		B
T-13-1	2013/09/04	0.0066	0.015		S
		0.0061	0.015		B
	2013/08/05	0.0031	0.0085		S
		0.0042	0.011		B
T-7	2013/08/08	ND(0.0015)	0.0037		S
		0.0016	0.0034		B
T-4-2	2013/10/01	0.11	0.26		S
	2013/09/25	0.079	0.16		S
	2013/09/17	0.084	0.19		S
T-12	2013/07/26	0.014	0.029		S
		0.0065	0.015		B
T-17-1	2013/07/26	0.0088	0.021		S
		0.0049	0.0093		B
M-C1	2013/08/19	ND(0.00055)	0.0018		1m
		ND(0.00098)	0.0022		46m
T-B1	2013/07/23	0.0052	0.011		S
		0.013	0.028		B
T-B2	2013/07/23	0.011	0.021		S
		0.0040	0.0086		B
M-D1	2013/08/19	ND(0.00099)	0.0018		1m
		ND(0.00092)	0.0016		50m
		0.0012	0.0028		112m
M-E1	2013/08/21	ND(0.00054)	0.0018		1m
		ND(0.00054)	0.0014		50m
		ND(0.00066)	0.0019		125m
M-F1	2013/08/20	ND(0.00062)	0.0018		1m
		ND(0.00072)	0.0028		136m
M-G1	2013/08/16	ND(0.00058)	0.0024		1m
		ND(0.00067)	0.0017		125m
M-G0	2013/08/20	0.00099	0.0033		1m
		0.0011	0.0039		50m
		ND(0.00074)	0.0028		97m

Sea area between 20-100km radius from the NPS(2)

Sampling Point	Sampling Date	Cs-134	Cs-137	S/B Depth (m) from sea level

S: 2m below sea level
B: 2-3m above sea bottom

Sea water radioacitivity (Bq/L):
ND: under detection limits Numbers in parentheses: detection limits



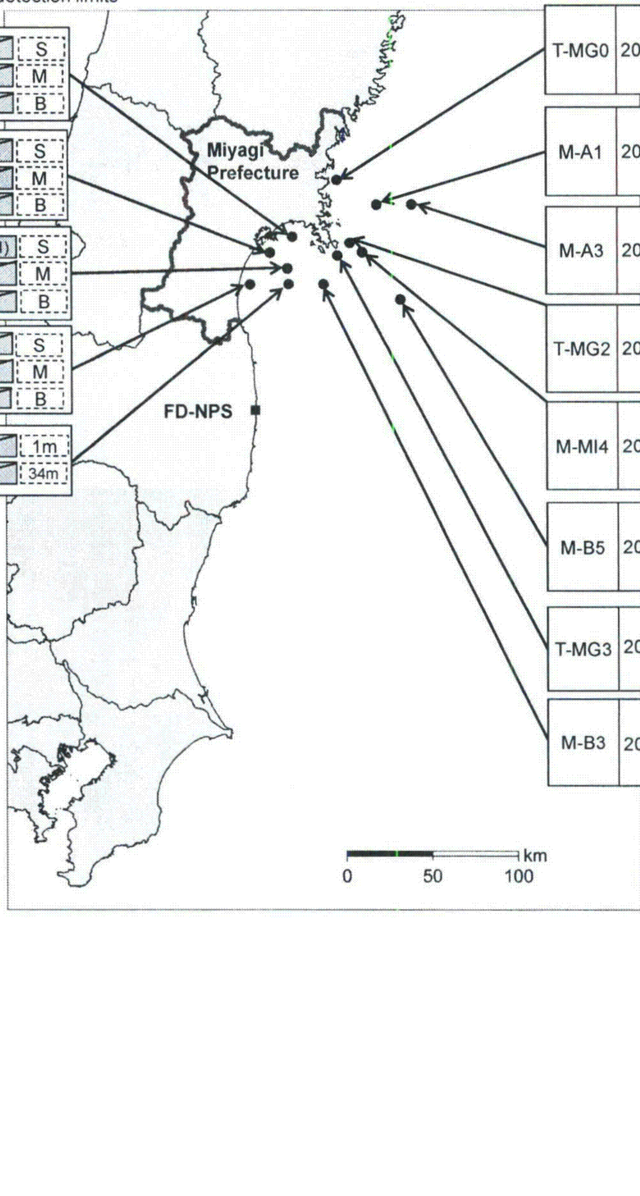
Sampling Point	Sampling Date	Cs-134	Cs-137	S/B / Depth
M-C3	2013/08/23	ND (0.00071)	0.0017	1m
		ND (0.00083)	0.0019	50m
		ND (0.00058)	0.0019	119m
T-22	2013/09/04	0.0037	0.0085	S
		0.0034	0.0090	B
	2013/08/05	0.0081	0.015	S
		0.0048	0.010	B
T-M10	2013/08/08	0.0046	0.0093	S
		0.0020	0.0071	B
T-20	2013/07/26	0.012	0.026	S
		0.0028	0.0069	B
T-18	2013/08/08	0.0062	0.018	S
		0.0068	0.018	B
M-H1	2013/08/16	0.0044	0.0099	1m
		0.0010	0.0030	122m
M-D3	2013/08/23	ND (0.00095)	0.0016	1m
		ND (0.00092)	0.0020	100m
		ND (0.00099)	0.0016	216m
M-E3	2013/08/23	ND (0.00077)	0.0020	1m
		ND (0.00066)	0.0013	100m
		ND (0.0071)	0.0019	221m
M-E5	2013/08/22	ND (0.00075)	0.0019	1m
		ND (0.00049)	0.0016	100m
		ND (0.00065)	0.00080	523m
M-F3	2013/08/21	ND (0.00079)	0.0022	1m
		ND (0.00060)	0.0016	100m
		ND (0.00086)	0.0019	226m
M-G3	2013/08/16	ND (0.00056)	0.0020	1m
		ND (0.00062)	0.0016	100m
		ND (0.00069)	0.0021	197m
M-G4	2013/08/17	0.00044	0.0018	1m
		ND (0.00074)	0.0019	100m
		ND (0.00071)	ND (0.00059)	671m
M-H3	2013/08/16	ND (0.00085)	0.0025	1m
		0.00095	0.0027	100m
		0.00043	0.0018	216m

Sea area along and off the coast of Miyagi Prefecture

Sampling Point	Sampling Date	Cs-134	Cs-137	Sr-90	S/M/B / Depth (m) from sea level

S: 2m below sea level
M: between 2m below sea level and 2-3m above sea bottom
B: 2-3m above sea bottom

Sea water radioacitivity (Bq/L):
ND: under detection limits; Numbers in parentheses: detection limits

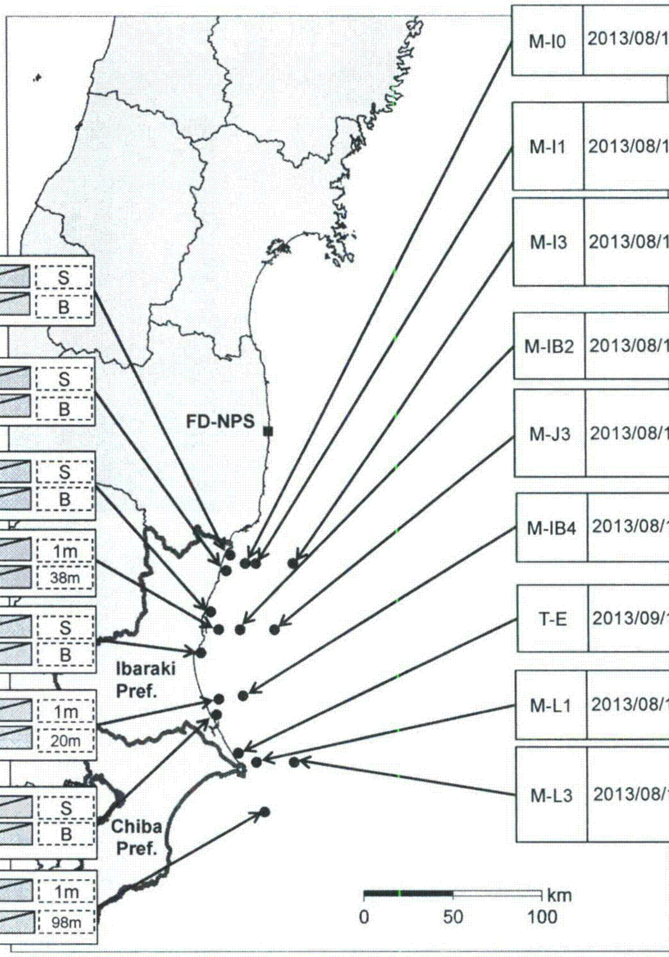


Sampling Point	Sampling Date	Cs-134	Cs-137	Sr-90	S/M/B / Depth
T-MG1	2013/0710	0.0056	0.011		S
		0.0039	0.0089		M
		ND(0.0017)	0.0046		B
T-MG4	2013/07/10	0.0040	0.010		S
		0.0027	0.0048		M
		0.0036	0.0074		B
T-MG5	2013/07/10	0.0050	0.010	ND(0.01)	S
		0.0020	0.0083		M
		0.0041	0.0069		B
T-MG6	2013/07/10	0.0040	0.010		S
		ND (0.0017)	0.0021		M
		0.0046	0.010		B
M-B1	2013/08/19	0.0021	0.0059		1m
		0.0014	0.0039		34m
T-MG0	2013/07/10	ND (0.0017)	0.0019		S
		ND (0.0017)	0.0014		M
		ND (0.0017)	0.0016		B
M-A1	2013/08/25	ND (0.00073)	0.0016		1m
		ND (0.00088)	0.0022		100m
		ND (0.00063)	0.0016		193m
M-A3	2013/08/25	ND (0.00074)	0.0018		1m
		ND (0.00065)	0.0017		100m
		ND (0.00065)	0.00064		470m
T-MG2	2013/07/10	ND (0.0017)	0.0016		S
		ND (0.0017)	0.0016		M
		ND (0.0017)	0.0020		B
M-MI4	2013/08/24	ND (0.00069)	0.0016		1m
		ND (0.00055)	0.0017		100m
		ND (0.00095)	0.0019		140m
M-B5	2013/08/26	ND (0.00064)	0.0019		1m
		ND (0.00081)	0.0019		100m
		ND (0.00065)	0.0012		345m
T-MG3	2013/07/10	0.0016	0.0064		S
		ND (0.0017)	0.0020		M
		ND (0.0017)	0.0015		B
M-B3	2013/08/24	ND (0.00072)	0.0033		1m
		ND (0.00054)	0.0019		50m
		ND (0.00087)	0.0023		108m

Sea area along and off the coast of Ibaraki Pref. and Chiba Pref.

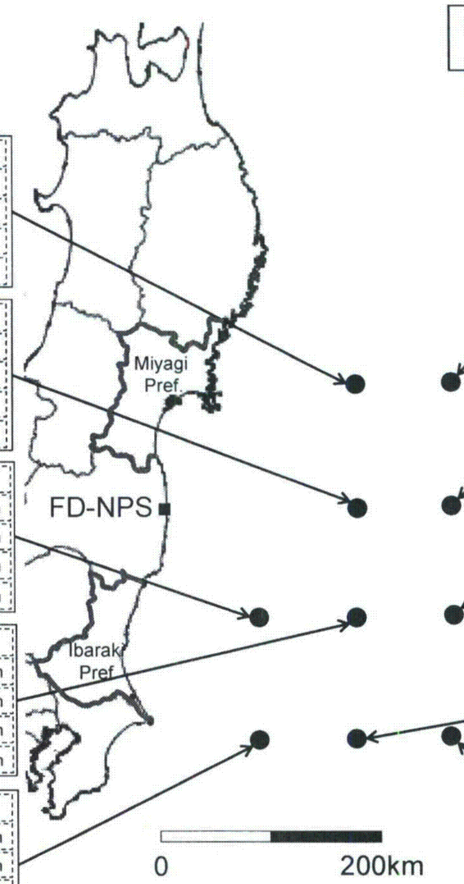
Sampling Point	Sampling Date	Cs-134	Cs-137	Sr-90	S/B / Depth (m) from sea level

S: 2m below sea level
B: 2-3m above sea bottom
Sea water radioacitivity (Bq/L):
ND: under detection limits; Numbers in parentheses: detection limits



Sampling Point	Sampling Date	Cs-134	Cs-137	Sr-90	S/B / Depth
T-Z	2013/09/09	ND (1.2)	ND(1.3)		S
		ND (1.2)	ND(1.3)		B
T-A	2013/09/09	ND (1.2)	ND(1.3)		S
		ND(1.2)	ND(1.3)		B
T-B	2013/09/11	ND (1.2)	ND(1.3)		S
		ND (1.2)	ND(1.3)		B
M-J1	2013/08/14	0.0028	0.0068		1m
		0.0028	0.0073		38m
T-C	2013/09/11	ND (1.2)	ND(1.3)		S
		ND (1.2)	ND(1.3)		B
M-K1	2013/08/12	0.0013	0.0033		1m
		0.00082	0.0040		20m
T-D	2013/09/19	ND (1.2)	ND(1.3)		S
		ND(1.2)	ND(1.3)		B
M-M1	2013/08/11	0.0013	0.0043		1m
		0.0013	0.0035		98m
M-I0	2013/08/14	ND (0.00060)	0.0022		1m
		0.0025	0.0057		57m
M-I1	2013/08/15	ND (0.00063)	0.0026		1m
		ND (0.00068)	0.0015		50m
		0.00077	0.0029		87m
M-I3	2013/08/15	ND (0.00057)	0.0021		1m
		ND (0.00063)	0.0019		100m
		ND (0.00050)	0.0020		172m
M-IB2	2013/08/13	0.0019	0.0046		1m
		0.00082	0.0039		104m
M-J3	2013/08/12	ND (0.00056)	0.0017		1m
		0.0011	0.0033		100m
		ND (0.00084)	0.0013		548m
M-IB4	2013/08/12	0.00072	0.0022		1m
		0.0014	0.0052		106m
T-E	2013/09/10	ND (1.2)	ND(1.3)		S
		ND (1.2)	ND(1.3)		B
M-L1	2013/08/11	0.0015	0.0049		1m
		ND (0.00071)	0.0026		32m
M-L3	2013/08/13	ND (0.00069)	0.0017		1m
		ND (0.00072)	0.0030		100m
		0.00079	0.0037		157m

Open sea off the coast of Eastern Japan

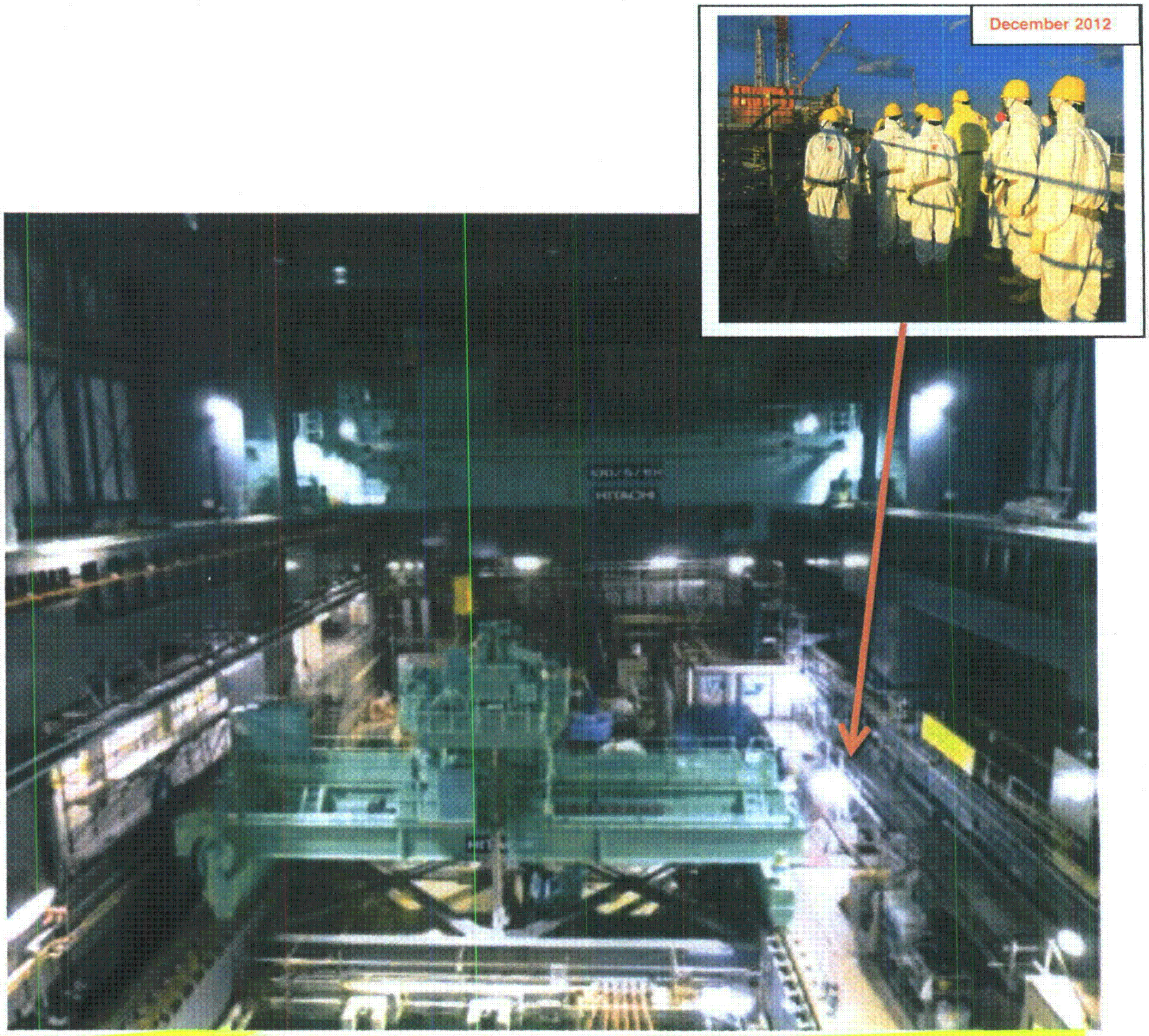


Sea water radioacitivity (Bq/L):
ND: under detection limits; Numbers in parentheses: detection limits

Sampling Point	Sampling Date	Cs-134	Cs-137	Depth (m) from sea level
M-10	2013/05/19	0.0011	0.0029	1m
		ND (0.00068)	0.0021	100m
		ND (0.00064)	0.0022	200m
		ND (0.00065)	0.0019	300m
		ND (0.00061)	0.00091	500m
M-14	2013/05/18	ND (0.00079)	0.0026	1m
		ND (0.00074)	0.0021	100m
		ND (0.00074)	0.0015	200m
		ND (0.00066)	0.0015	300m
		ND (0.00068)	0.00090	500m
M-19	2013/05/17	0.0010	0.0028	1m
		ND (0.00061)	0.0014	100m
		ND (0.00059)	0.0017	200m
		ND (0.00069)	0.0014	300m
		ND (0.00059)	0.0010	500m
M-20	2013/05/18	ND (0.00082)	0.0025	1m
		ND (0.00095)	0.0019	100m
		ND (0.00092)	0.0018	200m
		ND (0.00096)	0.0014	300m
		ND (0.00084)	0.00080	500m
M-25	2013/05/14	ND (0.0010)	0.0016	1m
		ND (0.00092)	0.0022	100m
		0.0020	0.0044	200m
		ND (0.00094)	0.0031	300m
		ND (0.00087)	0.0012	500m
M-11	2013/05/16	ND (0.00096)	0.0025	1m
		ND (0.00095)	0.0023	100m
		0.0010	0.0018	200m
		ND (0.00092)	0.00095	300m
		ND (0.00097)	0.00068	500m
M-15	2013/05/16	ND (0.00095)	0.0023	1m
		ND (0.00088)	0.0018	100m
		ND (0.00097)	0.0020	200m
		ND (0.00096)	0.0016	300m
		ND (0.00085)	0.00084	500m
M-21	2013/05/15	ND (0.00068)	0.0019	1m
		ND (0.00069)	0.0026	100m
		0.0026	0.0056	200m
		0.0013	0.0043	300m
		ND (0.00064)	0.0015	500m
M-26	2013/05/14	ND (0.00069)	0.0020	1m
		ND (0.00065)	0.0025	100m
		0.0011	0.0036	200m
		0.0011	0.0034	300m
		ND (0.00085)	0.0015	500m
M-27	2013/05/15	ND (0.00094)	0.0022	1m
		ND (0.00096)	0.0030	100m
		0.0012	0.0044	200m
		ND (0.0010)	0.0027	300m
		ND (0.00089)	0.0021	500m

Fukushima Update

October 2013



Ready for Fukushima fuel move: Unit 4 at Fukushima Daiichi is nearly ready for used reactor fuel removal. The main crane and the fuel handling machine are in place.*

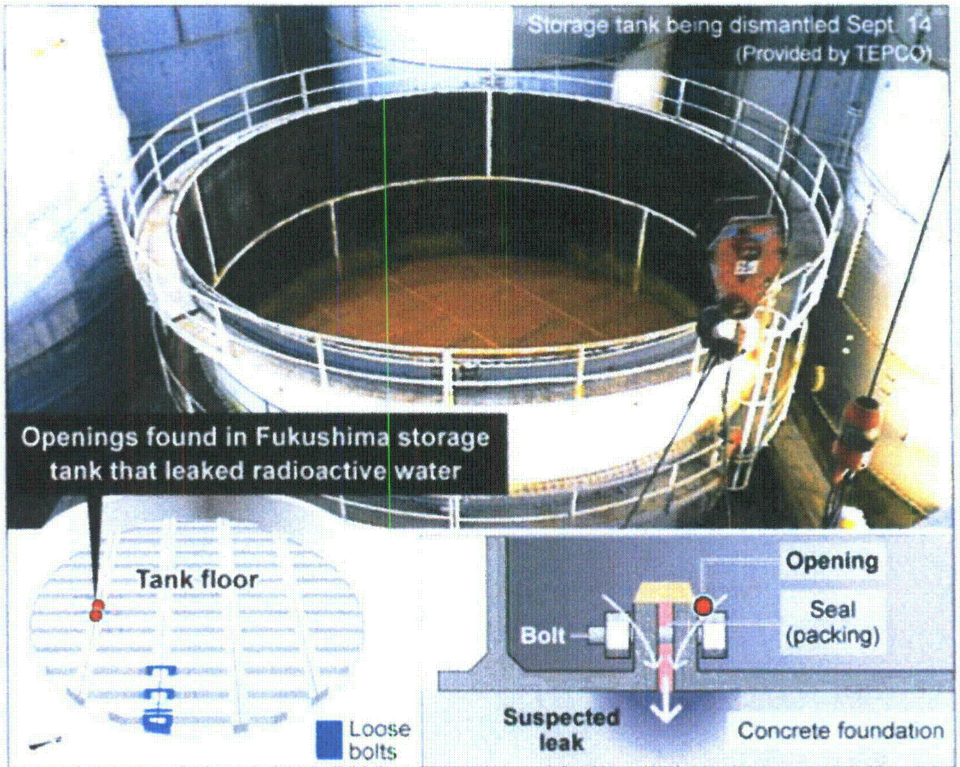
*Update information is from publically available sources as reported by: Asahi Japan, DSRI, IAEA, Japan Daily Press, JNRA, NOAA, TEPCO, WHOI, WNN Japan, and WSJ.

FI/4

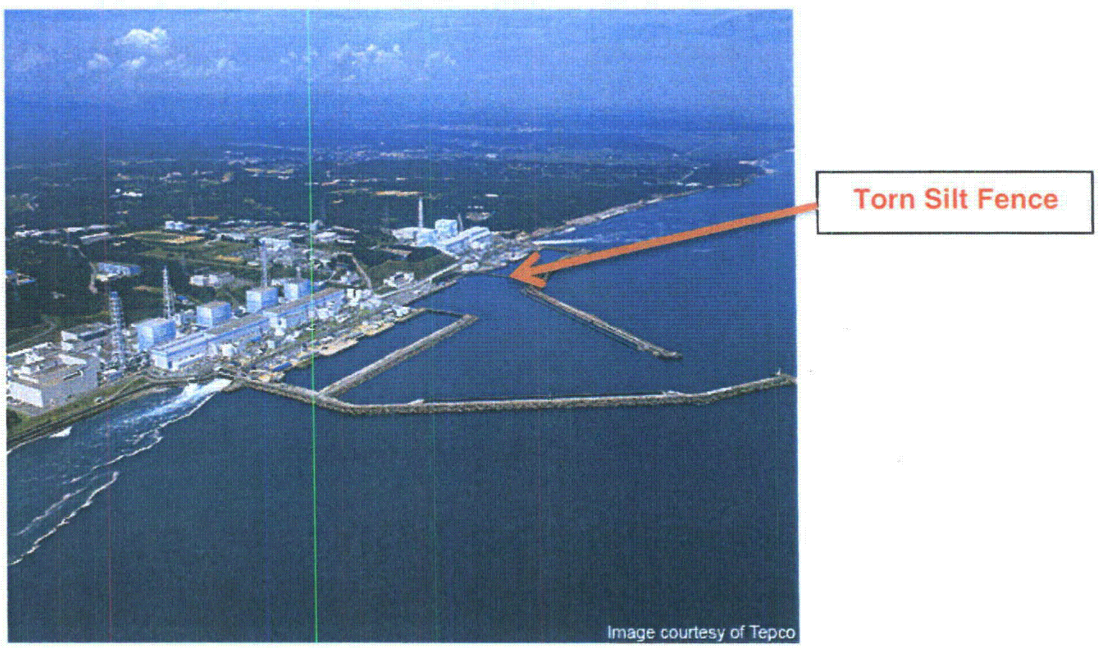
Agenda

News Update	15 minutes
Oceanic Radioactivity Migration	30 minutes

TEPCO pinpoints breaches in leaky water storage tank: Engineers found two openings along a joint in the Area 5 tank H4 that leaked 300 tons of highly radioactive water.



TEPCO Finds Hole in Anti-Radiation Silt Fence: Fukushima plant workers spotted a hole in the barrier intended to keep radioactive particles contained on the egress of reactors 5-6.



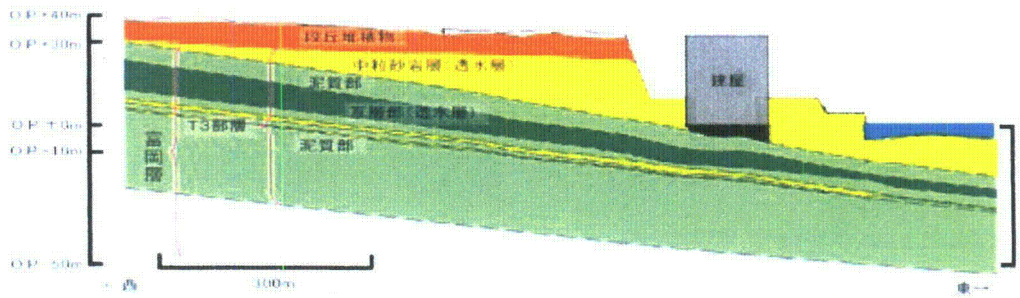
IAEA Offers Japan Help In Monitoring Seawater At Fukushima Plant: The U.N. nuclear watchdog is ready to help Japan with ocean monitoring in connection with the recent leak of radioactive water at the Fukushima Daiichi nuclear plant, its chief Yukiya Amano said Thursday.

Japan seeks outside help for contaminated water: The Japanese government has invited overseas companies and experts to submit technology proposals or advice for helping it resolve ongoing contaminated water issues at the Fukushima Daiichi plant.

TEPCO applies for safety screenings for restarting 2 reactors: Claiming it had learned from the Fukushima disaster, On Sept. 27 TEPCO applied for safety screenings to restart two nuclear reactors in Niigata Prefecture. The prefectural government demands that the utility promise not to use filtered venting equipment without prefectural approval.

Japan Officials Ignored Proposals To Control Fukushima Water Leak. Reuters recently reported on a memo issued two years ago by US nuclear experts to Japanese authorities, urging them to take immediate steps to contain groundwater contamination. A former GOJ official stated TEPCO lobbied against a proposed barrier wall to block the flow of water into the reactors out of fear that the cost would be seen as so exorbitant that it would've pushed TEPCO toward bankruptcy.

The memo, USNRC TT5310, recommended building an uphill ground water barrier. The umbrella effect would limit the flow of ground water into the site. TEPCO rejected the proposal in order to maintain ground water level higher than the reactor/turbine building basement water level so that water would leak into the buildings rather than out and directly to the sea.



Orange-surface deposits
Yellow-sandstone (permeable)
Light green-mudstone (impermeable)
Dark green-mudstone mixture (permeable)