Current situation in Japan

Reading of Environmental Monitoring by Japan
- After Fukushima accident -

Hiroki Fujita

Japan Atomic Energy Agency

Contents

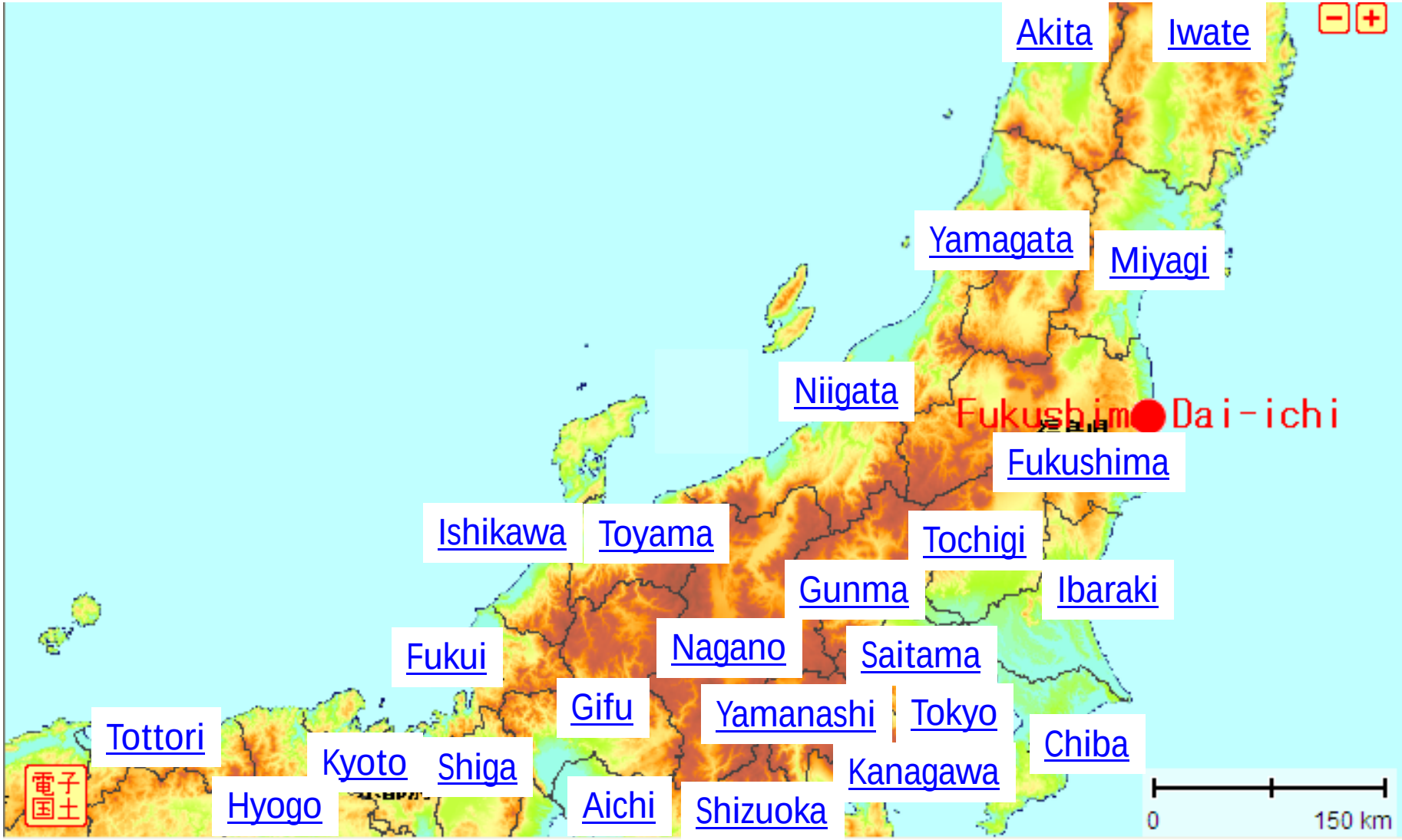
1) Change of dose rate in air and radioactivity in fallout right after the Fukushima accident

2) Monitoring plan

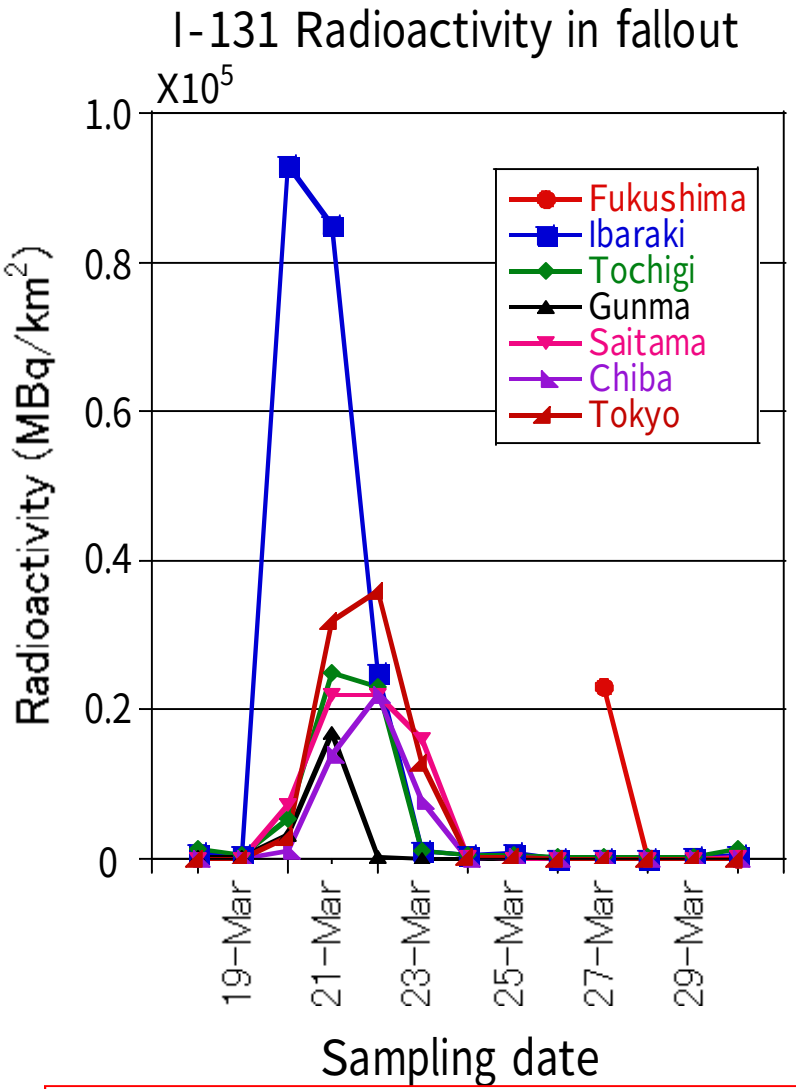
3) Readings of environmental monitoring at land

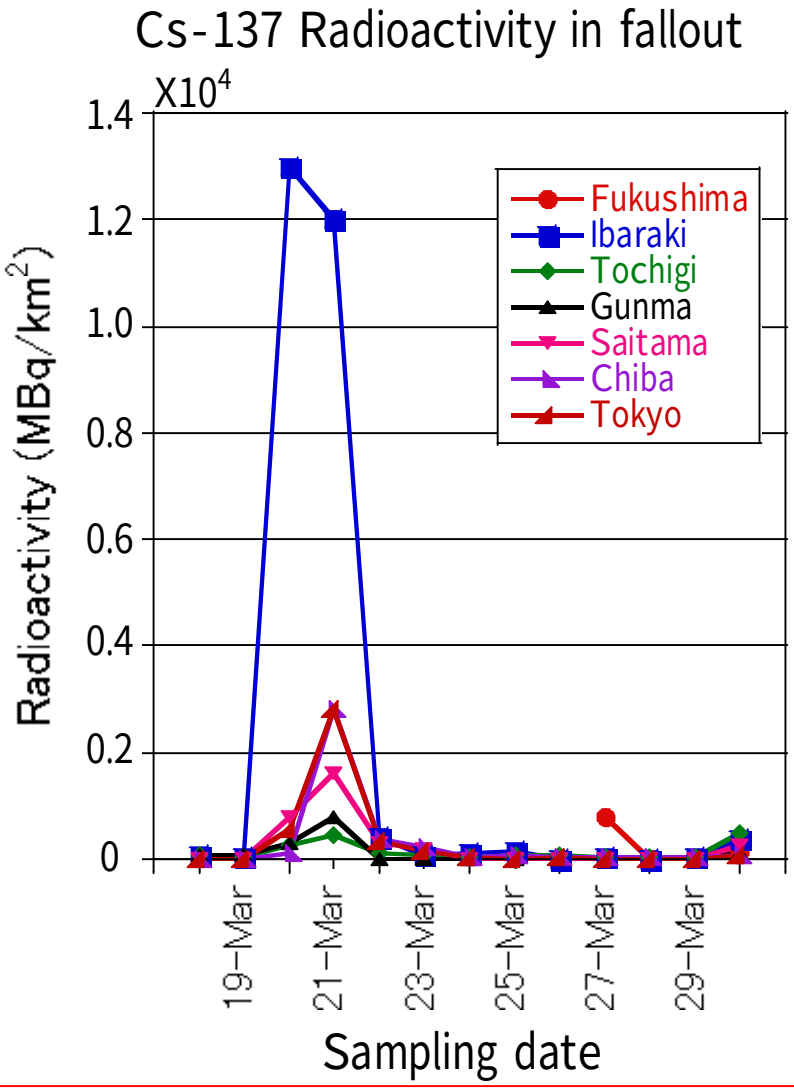
4) Readings of sea area monitoring

Change of dose rate around Fukushima after the accident



Radioactivity level in fallout





Fukushima could not measure radioactivity of I-131 and Cs-137 in fallout before 27, March because of corresponding to the earthquake.

Reference: http://radioactivity.mext.go.jp/ja/monitoring_by_prefecture_fallout/2011/03/index.html

Emergency Monitoring Plan
(March – July, 2011)

(Please refer to this URL for the results of these monitorings http://radioactivity.mext.go.jp/en/)

Monitoring target	Implementation agency
Dose rate, radioactivity concentration	MEXT, Fukushima, NPA, MOD, Nuclear operators and related companies
Airborne monitoring	SDF, JAXA, DOE
Sea area monitoring	JAMSTEC
Enhanced local monitoring program	Local governments

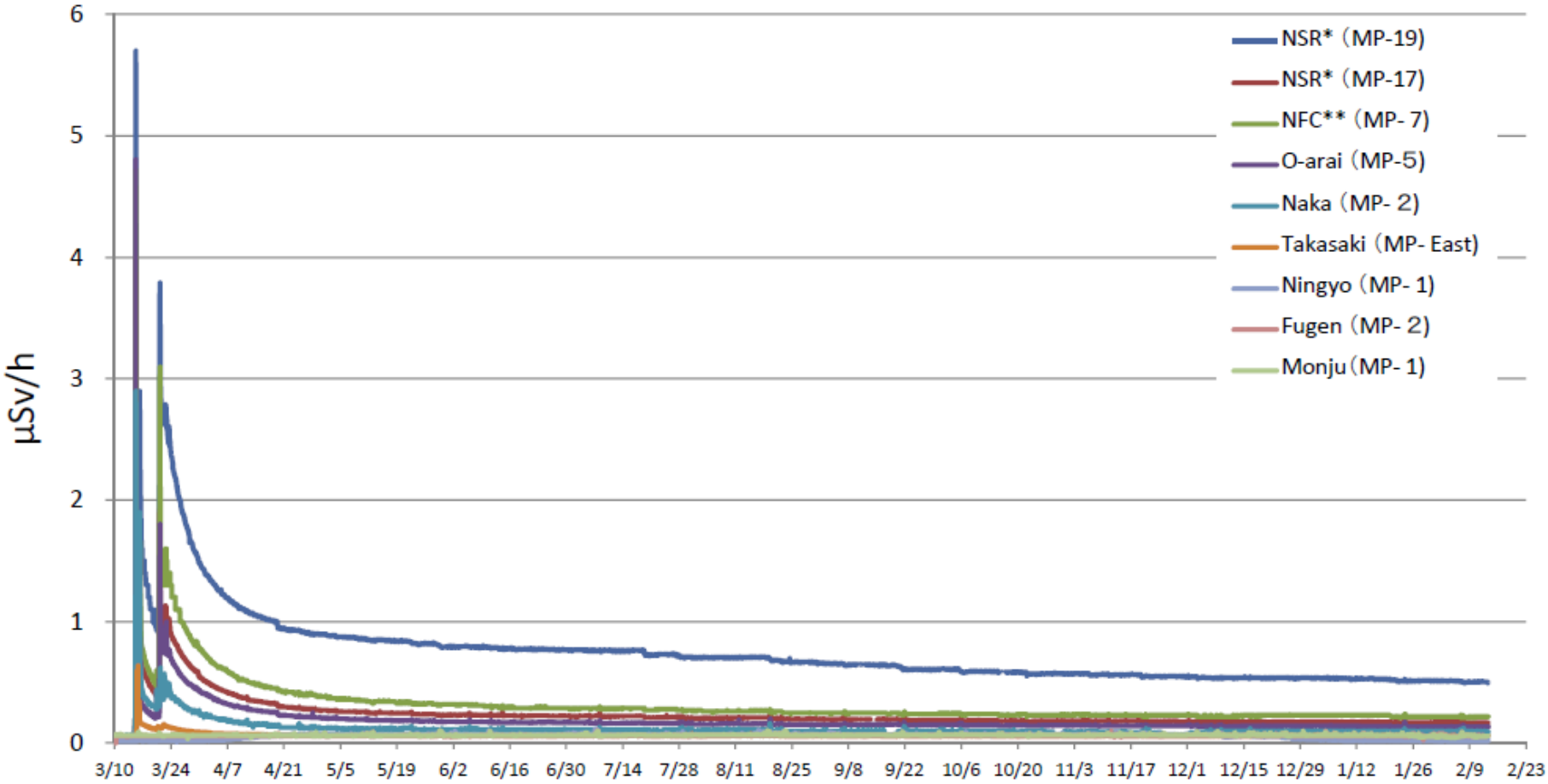
MEXT: Ministry of Education, Culture, Sports, Science and Technology
NPA: National Police Agency
MOD: Ministry of Defense
SDF: Self-Defence Forces
JAXA: Japan Aerospace Exploration Agency
DOE: U.S. Department of Energy
JAMSTEC: Japan Agency for Marine-Earth Science and Technology
Local governments: Tokyo, Hokkaido, and all the prefectures

Comprehensive Monitoring Plan

Monitoring target	Coordinator
General environmental monitoring (soil, water and atmosphere, etc.), air space, sea areas, schools and public facilities, etc.	MEXT http://radioactivity.mext.go.jp/en/
Ports, airports, parks and sewage, etc.	MEXT (with MLIT) http://www.mlit.go.jp/page/kanbo01_hy_001428.html
Water environment (Water resources, rivers and lakes, groundwater, and bathing resorts), natural parks, and waste	MOE http://www.env.go.jp/jishin/rmp.html
Cultivated soil, forests, and pasture grass	MAFF http://www.maff.go.jp/e/index.html
Foodstuffs (Agricultural products, forestry products, livestock products, and fishery products, etc.)	MHLW http://www.mhlw.go.jp/english/topics/2011eq/index.html
Tap water	MHLW http://www.mhlw.go.jp/english/topics/2011eq/index.html

MEXT: Ministry of Education, Culture, Sports, Science and Technology
MLIT: Ministry of Land, Infrastructure, Transport and Tourism
MOE: Ministry of the Environment
MAFF: Ministry of Agriculture, Forestry and Fisheries
MHLW: Ministry of Health, Labour and Welfare

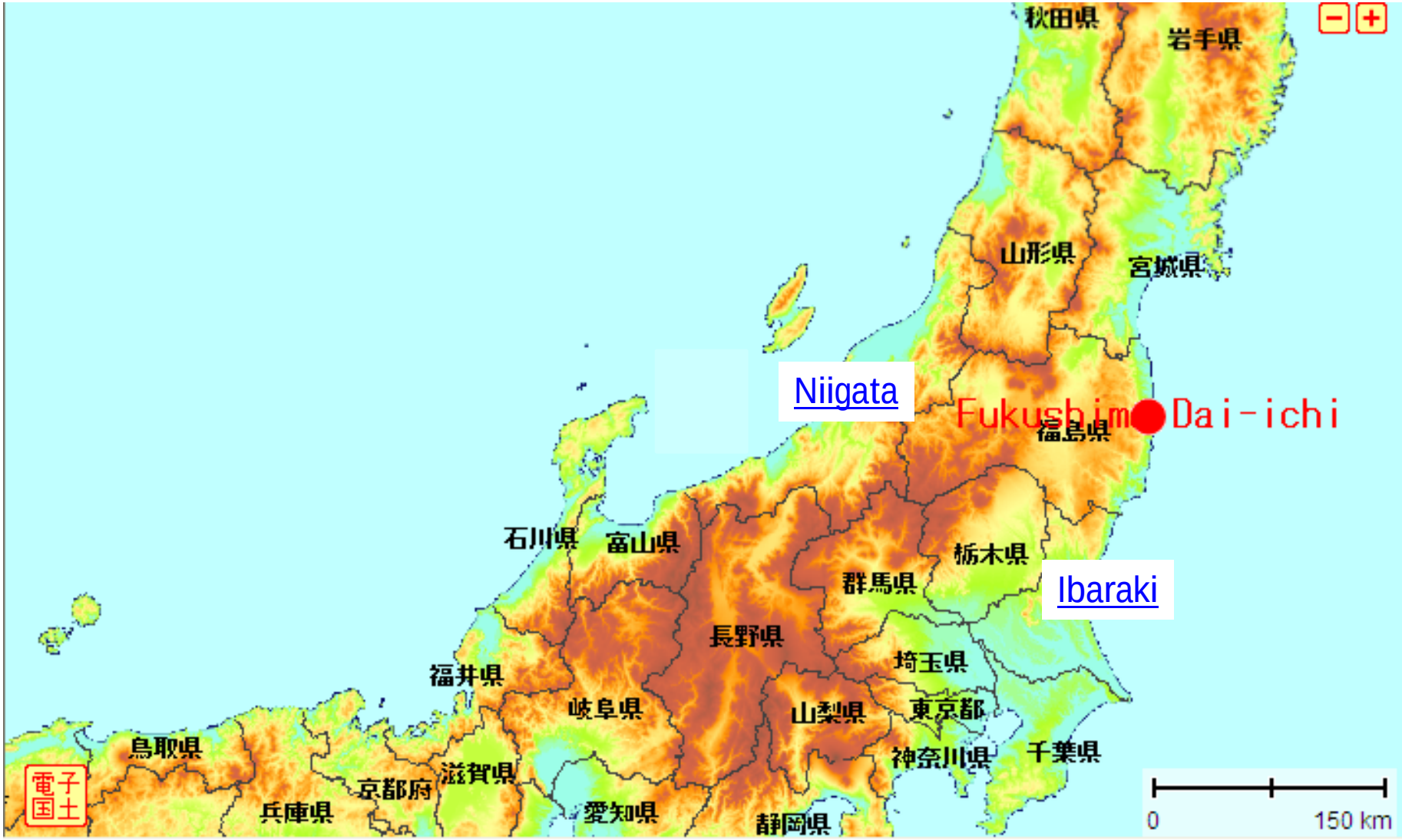
Transition of radiation rates measured
at environmental monitoring posts of the sites of JAEA（3/10～2/13）



Note1:μGy/h is assumed to be equivalent to μSv/h in this Figure.
Note2:Dose rates at monitoring posts depend on the situation of radiation around their installation locations. The dose rates at the Nuclear Science Research Institute (MP-19) tend to be a little higher than those at other monitoring posts as the results are influenced by the radioactive materials flying from the Fukushima Daiichi Nuclear Power Plant and adhering to the pine trees of the nearby forest. However, the radiation level is not hazardous to safety and health.

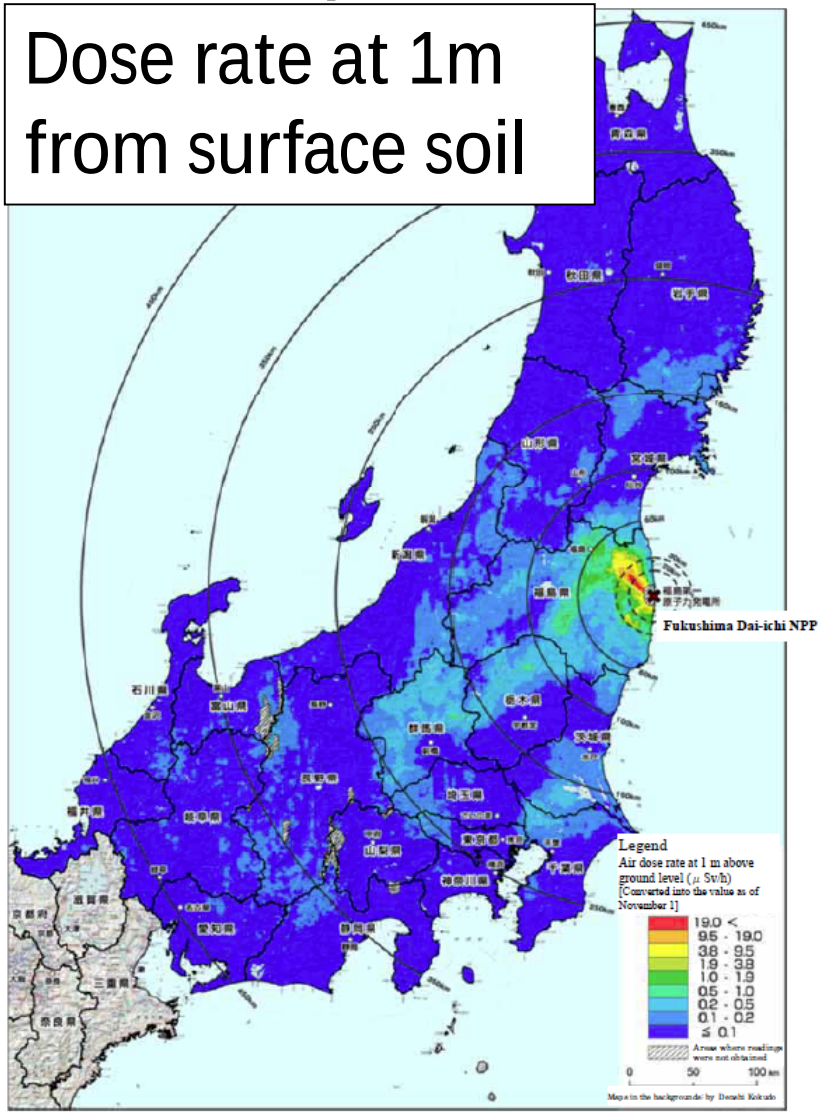
http://www.jaea.go.jp/jishin/monitor.pdf

Radioactivity level in monthly fallout



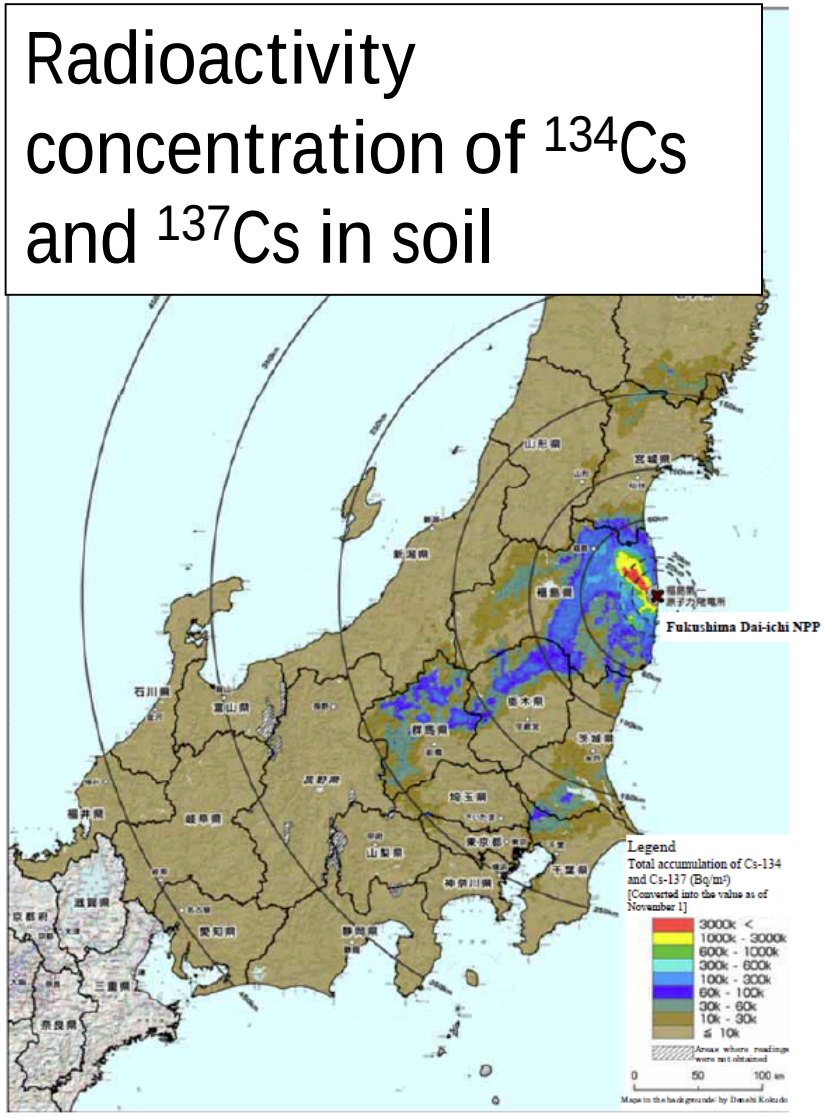
Airborne monitoring survey in the eastern part of Japan (Converted into the value as of November 1)

Dose rate at 1m from surface soil



Involving air dose rates of natural nuclides

Radioactivity concentration of ^{134}Cs and ^{137}Cs in soil



http://radioactivity.mext.go.jp/en/1270/2011/11/1270_1125.pdf

Sea area monitoring plan by Japanese government

Date	Plan
March 22	Sea Area Monitoring Action Plan
April 5	Enhancement of Sea Area Monitoring
April 25	Strengthening of Sea Area Monitoring
May 6	Sea Area Monitoring in Wider Areas
August 2	Comprehensive Monitoring Plan

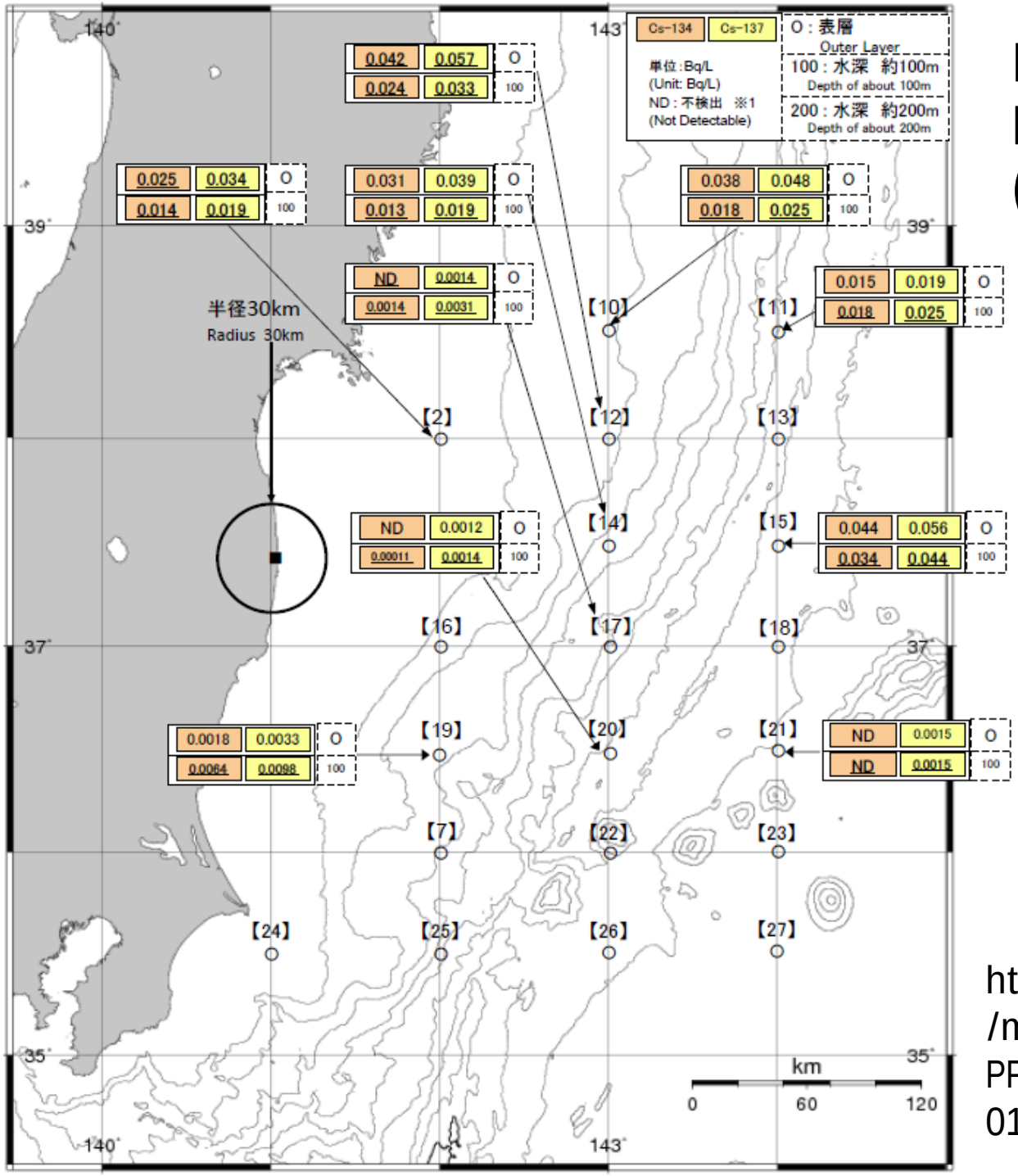
(1) Radioactivity concentrations in the seawater
(2) Air dose rates over the sea
(3) Radioactivity concentrations in airborne dust over the sea

Near field ⇨ + Far field
Gamma emitter ⇨ + Sr, Pu
High frequency ⇨ Low frequency
Higher detection limit ⇨ lower limit

Current plan for marine monitoring

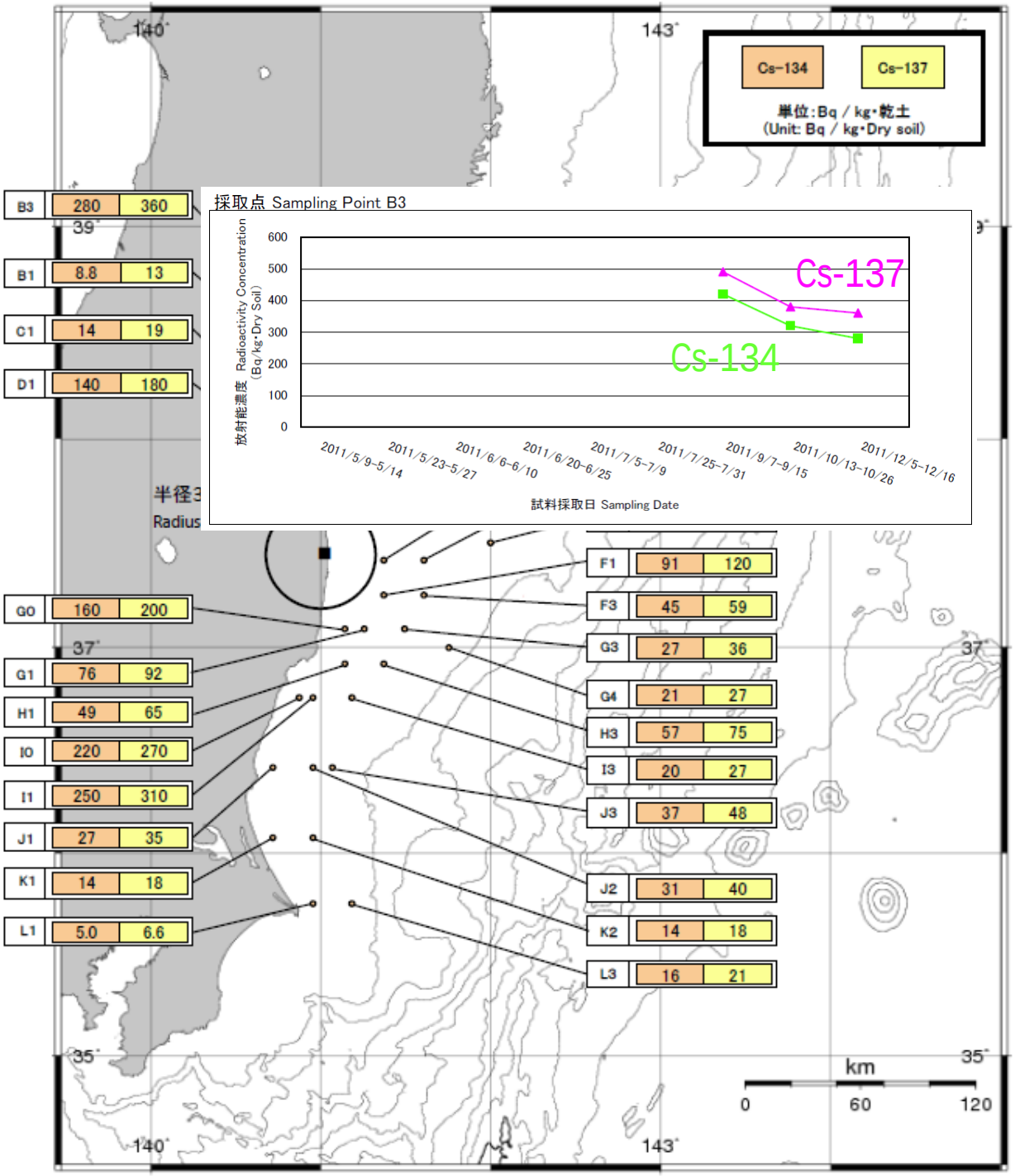
- Wider sampling area and lower detection limit by high resolution device
  - Larger volume: 30~50L
  - Chemical separation: AMP, coprecipitation of $FeNi[Fe(CN)_6]$
  - Long counting time: 80,000 sec〜

Sea area		Detection limit for ^{134}Cs and ^{137}Cs	Remarks
Front of NPP	~ 30km radius	Near NPP and coast: 1~2 Bq/L 10~30km from coast: 0.5Bq/L	For a few point, MEXT will analyze them with the limit of 0.025 Bq/L
Coastal	~ 30km from coast		
Off shore	30~90 km from coast	0.001 Bq/L	BG level
Deep sea	90~280 km from coast	0.001 Bq/L	



Readings of Sea Area Monitoring (Nov 30, 2011 ～ Dec 2, 2011)

http://radioactivity.mext.go.jp/en/monitoring_around_FukushimaNPP_sea_sea_area/2012/01/1330_012618.pdf



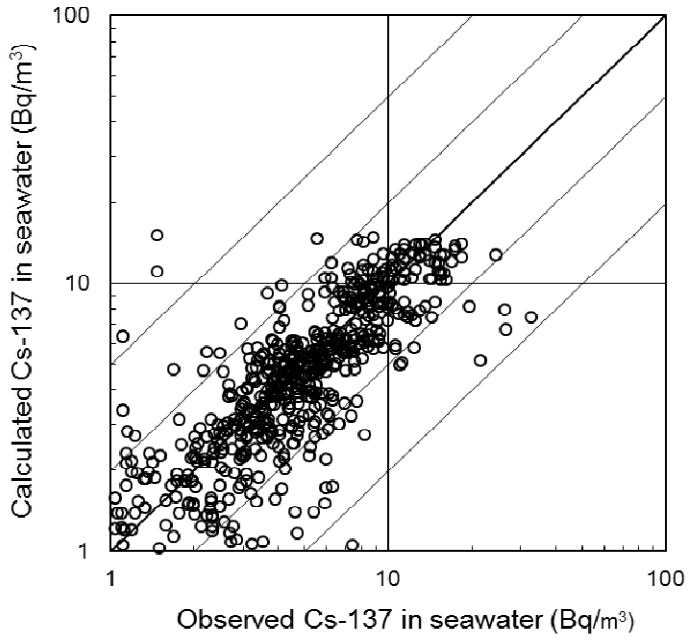
Distribution map of radioactivity concentration of Cs-134 and Cs-137 in marine soil (Dec 5, 2011 - Dec 16, 2011)

http://radioactivity.mext.go.jp/en/monitoring_around_FukushimaNPP_sea_marine_soil/2012/01/1350_013114.pdf

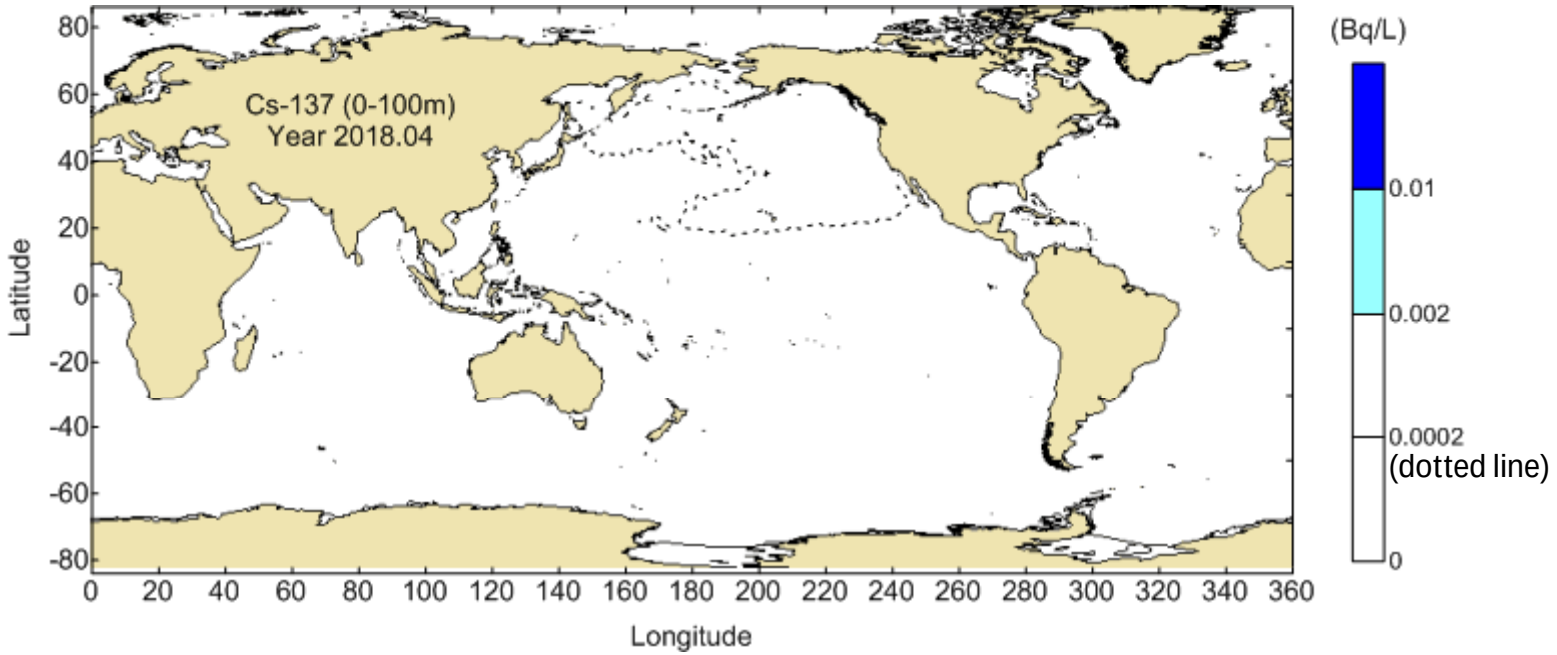
LAMER (JAEA)

- LAMER: Long-term Assessment Model of Radionuclides in the Oceans, developed by JAEA to predict the radioactive dispersion in global scale with the annual mean three dimensional velocity fields.
- The grid size of the velocity field is 2 degrees (200km*200km) horizontally and 15 layers vertically.)
- The surface mixed layer was considered.

  - Concerning the validation of used model, evaluation of ^{137}Cs concentration in the seawater which was released from the past atmospheric nuclear tests was carried out by using LAMER code, and the obtained results were compared with the observations.



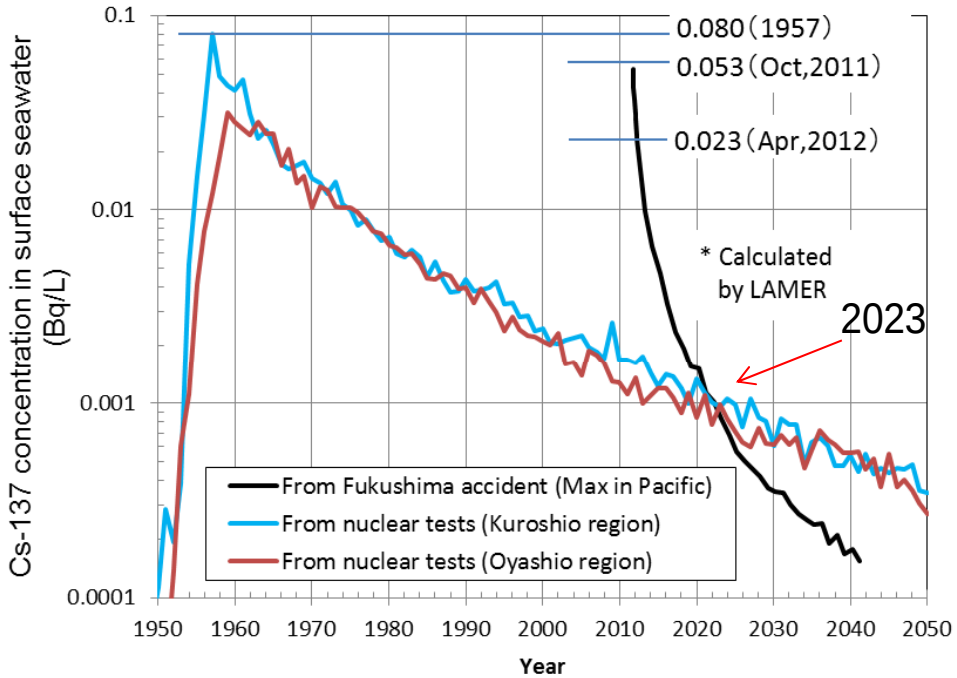
Change of ^{137}Cs concentration in seawater



- As the deposition from atmosphere was assumed as a point source, the spread and concentration of Cs are underestimated and overestimated, respectively.

- The radioactive concentration in all part of the Pacific Ocean would be less than 0.002 Bq/L in 7 years, and diluted into low level that we cannot discriminate from the present background.

Change of ^{137}Cs concentration in seawater – comparison of past concentration –



- The radioactive material from the nuclear tests has already dispersed in the world, so will not dilute more.
- The radioactive material from Fukushima Dai-ichi NPP is diluting rapidly.
- It is predicted that the maximum concentration in October 2011 would be the same level with that in 1957, and that the maximum concentration in 2023 would be the same with the background level.

Indices relating to limits on food and drink ingestion

○Indices relating to limits on food and drink ingestion

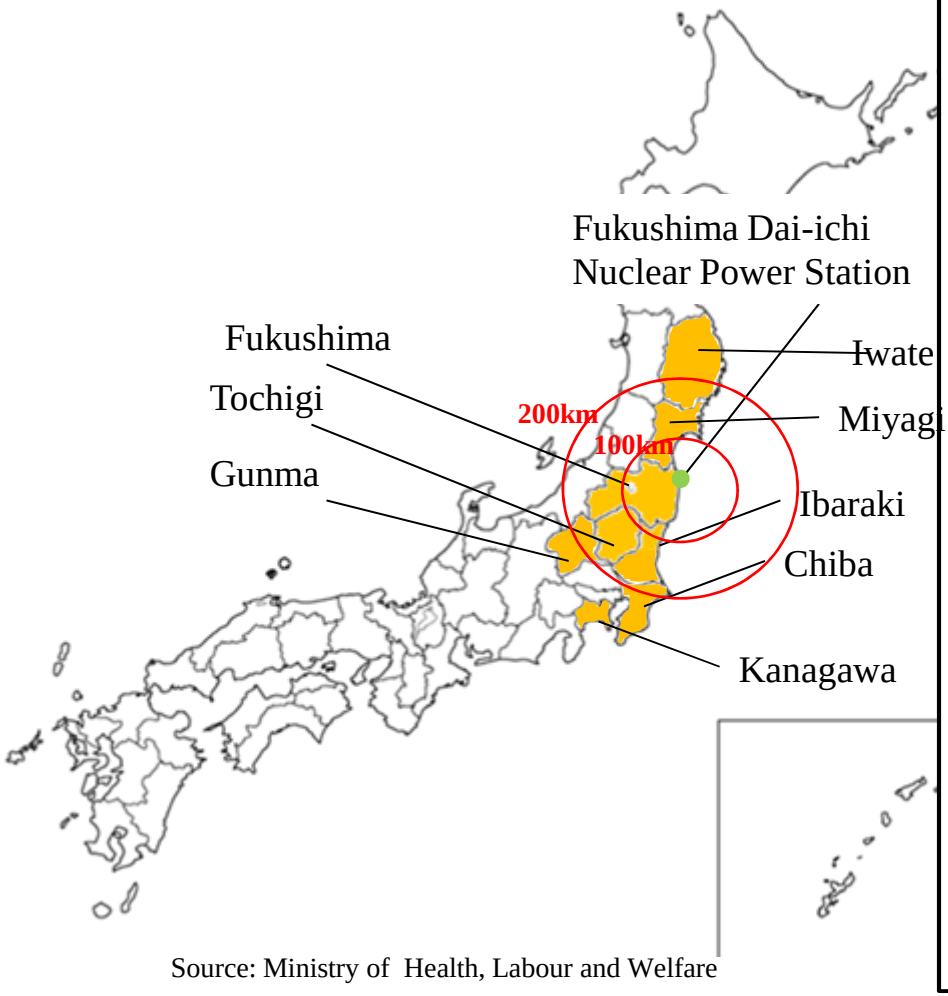
Nuclide	Index values relating to ingestion limits in guidelines for coping with disasters at nuclear facilities etc. (Bq/kg)	
Radioactive iodine (Representative radio-nuclides among mixed radio-nuclides: ^{131}I)	Drinking water	300
	Milk, dairy products*	
	Vegetables (Except root vegetables and tubers)	2,000
Radioactive cesium	Drinking water	200
	Milk, dairy products	
	Vegetables	500
	Grains	
	Meat, eggs, fish, etc.	
Uranium	Infant foods	20
	Drinking water	
	Milk, dairy products	
	Vegetables	100
	Grains	
	Meat, eggs, fish, etc.	
Alpha-emitting nuclides of plutonium and transuranic elements (Total radioactive concentration of ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am, ^{242}Cm, ^{243}Cm, ^{244}Cm)	Infant foods	1
	Drinking water	
	Milk, dairy products	
	Vegetables	10
	Grains	
	Meat, eggs, fish etc.	

*) Provide guidance so that materials exceeding 100 Bq/kg are not used in milk supplied for use in powdered baby formula or for direct drinking.

http://www.mhlw.go.jp/english/policy/health-medical/food/index.html

Safety of Food (1/2)

Japan inspects radioactivity in food every day, and restricts distribution of food that fails to meet provisional regulation values taking into consideration the spread of contamination.



Source: Ministry of Health, Labour and Welfare

Instructions (as of 16th January 2012)

… Not to Distribute

＊Fukushima Prefecture

- Raw milk, - Non-head type leafy vegetables (e.g. spinach)
- Head type leafy vegetables (e.g. cabbage)
- Flowerhead brassicas (e.g. broccoli, cauliflower)
- Turnip, - Log grown shiitake (grown outdoor, hothouse cultivation)
- Log grown pholiota nameko, - Wild mushroom
- Bamboo shoot, - Ostrich fern, - Ume, - Yuzu, - Chestnut
- Kiwi fruit, - Rice (produced in 2011)
- Fishery products
  (Sand lance, Cherry salmon yamame, Japanese dace and Ayu)
- Meat (Beef, Boar meat and Bear meat)

＊Ibaraki Prefecture

- Log grown Shiitake, Boar meat and Tea leaf

＊Tochigi Prefecture

- Log grown brick cap, Log grown pholiota nameko, Beef, Boar meat, Deer meat and Tea leaf

＊Chiba Prefecture

- Log grown Shiitake and Tea leaf

＊Miyagi Prefecture

- Log grown Shiitake and Beef

＊Iwate Prefecture

- Beef

＊Gunma and Kanagawa Prefectures

- Tea leaf

＊Instructions are applied to specific areas.
Please refer to the following URL for the details of Instructions.
http://www.mhlw.go.jp/english/topics/2011eq/index.html

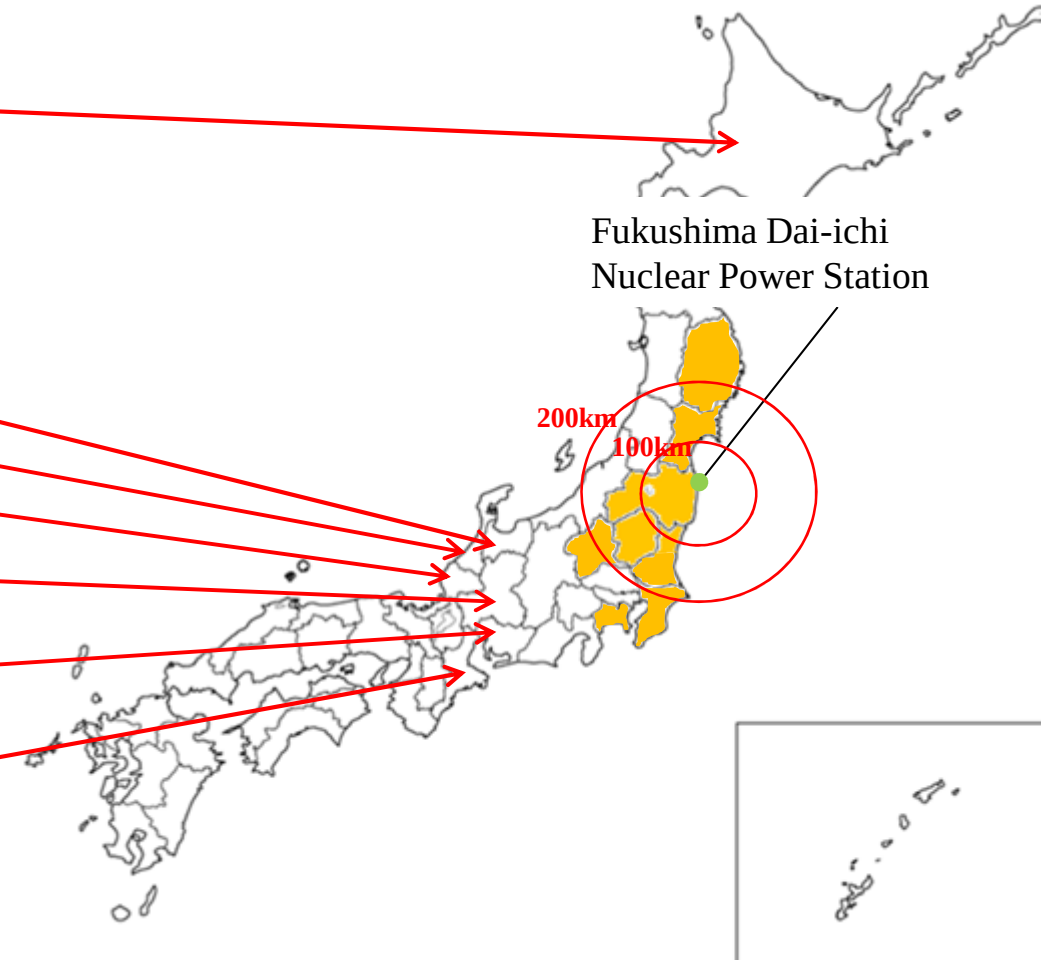
Safety of Food (2/2)

Sum up of radionuclide test results carried out at other places since 19 March 2011
(Up-to-date Report as of 19:00, 4 February 2012)

Food origin (Prefecture)	Food group	Number of food samples tested	Number of foods positive at levels exceeding provisional regulation limits (action levels)
Hokkaido	vegetable	39	–
	fishery products	438	–
	milk·dairyproducts	33	–
	meat·egg	878	–
	grain	9	–
	others	1	–
	subtotal	**1398**	**0**
Toyama	meat·egg	68	–
	grain	95	–
	subtotal	**163**	**0**
Ishikawa	meat·egg	101	–
	grain	40	–
	subtotal	**141**	**0**
Fukui	meat·egg	74	–
	grain	106	–
	subtotal	**180**	**0**
Gifu	vegetable	18	–
	milk·dairyproducts	3	–
	meat·egg	180	–
	grain	6	–
	subtotal	**207**	**0**
Aichi	vegetable	2	–
	fishery products	16	–
	milk·dairyproducts	4	–
	meat·egg	83	–
	others	9	–
	subtotal	**114**	**0**
Mie	vegetable	1	–
	fishery products	30	–
	meat·egg	108	–
	grain	4	–
	subtotal	**143**	**0**

Japan also inspects radioactivity in food originated from other areas except restricted areas.

→ The radioactivity in the food were under provisional regulation limits.



Indices relating to limits on food and drink ingestion

Current indices

Food group	^{137}Cs concentration (Bq/kg)
Drinking water	200
Milk, daily products	200
Vegetables	500
Grains	500
Meat, eggs, fish, etc.	500

New indices (April 2012~)

Food group	^{137}Cs concentration (Bq/kg)
Drinking water	10
Milk	50
Infant foods	50
General foods	100

Table Example of areas of high natural radiation background (UNSCEAR 2008 Report)

Region/country	Area	Reference	Exposure rate in air (nGy/h) Outdoors
	Monazite sand coastal area		
Brazil	Guarapari and Meaipe, ES	[S2]	84 (26-300)[d]
China	Yangiiang, Quangdong	[S27]	370
Egypt	Roseta coastal area	[S27]	20-400
India	Kerela and Madras	[G3. N1]	1500 (845-5270)

2012.2.7 14:00

環境放射能水準調査結果[Reading of environmental radioactivity level by prefecture]

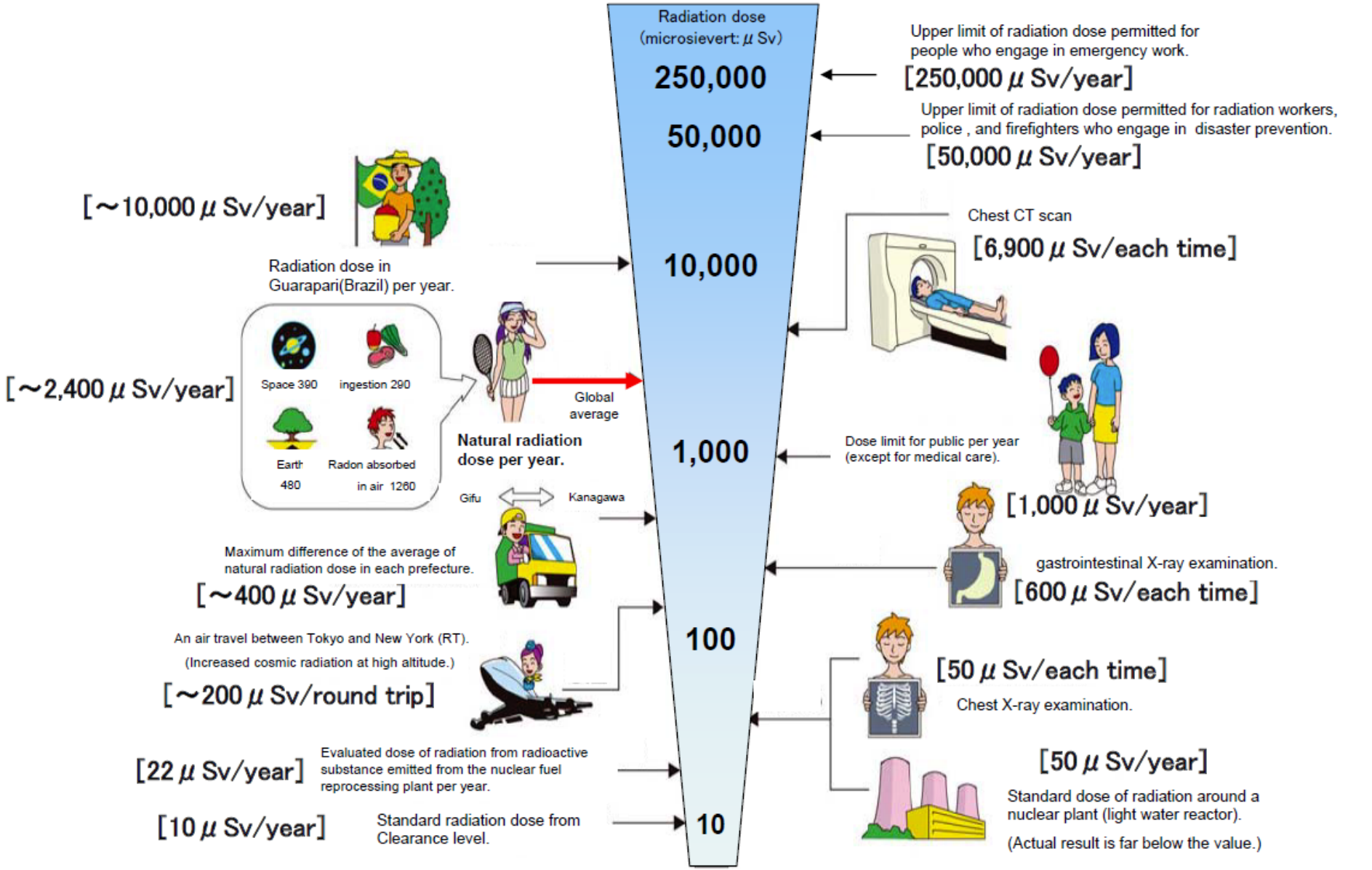
	都道府県名 [Prefecture(City)]	2月6日[6-February] 9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21
1	北海道(札幌市) [Hokkaido(Sapporo)]	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026	0.026	0.026	0.026
2	青森県(青森市) [Aomori(Aomori)]	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.012
3	岩手県(盛岡市) [Iwate(Morioka)]	0.020	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.021
4	宮城県(仙台市) [Miyagi(Sendai)]	0.047	0.047	0.048	0.047	0.048	0.048	0.048	0.047	0.048	0.049	0.053	0.052
5	秋田県(秋田市) [Akita(Akita)]	0.032	0.032	0.032	0.031	0.032	0.031	0.031	0.031	0.032	0.032	0.032	0.032
6	山形県(山形市) [Yamagata(Yamagata)]	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.028	0.028
7	福島県(福島市) [Fukushima(Fukushima)]	0.87	0.87	0.88	0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89
8	茨城県(水戸市) [Ibaraki(Mito)]	0.078	0.077	0.077	0.078	0.080	0.084	0.085	0.084	0.081	0.079	0.081	0.079
9	栃木県(宇都宮市) [Tochigi(Utsunomiya)]	0.053	0.053	0.052	0.053	0.052	0.056	0.059	0.057	0.055	0.053	0.053	0.053
10	群馬県(前橋市) [Gunma(Maebashi)]	0.029	0.028	0.027	0.026	0.026	0.030	0.031	0.028	0.027	0.027	0.027	0.027
11	埼玉県(さいたま市) [Saitama(Saitama)]	0.049	0.049	0.050	0.051	0.052	0.054	0.055	0.054	0.054	0.050	0.048	0.048
12	千葉県(市原市) [Chiba(Ichihara)]	0.042	0.044	0.044	0.044	0.047	0.049	0.050	0.049	0.047	0.045	0.042	0.042
13	東京都(新宿区) [Tokyo(Shinjuku)]	0.052	0.053	0.052	0.052	0.054	0.056	0.056	0.056	0.054	0.052	0.051	0.051
14	神奈川県(茅ヶ崎市) [Kanagawa(Chigasaki)]	0.046	0.047	0.047	0.049	0.054	0.056	0.059	0.062	0.058	0.051	0.047	0.047
15	新潟県(新潟市) [Niigata(Niigata)]	0.033	0.033	0.033	0.032	0.032	0.033	0.033	0.033	0.033	0.035	0.036	0.038
16	富山県(射水市) [Toyama(Imizu)]	0.034	0.034	0.033	0.034	0.035	0.035	0.036	0.035	0.037	0.038	0.034	0.037

Fukushima 0.87 μSv/h→870 nGy/h

Aomori 0.011 μSv/h→11 nGy/h

Radiation in Daily-life

※Unit : μ Sv



※ Sv【Sievert】＝Constant of organism effect by kind of radiation（※） × Gy【gray】

※ It is 1 in case of X ray and γ ray.

MEXT makes this, based on "Nuclear power 2002" made by Agency of Natural Resources and Energy.

K-40 radioactivity concentration in food items

Food items	K contents (mg/100g)	K-40 radioactivity concentration (Bq/kg)
Rice	35	11
Bread	97	29
Cheese	50	15
Milk	150	45
Chicken	350	106
Fava Bean	390	118
Green Onion	180	54
Chive	400	121
Garlic	530	160
Onion	150	45
Jews mallows	530	160
Strawberry	170	51
Mango	170	51