Japan Radioisotope Association

The Low-Level Radioactivity Measurement Techniques (LLRMT) 2016
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Screening test for radioactivity on self consumption products in Fukushima

after the Fukushima dai-ichi NPP accident in Japan

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Fukushima Dai-ich NPP
4
3
2
1
5, 6

Generic action levels for foodstuffs

Radionuclide	Generic action level in kBq/kg
Foods destined for general consumption	
^{134}Cs, ^{137}Cs, ^{131}I, ^{103}Ru, ^{106}Ru, ^{89}Sr,	1
^{90}Sr	0.1
^{241}Am,^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu	0.01
Milk, infant foods and drinking water	
^{134}Cs, ^{137}Cs, ^{103}Ru, ^{106}Ru, ^{89}Sr,	1
^{131}I, ^{90}Sr	0.1
^{241}Am,^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu	0.001

IAEA GS-R-2 (2004) Preparedness ^{131}I, for a Nuclear or Radiological Emergency Safety Requirements

Radionuclide	Level in Bq/kg
Foods other than infant foods	
^{3}H, ^{14}C, ^{99}Tc,	10000
^{35}S, ^{60}Co, ^{89}Sr, ^{103}Ru, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{192}Ir	1000
^{90}Sr, ^{106}Ru, ^{129}I, ^{131}I, ^{235}U	100
^{241}Am,^{238}Pu, ^{239}Pu, ^{240}Pu	10
Infant	
^{3}H, ^{14}C, ^{99}Tc,	1000
^{35}S, ^{60}Co, ^{89}Sr, ^{103}Ru, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{192}Ir	
^{90}Sr, ^{106}Ru, ^{129}I, ^{131}I, ^{235}U	100
^{241}Am,^{238}Pu, ^{239}Pu, ^{240}Pu	1

Codex Alimentarus Guideline levels for radionucleides in foods contaminated following a nuclear or radiological emergency (2011)

Regulatory action levels in Japan

	Iodine (^{131}I) (Bq/kg)	Cesium (^{134}Cs,^{137}Cs) (Bq/kg)
Drinking water	300	200
Milk	300	200
Milk for infants	(100)*	(100)*
Vegetables	2000	500
Food grain	2000	500
Meat, Egg, Fish, others	2000	500

** Recommended value*

Regulatory action levels on 17-Mar. 2011

New action levels for food in Japan (1-Apr-12)

	Iodine (^{131}I) (Bq/kg)	Cesium (^{134}Cs,^{137}Cs) (Bq/kg)	
Drinking water	300	200	10
Milk	300	200	50
Milk for infants	(100)*	(100)*	50
Vegetables	2000	500	100
Food grain	2000	500	
Meat, Egg, Fish, others	2000	500	

** Recommended value*

Implemented on 1st April 2012

These limits are based on 1 mSv in a year consistent with an intervention exemption level adopted by codex.

Food inspection in Japan

- Legal inspec

Items

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✓ To ensure the sa bility of producers

Food inspection in municipal labs

Inspection system for products cultivated in private vegetable gardens

- Conducted by the prefectural government
- Operated by municipalities

Items subjected to inspections

✓ Products cultivated in private gardens

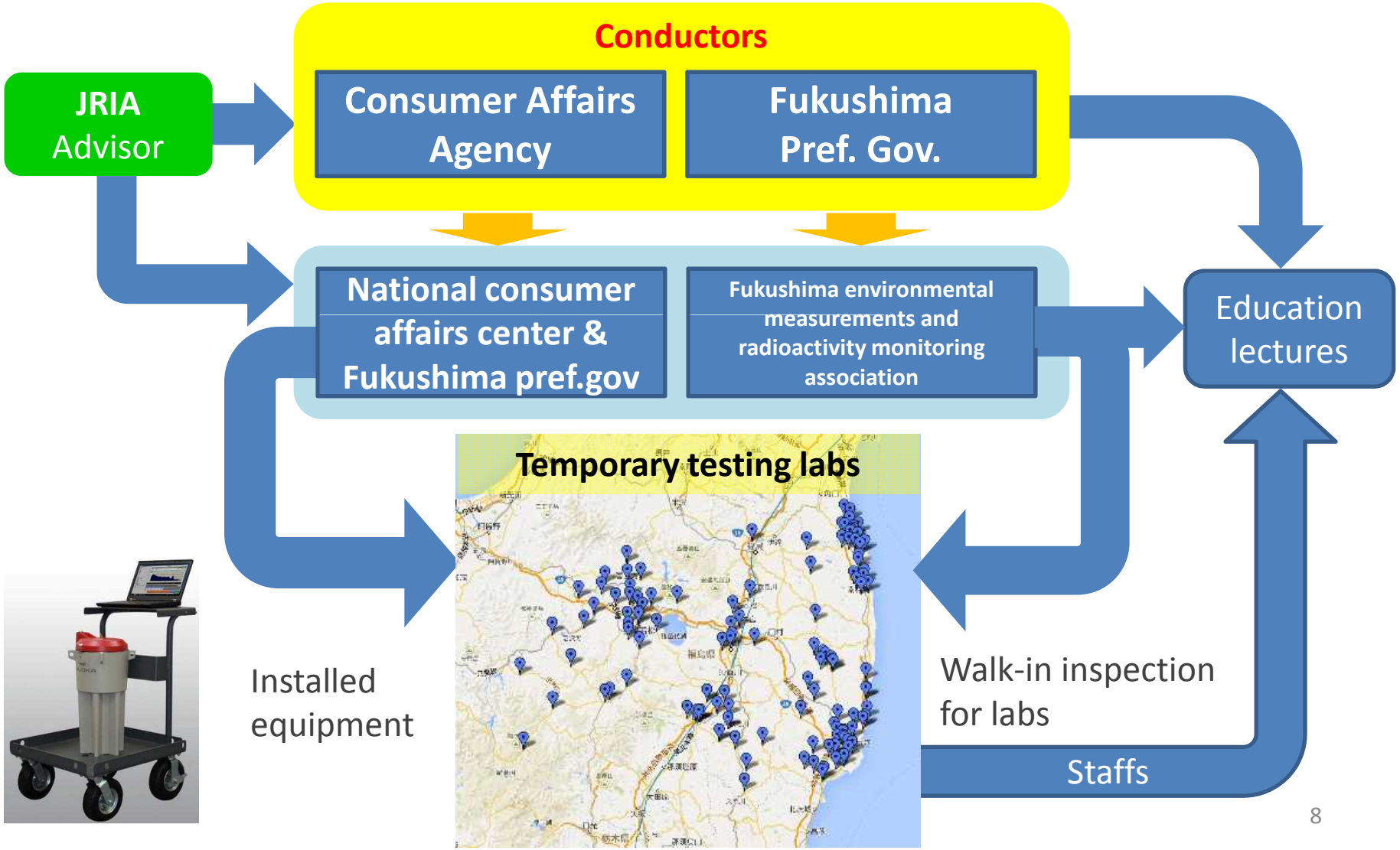
✓ Wild plants

✓ River/sea fishes

<<< Consumers themselves bring items to the testing lab.

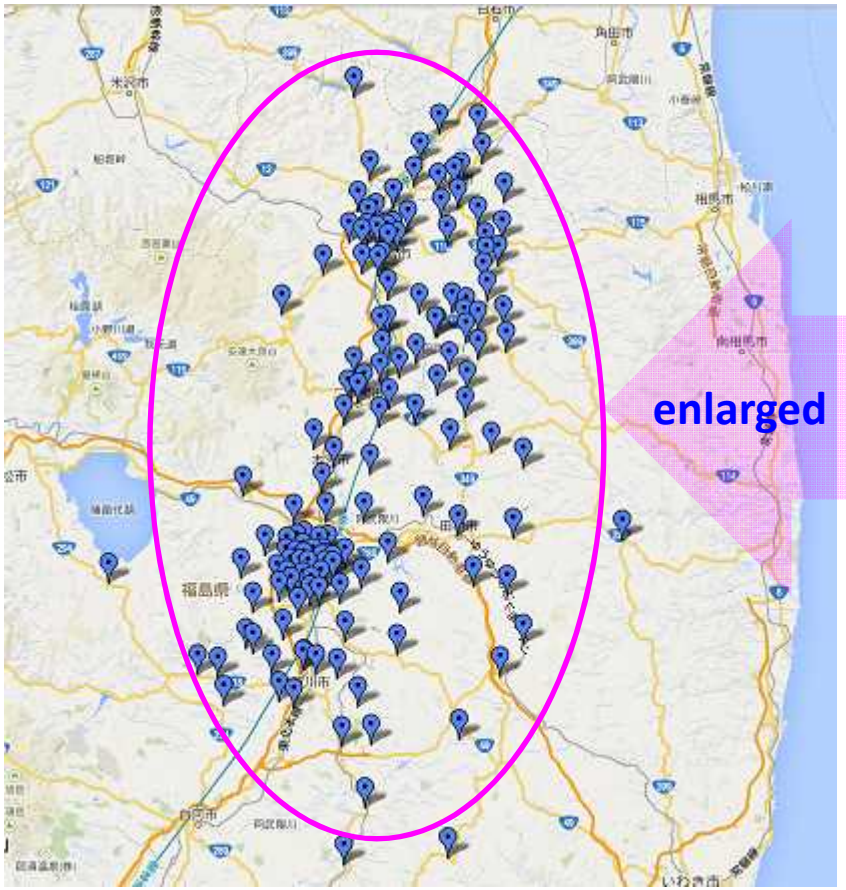
Framework of a food inspection service system

for self-consumption products



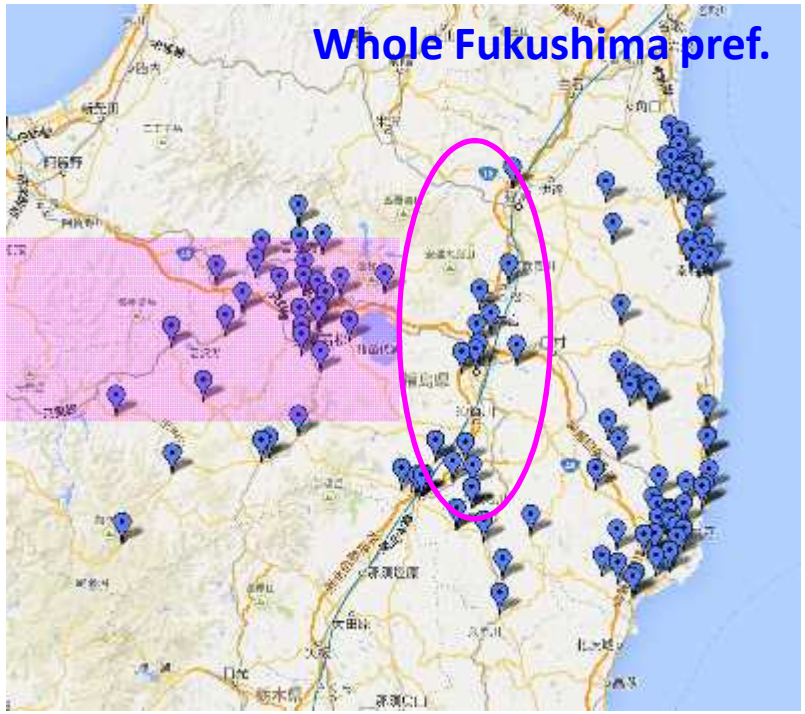
Temporary testing labs in Fukushima

for the food inspection of self consumption products



enlarged

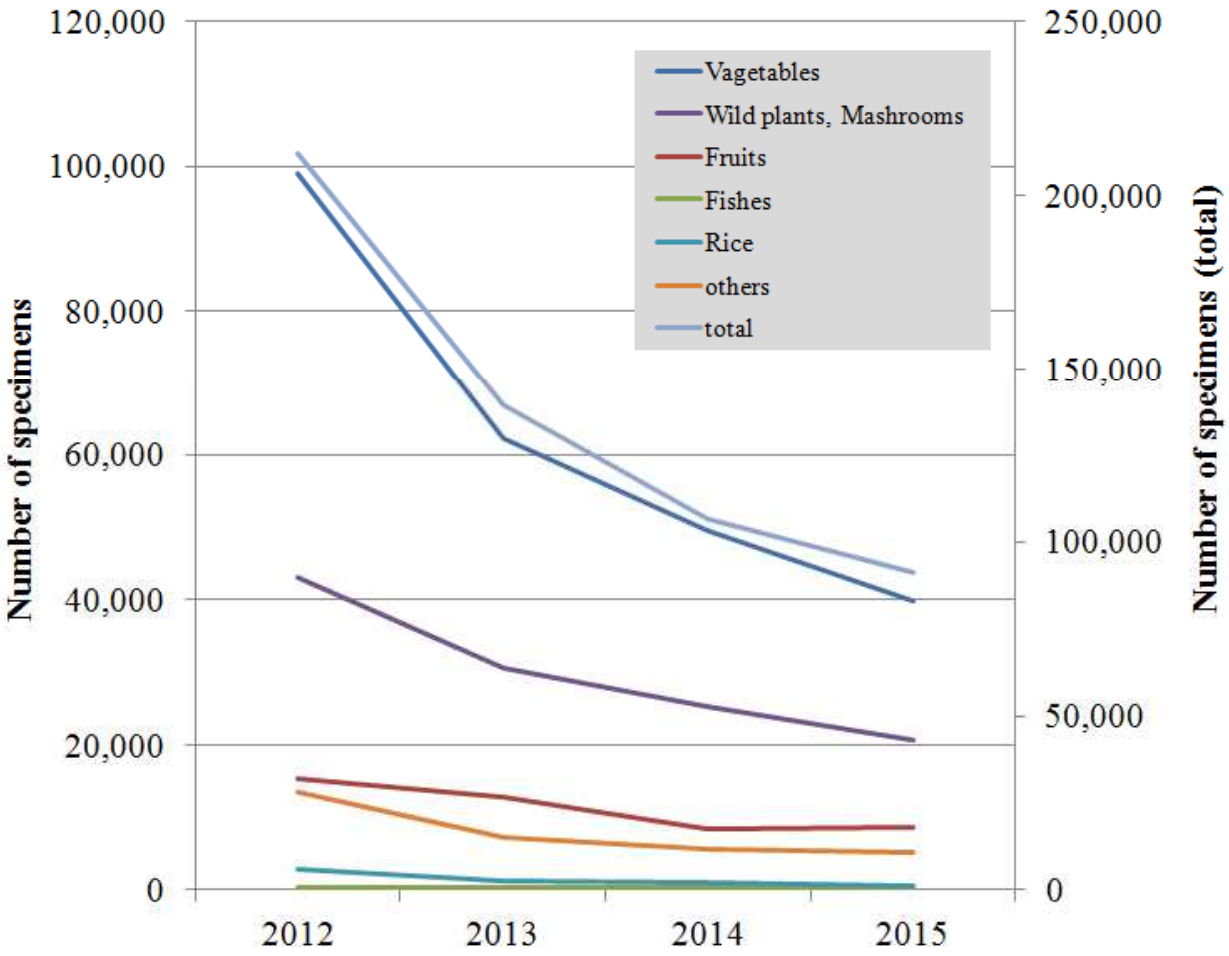
About 300 Labs /13,780 km²



About 1000 instruments were installed/ 2million inhabitants

Number of specimens for food inspections

of radio-cesium on self consumption products



Overview of temporary testing laboratory

- Several models of NaI(Tl) scintillation spectrometers are installed.
- The purpose of testing in labs are “SCREENING”.
- Temporary staffs carry out tests.
- Educational lectures for staff members are provided
- Quality Control activities
  - ✓Use of check source (brown rice)
  - ✓Background measurement
  - ✓Walk-in inspection by experts
  - ✓Ambient dose rate monitoring
  - ✓Room temperature monitoring

Radiocesium screening technique in foods

based on the specific technical guideline issued by MWHM

- The specific technical guideline for screening of radiocesium in foods was issued by the MHLW.

Requirements

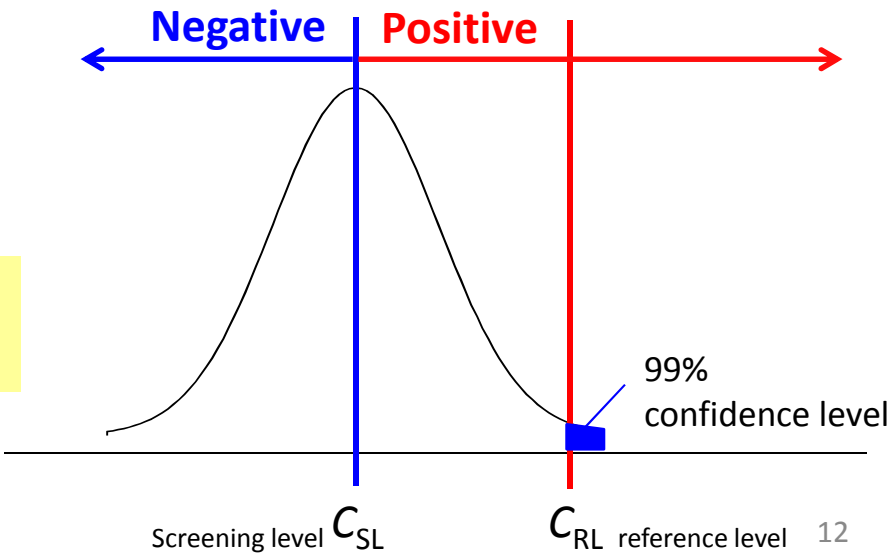
> 50 Bq/kg

100 Bq/kg

$$C_{SL}^{\triangleright} = C_{SL} + t_{k-1,\alpha} \cdot u(C_{SL}) < C_{RL}$$

$$c_A^* \leq 25 \text{ Bq/kg}$$

C_{SL} u_{SL} and C_{RL} are obtainable by measurement using a RM.



Future ISO standard

DRAFT INTERNATIONAL STANDARD

ISO/DIS 19581

ISO/TC **85**/SC **2** | Secretariat: **AFNOR**

Voting begins on: **2016-04-29** | Voting terminates on: **2016-07-28**

Measurement of radioactivity — Gamma emitting radionuclides — Rapid test method using NaI(Tl) gamma-ray spectrometry

Mesurage de la radioactivité — Radionucléides émetteurs gamma — Méthode d'essai rapide par spectrométrie gamma NaI(Tl)

ICS: 17.240

ISO/TC85/SC2 Radioactivity measurement

Convenor Dr. Dominique CALMET, CEA

Models of equipment installed in testing labs

- Multichannel analyzer counting (^{137}Cs, ^{134}Cs)

Model of equipment	radionuclides	Measurement time sec	Screening level Bq/kg	Reference level Bq/kg
RAD IQ™ FS200	^{137}Cs	600	49.14	60
	^{134}Cs	900	25.45	40
SPIR-Quanta	^{137}Cs	600	35.11	60
	^{134}Cs	600	24.01	40
Triathler	^{137}Cs	1800	56.35	60
	^{134}Cs	1800	31.57	40
CAN-OSP-NAI	^{137}Cs	600	77.05	80
	^{134}Cs	600	19.57	20

RAD IQ™ FS200

SPIR-Quanta

Triathler

CAN-OSP-NAI

Models of equipment installed in testing labs

for screening of self consumption products

・Total spectrum counting / Single channel analyzer counting ($^{137}Cs+^{134}Cs$)

Model of equipment	Measurement time sec	Screening level Bq/kg	Reference level Bq/kg
SX-SPA	600	67.25	100
AT1320A	120	92.81	100
TN300B	600	68.97	100

test condition: <0.1 μSv/h

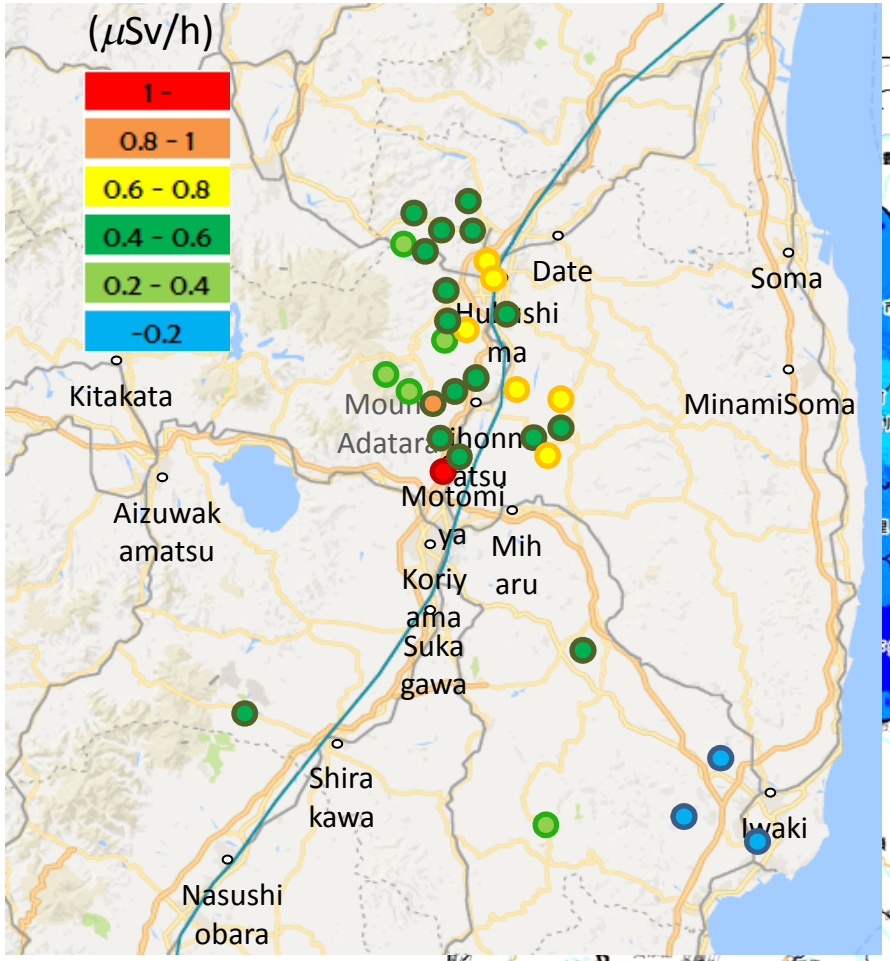
SX-SPA

AT1320A

TN300B

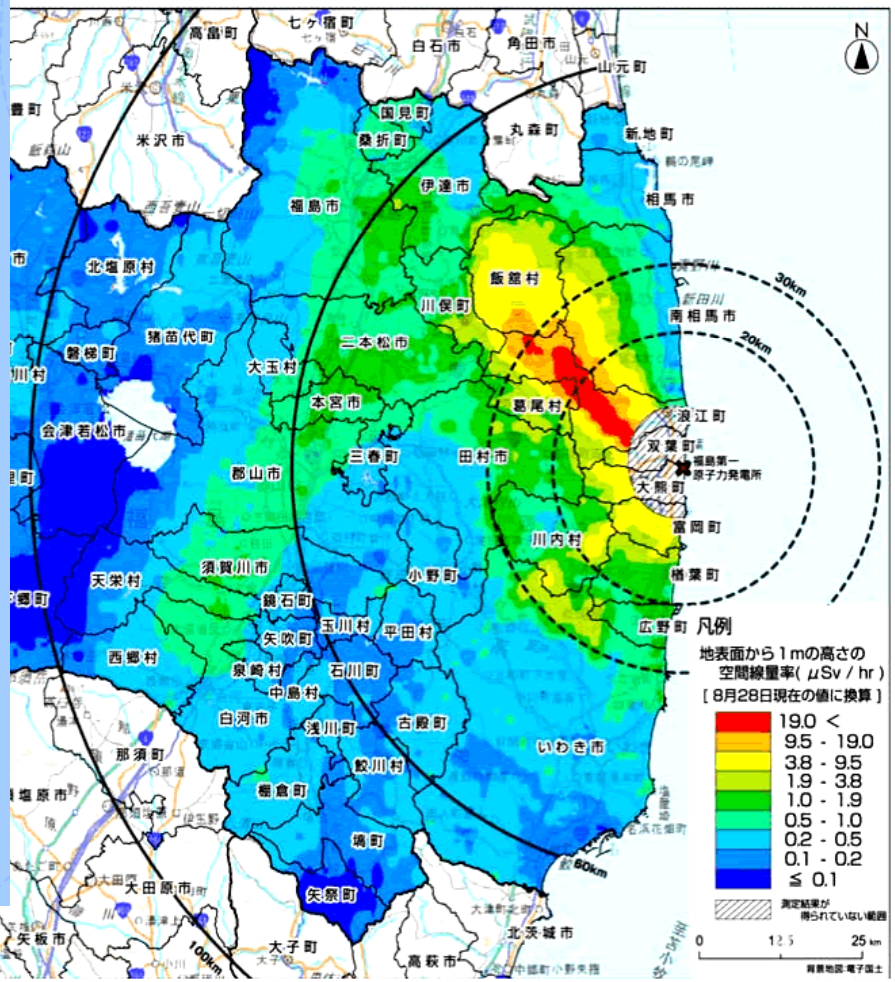
Map of measured ambient dose rates

at the outside of the 54 sampled laboratories

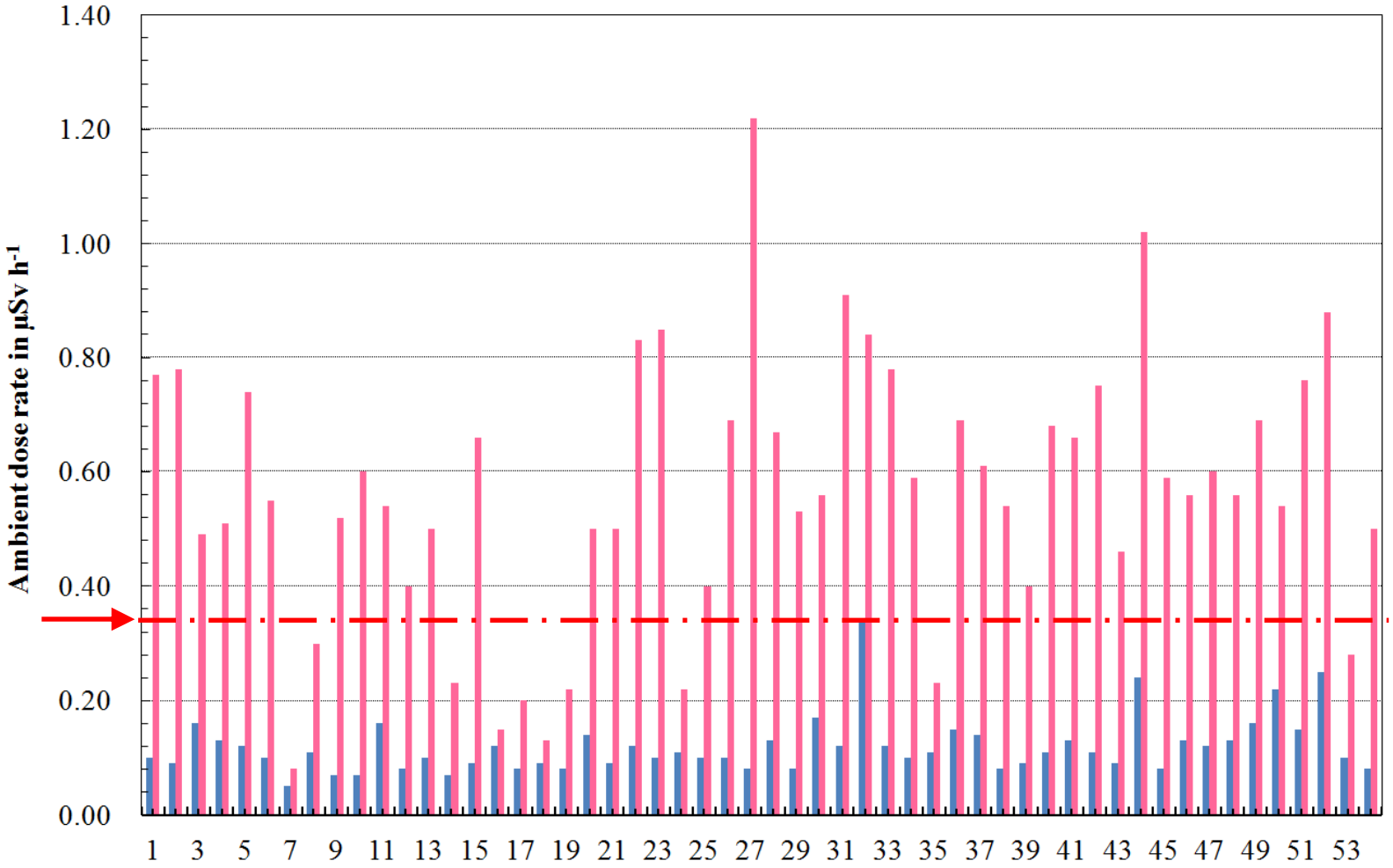


February 2012

Ref. web site of Nuclear Regulation Authority in Japan

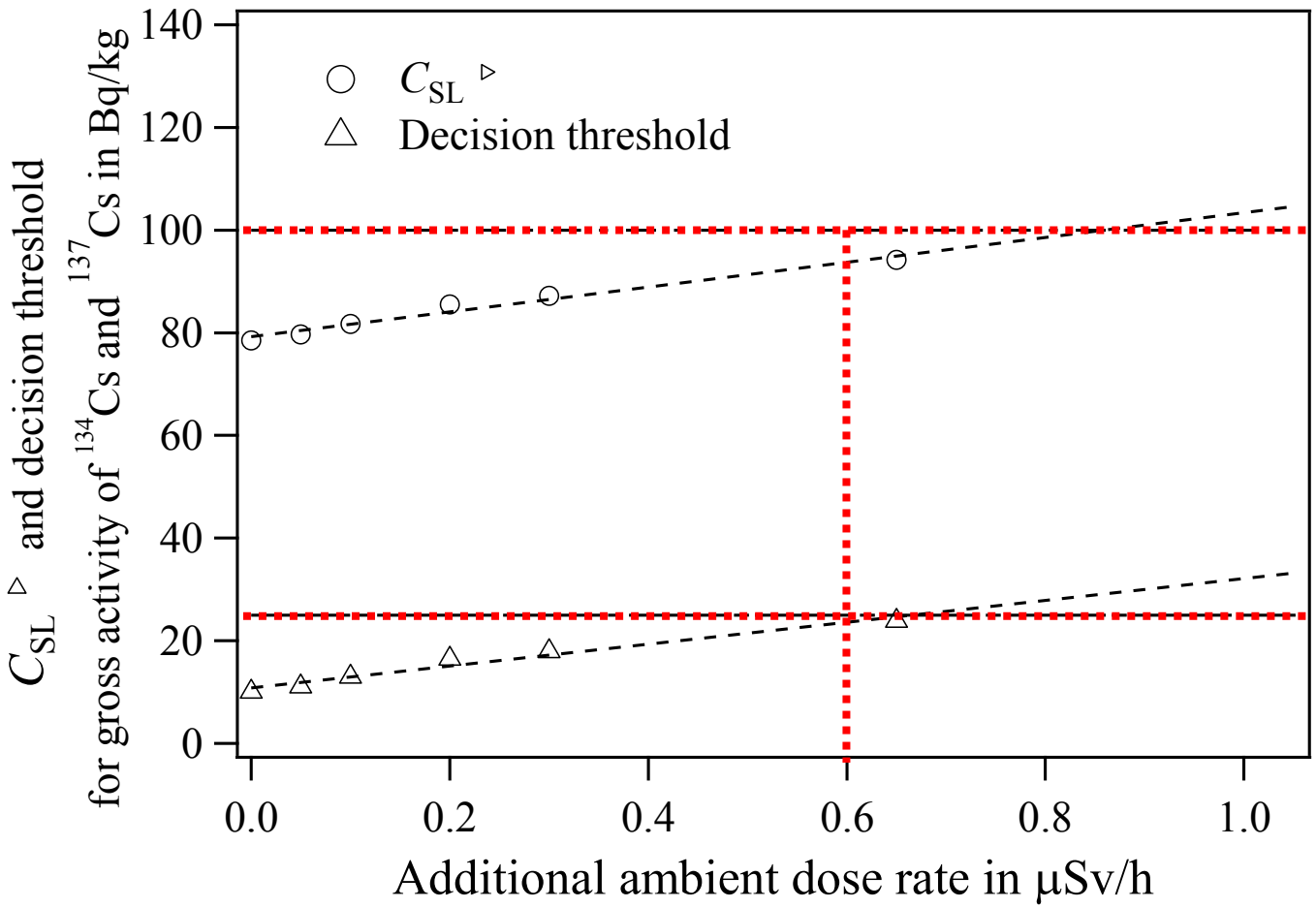


Ambient dose rate around testing labs (inside/outside)

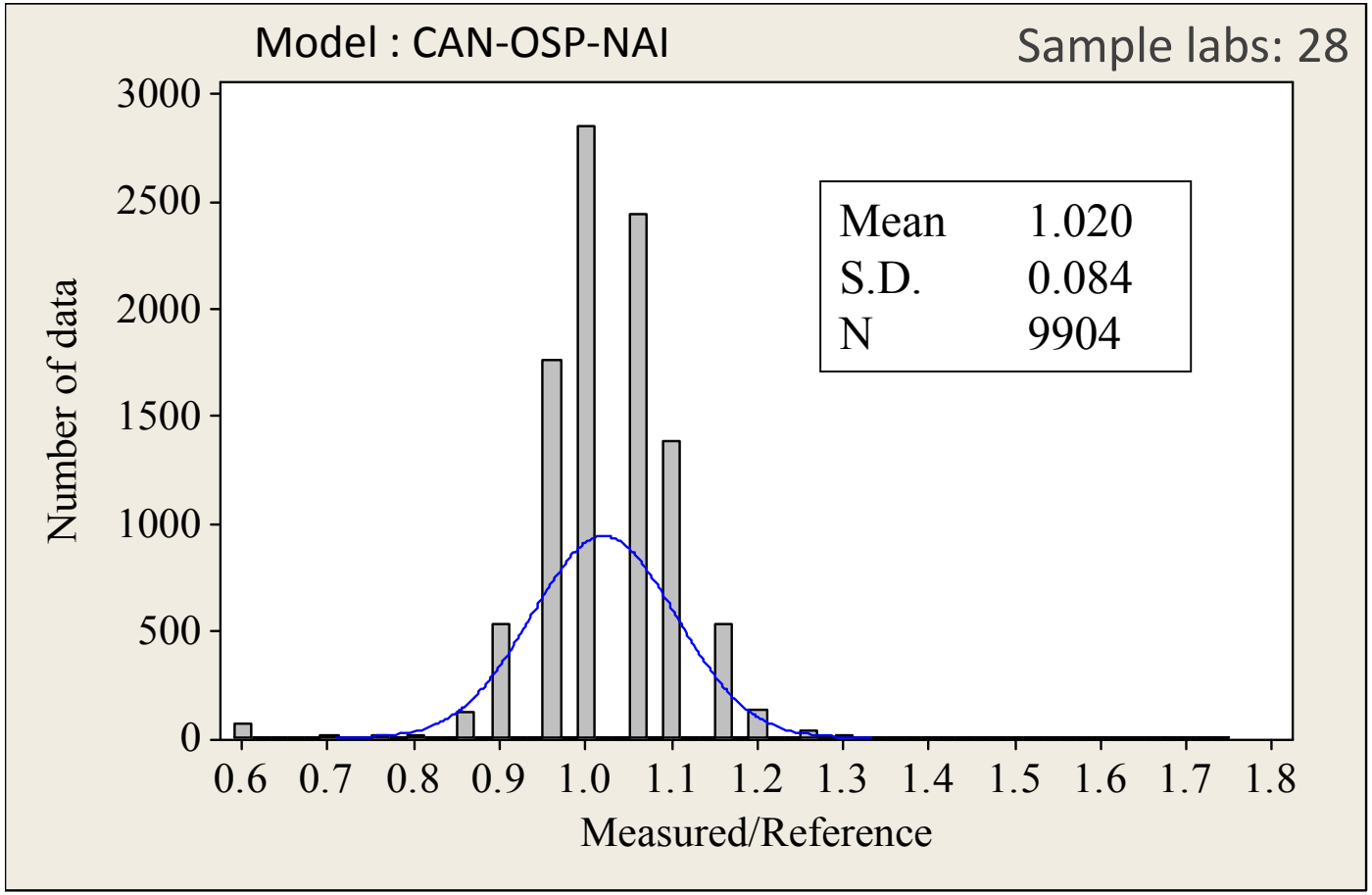


Experimentally determined screening level and decision threshold

for a model of NAI-OSP-CAN under various ambient dose rate conditions



Result of daily check measurements



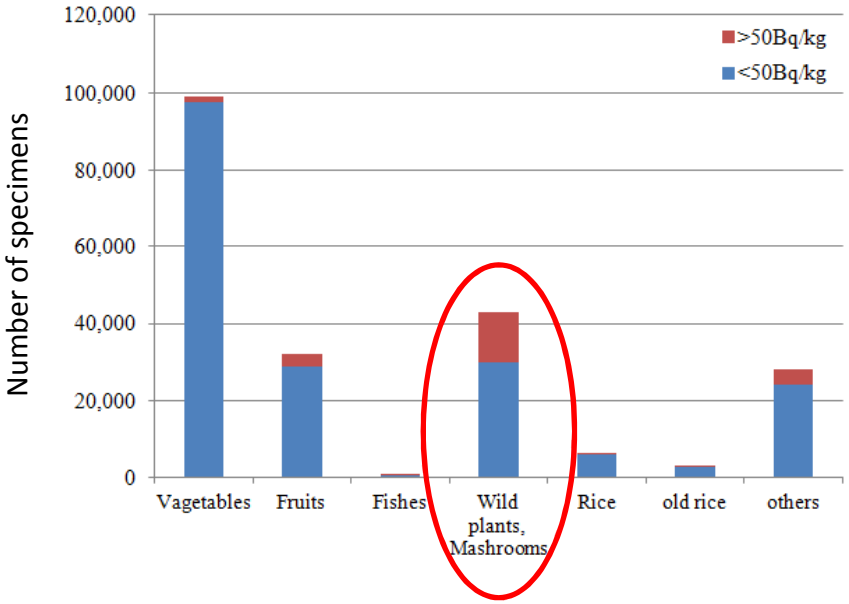
Standard Uncertainty due to counting statistics in each measurement ≃ 10%

Results of screening test of radio-cesium

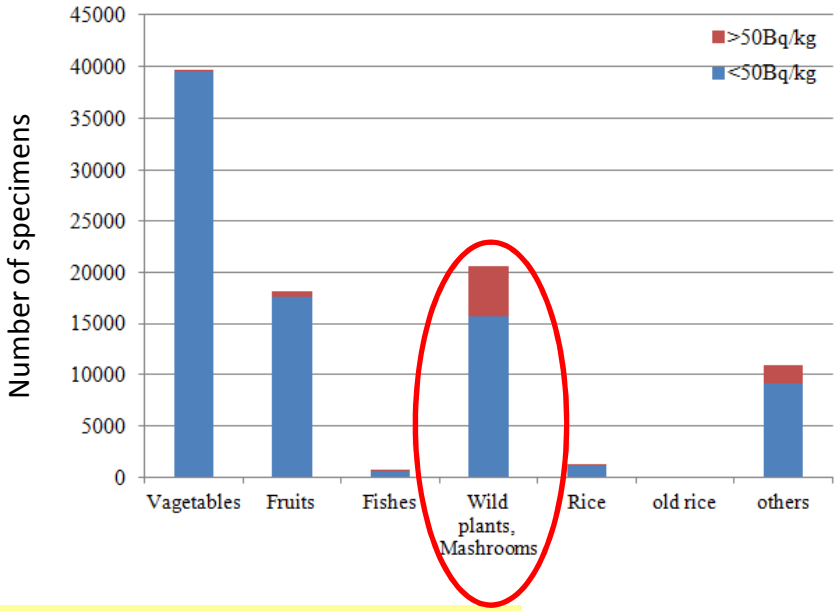
on self consumption products

Ref. http://www.pref.fukushima.lg.jp/site/portal/kennai-hoshanoukensa.html

2012fy



2015fy

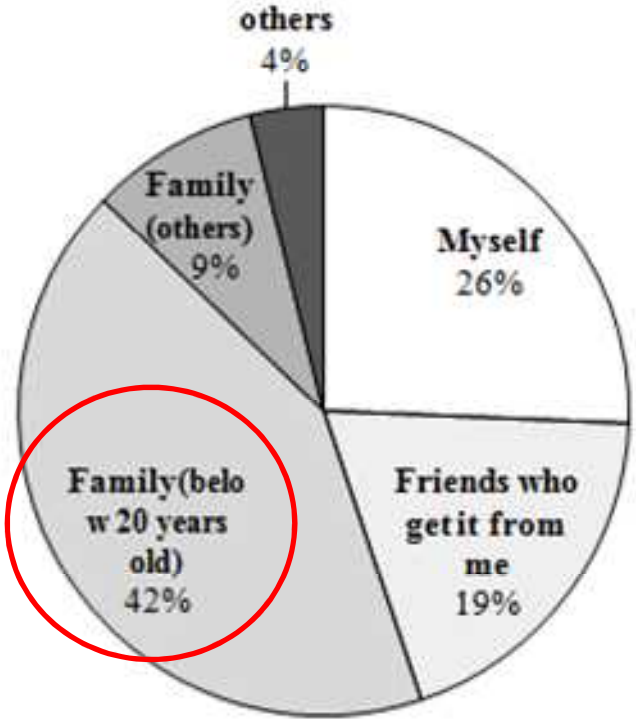


2012fy - 2015fy	
Total specimens	549,425
<50Bq/kg	498,497
Pass rate	90.7%

Results of customer satisfaction survey

>>Questionnaires were distributed to consumers who brought food samples to temporary testing laboratories.

Q: For whom did you use this service?

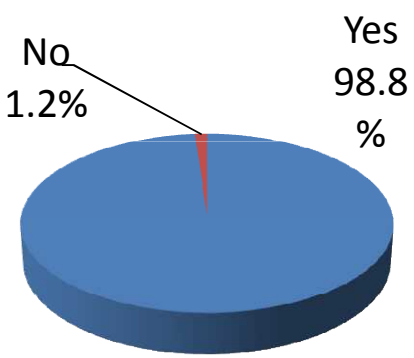


Investigated in 2012

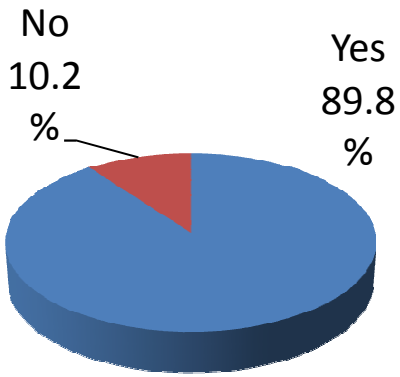
http://www.pref.fukushima.lg.jp/sec/16005b/hosoku-hoshanoukensa.html

Results of customer satisfaction survey

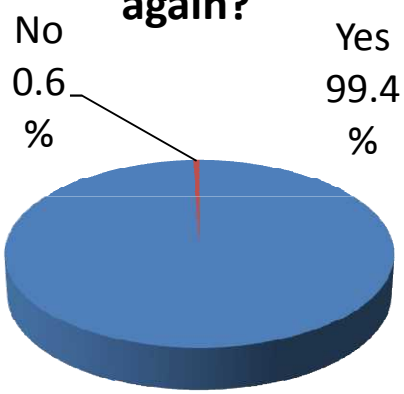
Q: Make use of the results?



Q:It relieved your anxiety?



Q:Use the service again?



Investigated in 2012

http://www.pref.fukushima.lg.jp/sec/16005b/hosoku-hoshanoukensa.html

Helpful in relieving their anxieties towards radioactivity contamination

Concluding remarks

- Outline of a food inspection service system for products collected by individual consumers for self-consumption was shown.
- A screening technique using a NaI spectrometer was adapted to food inspections.
- Results of the performance tests of several models of instruments based on the Japanese guideline were shown.
- Reliable inspections were possible even under higher dose rate as compared with the standard condition.
- Consequently 90% samples were judged as below the reference level.
- According to the results of CS survey the service has been helpful in relieving their anxieties towards radioactivity contamination.

Acknowledgement

The present works was supported by

- Ms.Sugawara, Mr.Okamura, Ms Baba and other members of the consumer section of Fukushima prefectural government
- Mr. Nakajima and other members of Hitachi helthcare
- All of staffs who are in charge of inspections

We would like to express our gratitude to all contributors.

Thank you for your attention!

Takahiro Yamada, Ph.D.