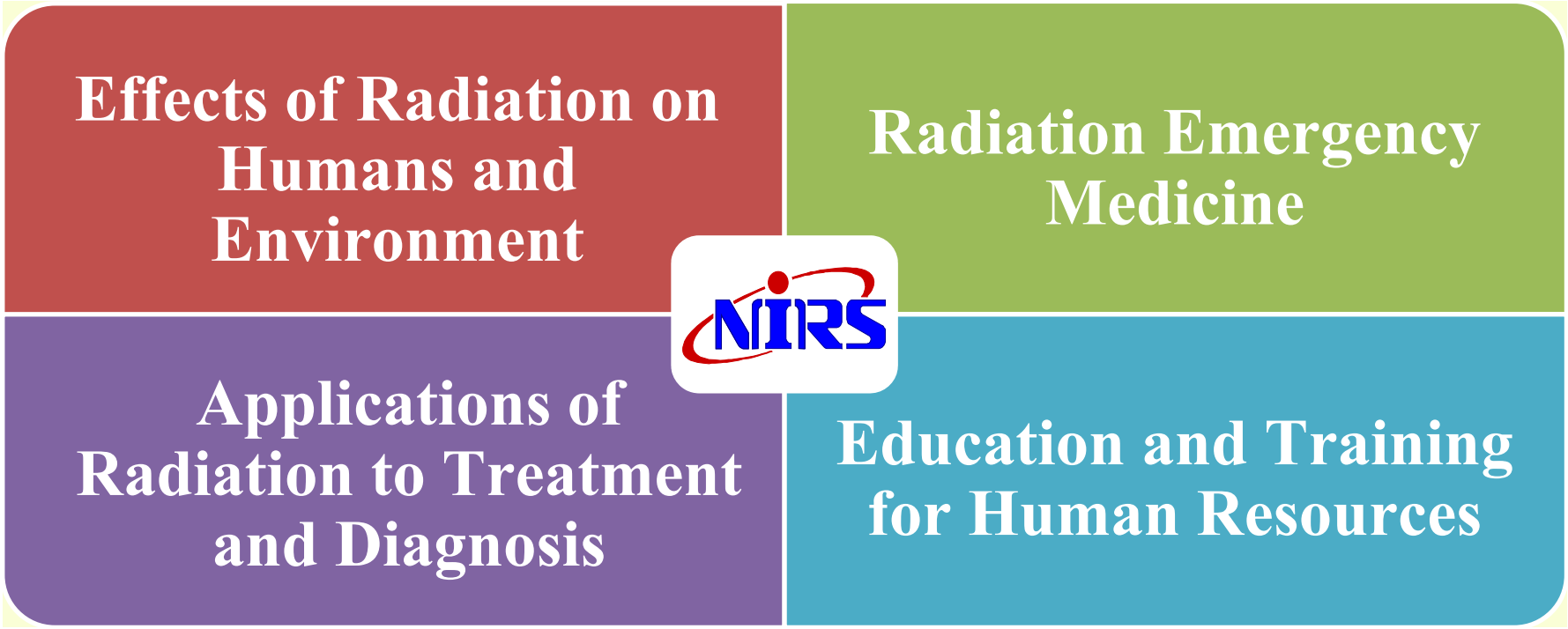
Roles of National Institute of Radiological Sciences (NIRS)

National Institute of Radiological Sciences
Makoto Akashi, MD, PhD

National Institute of Radiological Sciences (NIRS)

Unique institute in Japan dedicated to comprehensive research and development for radiation and health

Established in 1957



Establishment of NIRS

BACKGROUND

- **On 1 March 1954, a test explosion of the hydrogen bomb "Bravo" was performed at Bikini Atoll of the Pacific Ocean by U.S. authority**
- **The 5th Lucky Dragon with 23 Japanese fishermen (18-39 yo) was accidentally exposed to radiation from the fallout produced**

Radiation Emergency Medical Preparedness in Japan

National Institute of Radiological Sciences

Radiation Emergency Medicine Network

Physical Dosimetry Network

Chromosomes Network

National level

Cooperative hospitals

Regional Tertiary radiation emergency hospital
Hiroshima University

Cooperation and information sharing

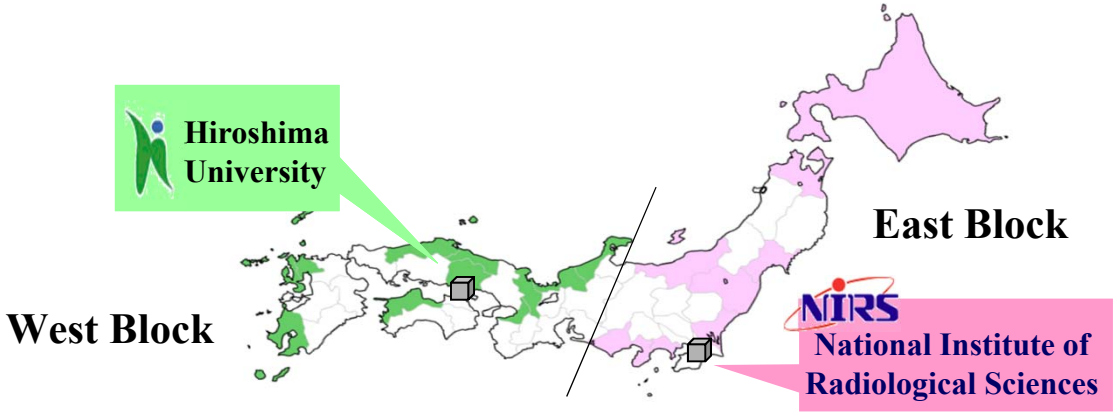
Regional tertiary radiation emergency hospital
National Institute of Radiological Sciences

Cooperative hospitals

Regional level (Third level)

Local governments in West Japan

Local governments in East Japan



Primary/ second level

Response to Fukushima Daiichi NPS Accident

1. At NIRS


Diagnosis/treatment and dose assessment of exposed patients（accepted 11 patients）

*** The photo taken in training**

2. Sending experts

Over 250 experts sent to the site and government organizations

3. On site



- Brief “Home-visit”

4. Providing knowledge and information about radiation



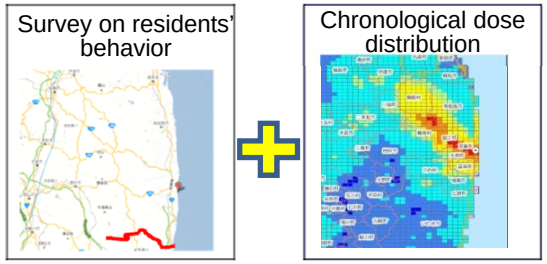
Telephone consultation **Lectures** **Providing information** **Sharing information**

- Body surface contamination monitoring
- WBC calibration”
- Radiation protection of first responders

5. Contribution to Fukushima Residents’ Health Management Survey

Estimation of external dose

- Based on their behavior, the external dose of residents in Fukushima Prefecture was estimated by the calculation system developed by NIRS

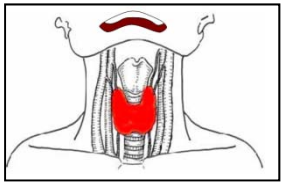


Map of dose-rate from data of the System for Prediction Environmental Emergency Dose Information (SPEEDI)

Internal dose evaluation

- Dose estimation of internal exposure for the public in Fukushima was performed by whole body counter at NIRS





Sending experts

Radiation Emergency Medical Assistance Team (REMAT)

March 12, 2011 8:10 am
(17 hr after the earthquake)
REMAT was dispatched from NIRS to Fukushima by a helicopter of JSDF

At off-site command center in Okuma-machi (from 12 to 15 March)

No electricity

No water supply

Combined Disaster

Damage to lifelines

- **Internet ×**
- **Mobile phone ×**
- **Facsimile ×**
- **Telephone ×**
- **Satellite phone ◎ (2 lines)**

At the forward base for battling nuclear disaster
- J-Village -

Radiation protection of firefighters during the operation of cooling reactors (spraying water)

Administration of stable iodine to first responders

Training courses for fire departments in Fukushima prefecture

Fire Department	Date	No. of fire-fighters	No. of sending NIRS experts
Futaba Area	Sep 21-22, 2011	83	4
Soma Area	Oct 3-4, 2011	50	3
Iwaki City	Oct 28 , 2011	32	4
Fukushima City	Nov 28-29, 2011	80	5
Aizu Area (Kitakata, Aizuwakamatsu, Minamiaizu)	Feb 2, 2012	147	4
Shirakawa Area	Feb 3, 2012	51	4
Date City	Mar 16, 2012	50	4

Screening of radiation for workers/residents at NIRS

Checking body surface

（As of February 22, 2013）

– TEPCO
– First responders
– Governments

} 2,430 persons

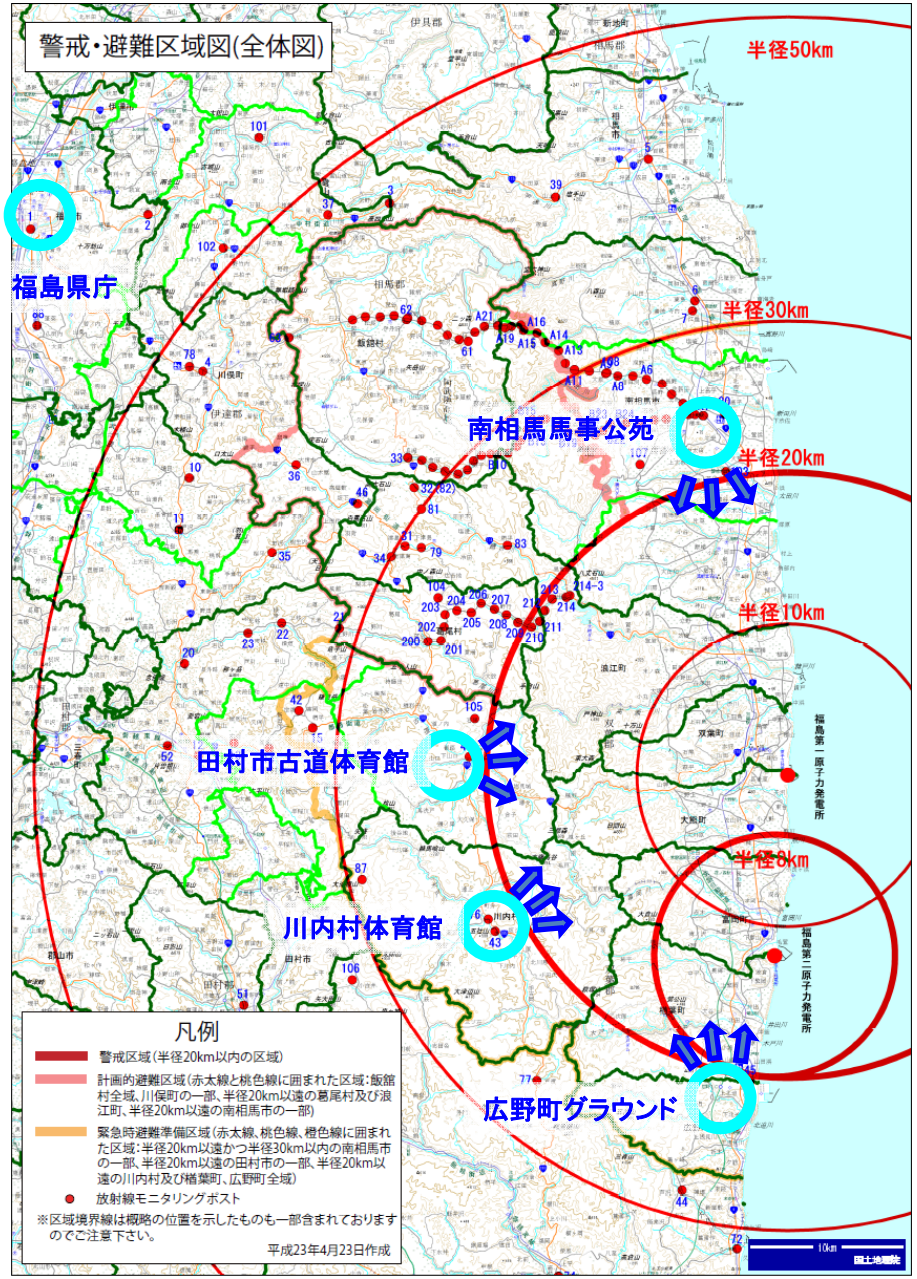
– Residents・・・・・・・・・331 persons

Dose assessment / Decontamination

－ Responders at NPP（JSDF 1, TEPCO 10）

（March 14, 25 / May 30 / June 10, 20, 24, 2011 / others）

Brief visit of home



Residents of nearby towns have been allowed to make a brief visit home in the exclusion zone

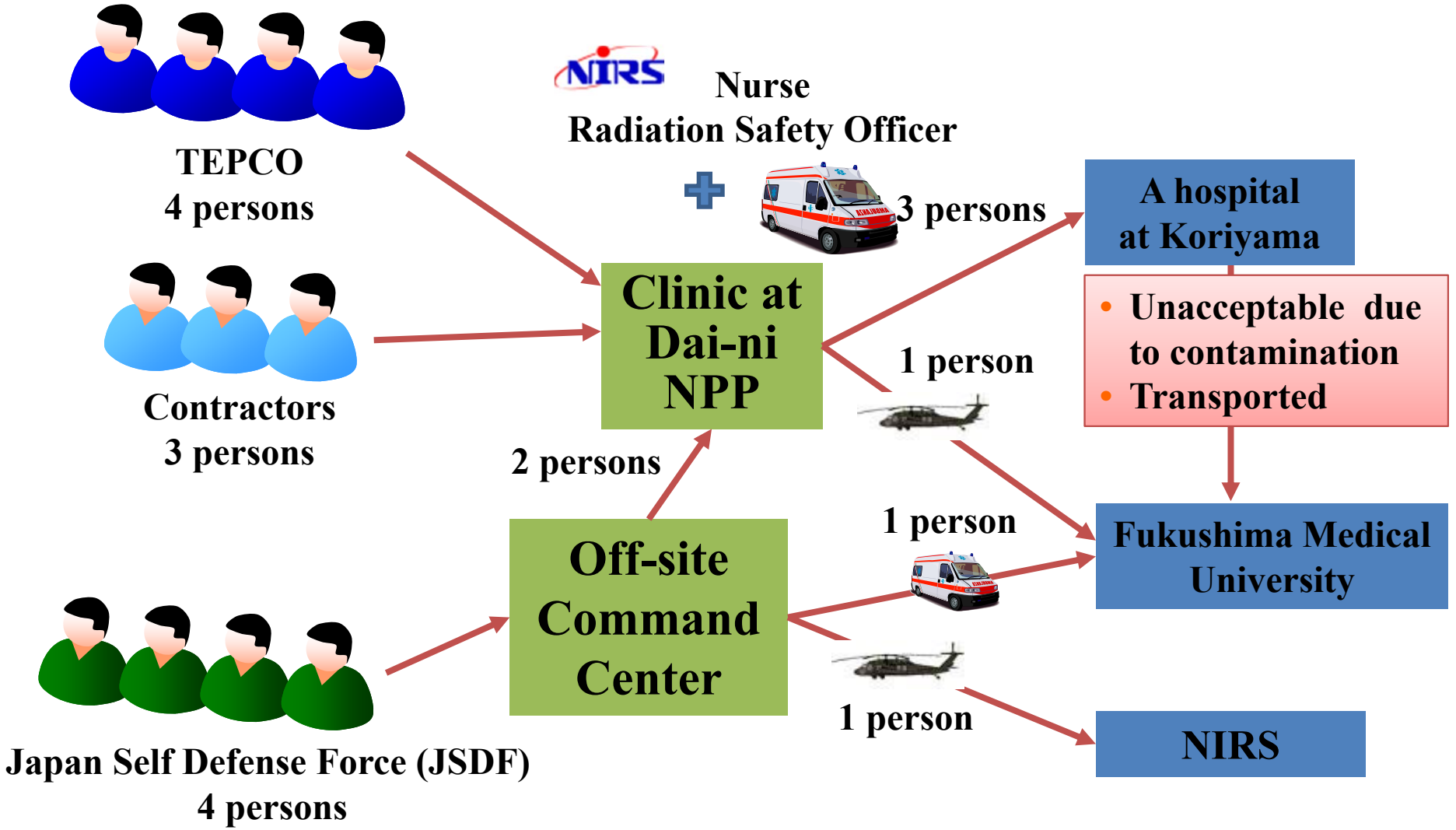
In school gyms, contamination check/medical consultation

Contaminated emergency workers at TEPCO Fukushima Daiichi NPP

Hydrogen explosion at Unit 3
- March 14, 2011 -
(1)

- An explosion occurred at the reactor Unit 3 on March 14, two days after that of Unit 1.
- The explosion injured 11 workers.

Hydrogen explosion at Unit 3
- March 14, 2011 -
(2)



Hydrogen explosion at Unit 3
- March 14, 2011 -
(3)

- **Decontaminated at a local hospital in Fukushima**
- **Transferred to National Institute of Radiological Sciences (NIRS) in Chiba**
- **Levels of contamination: < 100, 000 cpm on the whole body surface**

  Wound : 2,500 cpm

  Abdominal part: 31,000 cpm

- **^{131}I, ^{132} Te, & ^{132}I detected from the nasal swab**

Other workers contaminated with radionuclides - March 24, 2011 - (1)

- Accidentally stepped in the water contaminated with radionuclides (2 workers)
- Ignored alarm of personal dosimeter (set at 20 mSv)
- No iodine tablets
- Brought to Fukushima Med. Univ. Hospital and then NIRS

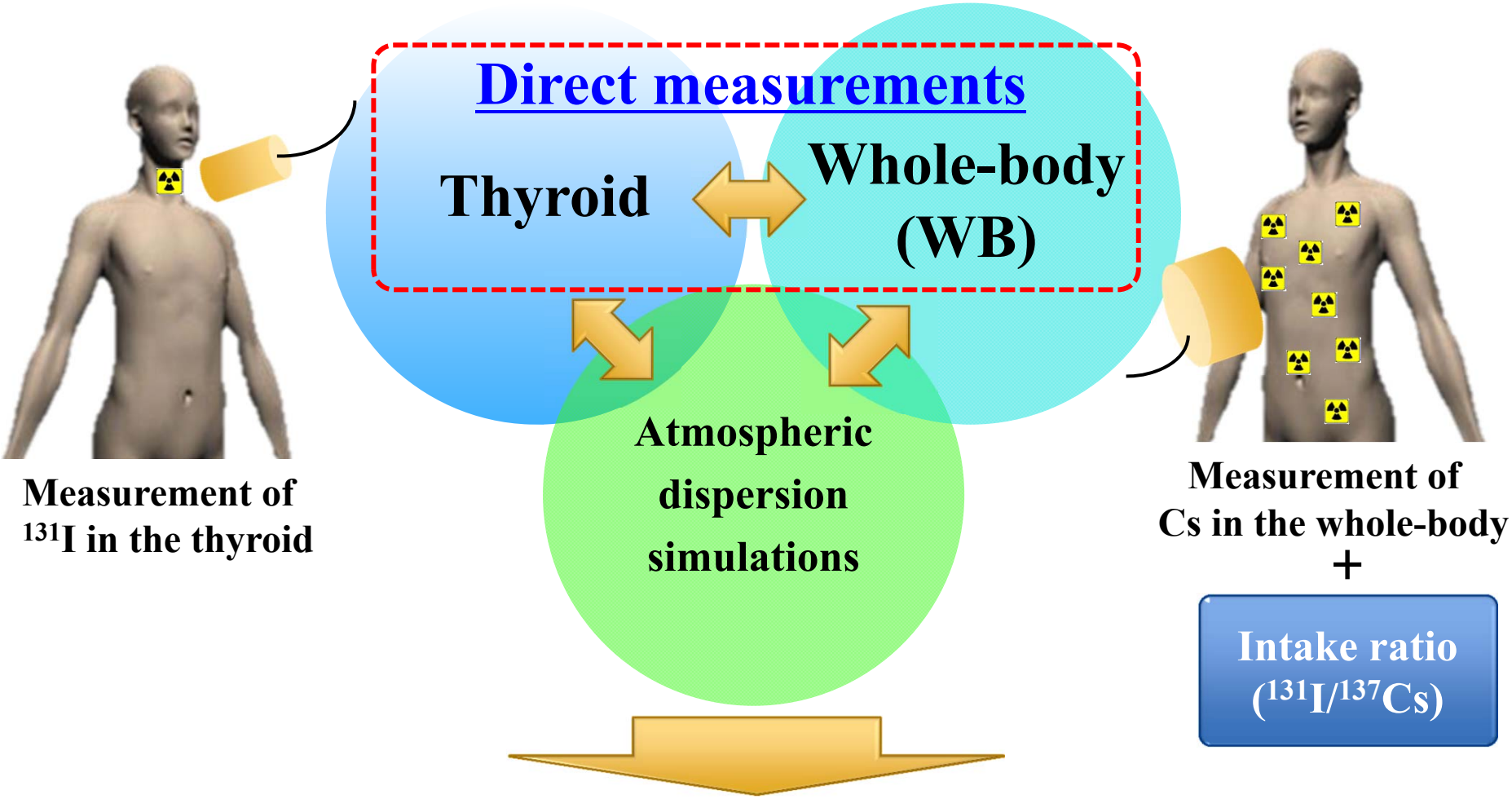
Other workers contaminated with radionuclides - March 24, 2011 - (2)

No β burn

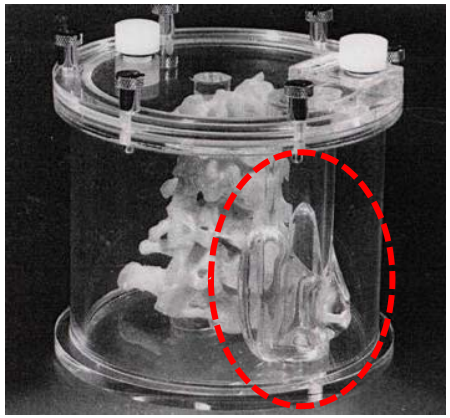
- **The lower part of leg was heavily contaminated**
- **The proximal part was contaminated due to wet underwear**
- **The sole was most heavily contaminated exceeding 100,000 cpm with the GM counter**

Dose assessment of thyroid gland for the public

Estimation of thyroid dose

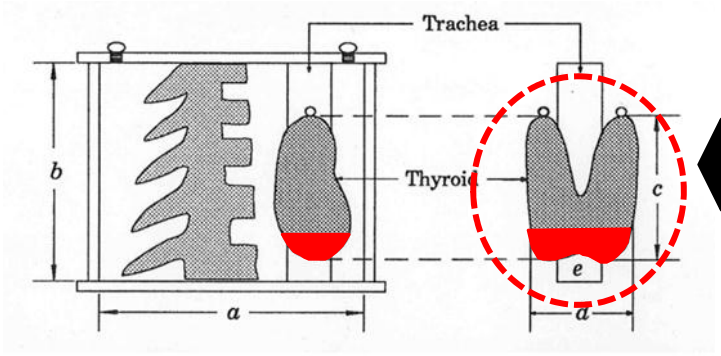


Measurement of ^{131}I in the thyroid



Neck phantom

Calibration



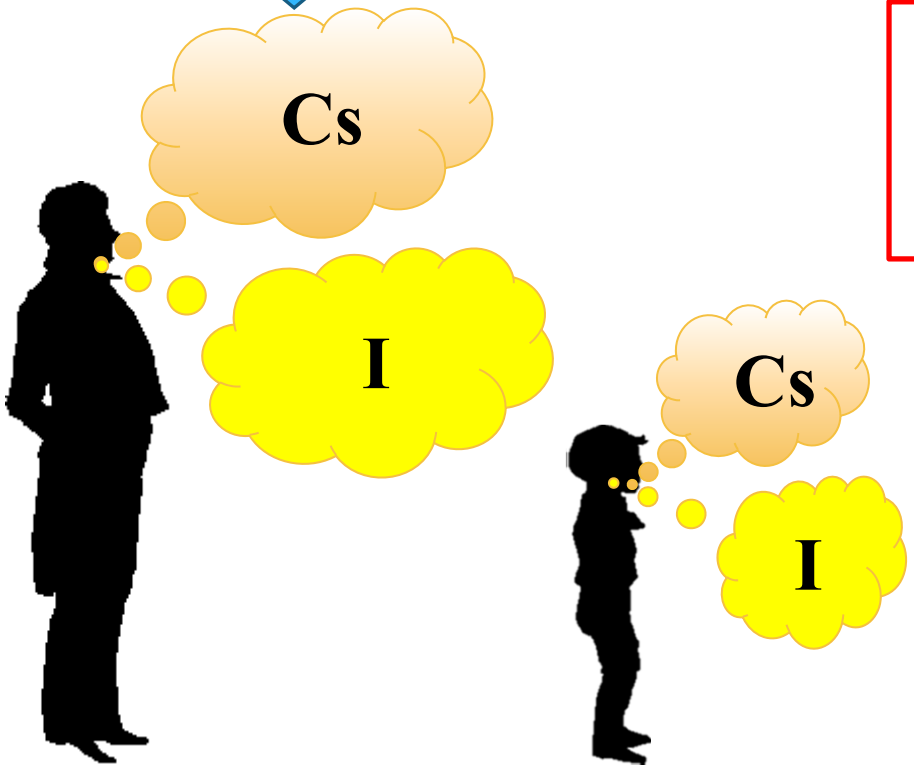
20 mL
(Volume)
^{133}Ba solution

a:100 mm, b:100 mm, c: 55 mm, d:45 mm, e:20 mm

1-year-old: thyroid 2.5 g → loading 2.5 mL
5-year-old: thyroid 6.1 g → loading 6.1 mL

Estimation of thyroid dose from “ Cs”

Committed effective dose (mSv) from Cs by WBC



Calculation of intake ratio of $^{131}I/^{137}Cs$

Thyroid

22.2 m^3/day
(adults)

8.72 m^3/day
(5-yo children)

Respiratory volume per day (ICRP model)

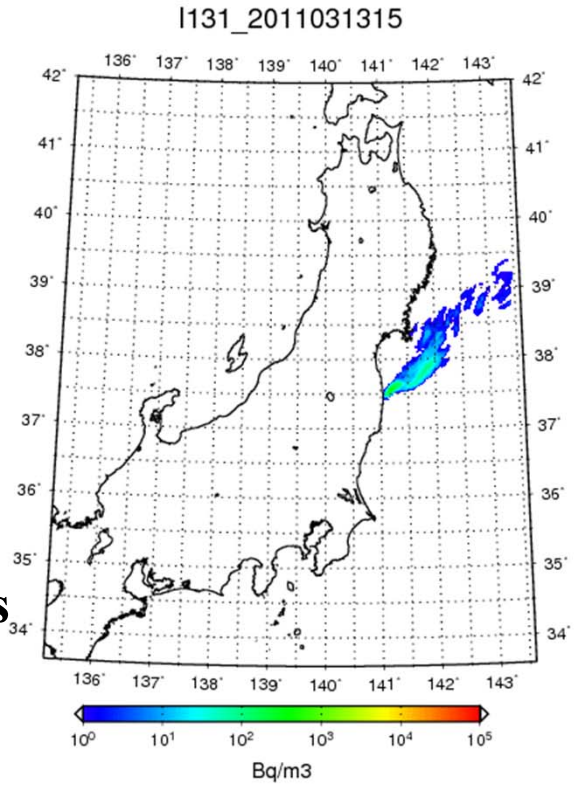
Atmospheric dispersion simulation

- **WSPEEDI: Worldwide version of the SPEEDI* system**

  *** SPEEDI: System for Prediction of the Environmental Emergency Dose Information**

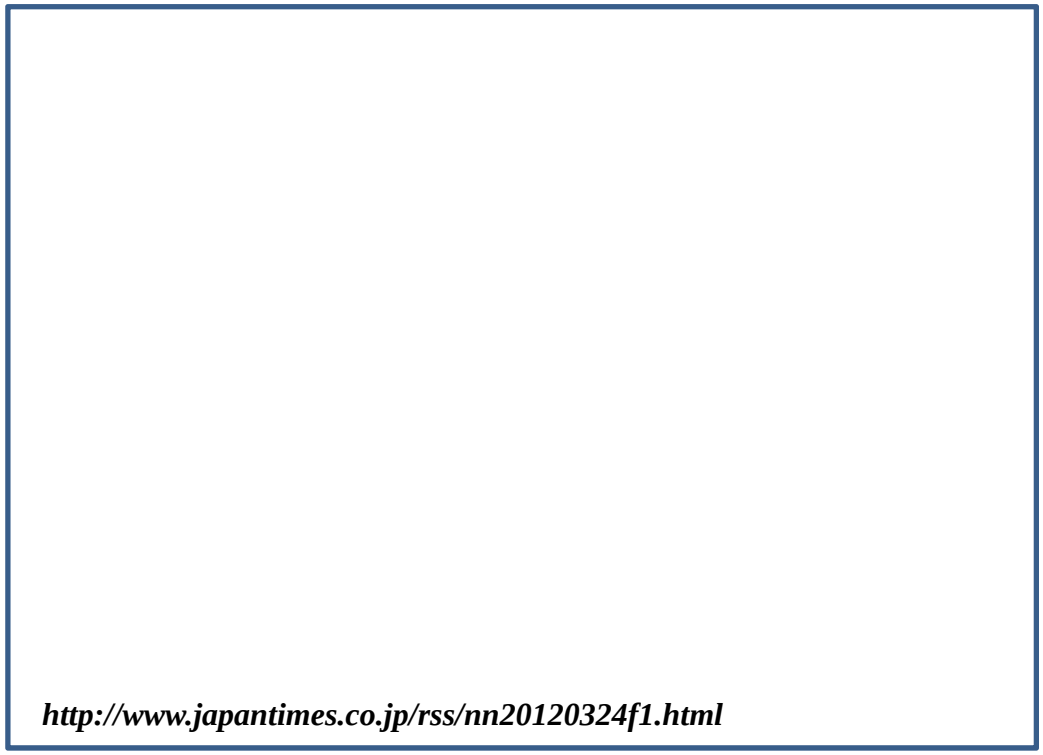
- **Air concentration map**
  - **Map data available: March 12 to April 30**
  - **Time interval: 1h**
  - **Spatial resolution: ~3 km mesh**

- **Calculation of thyroid dose**
  - **Dose coefficients: 60% vapor & 40% aerosols**
  - **Respiratory volume per day: 22.2 m^3 (adults)**



Lessons learned

- **Opportunity for obtaining basic knowledge of radiation is important in school**



http://www.japantimes.co.jp/rss/nn20120324f1.html

Fourth-graders discuss the health effects of radiation exposure at Akagi Elementary School in Koriyama, Fukushima Prefecture, on Feb. 21, 2012.

Conclusion

- **Roles of NIRS as core center for radiation emergency medicine**
  - **Dose assessment (workers, public)**
  - **Diagnosis & Treatment**
  - **Radiation protection (medical professionals, emergency workers)**
  - **Public information**
- **Basic education on radiation is essential for public and responders**

Thank you for your attention.