報道発表

文部科学省 MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY-JAPAN

December 22, 2011

Review of Radiation Monitoring Continuously Conducted by MEXT since the Occurrence of the Accident at TEPCO's Fukushima Dai-ichi NPP, based on the "Comprehensive Monitoring Plan"

Based on the experts' deliberations on future policies on radiation monitoring, which has been conducted continuously by MEXT since the occurrence of the accident, we have compiled the "Review of Radiation Monitoring Continuously Conducted by MEXT since the Occurrence of the Accident at TEPCO's Fukushima Dai-ichi NPP, based on the 'Comprehensive Monitoring Plan'" (Attachment 1). We have also compiled the deliberation results of the experts in the field of radiation into the "Deliberations on the Review of Radiation Monitoring Continuously Conducted by MEXT since the Occurrence of the Accident at TEPCO's Fukushima Dai-ichi NPP (Report)" (Attachment 2).

1. Developments

- The "Comprehensive Monitoring Plan" (decided by the Monitoring Coordination Meeting in August 2011) states that regarding radiation monitoring, which has been conducted continuously, its methods, such as the frequency, measurement accuracy, and monitoring targets, should be reviewed, based on measured radiation doses up to July as well as on the Monitoring Post Installation Plan.
- In response, MEXT appointed eight experts in the field of radiation as MEXT's technical advisors and has continued deliberations on future policies on radiation monitoring by MEXT, from a technical standpoint, based on changes in radiation doses nationwide and in Fukushima prefecture and on how monitoring posts have been installed in Fukushima prefecture. The results are compiled into the "Deliberations on the Review of Radiation Monitoring Continuously Conducted by MEXT since the Occurrence of the Accident at TEPCO's Fukushima Dai-ichi NPP (Report)."
- Based on the aforementioned results of experts' deliberations and opinions of the related municipalities, MEXT compiled the "Review of Radiation Monitoring Continuously Conducted by MEXT since the Occurrence of the Accident at TEPCO's Fukushima Dai-ichi NPP, based on the 'Comprehensive Monitoring Plan'," and plans to review its radiation monitoring sequentially in line with this after the turn of the year.
- However, in the event of any abnormalities, such as a rapid increase of radiation dose rates,

MEXT will immediately move back to emergency monitoring corresponding to possible massive release of radioactive materials.

2. Basic Idea for Review

○ MEXT has conducted emergency monitoring corresponding to massive release of radioactive materials since the occurrence of the accident, mainly around the NPP for the purpose of ascertaining changes with the passage of time of influences and diffusion of radioactive materials in detail (for example, MEXT has conducted frequent monitoring of air dose rates at fixed points).

○ At this point of time, the results of the radiation monitoring up till now show that the release of radioactive materials from the reactor facilities has been decreasing, and that air dose rates have been stable with extremely minor changes over time but vary significantly depending on locations. The amounts of radioactivity in environmental monitoring samples have also decreased significantly.

○ Based on these circumstances, it is considered to be appropriate to shift away from emergency monitoring corresponding to massive release of radioactive materials and move on to assess the overall influence of radioactive materials in the surrounding environment and conduct a new type of monitoring that will contribute to the review of the future countermeasures to be taken. MEXT will move on to a new stage of monitoring, focusing on ascertaining the diffusion of radioactive materials more in detail, in a medium- and long-term standpoint rather than a short-term standpoint.

- The measurement of air doses will be carried out more extensively covering the whole area, and in greater detail, and at the same time automated measurement will be promoted and human measurement will be reduced accordingly.
- Regarding the measurement of environmental monitoring samples, efforts will be made to improve measurement accuracy and narrow down monitoring targets, and the frequency will be reduced.

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Attachment 1

Review of Radiation Monitoring Continuously Conducted by MEXT since the Occurrence of the Accident at TEPCO's Fukushima Dai-ichi NPP, based on the "Comprehensive Monitoring Plan"

December 22, 2011
Ministry of Education, Culture, Sports, Science and Technology
Emergency Operation Center

1. Overview

Upon the occurrence of the accident at Tokyo Electric Power Company's (TEPCO's) Fukushima Dai-ichi Nuclear Power Plant (hereinafter referred to as the "Fukushima Dai-ichi NPP"), emergency monitoring has so far been conducted in response to a massive release of radioactive materials from the plant. However, the nuclear reactors have become relatively stabilized and the release of radioactive materials from the nuclear facilities is considered to have decreased considerably. In light of this, the "Comprehensive Monitoring Plan," which was decided by the Monitoring Coordination Meeting on August 2, 2011, states that "it is appropriate to move on to a new stage of radiation monitoring for the purpose of assessing the overall impact in the surrounding environment and contributing to the review of the future countermeasures to be taken," and proposes review of the methods of MEXT's monitoring surveys, such as the frequency, measurement accuracy, and monitoring targets, with regard to those regularly conducted mainly in areas within 30km from the Fukushima Dai-ichi NPP and those conducted nationwide in 47 prefectures, based on radiation doses measured up till now and the progress of the installation of monitoring posts.

Since August, fluctuations in radiation doses have become even smaller and air dose rates have been moderately decreasing on an exponential basis, but air dose rates vary significantly by location. The results of nuclide analysis also show a significant decrease of radiation doses in environmental monitoring samples and measurement of dust (air) and measurement carried out nationwide with regard to drinking water and fallout have come to detect no radioactive materials at the present measurement accuracy (detection limits). Therefore, through the present method of conducting the same measurement at the same point at high frequencies, no significant changes in air dose rates can be observed over time. The measurement carried out in such a manner has lost its significance and has become less effective given the manpower allocated.

Under such circumstances, it is becoming more and more important to conduct monitoring around Fukushima Dai-ichi NPP, focusing on ascertaining the detailed distribution of air dose rates and radioactive materials over broad areas.

In light of the progress of the preparations to install additional monitoring posts in line with the Comprehensive Monitoring Plan since August, MEXT has conducted deliberations on the review of the content of monitoring being conducted nationwide and around Fukushima Dai-ichi NPP, with the participation of experts from universities and other research institutes as MEXT's technical advisors.

From the medium and long-term viewpoint, MEXT compiled the details of the review of radiation monitoring continuously conducted by MEXT since the occurrence of the accident at Fukushima Dai-ichi NPP, concerning the setting of conditions for the frequency, measurement accuracy, and monitoring targets, based on the report by said experts, and in light of an increasing

requests for monitoring for the purpose of ascertaining wide-area distribution of radioactive materials in the environment in Fukushima prefecture. In response to the review results, MEXT will make necessary improvements of monitoring methods in sequence so that significant information can be collected and disseminated in a rational manner. However, in the event of any abnormal situations, such as a rapid increase in dose rates, we will move back to emergency monitoring to respond to a massive release of radioactive materials.

The results of the review by the experts that are related to matters other than MEXT's radiation monitoring are to be discussed by relevant ministries and agencies, respectively, in line with the Comprehensive Monitoring Plan, and MEXT will conduct collaborations with them as necessary.

2. Monitoring around Fukushima Dai-ichi NPP

1) Measurement of air dose rates (monitoring cars, portable monitoring posts, etc.)

After the announcement of the review, amendments should be promoted gradually as follows, thereby enhancing the rationality and improving the monitoring content. The number of targeted points for the measurement using monitoring cars is 202 at present, but through the introduction of portable monitoring posts with automated measurement and delivery systems, the number of measuring points will be increased to 589 in total within this fiscal year, and more detailed monitoring for broad areas will become possible.

(i) At measuring points for air dose rates where measurement can be carried out using portable monitoring posts, installment of portable monitoring posts should be promoted and a real-time delivery system should be adopted sequentially. A total of 434 portable monitoring posts should be installed within this fiscal year to increase measuring points from which the measuring results can be delivered on a real-time basis [firstly, with 20 units currently operating, the real-time delivery should be initiated (at five overlapping points, the real-time delivery will be started upon the announcement of the review); installment of monitoring posts will be promoted in February onward].

(ii) As measurement using monitoring cars has recently shown no significant fluctuations over time in measured values, measuring points will be divided into three groups and measurement will be carried out at all the measuring points in three weeks (to be started upon the announcement of the review). In the future, the continuous vehicle-borne survey system should be introduced to enable us to obtain more detailed radioactive distribution over broad areas.

In restricted areas (within a 20 km range) and planned evacuation areas, present measuring points should be maintained and measurement should be carried out once a week (when the designation of such areas is lifted by the national government, the introduction of the same estimation method used in other areas should be considered).

* See Exhibits 1 and 2 for the details of measuring points.

2) Measurement of accumulated doses (simple dosimeters, glass badges, portable monitoring posts)

Amendments should be promoted as follows, thereby enhancing the rationality and improving the monitoring content.

(i) Measuring points of accumulated doses should be increased through automatically collecting necessary data by portable monitoring posts that are to be installed within this fiscal year (20 units are to be newly installed by the end of 2011, and installation of additional monitoring posts will be promoted in February onward).

(ii) Present fixed-point measurement by using accumulating dosimeters will be carried out at the same time as the measurement by monitoring cars in January 2012 onward, and data will be checked once every seven to ten days (to be started upon the announcement of the review). Glass badges will continue to be used in the same manner.

At measuring points in restricted areas (within a 20 km range) and planned evacuation areas, measurement should be carried out once a week.

3) Measurement of environmental monitoring samples (at present: dust, weeds, and soil)

From January 2012, efforts should be made as shown in (i) to (iii) and the table below, for the purpose of enhancing the measurement accuracy, reviewing the frequency, and altering specified indicator plants, etc.

(i) Dust

- The measurement accuracy should be enhanced by making sampling hours four times longer*, and at selected representative points, sampling and measurement should be conducted (the frequency of sampling and measurement should be reduced to once every two weeks in restricted areas, and around once a month in other areas; to be started in January 2012 after the announcement of the review). In the future, high-volume dust samplers should be installed to further enhance the measurement accuracy.

* Sampling time: Before review – 15 minutes → After review – 60 minutes

(ii) Soil

- Within a 20 km range, around five measuring points should be selected, and in areas 20 km or farther from the NPP, points showing relatively high air dose rates should be targeted (the frequency should be reduced to around once every three months) (to be started after the announcement of the revision).

(iii) Weeds (indicator plants)

- Present measurement of weeds as environmental monitoring samples should be changed to more limited targets (pine needles) (the frequency should be reduced to around once every three months) (to be started after the announcement of the revision).

Table: Points for Collecting Environmental Monitoring Samples after the Revision

Targets	Sampling point	Frequency	Remarks
Dust	20 km or farther 112,113,115,181,k10,n2,ms7	1 month	・Select points in all directions within a 20 km range and a 30 km range
	Within a 20 km range 5,21,26,34,44	2 weeks	

Soil	20 km or farther 32,81,83,ms6,k8	3 months	・Select points showing high air doses
	Within a 20 km range 8,37,46,51,55		・
Indicator plants	2-1,2-2,2-3,2-4,2-5,2-6,2-7, 2-8,2-9,3-13,79,83,ms6,k8 (14 points)	3 months	・Similar points as those for sampling weeds ・Similar points as those for sampling soil

＜Notes＞

With regard to monitoring on freshwater fish and marine organisms, adjustments should be made among related ministries and agencies to discuss responsible entities and monitoring methods.

3. Nationwide monitoring (including Fukushima prefecture)

1) Measurement of air dose rates (measurement at the height of 1m around monitoring posts using monitoring posts and survey meters)

The automated measurement and delivery systems should be installed at existing fixed mount type monitoring posts nationwide, and additionally, a total of 250 fixed mount type monitoring posts with said system should be installed nationwide, and a total of 130 portable monitoring posts with said system should be installed in the prefectures neighboring Fukushima. Through these systems, more detailed monitoring should be promoted and at the same time, the real-time delivery system via the Internet should be adopted sequentially for the release of the measurement results. Furthermore, with regard to air dose rates at the height of 1 m, which have shown only minor fluctuations over time in their ratios compared to past values and those measured by monitoring posts (hereinafter simply referred to as "posts"), a method of obtaining them through estimation by using values measured by posts, based on past values, (see Exhibit 3) should be adopted gradually (for the time being, air dose rates at the height of 1 m should be measured using survey meters once a month to verify whether the estimation is made properly).

＜Present state＞

(i) Frequency:

Post) Every hour (every day, and the results are released the next day)

At 1m) Once a day together with the above (every day, and the results are released the next day)

(ii) Accuracy: 1 nSv/h (0.001 μSv/h)

(iii) Method: Automated measurement using posts

＜After the announcement of the review＞ Move to the following method promptly.

(i) Frequency:

Post) Every hour (the results are to be released the next day in principle; as there have been no significant fluctuations over time, data for weekends and holidays are to be released collectively on the following business day)

* This shall not preclude respective local governments from releasing data on weekends and holidays.

At 1m) Estimated values are to be released together with the measurement results using posts. For the time being, measurement using survey meters shall be carried out once a month for verification (to be started in January 2012).

(ii) Accuracy: Unchanged

(iii) Method: Unchanged

＜Within this fiscal year＞

(i) Frequency:

Post) In line with the commencement of the operation of the automated measurement and delivery system by monitoring posts installed nationwide, the real-time delivery of data via the Internet will start and hourly measured air dose rates are to be released

on a timely basis.

Furthermore, a total of 250 fixed mount type monitoring posts will be installed nationwide, and a total of 130 portable monitoring posts will be installed in prefectures located next to Fukushima, thereby enabling the release of hourly measured air dose rates through the real-time delivery system via the Internet.

At 1m) Estimated values are to be released together with the measurement results using posts. For the time being, measurement using survey meters shall be carried out once a month for verification.

(ii) Accuracy: Unchanged

(iii) Method: Unchanged

＜Notes＞

As fluctuations over time in air dose rates are minor, as previously, data for weekdays are to be released on the next day, but data for weekends and holidays are to be released collectively on the following business day in principle, for the purpose of laborsaving. If any risk of an increase is a concern in air dose rates, the prior system should be resumed promptly.

2) Drinking water (including surrounding areas of Fukushima prefecture)

The measurement accuracy should be enhanced to the same level (around 100 times more accurate) as that for the highly accurate examination (environmental radioactivity level survey) that had been carried out since before the accident (under normal situations), and the frequency should be reduced to once every three months.

＜Present state＞

(i) Frequency: Once a day (the results are released every day)

(ii) Accuracy: Around 0.1 to 0.7 Bq/kg

(iii) Method: Collected samples are directly measured using germanium semiconductor detectors

＜Until the end of 2011＞ Promptly move to the new system upon the announcement of the review (measurement will be terminated at the end of the year)

＜Within this fiscal year＞【To be started in January 2012】

(i) Frequency: Once every three months (the first results are to be released late April)

(ii) Accuracy: Around 1 mBq/kg (around 100 times more accurate)

(iii) Method: Collected samples are to be pretreated (evaporated and/or concentrated) and then measured using germanium semiconductor detectors

＜Notes＞

At the current measurement accuracy, no radioactive materials have long been detected. Therefore, the measurement accuracy should be enhanced by sufficiently lowering detection limits, but the frequency should be reduced to once every three months (e.g. sampling is to be conducted between January and March and the results are to be released late April). In order to obtain average values during the relevant period, measurement should be carried out by collecting 1.5 liters of drinking water every day except on weekends and holidays, which

amount to around 100 liters in three months.

3) Fallout

The measurement accuracy should be enhanced to the same level (around 100 times more accurate) as that for the highly accurate examination (environmental radioactivity level survey) that had been carried out since before the accident (under normal situations), and the frequency should be reduced to once a month.

＜Present state＞

(i) Frequency: Once a day (the results are released every day)
(ii) Accuracy: 10 Bq/m^2 or lower
(iii) Method: Collected samples are directly measured using germanium semiconductor detectors

＜After the announcement of the review＞

Measurement will be terminated at the end of 2011, and monthly results of the measurement (for July onward) that have yet to be released will be compiled.

＜Within this fiscal year＞【To be started in January 2012】

(i) Frequency: Once a month (the results for January are to be released at the end of February)
(ii) Accuracy: 0.1 Bq/m^2 (around 100 times more accurate)
(iii) Method: Collected samples are to be pretreated (evaporated and/or concentrated) and then measured using germanium semiconductor detectors

＜Notes＞

At the current measurement accuracy, no radioactive materials have long been detected. Therefore, the measurement by maintaining sufficiently low detection limits should be carried out once a month (the results are to be released at the end of the following month). Regarding the measurement of fallout, which is now being carried out together with other daily measurement monthly data will be compiled and released promptly.

(Exhibit 1)

List of Changes in Points for Fixed-point Measurement (Points for Measurement Using Monitoring Cars: 202 points → After the Review within the Fiscal Year: 589 points)

Address of Sampling Point	Measurement is carried out using monitoring cars in the same manner as before*1 (136 points in total)	Shifting to the method using portable monitoring posts*1,*2 (47 points in total)	Newly installing portable monitoring posts*2 (387 points in total)	Shifting to the estimation method*1,*3 (19 points in total)
		[Existing points: 20 points]		
Fukushima City 12 points→32 points	1,85,d1,d9,d11,d12,d13 (7 points)	—	20 points [Existing points: 1]	2,d6,d7,d8,d10 (5 points)
Date City 8 points→15 points	d3 (1 point)	3,37,101,102,d2, d4,d14 (7 points)	7 points [Existing points: 1]	—
Nihonmatsu City 4 points→19 points	ni1,ni2 (2 points)	10,11 (2 points)	15 points [Existing points: 1]	—
Motomiya City 1 point→8 points	mo1 (1 point)	—	7 points	—
Koriyama City 4 points→30 points	86,ko2 (2 points)	ko3 (1 point)	26 points [Existing points: 1]	ko1 (1 point)
Soma City 2 points→16 points	5,39 (2 points)	—	14 points [Existing points: 1]	—
Minamisoma City (including the restricted areas and planned evacuation areas) 23 points→34 points	ms1,ms7,ms9,ms10,ms11 (5 points)＋Restricted areas 7 points	7,ms4,ms6,ms8 (4 points)	11 points [Existing points: 1]	80,103,107,108, ms2,ms3,ms5 (7 points)
Iitate Village (planned evacuation areas) 35 points→39 points	61,63,i2,i3,i4,i5,i6,i8,i10,i12,i13,i14,i15,i17,i19,i20,i21,i23,i24,i25,i26,i28,i29,i30,i32 (25 points)	33,62,i1,i7,i9,i11,i16, i18,i22,i31 (10 points [Existing points: 1])	4 points	—
Kawamata Town 10 points→14 points	46,78,kw1,kw4,kw5,kw6 (6 points)	4,36,kw3 (3 points)	4 points	kw2 (1 point)
Katsurao Village (planned evacuation areas) 13 points→13 points	21,k1,k3,k4,k6,k8, k9,k10 (8 points)	104,k2,k5,k7,k11 (5 points [Existing points: 1])	0 point	—
Namie Town (the restricted areas and planned evacuation areas) 26 points→36 points	31,32,34,81,83,n1,n2,n3,n5,n6,n7,n8,n10 (13 points)＋ Restricted areas 10 points	79,n4,n11 (3 points)	10 points [Existing points: 1]	—
Tamura City (including the restricted areas) 14 points→30 points	23,42,52,113 (4 points)＋Restricted areas 2 points	14,41,22,105 (4 points [Existing points: 1])	16 points	13,15,20,110 (4 points)
Ono Town 1 point→6 points	—	51 (1 point)	5 points	—
Kawauchi Village (including the restricted areas) 8 points→15 points	43,177,181 (3 points)＋Restricted areas 2 points	76,111 (2 points [Existing points: 1])	7 points	87 (1 point)
Naraha Town (including the restricted areas) 4 points→9 points	45 (1 point)＋Restricted areas 3 points	—	5 points	—
Hiorono Town 2 points→4 points	112 (1 point)	71 [Existing points: 1]	2 points	—
Iwaki City 9 points→55 points	38,44,75,84,115 (5 points)	72,106,114,174 (4 points)	46 points [Existing points: 2]	—
Okuma Town (restricted areas) 12 points→18 points	Restricted areas 12 points	—	6 points	—
Tomioka Town (restricted areas) 7 points→12 points	Restricted areas 7 points	—	5 points [Existing points: 1]	
Futaba Town (restricted areas) 7 points→10 points	Restricted areas 7 points		3 points [Existing points: 1]	—
Other zones 0 point→174 points	—	—	174 points [Existing points: 1]	—

*1 Measuring method conducted so far. Several measuring staff members make a team to carry out measurement regularly using a monitoring car. They measure air dose rates at the height of 1m above the ground at each measuring point using dosimeters, such as survey meters.

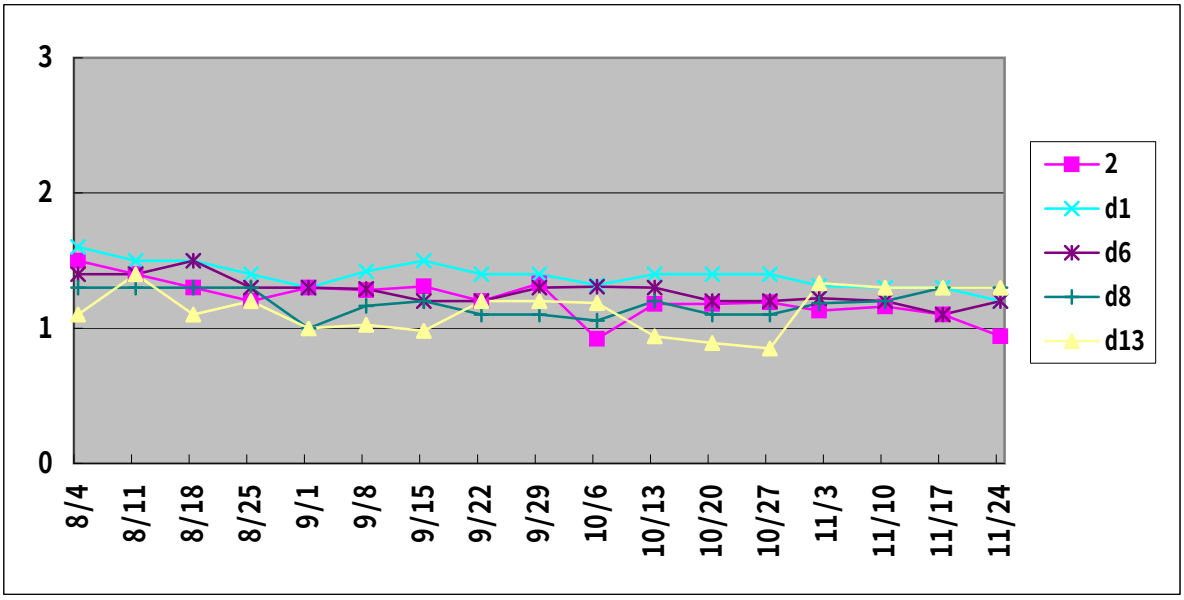
*2 Portable monitoring posts to be installed within FY2011

*3 Locations where multiple measuring points are concentrated in certain areas and the measurement is to be replaced with estimation (see Appended Tables ① to ⑥). See Appended Table ⑦ for details of the estimation method.

①Fukushima City

Base point【d1】

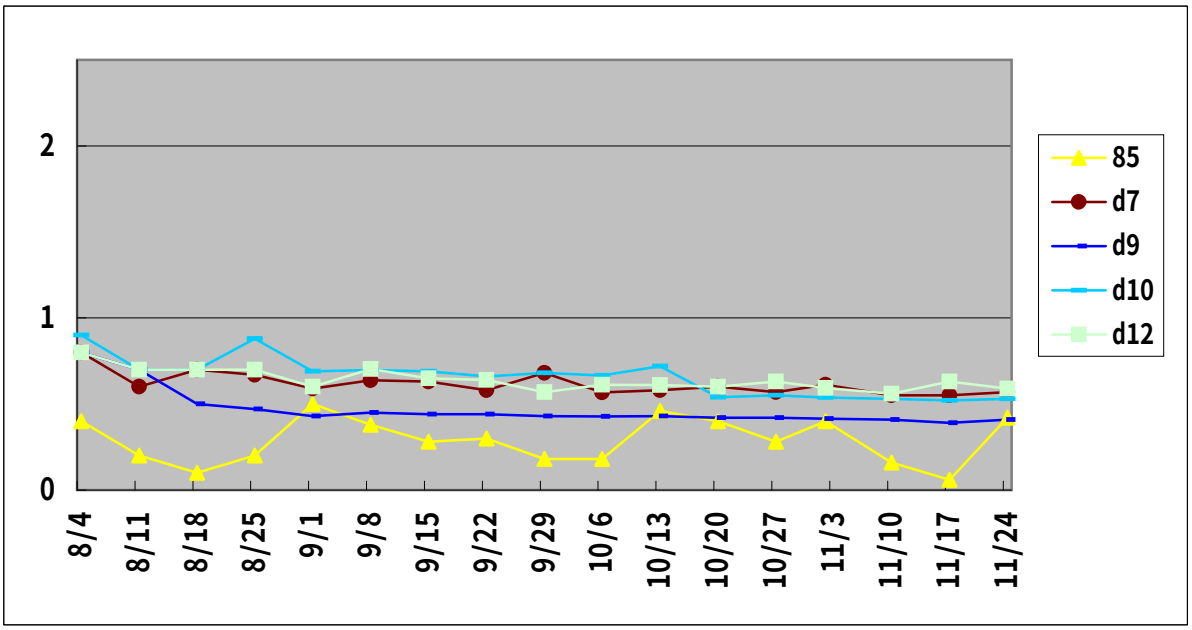
Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
2	1.000	0.697	0.870	0.068	0.078	0.130	0.173	○
d6	1.000	0.800	0.915	0.060	0.066	0.085	0.115	○
d8	1.083	0.769	0.857	0.087	0.102	0.226	0.088	○
d13	1.083	0.607	0.822	0.150	0.183	0.261	0.215	○



→ Values for points 2, d6, and d12 are estimates, based on those at the base point d1.
The variation in values at point d13 is within 3σ, but as the variation coefficient is large, a measurement needs to be continued.

Base point【d12】

Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
85	0.833	0.095	0.455	0.218	0.479	0.379	0.359	○
d7	1.193	0.857	0.965	0.076	0.079	0.228	0.108	○
d9	1.000	0.619	0.728	0.107	0.147	0.272	0.109	○
d10	1.257	0.825	1.025	0.126	0.123	0.232	0.200	○

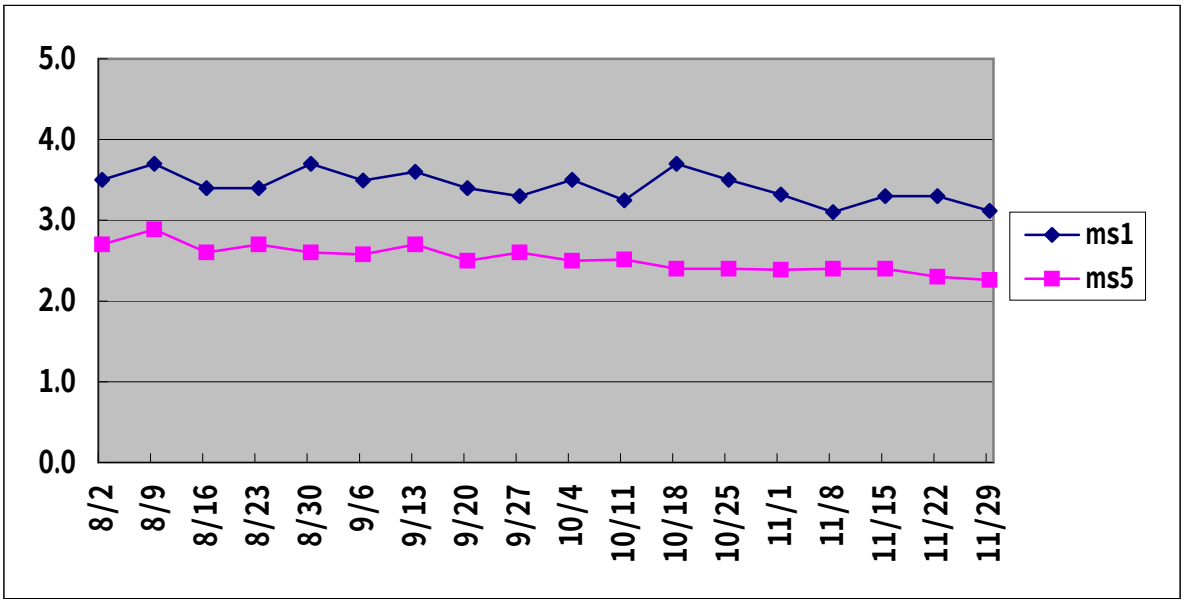


→ **Values for points d7 and d10 are estimates, based on those at the base point d12.**
The variation in values at point 85 and d9 are within 3σ, but as the variation coefficient is large, a measurement needs to be continued.

②Minamisoma City

Base point【ms1】

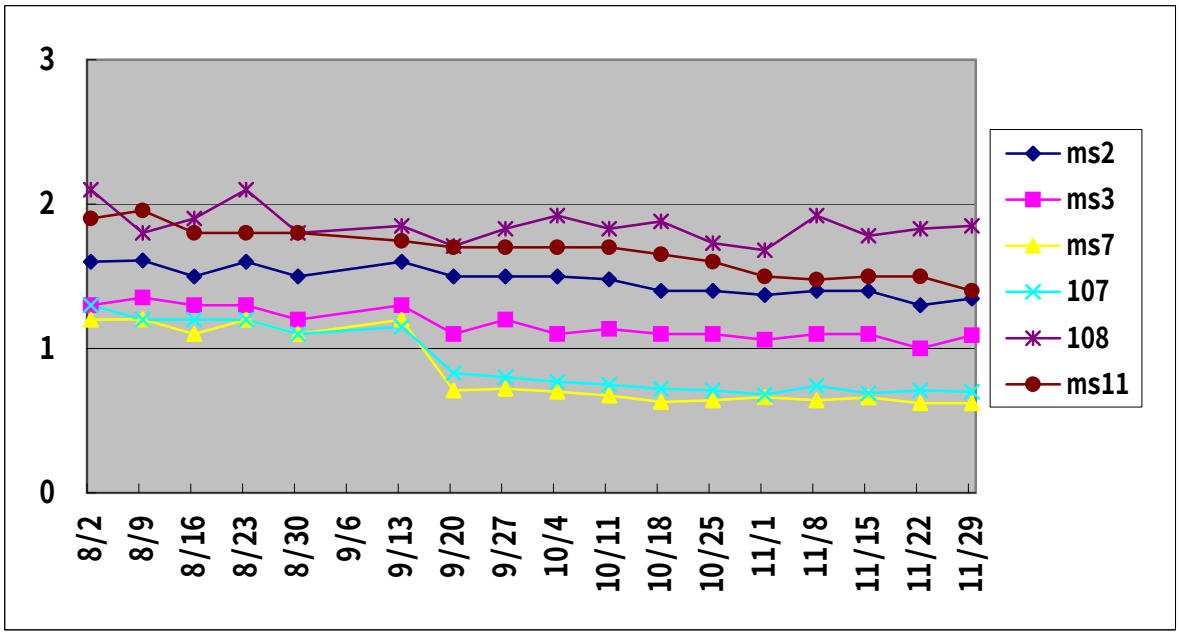
Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
ms5	0.794	0.649	0.739	0.041	0.055	0.055	0.091	○



→ Values for point ms5 are estimates, based on those at the base point ms1.

Base point【ms11】

Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
ms2	0.949	0.823	0.878	0.037	0.042	0.071	0.054	○
ms3	0.745	0.647	0.694	0.033	0.047	0.051	0.047	○
ms7	0.688	0.381	0.499	0.113	0.227	0.189	0.118	○
107	0.684	0.436	0.533	0.097	0.182	0.152	0.097	○
108	1.301	0.920	1.103	0.091	0.083	0.198	0.182	○

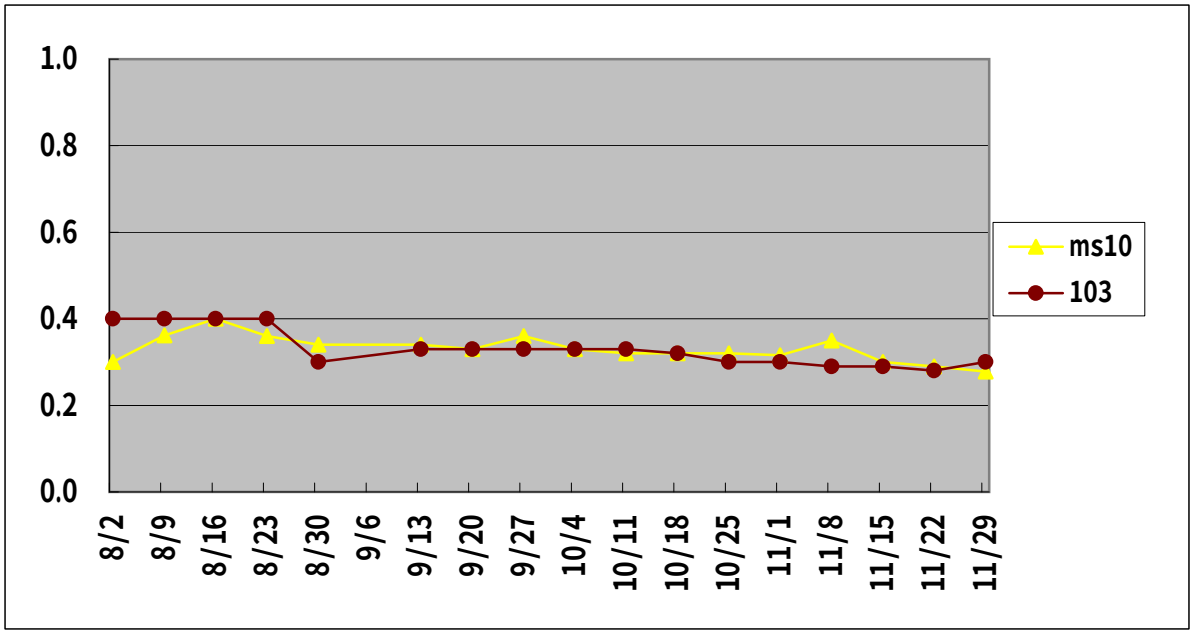


→ Values for points ms2, ms3, 107 and 108 are estimates, based on those at the base point ms11.
The variation in values at point ms7 is within 3σ, but as the variation coefficient is large, a measurement needs to be continued.
(As point 107 and point ms7 refer to the same point, values for these points are integrated into those for point ms7.)

*Point 108 and point ms11 refer to the same point, but point ms11, where measured values are stable, is considered to be the base point.

Base point【ms10】

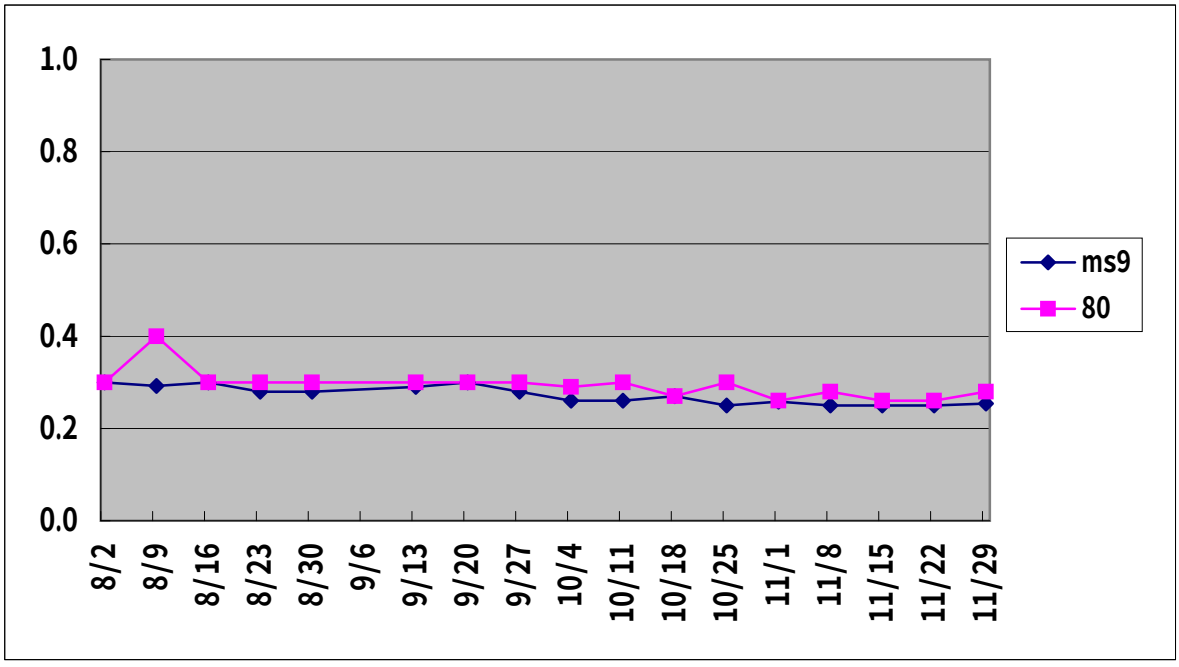
Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
103	1.333	0.829	1.005	0.112	0.112	0.329	0.176	○



→ Values for points 103 are estimates, based on those at the base point ms10.

Base point【ms9】

Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
80	1.370	1.000	1.082	0.095	0.087	0.288	0.082	×

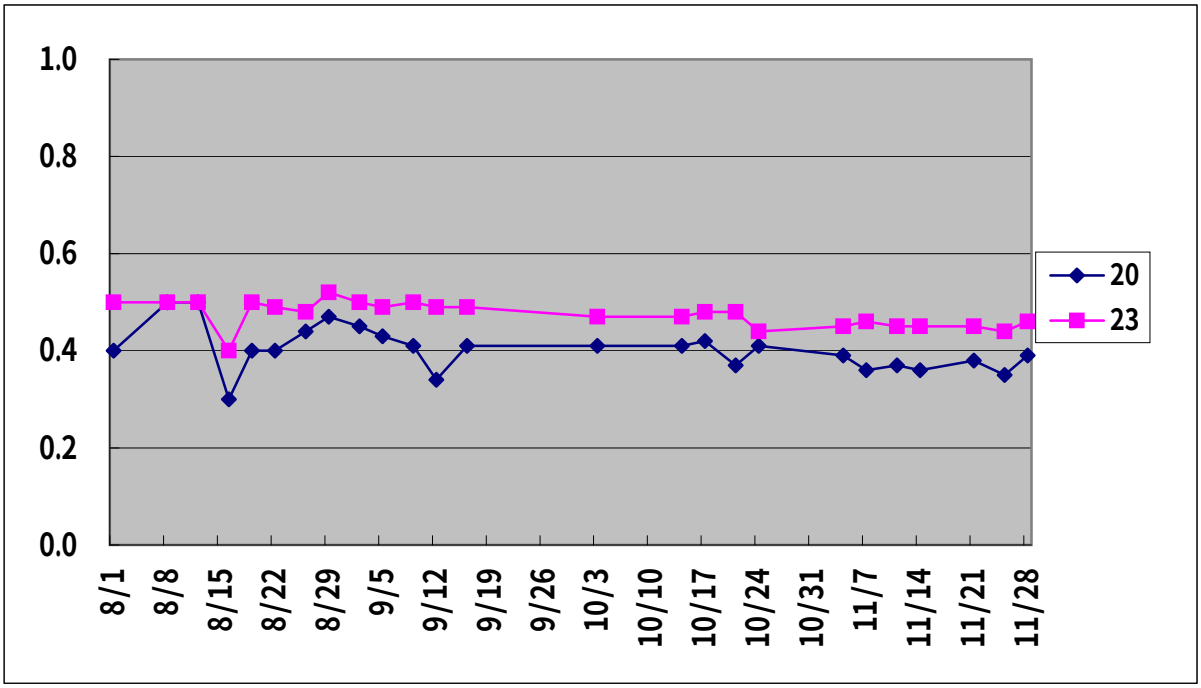


→ Values for point 80 are estimates, based on those at the base point ms9. (The variation in values exceeds 3σ, but this is only due to the influence of the values obtained on August 9, and values thereafter have remained within the range of 3σ. These points are all in the premises of the same facility.)

③Tamura City

Base point【23】

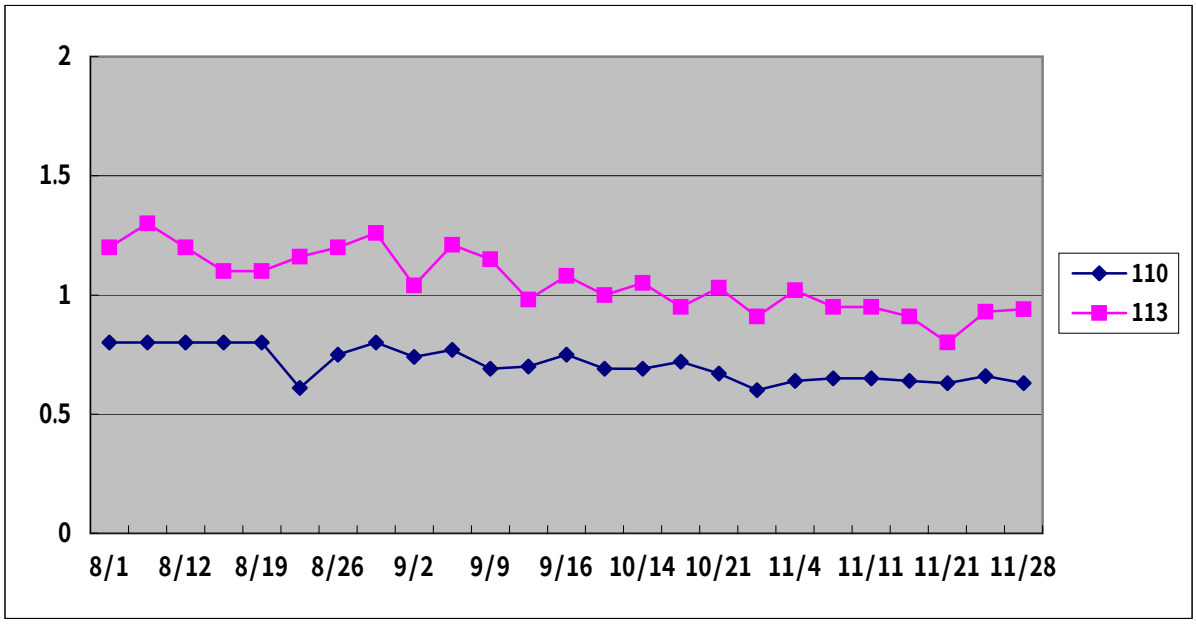
Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
20	1.000	0.694	0.848	0.072	0.084	0.152	0.154	○



→ Values for point 20 are estimates, based on those at the base point 23.

Base point【113】

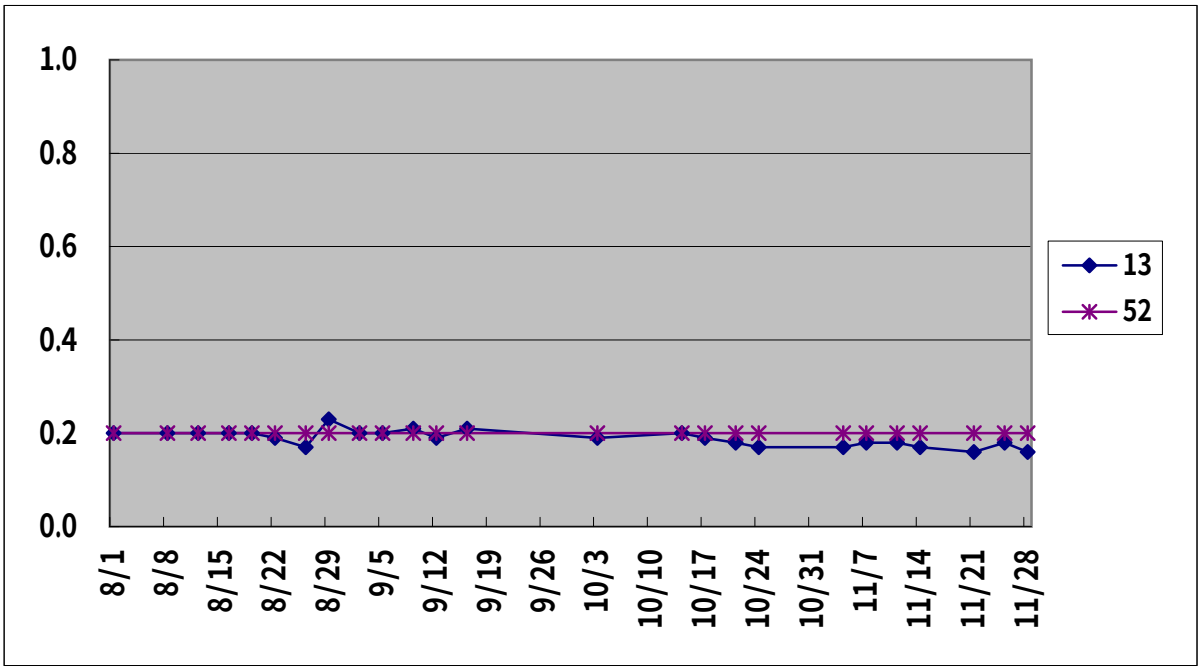
Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
110	0.788	0.526	0.673	0.054	0.081	0.114	0.147	○



→ Values for points 110 are estimates, based on those at the base point 113.

Base point【52】

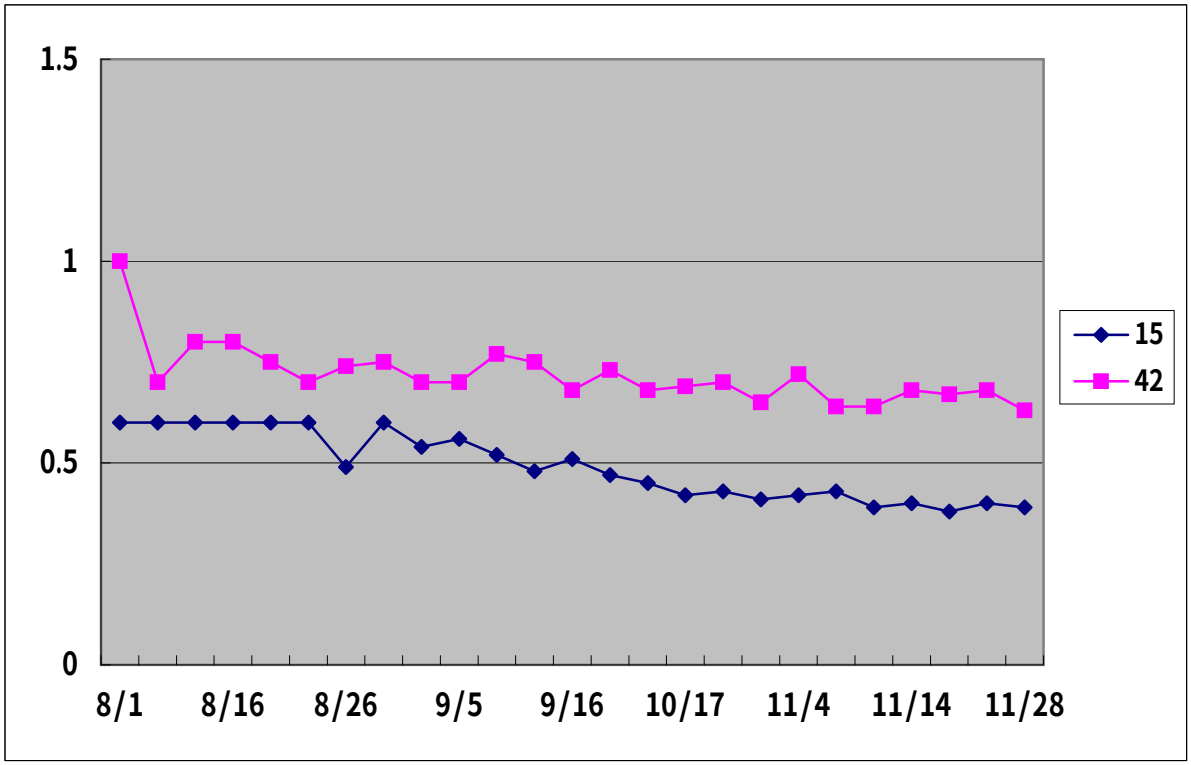
Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
13	1.150	0.800	0.946	0.085	0.090	0.204	0.146	○



→ Values for points 13 are estimates, based on those at the base point 52.

Base point【42】

Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
15	0.857	0.567	0.684	0.091	0.133	0.173	0.117	○

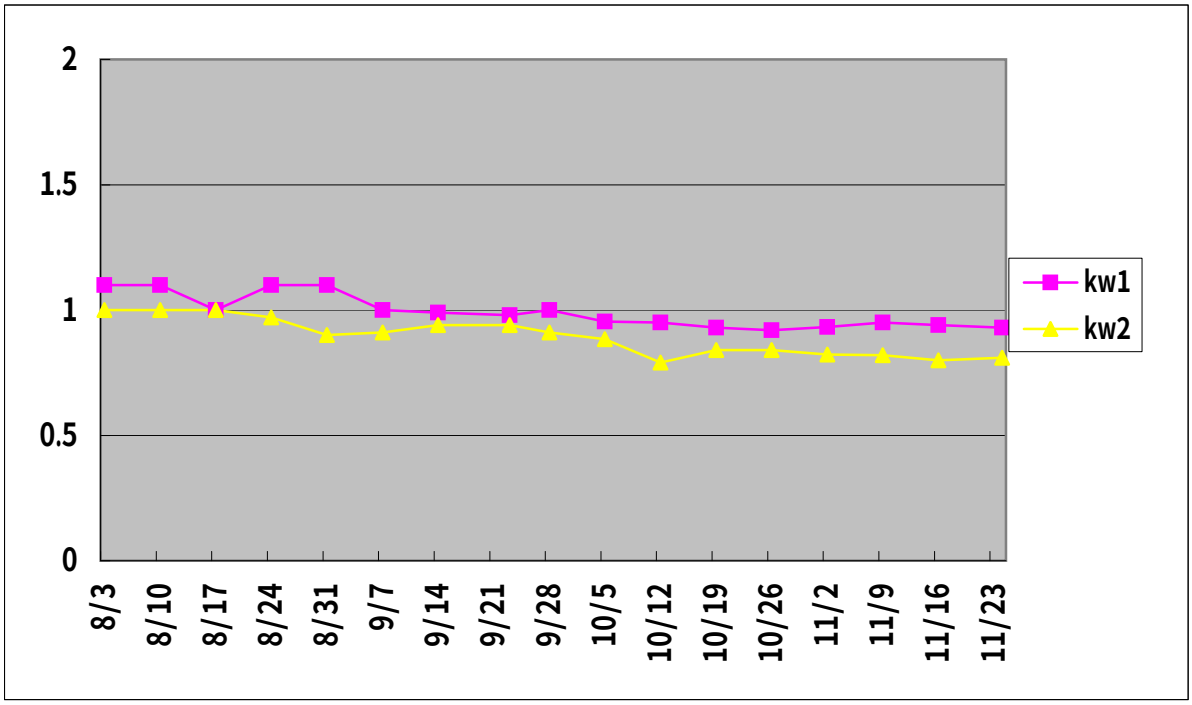


→ Values for points 15 are estimates, based on those at the base point 42.

④Kawamata Town

Base point【kw1】

Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
kw2	1.000	0.818	0.899	0.046	0.051	0.101	0.081	○

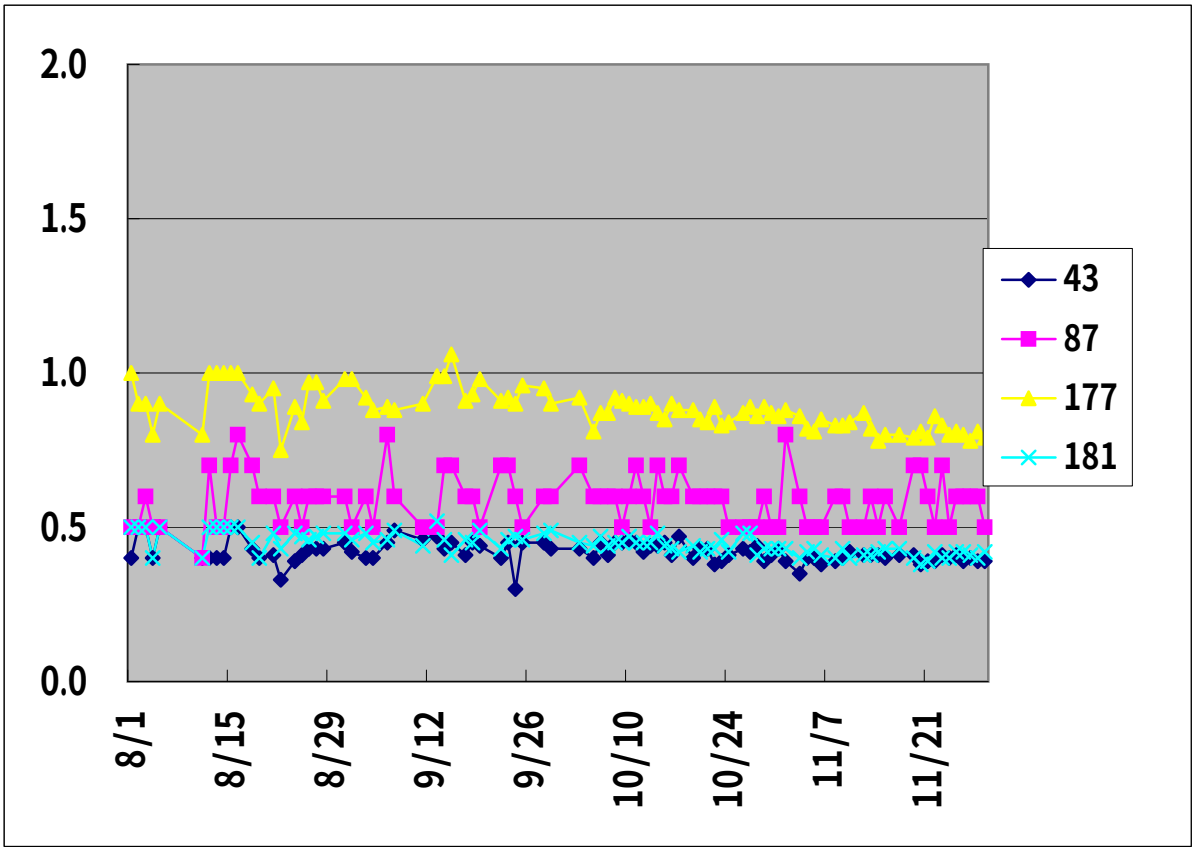


→ Values for points kw2 are estimates, based on those at the base point kw1.

⑤Kawauchi Village

Base point【177】

Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
43	0.557	0.333	0.477	0.039	0.082	0.080	0.143	×
87	0.909	0.500	0.663	0.095	0.143	0.246	0.163	◯
181	0.573	0.387	0.505	0.029	0.058	0.068	0.119	×

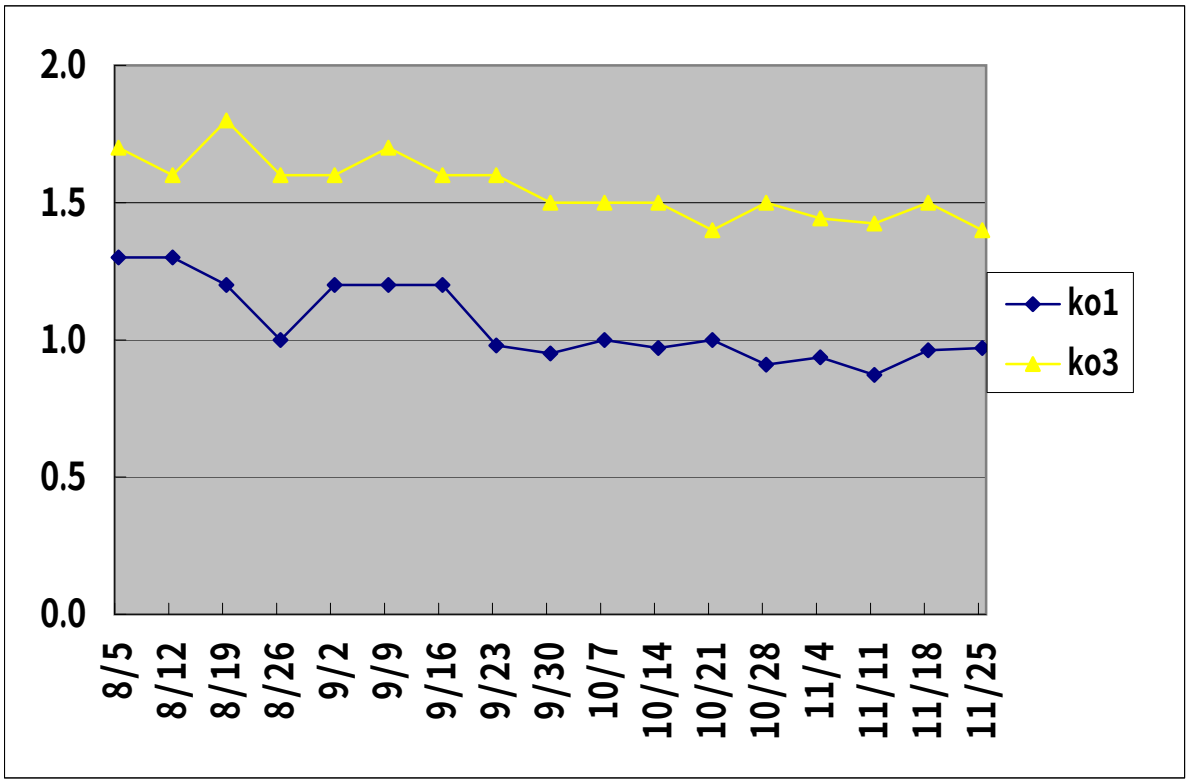


→ Values for points 87 are estimates, based on those at the base point 177.
A measurement will be continued for points 43 and 181.

⑥Koriyama City

Base point [ko3]

Location no.	Maximum	Minimum	Average	Standard deviation	Variation coefficient	Maximum-Average	Average-Minimum	Less than 3σ
ko1	0.813	0.607	0.679	0.061	0.090	0.133	0.073	○



→ Values for point ko1 are estimates, based on those at the base point ko3.

⑦Estimation Method for Air Dose Rates

Address of Sampling Point	Base point (A)	No. of points for estimation (B)	Ratio used for estimation (α)
Fukushima City	d1	2	0.87
		d6	0.92
		d8	0.86
	d12	d7	0.97
		d10	1.02
Minamisoma City	ms1	ms5	0.74
	ms11	ms2	0.88
		ms3	0.69
		107	0.53
		108	1.10
	ms10	103	1.01
	ms9	80	1.08
Tamura City	23	20	0.85
	113	110	0.67
	52	13	0.95
	42	15	0.68
Kawamata Town	kw1	kw2	0.90
Kawauchi Village	177	87	0.66
Koriyama City	ko3	ko1	0.68

→Estimation method: Estimated values are obtained by multiplying values measured at each base point by a certain ratio

Estimated values for point B = Value measured at point B × Ratio α

(Exhibit 2)

Division of Areas for Fixed-point Measurement Using Monitoring Cars (After the Review)

At points with □, measurement is carried out once a week.

City	Points for fixed-point measurement using monitoring cars (86 points in total)	Shifting to the method using portable monitoring posts or the estimation method (66 points in total)	Division of areas
Fukushima City	1,85,d1,d9,d11,d12,d13 (7 points)	2,d6,d7,d8,d10 (5 points)	A
Date City	d3 (1 point)	3,37,101,102,d2,d4,d14 (7 points)	
Nihonmatsu City	ni1,ni2 (2 points)	10,11 (2 points)	
Motomiya City	mo1 (1 point)	—	
Koriyama City	86,ko2 (2 points)	ko1,ko3 (2 points)	
Soma City	5,39 (2 points)	—	B
Minamisoma City	ms1,ms7,ms9,ms10,ms11 (5 points)	7, 80,103,107,108,ms2,ms3, □ms4,ms5,□ms6,ms8 (11 point)	
Iitate Village	□61,63,i2,i3,i4,i5,i6,i8,i10, □i12,i13,i14,i15,i17,i19,i20,i21, □i23,i24,i25,i26,i28,i29,i30,i32 (25 points)	□33,62,i1,i7,i9,i11,i16,i18,i22,i31□ (10 points)	
Kawamata Town	□46,78,kw1,□kw4,kw5,kw6 (6 points)	4,36,kw2,kw3 (4 points)	
Katsurao Village	□21,k1,k3,k4,k6,k8,k9,k10 (8 points)	□104,k2,k5,k7,k11□ (5 points)	
Namie Town	□31,32,34,81,83,n1, n2,n3,n5,n6,n7,n8,n10□ (13 points)	□79,n4,n11□ (3 points)	
Tamura City	23,42,52,113 (4 points)	13,14,15,20,22,41,105,110 (8 points)	C
Ono Town	—	51 (1 point)	
Kawauchi Village	43,177,181 (3 points)	76,87,111 (3 points)	
Naraha Town	45 (1 point)	—	
Hirono Town	112 (1 point)	71(1 point)	
Iwaki City	38,44,75,84,115 (5 points)	72,106,114,174 (4 points)	

(Exhibit 3)

Variation Coefficient and Standard Deviation of Ratios of Air Dose Rates Measured at Monitoring Posts and those Measured at the Height of 1m above the Ground

Prefecture	Average ratios of air dose rates	The maximum variation coefficient of the ratios of air dose rates	The minimum variation coefficient of the ratios of air dose rates	Standard deviation of ratios of air dose rates
Hokkaido (Sapporo)	0.76	1.27	0.74	0.11
Aomori (Aomori)	0.84	1.25	0.79	0.09
Iwate (Morioka)	0.61	1.21	0.84	0.07
Miyagi (Sendai)	0.85	1.1	0.84	0.05
Akita (Akita)	0.67	1.2	0.73	0.1
Yamagata (Yamagata)	0.51	1.19	0.72	0.1
Fukushima (Fukushima)	0.78	1.1	0.86	0.06
Ibaraki (Mito)	0.86	1.08	0.94	0.03
Tochigi (Utsunomiya)	0.58	1.41	0.72	0.15
Gunma (Maebashi)	0.34	1.46	0.83	0.1
Saitama (Saitama)	0.92	1.13	0.74	0.06
Chiba (Ichihara)	0.59	1.07	0.91	0.04
Tokyo (Shinjuku)	0.81	1.2	0.85	0.05
Kanagawa (Chigasaki)	1.01	1.12	0.91	0.04
Niigata (Niigata)	0.78	1.23	0.8	0.09
Toyama (Imizu)	0.75	1.18	0.9	0.05
Ishikawa (Kanazawa)	0.95	1.17	0.91	0.04
Fukui (Fukui)	0.75	1.21	0.83	0.06
Yamanashi (Kofu)	0.88	1.21	0.86	0.06
Ngano (Nagano)	0.6	1.34	0.75	0.16
Gifu (Kakamigahara)	0.95	1.19	0.86	0.05
Shizuoka (Shizuoka City)	0.73	1.12	0.87	0.06
Aichi (Nagoya)	0.62	1.11	0.9	0.04
Mie (Yokkaichi)	0.69	1.12	0.89	0.04
Shiga (Otsu)	0.54	1.26	0.87	0.06
Kyoto (Kyoto)	0.84	1.26	0.83	0.1
Osaka (Osaka)	0.54	1.19	0.9	0.05
Hyogo (Kobe)	0.54	1.16	0.88	0.04
Nara (Nara)	0.65	1.17	0.82	0.05
Wakayama (Wakayama)	0.42	1.14	0.87	0.05
Tottori (Tohhaku)	0.85	1.11	0.93	0.06
Shimane (Matsue)	0.68	1.15	0.84	0.05
Okayama (Okayama)	0.72	1.27	0.76	0.1
Hiroshima (Hiroshima)	0.58	1.16	0.7	0.06
Yamaguchi (Yamaguchi)	1.23	1.14	0.78	0.05
Tokushima (Tokushima)	0.61	1.11	0.84	0.05
Kagawa (Takamatsu)	0.89	1.12	0.91	0.03
Ehime (Matsuyama)	0.57	1.28	0.91	0.05
Kochi (Kochi)	0.74	1.67	0.76	0.16
Fukuoka (Dazaifu)	0.62	1.24	0.88	0.07
Saga (Saga)	0.71	1.25	0.92	0.06
Nagasaki (Ohmura)	0.57	1.33	0.78	0.07
Kumamoto (Uto)	0.68	1.11	0.88	0.04
Oita (Oita)	0.97	1.18	0.77	0.08
Miyazaki (Miyazaki)	0.82	1.31	0.78	0.09
Kagoshima (Kagoshima)	1.08	1.3	0.77	0.09
Okinawa (Uruma)	1.1	1.22	0.67	0.12

Ratios of air dose rates＝Values at monitoring posts/values at the height of 1m

Variation coefficient＝Ratios of air dose rates/Average ratios of air dose rates

*The standard deviation is 0.15 for Tochigi prefecture, and the maximum variation coefficient is 1.67 and the standard deviation is 0.16 for Kochi prefecture. However, these are due to differences in ratios compared between very low measurement results that are close to the lower measurement limit, and pose no problems.

*The standard variation for Nagano prefecture is 0.16, but this is due to the replacement of the detector on October 7. Measured values pose no problems as continuous detection results.

(Attachment 2)

Deliberations on the Rethink of Plan of Radiation Monitoring Continuously Conducted by MEXT since the Occurrence of the Accident at TEPCO's Fukushima Dai-ichi NPP (Report)

December 2011

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Contents

1. Overview

Emergency monitoring has so far been conducted in response to a massive release of radioactive materials from Tokyo Electric Power Company's (TEPCO's) Fukushima Dai-ichi Nuclear Power Plant (hereinafter referred to as the "Fukushima Dai-ichi NPP"), but the nuclear reactors have become relatively stabilized and the release of radioactive materials from the nuclear facilities is considered to have decreased considerably. In light of this, the "Comprehensive Monitoring Plan," which was decided by the Monitoring Coordination Meeting on August 2, 2011, states that "it is appropriate to move on to a new stage of radiation monitoring for the purpose of assessing the overall impact in the surrounding environment and contributing to the review of the future countermeasures to be taken," and proposes to review methods of MEXT's monitoring surveys, such as the frequency, measurement accuracy, and monitoring targets, with regard to those regularly conducted mainly in areas within 30km from the Fukushima Dai-ichi NPP and those conducted nationwide in 47 prefectures, based on radiation doses measured up till now and the progress of the installation of monitoring posts.

In response, since August, MEXT has made preparations to install additional monitoring posts in line with the Comprehensive Monitoring Plan. Furthermore, it was confirmed that the overall fluctuations in radiation doses have become even smaller since August, and that air dose rates have been moderately decreasing on an exponential basis. Under such circumstances, MEXT has conducted deliberations on the review of the content of nationwide monitoring and monitoring around the Fukushima Dai-ichi NPP, with the participation of experts from universities and other research institutes.

MEXT organized the knowledge of experts who participated in the deliberations as MEXT's technical advisors (see Attachment 1), and compiled a report of the deliberation results on short-term, medium and long-term future policies concerning monitoring content that need to be reviewed, such as the frequency, measuring points, and measurement accuracy, mainly with regard to the monitoring that MEXT has conducted continuously since the occurrence of the accident.

The review of the monitoring shown here is based on the premise that the release of radioactive materials remains sufficiently small, and in the event that another massive release of radioactive materials occurs or a notable increases in air dose rates are observed in broad areas, it will be necessary to move back to emergency monitoring corresponding to a massive release of radioactive materials.

2. Review of the Monitoring around the NPP

2.1 Measurement of air dose (rates) (vehicle-borne monitoring, fixed-point measurement, and integrated dose measurement)

(1) Present state

The release of radioactive materials from the Fukushima Dai-ichi NPP has decreased significantly and changes with the passage of time in pollution levels and air dose rates at the

same points have become small. As shown in the soil concentration map created by MEXT, major nuclides deposited as of June 14 were Cs-137 and Cs-134, which are presumed to have contributed to air dose rates by around 30% and 70%, respectively. Other than these, I-131, Te-129m, and Ag-110m, etc. were detected in some locations, but their contribution to air dose rates is 1% or lower. Considering that another massive release of radioactive materials is very unlikely to happen, gamma-rays emitted from Cs-137 and Cs-134 are expected to be the major factors for determining air dose rates for long into the future.

Figure 1 shows the estimation of how air dose rates due to gamma-rays emitted from Cs-137 and Cs-134 change over time, while taking into account their attenuation based on their half-lives. According to the results, it is estimated that air dose rates will decrease to around 80% of the present level in one year, and to around a quarter in ten years. However, short-term changes in air dose rates are very small, with a monthly decrease, for example, being estimated to be around 2%.

In contrast, air dose rates vary significantly by location in accordance with the wide-area distribution of radioactive concentrations, as observed in various contamination maps released by MEXT. Characteristically, radioactive concentrations vary notably in some locations within a 100m or smaller distance. Figure 2 shows the measurement results of air dose rates within a 2km square area around Tomioka Station by dividing the area into 100m×100m grids, and Figure 3 shows the vehicle-borne survey results conducted continuously in Futaba town. It can be confirmed from these figures that there are places where air dose rates vary considerably in a 100m distance or so.

(2) Basic idea

In light of these circumstances, a review draft is to be discussed based on the following idea.

a) As changes with the passage of time in air dose rates are minor, it is not so important to obtain information on short-term changes in air dose rates at the same points. Through the use of the automated measurement system, wide area monitoring of air dose rates will be conducted more efficiently at a larger number of points, thereby promoting labor saving as measurement has been carried out directly by staff workers.
b) As air dose rates vary largely by location, it is important to obtain detailed information on how air dose rates depend on certain locations. For that purpose, the technique of continuous measurement by vehicle-borne survey, etc. will be employed for ascertaining detailed changes in air dose rates in broad areas caused by dependence on locations or other factors.
c) Existing facilities and planned facilities that do not require significant labor for operation will be fully utilized, irrespective of the principle mentioned above.

(3) Proposals concerning each type of measurements

a) Fixed-point measurement (fixed mount type monitoring posts and portable monitoring posts, etc.)

・ It is appropriate to utilize existing monitoring posts in the same manner as they are

currently used, on condition that they have a continuous automated measurement and recording function, and to systematically increase installation points for monitoring posts.

- Measuring points will be added if it is necessary to measure air dose rates at representative points, such as schools and government offices, from the standpoint of easing residents' anxiety.

b) Fixed-point measurement (using survey meters) and vehicle-borne survey (measurement at fixed points out of the vehicle)

- As significant changes in air dose rates are no longer expected, it is appropriate to considerably reduce the measurement frequency.
- At present, fixed-point survey and vehicle-borne survey are conducted at 148 points.
- At points where portable monitoring posts are to be newly installed, continuous measurement will be carried out using those portable monitoring posts, in place of the fixed-point survey or vehicle-borne survey that has been conducted so far. However, such shift will be made sequentially after confirming that values obtained through conventional measurement and those obtained using each portable monitoring post coincide with each other within the allowable limit of error.
- Sufficient data can be obtained by dividing points where fixed-point surveys or vehicle-borne surveys are conducted into three areas, and carrying out measurement at one of these three areas once every three months, and carrying out measurement at the other of these three areas at a one-month interval.
- At present, multiple measuring points are set densely in some areas, but at some of them, air dose rates have decreased and differences among those multiple points have become small. When statistical analysis verifies that air dose rates at nearby measuring points can be estimated within the allowable limit of error, based on air dose rates at representative points, measurement at such areas may be reduced to the extent rationally possible, after examining correlations of air dose rates among nearby measuring points, and actual measurement may be replaced with estimation based on values obtained through measurement at neighboring points. In such cases, a representative point should be selected from among the measuring points in the relevant area which show relatively high air dose rates with small fluctuations, from the perspective of ensuring security and safety. Considering that overall air dose rates have become stabilized and that Step 1 of the Roadmap was terminated on July 17, it would be appropriate to use data in or after August for statistical processing for making estimation.
- The past measurement results of air dose rates using monitoring vehicles are now being utilized as basic data when the national government periodically prepares the "accumulated dose estimation map.*" Therefore, while the national government continues to prepare the "accumulated dose estimation map," fixed-point monitoring should be continued at rational and required frequency, based on the recognition that air dose rates have become stabilized.

* The “accumulated dose estimation map” is a map showing estimated accumulated doses in areas around TEPCO’s Fukushima Dai-ichi NPP for the period up to one year from the occurrence of the accident. The national government has prepared and published the map around once a month since April 11 (ten times as of December 1, 2011).
(Data published on November 16, 2011: http://radioactivity.mext.go.jp/ja/1750/2011/11/1750_1116.pdf)

c) Measurement of accumulated doses

- As significant changes in air dose rates are no longer expected, the frequency of the measurement of accumulated air doses for the purpose of ascertaining air dose rates should be reduced considerably.
- A measurement will be carried out once every one to three months.
- In order to ensure the representativeness and continuity of the measurement, the number of measuring points will not be reduced for the time being. When the automated measurement system starts to function in Fukushima prefecture, expected roles of outdoor accumulating dosimeters will decrease considerably. Therefore, measuring points need not be increased any further.

(4) Future prospects

- In the future, it is appropriate to fully employ vehicle-borne surveys that enables continuous measurement, through which detailed distribution of air dose rates over broad areas can be obtained.
  When this survey system is made widely available, it will become possible for respective local governments or MEXT to own their vehicle-borne survey system, and carry out measurement on the same courses repeatedly on a regular basis to ascertain the situation in broad areas. Sufficient data can be obtained by carrying out such repeated measurement on the same courses once every one to three months, as in the case of fixed-point measurement.
- If there is any system that enables wide-area measurement in unspecified areas, without setting certain courses, by installing a simplified vehicle-borne survey system on public transportation, such as shuttle buses and taxies, it will be effective to utilize such a system to expand measuring areas significantly.
- In the event that handling of the accident progresses smoothly, the automated measurement system should be utilized to the extent possible to ensure measuring points, and the measurement carried out directly by working staff should be scaled down to the routine level prior to the occurrence of the accident, thereby realizing an efficient and rational new measurement system. In several years, at the latest, necessary information on radiation doses will become available through the use of the automated measurement system, without conducting fixed-point measurement by humans.

2.2 Measurement of Environmental Monitoring Samples

2.2.1 Concentration of radioactive materials in the air (dust monitoring)

(1) Present state

The release of radioactive materials from the Fukushima Dai-ichi NPP is hardly observed at present, and the concentration of radioactive materials in the air is considered to have decreased to a very low level. The measurement results of dust sampling by Fukushima prefecture show that radioactive materials have not been detected at any points since June 1. Possible exposure due to inhalation of radioactive materials in the air is extremely small.

(2) Basic idea

It is meaningless to regularly carry out measurement only to obtain the results of detecting no radioactive materials. From the perspective of assessing exposure doses more accurately, detection limits need to be lowered by extending sample collection time and measurement time to show concrete values even if concentration levels are low. Under the current circumstances where the concentration of radioactive materials in the air is very low and the daily fluctuations in concentrations do not have any significant impact on exposure doses, measurement at short time/space intervals is not necessary. Regular measurement that requires significant labor should be scaled down.

(3) Proposals

- With the aim of utilizing the results as basic data for assessing radiation doses, detection limits should be further lowered by extending collection sample time and measurement time. Measurement should be carried out under better conditions that enable us to obtain significant data.
- Sampling and measurement should be carried out only at representative points and mobile sampling and measurement should be terminated.
- Equipment to enable uninterrupted sampling and measurement of radioactive materials in the air should be used to the extent possible and measurement should be carried out in a labor-saving manner.
- In order to ensure the representativeness of collected samples and lower detection limits, as much time as possible should be taken to collect dust samples.

2.2.2 Land water and bottom sediment

(1) Present state

The Ministry of the Environment and Fukushima prefecture have made adjustments and have conducted monthly monitoring of water quality of rivers, lakes, and dams since May and of agricultural reservoirs since June, 2011. Regarding bottom sediment, measurement was first carried out for rivers, lakes, and dams in May and has been carried out once every two months since September. Bottom sediment of agricultural reservoirs has also been

surveyed once every two months since September. The maximum values of Cs-134 and Cs-137 detected in river water samples collected in September were 12 Bq/L and 15 Bq/L, respectively. Measurement has been carried out with the detection limit being set by Fukushima prefecture at around 1 Bq/L and by the Ministry of the Environment at 10 Bq/L (reduced to 1 Bq/L in September). The detection limit set by Fukushima prefecture for the monitoring of underground water has been around 1 Bq/L. Monitoring of land water and bottom sediment has also been conducted at some locations even within a 20km range.

Radiation doses exceeding the provisional regulation values for food have been detected in some freshwater fish, suggesting possible correlations with contamination of land water and bottom sediment.

(2) Basic idea

Movement of radioactive materials via rivers is most dynamic during the moderate attenuation and movement over time of those deposited on the ground surface. Therefore, it is important to ascertain the present distribution of those radioactive materials and to follow their medium and long-term movement.

In the meantime, how radioactive materials flow into rivers vary significantly on a temporal and spatial basis, and there is a limit to the ability to ascertain such uneven phenomena using only regular monitoring. A separate study by a research team will be necessary with the aim of understanding the entire movement of radioactive materials. Presuming that such study is conducted separately, the basic idea for monitoring is as follows.

A) For the purpose of ascertaining detailed deposition of radioactive materials in the environment, there is little necessity to continue only the present measurement of land water with the present detection limits, through which radiation materials have not been detected at almost all points. However, the measurement scheduled to be carried out for bottom sediment at several hundred points is considered to be significant for ascertaining deposition of radioactive materials in the aquatic environment. With regard to the analysis of water samples, it should be considered to also carry out measurement by setting lower detection limits.

B) Freshwater fish is affected significantly by the quality of bottom sediment and the concentration of coexistent ions is low. It should be noted that the Chernobyl accident revealed some facts completely different from those for the seawater environment, such as that their apparent concentration factor against the concentration of radioactive cesium in land water is high (CF-10^4), and that freshwater fish with higher nutrient levels shows a stronger tendency to bioconcentrate.

C) When detection limits are lowered, a small amount of radionuclides is highly likely to be detected in land water. In order to ascertain distribution of radionuclides more accurately and obtain parameters concerning the movement of deposited nuclides, it is necessary to measure radiation doses at certain time intervals by setting lower detection limits.

D) Approach by target

- Short-term fluctuations in radiation levels are presumed with regard to land water (lake water and river water), depending on precipitation, and it is difficult to follow such dynamic fluctuations except for research purposes. Measurement at certain time intervals would be enough for ascertaining representative radiation levels. With regard to all the lakes and marshes that are in virtually closed systems in areas where radiation levels in soil are relatively high, and fish and seafood caught therein are consumed on a daily basis (or where people enjoy fishing as leisure), environmental monitoring should be conducted at least once at an early stage.
- As changes in radiation levels in land water (underground water as environmental monitoring samples) and in bottom sediment of lakes and rivers are presumed to be moderate, it would be enough to carry out measurement at relatively low frequencies.

(3) Proposals concerning each type of measurements

Each type of measurements should preferably be carried out under the following conditions. When carrying out measurement, efforts should be made to conduct the measurements as closely as possible to these conditions, while making adjustments with local communities and taking into consideration the number of samples and actual analytical capability.

Detection limits:	Land water – around 1 mBq/kg (lower values are more preferable) Bottom sediment – around several Bq/kg
Targeted nuclides:	Radioactive iodine, radioactive cesium, radioactive strontium, and other radionuclides (nuclides discharged by the accident that are subject to soil monitoring)
Frequency:	For approximately one year from now, highly accurate analysis at the level of around 1 mBq/kg should preferably be conducted once every three months, and thereafter, it is desirable to conduct analysis once every six to twelve months based on the results of the analysis in the first one year.
Points:	Monitoring by the Ministry of the Environment covers around 500 to 600 points, targeting all areas of Fukushima, Miyagi, Ibaraki, Tochigi, and Gunma prefectures and part of Yamagata and Chiba prefectures, including beaches. The aforementioned detection limits should be adopted at as many points as possible in these measuring points. When selecting measuring points, it is appropriate to prioritize points that have been selected based on the Water Pollution Control Act and respective local governments' environmental preservation-related ordinances, so that measurement results can be obtained along with other environmental indices. With regard to major rivers, it is desirable to set multiple measuring points with different environments, such as setting one point each at the upstream region, midstream region, and

downstream region, while taking into account geographical distributions of river basins and deposition of radioactive cesium. In the midstream and downstream regions of rivers that collect water from contaminated areas, measuring points should be selected as needed, irrespective of the amounts of deposited radioactive materials at neighboring areas.

2.2.3 Soil

(1) Present state

MEXT conducted soil analysis as part of environmental sample monitoring from the early stage after the accident, covering around 100 points. MEXT has not conducted regular monitoring since it conducted the last soil analysis in June 2011, but Fukushima prefecture has been carrying out monthly measurement at around ten points. Targeted radionuclides are I-131, Cs-134, Cs-137, Te-129m, Te-132, Cs-136, La-140, Te-129, and Ag-110m. Soil monitoring was also conducted with regard to uranium and plutonium in March.

Based on soil samples collected at around 2,200 locations in Fukushima prefecture in June and July for the purpose of preparing soil concentration maps, MEXT has conducted nuclide analyses for radioactive cesium, radioactive iodine, radioactive strontium, and plutonium, etc. in order and has published the results thereof.

Furthermore, the Ministry of Agriculture, Forestry and Fisheries (MAFF) has been carrying out measurement of soil at the depth of 15 to 30 cm, mainly targeting Cs-134 and Cs-137, at 360 points in Fukushima prefecture and 220 points in five other prefectures (measuring points are scheduled to be increased to 3,000).

(2) Basic idea

A) Measurement content (frequency, points, etc.) varies significantly depending on purposes. It is necessary to clarify the division of roles between the environmental monitoring discussed here and the “soil concentration map” by MEXT, “measurement of concentration in farmland soil” by MAFF, and other measurements for research purposes. The environmental monitoring should mainly focus on the amounts of radionuclides per unit area.

B) Radiation levels in soil show extremely high localization (which raises questions about the representativeness of measuring points and collected samples) and there are restrictions on locations where samples can be collected. Given these, it is difficult to obtain detailed space distribution of radiation levels in soil within the framework of environmental monitoring. Therefore, as basic data for making decisions on the lifting of evacuation orders, etc., air dose rates should be mainly utilized and efforts should be made to significantly increase measuring points for air dose rates. Radiation levels in soil should only be utilized as additional or supplementary data for the purpose of making such decisions.

C) If there is no more massive release of radioactive materials from Fukushima Dai-ichi NPP, it is expected that only slow changes due to radioactive disintegration and weathering will follow. Environmental monitoring at the time of moving from emergency response to normal measures should focus on ascertaining medium and long-term changes at representative points. Therefore, the necessity of carrying out measurement at high frequencies is relatively low from the perspective of allocating limited personnel and equipment resources to measurement items with greater importance.

D) It is necessary to continue promoting the preparation of soil concentration maps, etc. for ascertaining distribution of deposition of radioactive materials, and long-term follow-up is required.

E) MAFF has been promoting the analysis of farmland, and it is important to pay attention to their plan and progresses. As fluctuations depending on the use of farmland (cultivation, etc.) are large, it should be noted when referring to the analysis results as environmental index.

(3) Proposals concerning each type of measurements

Radiation levels in soil for the environmental monitoring

Targeted nuclides:	Radioactive iodine, radioactive cesium, radioactive strontium, and other radionuclides discharged by the accident (Te-129m, Te-132, Cs-136, La-140, Te-129, Ag-110m, etc.)
Frequency:	Measurement should be carried out around twice in the coming six months, and once every three to six months thereafter.
Points:	From the viewpoint of the continuity of data, the present number of measuring points (100 points) should be maintained, in principle. When soil concentration maps continue to be prepared and targeted locations and categories of land use coincide with those for this monitoring, measurement need not be carried out separately. It is necessary to confirm all of the present measuring points by category of land use and scrutinize their representativeness. It is also necessary to set new measuring points other than the present ones in a 20 km range from Fukushima Dai-ichi NPP and at other areas in Fukushima and other prefectures where deposition of radioactive materials is large. It is preferable to set measuring points at densely populated areas where air dose rates are relatively high compared with neighboring areas. Measuring points in forests for the monitoring conducted by the Forestry Agency should be checked to avoid overlap when selecting measuring points for the environmental monitoring, and in accordance with the purport thereof, measurement items should be adjusted to ensure that the amounts of radionuclides per unit area can be properly

assessed.

Points to be noted concerning measurement method:

When continuing measurement of radiation levels in soil on a long-term basis, we will face problems concerning such matters as the representativeness of samples and increasing difficulties in ensuring measuring points due to disturbance caused by sampling work. In order to deal with such problems, it is recommended to positively adopt the in-situ measurement method by using portable germanium semiconductor detectors. Through this method, average radiation levels for certain space can be obtained, and, as soil sampling is not required, the same measuring points can be used continuously free from any disturbances caused by the measurement.

2.2.4 Indicator organisms

(1) Present state

Monitoring of indicator organisms is not being conducted at present. As related monitoring of biological samples, MEXT and other organizations have conducted sampling and measurement of food such as agricultural products and marine products, wild beasts and birds, and inedible weeds, etc.

Monitoring of agricultural and marine products in distribution processes is conducted as needed for wide-ranging products and various points, and those showing radiation levels exceeding the provisional regulation values for food have still been found. Monitoring of wild beasts and birds has revealed that some boars and black bears caught in Fukushima prefecture showed radiation levels exceeding the provisional regulation values for edible meat. Some sorts of weeds have been collected as samples for measurement in lieu of leaf vegetables, which are targeted for the first stage monitoring as stipulated in the Guidelines for the Environmental Radiation Monitoring in Emergencies, but their types are not identified. Those weeds are collected at 10 points over 36 km to 60 km from Fukushima Dai-ichi NPP, with the frequency being decreased to around once every several days at present. Levels of detected radioactive cesium are below the detection limit at some points but are in a range of several hundreds to 1,000 Bq/kg at other points.

(2) Basic idea

a) Monitoring by using indicator organisms should be separated from that of foods in distribution processes for the purpose of taking measures for food contamination, such as imposing intake restrictions. However, food animals should also be covered by the monitoring if they can offer appropriate data for ascertaining the situation of the surrounding environment.

b) Monitoring by using indicator organisms is effective in particular in the following cases.

- When it is expected that representative contamination levels can be assessed through indicator organism samples at places where radiation levels in water, air and other media easily fluctuate on a temporal and spatial basis
- When it is highly likely that there are any unique exposure routes that cannot be covered by soil monitoring or water monitoring

  For example, when biological concentration is suspected, or when there is a possibility that nuclides that have not been measured systematically so far can be monitored in an effective manner

c) The following is the basic idea concerning whether or not to take into consideration possible "radiation effects on the environment itself" and incorporate any relevant monitoring targets. Since the occurrence of the accident, multiple reports have pointed out the possibility of radiation effects on the environment and the international community has shown strong interest in this issue. Some surveys may need to be commenced right now to ascertain initial radiation effects, but concrete indicators for assessing radiation effects have yet to be established and there is a risk of causing unnecessary misunderstandings. This issue has been discussed in research by the National Institute of Radiological Sciences and other organizations related to the Ministry of the Environment, as well as in university research financed with competitive funds. MEXT's monitoring project should first focus on "assessing contamination levels of the environment using indicator organisms." If the targeted organisms can be utilized for the assessment of radiation effects, then MEXT will consider collaboration with other projects.

d) Given the above, when selecting indicator organisms, it is important to ensure that data to be obtained "can be the indicators for environmental contamination that cannot be presumed from other environmental media." Furthermore, full consideration should also be given to whether data prior to the accident are available, and whether it is possible to collaborate with other environmental survey programs.

(3) Proposals concerning each type of measurements

In order to clarify the significance as indicator organisms, the monitoring of weeds should be terminated and new indicator organisms to be monitored should be selected. It is appropriate to replace the monitoring of weeds with monitoring focusing on indicator organisms and pine needles are one of the candidates. Other than pine needles, representative organisms of each of the land areas, freshwater areas, and coastal areas, as well as those at the upper of the food chain are to be monitored. The following are the examples of indicator organisms.

- Freshwater fish (carp or crucian)
- Common mussels
- Organisms at the upper end of the food chain (deer or boars)

Other organisms should also be selected as indicator organisms as necessary, based on the circumstances of respective regions and relevant knowledge.

a) Pine needles

(Purpose and points to be noted)

Pine needles are selected as one of the representative organisms on the land surface and are expected to be an indicator of contamination levels of air and soil. Monitoring should be conducted so as to comprehensively check changes in direct deposition on the surface of pine needles and root absorption from soil. The surface of pine needles are contaminated with radioactive materials discharged by the accident but the effect of root absorption is expected in the future. Therefore, it is necessary to identify when each pine needle was collected. Pine needles have already been used for monitoring of indicator organisms and may be easily accepted as a substitute of weeds. The fact that they are widely distributed is also a merit.

(Measuring points)

According to the "Basic Plan for Environmental Radioactivity Measurement around NPPs in Fukushima Prefecture,"[1)] the Environmental Radioactivity Monitoring Center of Fukushima conducted sampling and measurement at seven points* in Fukushima prefecture four times a year up to FY2010. These points are relatively close to Fukushima Dai-ichi and Dai-ni NPPs, and six of them are within the restricted areas, and no sampling and measurement seems to have been conducted after the accident.

* Kamikitaba, Hirono Town; Namikura, Naraha Town; Kegaya, Tomioka Town; Ottozawa, Okuma Town; Ogawara, Okuma Town; Koriyama, Futaba Town; Tanashio, Namie Town

The resumption of the monitoring in these areas close to the NPP should be discussed later, but at present, measuring points should be selected from among points 20 km or farther from the NPP where monitoring of weeds has been conducted so far. Candidates are the following, and preferably, selected points are to be linked to points where soil monitoring is being conducted.

One point each in Minamisoma City, Iidate Village, Kawamata Town, Tamura City, Ono Town, and Iwaki City

(Frequency)

For the time being, once every quarter (based on the results, the reduction (to once every six months or once a year) will be discussed)

(Accuracy (setting of detection limits))

0.4 to 1 Bq/kg raw (same level as in the case of ordinary environmental radioactivity measurement)

b) Freshwater fish (carp or crucian)

(Purpose and points to be noted)

Targets are to be selected as one of the representative organisms in the freshwater area and are expected to be an indicator of contamination levels of the area. In the aquatic environment where radioactive concentrations vary on a temporal and spatial basis,

monitoring should be conducted in order to comprehensively check effects on organisms living in water and bottom sediment. It is expected that the monitoring can also be utilized for assessing effects of highly concentrated suspended solids or deposited substances instead of highly concentrated water. From this viewpoint, carp or crucian, which has already been used for environmental monitoring of matters other than radioactive materials, and lives relatively close to the bottom of downstream areas, is appropriate as monitoring targets.

(Measuring points)

It is desirable to select points where measurement of bottom sediment has been carried out. The "Readings of Environmental Radiation Monitoring of Public Water Areas,"[2] which is published jointly by the Local Nuclear Emergency Response Headquarters (Radioactivity Team) and the Disaster Provision Main Office of Fukushima Prefecture, shows 34 points for monitoring bottom sediment of rivers. Furthermore, the "Results of Examination of Radioactive Materials in Marine Products by Type"[3] published by MAFF cited Abukuma River and Agagawa River in Fukushima prefecture as sampling points of carp, cyprinidae, and carassius cuvieri. It is appropriate to select at least two points as fixed measuring points from among these in the downstream area.

(Frequency)

For the time being, once every quarter (or once every six months in line with the frequency of the measurement of bottom sediment)

(Accuracy (setting of detection limits))

0.4 to 1 Bq/kg raw (same level as in the case of ordinary environmental radioactivity measurement)

c) Common mussels

(Purpose and points to be noted)

Common mussels are selected as one of the representative organisms in the coastal area and are expected to be an indicator of contamination levels of such areas. They have been used for monitoring of many types of contaminants and are expected to be effective in comprehensively checking contamination in the coastal environment where circumstances can easily vary. The "Results of Examination of Radioactive Materials in Marine Products by Type"[4] published by MAFF shows data for samples collected at four locations in Iwaki City after the accident between May and July 2011. The concentration of radioactive cesium, which exceeded the provisional regulation values in May, remained below said level in and after June, but there are no recent data available. As common mussels are edible organisms living in the marine environment, adjustments need to be made with food (marine products) monitoring.

(Measuring points)

It is appropriate to select around four points in total in the northern and southern coastal areas from Fukushima Dai-ichi NPP, and measurement should be commenced from where

it is possible. Points off Hisanohama or around Nakanosaku, Shimokajiro, and Onahama in Iwaki City, where sampling was conducted for food monitoring, can be included in the candidates.

(Frequency)

Once every quarter

Even if monitoring has lost its significance as food monitoring, on the grounds that the results remain below the provisional regulation values for food, the monitoring should be continued as one of the indicator organisms.

(Accuracy (setting of detection limits))

0.4 to 1 Bq/kg raw (same level as in the case of ordinary environmental radioactivity measurement)

d) Organisms at the upper end of the food chain (deer or boars)

(Purpose and points to be noted)

The purpose is to assess contamination levels of the ecosystem and the monitoring is positioned as checking effects on the ecosystem based on the consideration for the food chain. The Nature Conservation Division of the Fukushima Prefectural Government publishes the results of the surveys conducted by the prefecture and a private research institute, entitled the “Results of Measurement of Radionuclides in Meat of Wild Animals (Boars)”[5] (dated October 3) and the “Results of Measurement of Radionuclides in Meat of Wild Beasts and Birds”[6] (dated November 7), on the website of the prefecture. The former, which has the entry, “Survey by Fukushima Wildlife Citizen & Scientist Forum,” states that “the prefecture will conduct monitoring surveys on major hunting beasts and birds all over the prefecture and will publish the results thereof as needed.” The latter shows the results of measurement concerning black bears, pheasants, copper pheasants, ducks, and Japanese deer, in addition to boars.

The following two points need to be noted in particular.

- As it is difficult for monitoring staff to arbitrarily collect samples by themselves, proper sampling methods need to be established.
- As targeted organisms move around within relatively broad areas, targeted areas for assessment through the monitoring cannot be easily specified.

Given these facts, it is considered to be rational for the national government to first confirm the validity of measurement methods adopted in preceding surveys and utilize the results of those surveys or conduct monitoring only with regard to additional measurement items as necessary, instead of commencing a new monitoring project independently.

1) Basic Plan for Environmental Radioactivity Measurement around NPPs in Fukushima Prefecture

http://www.pref.fukushima.jp/nuclear/kanshi/keikaku.html

2) Readings of Environmental Radiation Monitoring of Public Water Areas (preliminary)
http://www.pref.fukushima.jp/j/koukyouyousuiiki0909.pdf

3) Results of Examination of Radioactive Materials in Marine Products by Type: 6 Types of Freshwater Fish
http://www.maff.go.jp/j/kanbo/joho/saigai/suisan/tansui.html

4) Results of Examination of Radioactive Materials in Marine Products by Type: 4 Types of Shellfish and Crustacea
http://www.maff.go.jp/j/kanbo/joho/saigai/suisan/kairui.html

5) Results of Measurement of Radionuclides in Meat of Wild Animals (Boars)
http://wwwcms.pref.fukushima.jp/download/1/shizen23-naibuhibaku23030.pdf

6) Results of Measurement of Radionuclides in Meat of Wild Beasts and Birds
http://wwwcms.pref.fukushima.jp/download/1/shizen23-naibuhibaku.pdf

3. Review of Monitoring being Conducted in Prefectures Nationwide

3.1 Measurement of Air Dose Rates

(1) Present state

According to daily published results of the measurements using fixed mount type monitoring posts and the measurements by survey meters at the same points at the height of 1 m above the ground surface, the release of radioactive materials from Fukushima Dai-ichi NPP has almost subdued and radiation levels in the air are considered to be extremely low. As a result, air dose rates have decreased and have remained stable.

(2) Basic idea

- At present, changes with the passage of time in air dose rates are minor and it is not urgently needed to publish information on short-term changes in air dose rates at the same points on a regular basis. Labor saving should be considered with regard to labor-consuming daily measurement of air dose rates and publication of the results thereof.
- Existing facilities and planned facilities that do not require significant labor for operation should be fully utilized, irrespective of the principle mentioned above.

(3) Proposals

- With regard to daily publication of the results of the measurement using monitoring posts in respective prefectures that have been carried out since the occurrence of the accident as an environmental radioactivity level survey, the measurement and recording is automatically carried out continuously, and the publication schedule should be reviewed so that the

publication can be incorporated into staff officials' routine work.

- With regard to daily measurement of air dose rates using monitoring posts in respective prefectures at the height of 1 m above the ground, as changes with the passage of time are minor and estimation can be made based on values measured at existing posts, the measurement frequency should be reduced considerably.
- We calculated the ratios of the past results of air dose rates at the height of 1 m above the ground and those measured using monitoring posts and statistically processed the calculation results. As a result, it was confirmed that fluctuations in the ratios are not particularly significant, mainly centering on the average value, and the standard deviation of variation coefficients is within the range of 3 to 16%. Therefore, air dose rates at the height of 1 m above the ground can be estimated with sufficient accuracy by multiplying values obtained using monitoring posts by the average ratio.
- Based on these analysis results, it is considered to be rational that the measurement of air dose rates at the height of 1 m above the ground by using survey meters should be carried out less frequently, decreasing to around once a month for the time being, and that the measurement should be carried out only by using monitoring posts in the future.

3.2 Fallout and Drinking Water

(1) Present state

A release of radioactive materials from Fukushima Dai-ichi NPP is scarcely observed at present, and radiation levels in the air are considered to be very low. As a result, radioactive materials contained in fallout and drinking water have been in minute amounts and have not been detected at almost all measuring points.

In Fukushima prefecture and other areas nationwide, the national government and local governments have carried out measurement of radionuclide in drinking water (radioactive iodine and radioactive cesium) every day or once every several days. Detection limits vary by responsible entities, but most of the measurement results show that the amounts of I-131, Cs-134, and Cs-137 have been within the range between 0.1 and 1.0 Bq/kg, with some exceptions showing values around several Bq/kg in some areas.

Since July 2011, I-131 has not been detected at all, and Cs-134, Cs-137, etc. have also not been detected at most measuring points, except having been rarely detected at a low level below 1 Bq/kg at a few number of measuring points. These values are more than 2-digits lower than the provisional regulation values for water intake restriction (I-131: 300 Bq/kg and 100 Bq/kg for infants; Cs-137: 200 Bq/kg).

(2) Basic idea

It is meaningless to regularly carry out measurement only to obtain the results of detecting no radioactive materials. From the perspective of assessing radiation doses, detection limits need to be lowered by extending sample collection time to show concrete values if possible even though

concentration levels are low. Under the current circumstances where the concentration of radioactive materials in samples is very low and daily fluctuations do not have any significant impact on exposure doses, measurement at short time/space intervals is not necessary. Regular measurement that requires significant labor should be scaled down.

A) If the current release ratio of radioactive materials is maintained, it is unlikely that any radiation levels exceeding the provisional regulation values will be detected in the future. Therefore, the necessity of carrying out daily measurement is relatively low. From the perspective of allocating limited personnel and equipment resources to measurement items with greater importance, it is necessary to confirm that the average concentration per a certain period of time is sufficiently below the provisional regulation values.

B) It cannot be denied that there is a possibility that part of the radioactive materials once deposited on the ground surface have flowed into drinking water at extremely small amounts. In order to ascertain long-term movement of deposited radionuclides as a part of environmental monitoring, as well as to obtain parameter concerning their movement into drinking water, it is required to obtain the average concentration per a certain period of time by lowering current detection limits.

In addition to these viewpoints, we will present proposals on future measurement policies, while taking into account the period required for each prefecture carrying out measurement to make preparations for enhancing the accuracy of their analysis.

(3) Proposals

- With regard to the measurement in the environmental radioactivity level survey having been conducted nationwide, the measurement accuracy should be enhanced from the current level while maintaining sufficiently low detection limits, and the measurement should be carried out at lower frequencies, with the aim of utilizing obtained data as the basis for assessing radiation doses. However, considering that people in the vicinity of Fukushima prefecture have a strong concern about the pollution of drinking water, it is necessary to confirm that radiation levels in drinking water do not exceed the government's provisional standard value. It is important to ensure that bureaus of waterworks in Fukushima and neighboring prefectures will continue their monitoring at the accuracy to surely confirm this fact.
- Taking into account the period required for ensuring analysis accuracy, measurement should be carried out around once a month for fallout and once every three months for drinking water.
- The detection limit should be set at around 1 mBq/kg or lower, if possible.
  From the perspective of utilizing the results as an environmental index and assessing radiation doses, it is important to ascertain the average concentration for a certain period of time. For that purpose, during said period, sampling of drinking water should preferably be conducted every day, or if that is difficult, as frequently as possible. By accumulating and

analyzing drinking water samples collected throughout the period, fluctuations in radiation levels due to daily weather conditions, etc. can be ascertained and measurement results based thereon can be obtained. In this case, analysis may be conducted for those accumulated samples at one time.

3.3 Others

In the environmental radioactivity level survey that has been conducted nationwide, the concentration of radioactive materials in soil has been measured every year. It is important to continue collecting samples of virgin soil (not disturbed) from multiple points as has been conducted up till now. These data are necessary to make rational judgment whether detected radioactive materials are the results of past nuclear tests or from the accident, and the concentration of Cs-137 discharged by the accident can be estimated from the concentration of Cs-134, based thereon.

4. Other Matters for which Implementation should be Considered in the Future

(1) As it is important to measure exposure doses indoors or with dosimeters carried by individuals, measurement in representative houses and by representative individuals should be discussed.

(2) As a result of this review of the monitoring, personnel are to be reallocated to resume their original duties or be assigned for decontamination work or other duties relating to the response to the accident at Fukushima Dai-ichi NPP. It is necessary to ensure flexible reallocation that enables such personnel to offer technical support for measurement carried out by local governments in monitoring surveys.

(3) In preparation for the event that another massive release of radioactive materials occurs or notable increases in air dose rates are observed in broad areas, it is important to take necessary measures to ensure a system that makes it possible to promptly shift to emergency monitoring corresponding to a massive release of radioactive materials.

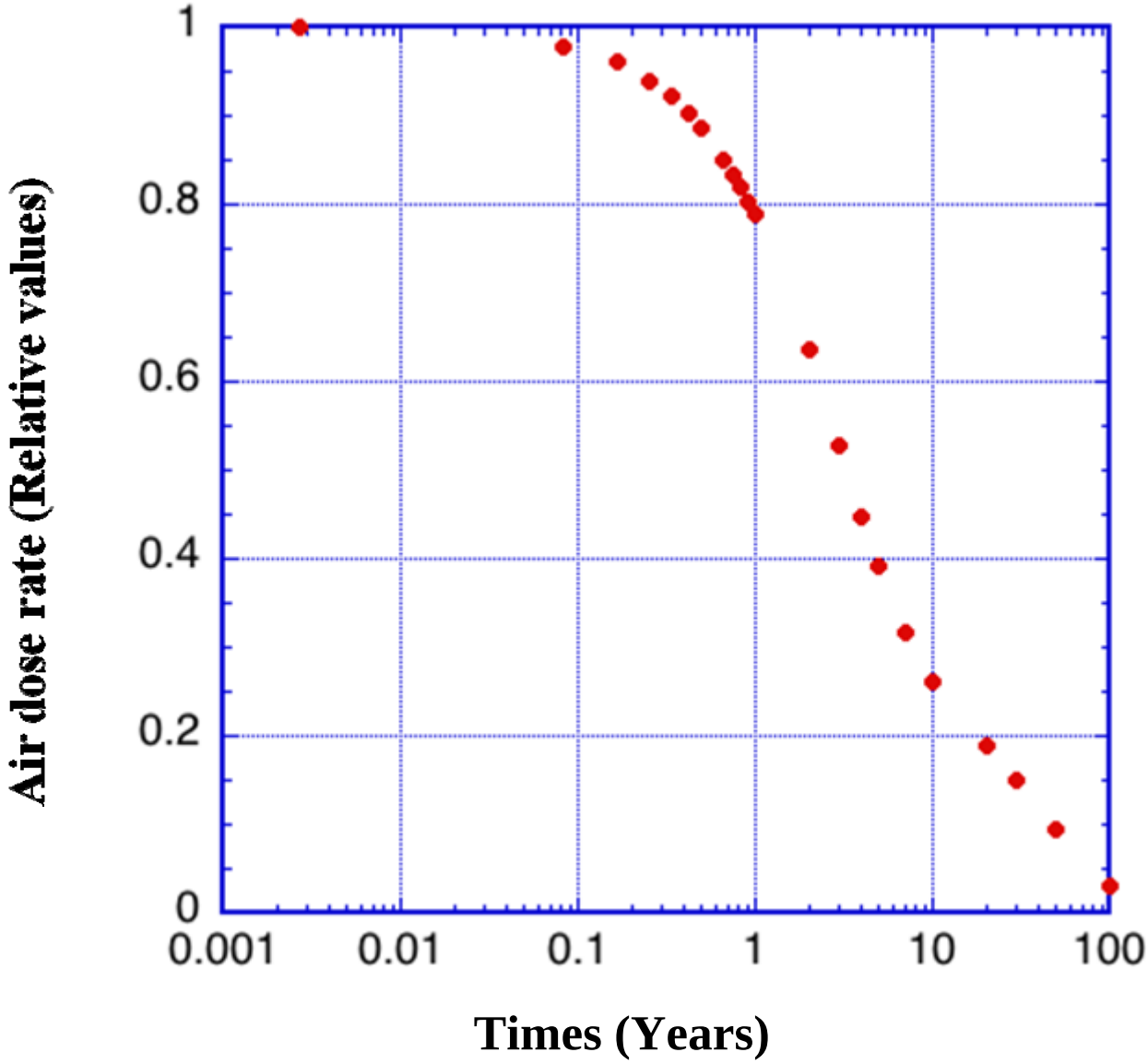

Figure 1 Estimated Changes in Air Dose Rates

Results of the measurement of air dose rates carried out within a 2 km square area around Tomioka Station by dividing the area into 100m×100m grids

Air dose rates (μSv/h)

Area	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	11.3	10.6	12.5	14.7	12.3	12.2	11.3	12.5	13.4	11.7	10.1	13.4	10.8	9.1	10.8	9.1	10.0	7.4	7.7	8.3
2	5.5	11.5	11.8	12.0	12.2	11.1	11.9	14.0		11.9	10.4	12.8	5.3	9.2	5.3	9.2		8.4		
3	8.6	11.5	10.5	13.5	11.4	11.8	10.0	9.5	8.3	7.9	9.1	9.5	4.1	7.2	4.1	7.2		6.3		
4	9.3	10.0	12.1	12.5	11.5	10.9	10.3	11.1		8.2	8.8	7.5	7.3	8.1	7.3	8.1		7.2		
5	9.5	8.6	12.0	12.2	10.7	10.1	10.7			6.3	10.0	8.0		6.8		6.8	7.2	5.4		
6	10.5	9.9	7.0	13.8	13.2		7.6	9.3		7.5	8.0	9.6		6.9		6.9	5.9	6.0		
7	9.7	8.4	8.4	8.2	10.0		9.6	9.5		9.2	9.1	8.1						6.7	5.4	
8	10.3	7.4	8.4	6.7	9.9	7.9	9.5	7.4	6.7	7.7	7.5	4.8	6.2		6.2		5.5		4.9	5.3
9	8.6	8.1	8.7	6.3	8.7	9.6	7.4	7.4	7.9	7.0	7.8	6.1	6.4	5.4	6.4	5.4	4.8		3.6	3.5
10	8.6	7.5	7.6	7.3	9.3	9.0	7.4	4.8	7.5	7.2	6.8	7.4	6.1	4.4	6.1	4.4	5.0	5.3		
11	5.3	7.3	6.7	5.8	7.5	7.0	7.7	6.2	4.2	6.2	8.3	5.4	4.2	4.6	4.2	4.6	4.6	4.6		
12	5.3	6.1	6.0	6.6	6.3	6.5	7.3	6.0	6.1	5.9	3.3	5.1	4.3	3.9	4.3	3.9	3.7	2.0	3.1	3.4
13	6.3	5.3	7.2	5.3	5.2	6.0	5.5	4.9	5.5	5.4	4.7	5.3	2.2	4.1	2.2	4.1	4.6	4.2	3.6	3.3
14	7.9	7.7	7.0	4.1	5.6	6.4	6.8	7.1	5.4	4.9	4.4	4.4	4.3	2.3	4.3	2.3	3.8	3.2	3.9	2.6
15	5.9	5.8	4.9	5.4	5.8	4.8	4.9	3.9	3.9	3.8	4.6	3.8	3.6	1.8	3.6	1.8	3.1	3.6	3.5	2.4
16	6.9	7.4		4.9	5.0	5.8	4.5	4.7	3.0	4.3	4.4	5.5	3.2	2.8	3.2	2.8	2.4	1.8	3.4	2.1
17		6.2		5.4	4.4	4.6	5.7	4.9	5.6		4.8	4.5	4.8	3.7	4.8	3.7	1.3	1.2	3.3	1.6
18	6.1	6.3		6.7	6.6	5.8	4.7	4.0	6.0		5.7	4.5	4.1	3.3	4.1	3.3	3.0	0.7	2.1	3.0
19					6.1	5.1	6.7	5.5	6.0		i5.6	3.3	3.6	3.6	3.6	3.6	2.7	0.2	2.8	2.4
20				5.5	4.3	4.1	4.2	6.0	4.7	5.2	4.8	3.0	3.1	2.7	3.1	2.7	1.8	3.1	2.0	2.5

Average	6.4
Standard deviation	2.9
Maximum	14.7
Minimum	0.2

Prepared based on the “Results of the Monitoring for Collecting Basic Data in Restricted Areas and Planned Evacuation Areas” (July 2011, by the Team in Charge of Assisting the Lives of Disaster Victims of the Cabinet Office, and MEXT)

Figure 2 Measured changes in air dose rates within a small 2 km square area

s1

s3

Distribution map of air dose rate, etc.
Enlarged site

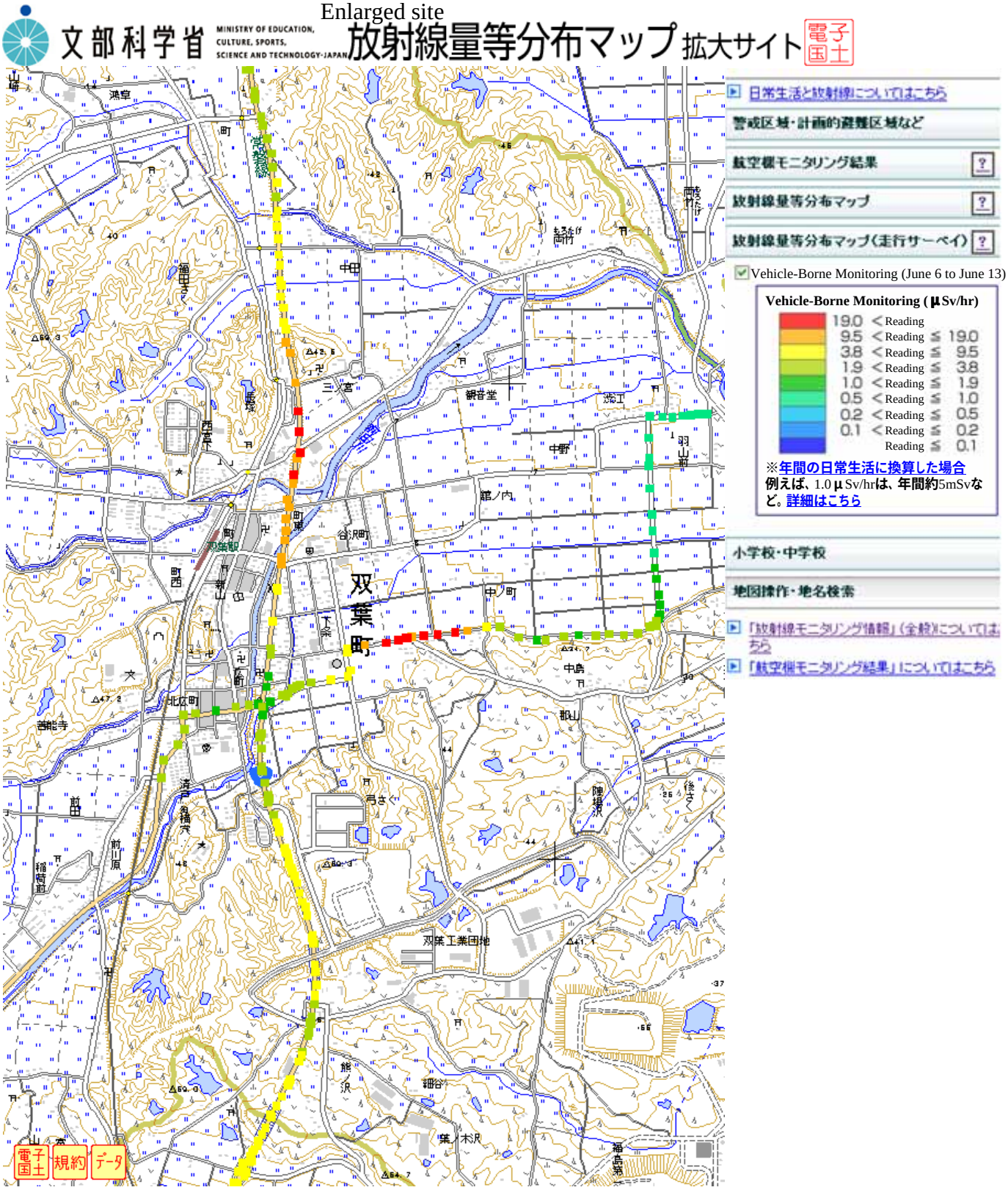

Figure 3 Results of the vehicle-borne monitoring survey in Futaba Town, located within the 20 km range

(Reference)

Variation Coefficient and Standard Deviation of Ratios of Air Dose Rates Measured at Monitoring Posts and those Measured at the Height of 1m above the Ground

Prefecture	Average ratios of air dose rates	The maximum variation coefficient of the ratios of air dose	The minimum variation coefficient of the ratios of air	Standard deviation of ratios of air dose rates
Hokkaido (Sapporo)	0.76	1.27	0.74	0.11
Aomori (Aomori)	0.84	1.25	0.79	0.09
Iwate (Morioka)	0.61	1.21	0.84	0.07
Miyagi (Sendai)	0.85	1.1	0.84	0.05
Akita (Akita)	0.67	1.2	0.73	0.1
Yamagata (Yamagata)	0.51	1.19	0.72	0.1
Fukushima (Fukushima)	0.78	1.1	0.86	0.06
Ibaraki (Mito)	0.86	1.08	0.94	0.03
Tochigi (Utsunomiya)	0.58	1.41	0.72	0.15
Gunma (Maebashi)	0.34	1.46	0.83	0.1
Saitama (Saitama)	0.92	1.13	0.74	0.06
Chiba (Ichihara)	0.59	1.07	0.91	0.04
Tokyo (Shinjuku)	0.81	1.2	0.85	0.05
Kanagawa (Chigasaki)	1.01	1.12	0.91	0.04
Niigata (Niigata)	0.78	1.23	0.8	0.09
Toyama (Imizu)	0.75	1.18	0.9	0.05
Ishikawa (Kanazawa)	0.95	1.17	0.91	0.04
Fukui (Fukui)	0.75	1.21	0.83	0.06
Yamanashi (Kofu)	0.88	1.21	0.86	0.06
Ngano (Nagano)	0.6	1.34	0.75	0.16
Gifu (Kakamigahara)	0.95	1.19	0.86	0.05
Shizuoka (Shizuoka City)	0.73	1.12	0.87	0.06
Aichi (Nagoya)	0.62	1.11	0.9	0.04
Mie (Yokkaichi)	0.69	1.12	0.89	0.04
Shiga (Otsu)	0.54	1.26	0.87	0.06
Kyoto (Kyoto)	0.84	1.26	0.83	0.1
Osaka (Osaka)	0.54	1.19	0.9	0.05
Hyogo (Kobe)	0.54	1.16	0.88	0.04
Nara (Nara)	0.65	1.17	0.82	0.05
Wakayama (Wakayama)	0.42	1.14	0.87	0.05
Tottori (Tohhaku)	0.85	1.11	0.93	0.06
Shimane (Matsue)	0.68	1.15	0.84	0.05
Okayama (Okayama)	0.72	1.27	0.76	0.1
Hiroshima (Hiroshima)	0.58	1.16	0.7	0.06
Yamaguchi (Yamaguchi)	1.23	1.14	0.78	0.05
Tokushima (Tokushima)	0.61	1.11	0.84	0.05
Kagawa (Takamatsu)	0.89	1.12	0.91	0.03
Ehime (Matsuyama)	0.57	1.28	0.91	0.05
Kochi (Kochi)	0.74	1.67	0.76	0.16
Fukuoka (Dazaifu)	0.62	1.24	0.88	0.07
Saga (Saga)	0.71	1.25	0.92	0.06
Nagasaki (Ohmura)	0.57	1.33	0.78	0.07
Kumamoto (Uto)	0.68	1.11	0.88	0.04
Oita (Oita)	0.97	1.18	0.77	0.08
Miyazaki (Miyazaki)	0.82	1.31	0.78	0.09
Kagoshima (Kagoshima)	1.08	1.3	0.77	0.09
Okinawa (Uruma)	1.1	1.22	0.67	0.12

Ratios of air dose rates＝Values at monitoring posts/values at the height of 1m

Variation coefficient＝Ratios of air dose rates/Average ratios of air dose rates

*The standard deviation is 0.15 for Tochigi prefecture, and the maximum variation coefficient is 1.67 and the standard deviation is 0.16 for Kochi prefecture. However, these are due to differences in ratios compared between very low measurement results that are close to the lower measurement limit, and pose no problems.

*The standard variation for Nagano prefecture is 0.16, but this is due to the replacement of the detector on October 7. Measured values pose no problems as continuous detection results.

(Exhibit 1) Name List of Experts in Charge of Countermeasures against Environmental Radioactivity (Technical Advisors)

Name	Specialty	Professional affiliation
Hikaru Amano	Environmental radioactivity/Health physics	Technical counselor, Japan Chemical Analysis Center (JCA)
Takeshi Iimoto	Radiation protection in general	Associate Professor, Division for Environment, Health and Safety, the University of Tokyo
Kimiaki Saito	Analysis of radiation effects/Assessment of radiation doses	Chief of Senior Researcher, Headquarters of Fukushima Partnership Operations, Japan Atomic Energy Agency (JAEA)
Tomoyuki Takahashi	Radiation safety engineering/Environmental radiation dynamics	Associate Professor, Division of Nuclear Engineering Science, Kyoto University Research Reactor Institute
Toshi Nagaoka	Environmental radiation/Chernobyl accident	Head of the Safety Management Division, Japan Synchrotron Radiation Research Institute (JASRI)
Hiromi Yamazawa	Dynamics of environmental materials and environmental radiation	Professor, Energy science and engineering major, Graduate School of Engineering, Nagoya University
Hideaki Yamamoto	Radiation control	Deputy chief, Department of Radiation Protection, Nuclear Science Research Institute, Tokai Research and Development Center, Japan Atomic Energy Agency (JAEA)
Satoshi Yoshida	Impact of environmental radiation/Radiation protection	Unit Chief, Operation and Planning Unit, Research Center for Radiation Protection, National Institute of Radiological Sciences

Comprehensive Monitoring Plan

(decided at the Monitoring Coordination Meeting on August 2, 2011) [Extract]

3. Implementation Plan

1) Plan for the monitoring of general environmental monitoring (soil, water, and atmosphere, etc.), air space, sea areas, schools, and public facilities, etc.

◯Nationwide monitoring

<Monitoring of prefectures using monitoring posts, etc.>

- Measurement of air dose rates through the monitoring of environmental radioactivity levels (measurement using monitoring posts and at the height of 1 meter above the ground) by prefecture will be continued, while reviewing the past trends in air dose rates to reduce the frequency of publication of the results. [omission] Analysis of monitoring results of environmental radioactivity levels (tap water and fallout) will be further refined to the standard equivalent to that prior to the occurrence of the accident to reduce the frequency of measurement. [To be conducted regularly] (MEXT and respective prefectures)

◯Monitoring of the land area mainly around TEPCO's Fukushima NPPs

[Wide-area monitoring covering the entire Fukushima prefecture]

<Ascertaining air dose rates and accumulated doses>

- In the vicinity of TEPCO's Fukushima Dai-ichi NPP, continuous measurement will be conducted using integrating dosimeters, as well as potable monitoring posts that have already been equipped and will be newly equipped (60 units are planned to be newly equipped) [omission] In the light of with the installation of new monitoring posts, the measuring points and scale will be reviewed sequentially with regard to regular measurement using monitoring vehicles and survey meters, and measurement of accumulated doses using simple integrated dosimeters. [To be conducted regularly] (MEXT, Nuclear Emergency Response Headquarters, and Fukushima prefecture)

<Dust>

- Regarding dust in the air (air dust), monitoring will be conducted at schools and public facilities, etc., focusing on highly-accurate measurement of people's living environment. [To be conducted regularly] (MEXT, Nuclear Emergency Response Headquarters, and Fukushima prefecture)

< Indicator plants >

- Emergency monitoring conducted so far for weeds will be changed into measurement of the radioactivity concentrations for designated indicator plants (such as pine needles). [To be conducted regularly] (MEXT, Nuclear Emergency Response Headquarters, and Fukushima prefecture)