RADIATION PROTECTION IN JAPAN

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Taipei VGH 2017.4.15

Topics

- About us
- System of Radiation Safety Regulation
- After the Fukushima
- Emergency responses / radiation education

ABOUT US

The Atomic Bomb Disease Institute

- Established in 1962

- 4 units and 1 center
  - *Radiation Risk Control Unit*
  - *Cellular Function Analysis Unit*
  - *Genomic Function Analysis Unit*
  - *Atomic Bomb Disease and Hibakusha Medicine Unit*
  - *Center for Promotion of Collaborative Research on Radiation and Environmental Health Effects*

⇐ **Radiation Biology and Protection (Radioisotope Research Center)**

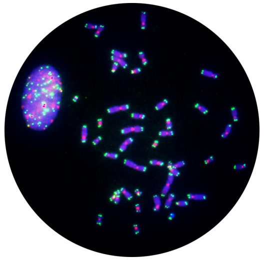
Aim

放射線生物・防護学分野

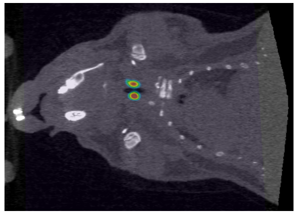
Department of Radiation Biology and Protection

研究目的

The goal of our research is to determine the radiation effect on human body, to develop methodology for radiation protection, and thereby, to establish effective radiation risk control.



放射線生物学を核に



その応用分野として**放射線防護学**を推進し

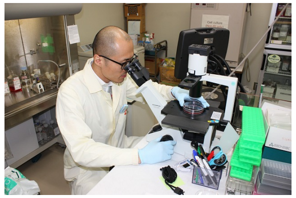
実践的領域として**放射線リスク制御学**の確立を目指す

Specialty

放射線生物・防護学分野

Department of Radiation Biology and Protection

専門性



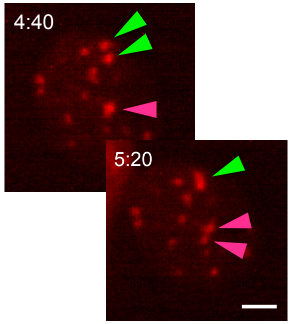
- サイエンス　Science
  - 放射線生物学
    - Radiation Biology
  - 放射線防護学
    - Radiation Protection
  - 分子細胞生物学
    - Molecular Cell Biology
  - 核医学
    - Nuclear Medicine
  - 規制科学
    - Regulatory Science
  - リスクコミュニケーション
    - Risk Communication
- テクノロジー　Technology
  - 放射線照射
    - Irradiation
  - 放射線測定
    - Measurement
  - 核種分析
    - Radionuclide analysis
  - 生物影響解析
    - Biological effect
  - トレーサー利用
    - Tracer use of radioisotopes
  - 分子イメージング
    - Molecular imaging

Mission

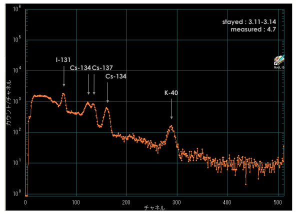
放射線生物・防護学分野

Department of Radiation Biology and Protection

研究課題



- **放射線生物学　Radiation Biology**
  - 放射線によって起こるDNA損傷に対する細胞・分子応答
    - Cellular and molecular responses to DNA damage
  - 放射線によって起こる染色体再構成の生成・生成抑制機構
    - Molecular mechanisms of chromosome rearrangement



- **放射線防護学　Radiation Protection**
  - PET/SPECTによる内部被ばく影響解析
    - Analysis of internal exposure by PET/SPECT
  - 外部、内部被ばく線量評価
    - Dose evaluation of external and internal exposure

- **放射線安全管理学　Radiation Safety Management**
  - 緊急モニタリングプラットフォーム構築
    - Establishment of emergency monitoring platform
  - 放射線教育パッケージの開発
    - Radiation education package

Chinnavilai in Manavalakurichi Town Panchayath, Kanyakumari District, Tamilnadu, India

Chinnavilai in Manavalakurichi Town Panchayath, Kanyakumari District, Tamilnadu, India

Chinnavilai in Manavalakurichi Town Panchayath, Kanyakumari District, Tamilnadu, India

2011/3/15 17:34　福島医大→福島市街移動車中

12.48μSv/h（109.3mSv/y）

2011/3/15 17:59　福島医大→福島市街移動車中

16.38μSv/h（143.5mSv/y）

2011/3/15 18:13　福島自治会館4F

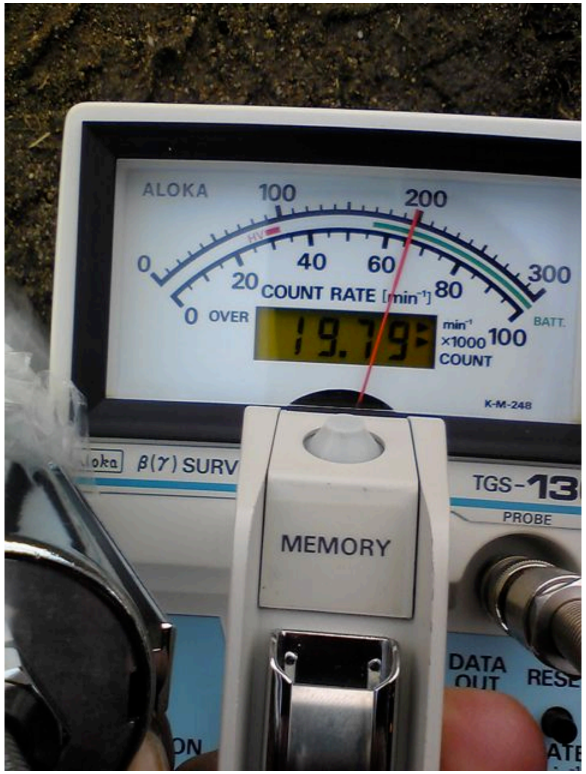
1.58μSv/h（13.8mSv/y）

2011/3/16 15:56　福島医大除染室前

5,470cpm

2011/3/16 15:56　福島医大除染室前

8.34μSv/h （73.1mSv/y）

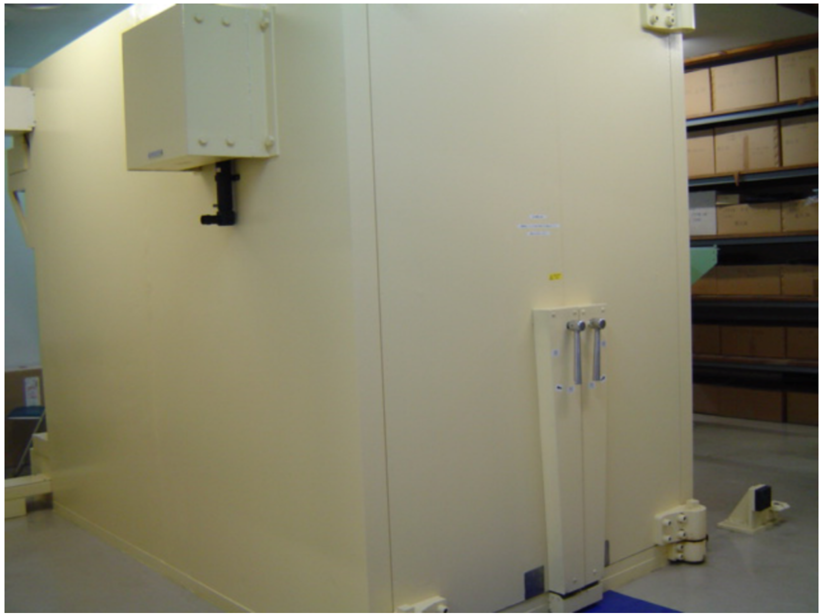


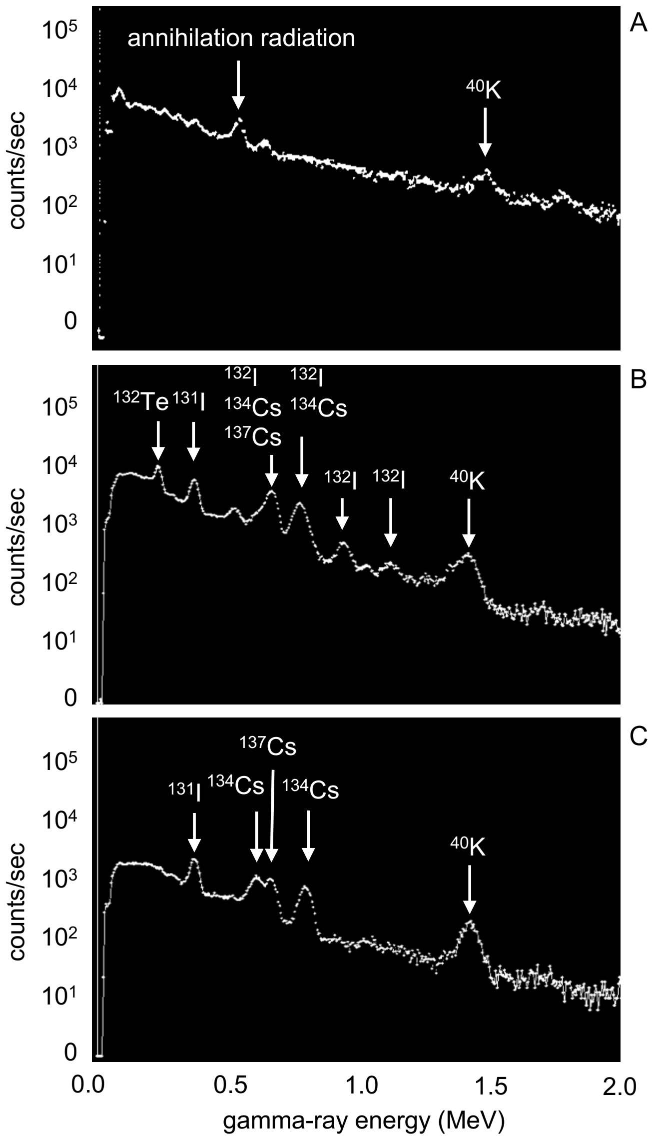
2011/3/16 15:56　福島医大除染室前

19,790cpm

2011/3/16 15:56　福島医大除染室前

43,900cpm




A
annihilation radiation
40K
B
132Te
131I
132I
134Cs
137Cs
132I
134Cs
132I
132I
40K
C
131I
134Cs
137Cs
134Cs
40K
counts/sec
10^5
10^4
10^3
10^2
10^1
0
0.0
0.5
1.0
1.5
2.0
gamma-ray energy (MeV)

Internal radioactivity of evacuees and first respondors

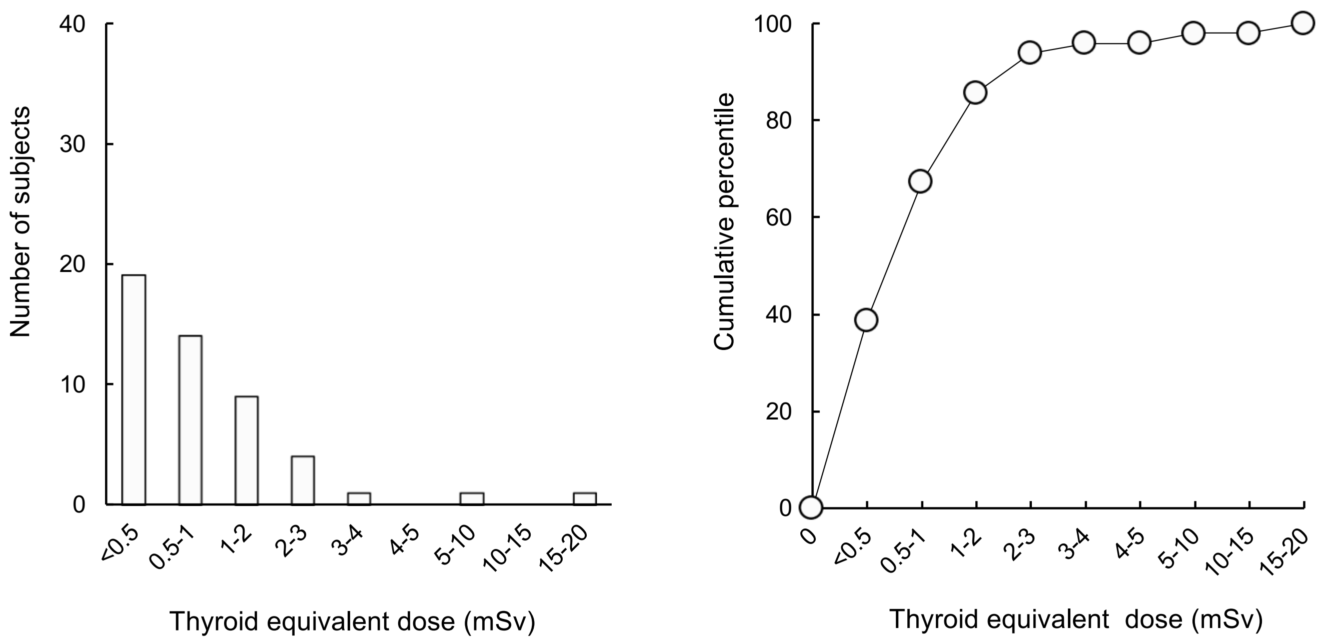
Table 1. Detection rate and internal radioactivity

Group	Period in Fukushima	n	Number of detections			Detection rate (%)			Internal radioactivity (Bq/body)					
									^{131}I		^{134}Cs		^{137}Cs	
			^{131}I	^{134}Cs	^{137}Cs	**^{131}I**	**^{134}Cs**	**^{137}Cs**	Mean	Max.	Mean	Max.	Mean	Max.
1	3/11- 3/18	45	21	24*	22*	46.7	53.3	48.9	574.7	3940.0	494.2	4978.0	666.5	4978.0
2	3/14 - 3/22	66	11	11	10	16.7	16.7	15.2	185.4	605.0	85.5	319.0	89.9	319.0
3	3/18 - 3/31	31	14	12	10	45.2	38.7	32.3	85.9	142.0	63.2	111.0	64.9	111.0
4	3/22 - 4/10	31	9	20	14	29.0	64.5	45.2	140.5	318.0	94.9	544.0	101.9	365.0
	Total	173	55	67	56	**31.8**	**38.7**	**32.4**	419.4		456.8		539.9	

* Slight difference in the numbers of subjects with detected radioactivity is due to the poor resolution between the low-energy ^{134}Cs and ^{137}Cs peaks.

Matsuda et al., Radiat Res, 2013.

Distribution of thyroid eqiuivalent dose by ^{131}I



Morita et al., Radiat Res, 2013.

Detection of internal ^{131}I, ^{134}Cs and ^{137}Cs in persons who were dispatched to Fukushima from April 2011 to March 2012 by WBC examination

Year	Month of dispatch	Number of subjects	Average days of stay (range)	^{131}I		^{134}Cs		^{137}Cs	
				Number of detected	Detection rate (%)	Number of detected	Detection rate (%)	Number of detected	Detection rate (%)
2011	Apr	71	12.4 (1-101)	4	5.6	28	39.4	17	23.9
	May	71	13.0 (3-91)	0	0	5	7.0	5	7.0
	Jun	64	9.8 (2-32)	0	0	4	6.3	0	0
	Jul	42	11.4 (7-33)	0	0	0	0	0	0
	Aug	41	25.2 (5-272)	0	0	8	19.5	3	7.3
	Sep	20	18.7 (14-62)	0	0	1	5.0	0	0
	Oct	6	45.5 (13-154)	0	0	0	0	0	0
	Nov	14	39.9 (13-64)	0	0	1	7.1	1	7.1
	Dec	4	13.0 (13-13)	0	0	0	0	0	0
2012	Jan	21	37.8 (2-89)	0	0	0	0	0	0
	Feb	11	25.7 (12-60)	0	0	0	0	0	0
	Mar	7	15.7 (11-29)	0	0	0	0	0	0
Total		372	22.3 (1-272)	4	1.1	47	12.6	26	7.0

Matsuda et al., Env Occup Sci, 2013

SYSTEM OF RADIATION SAFETY REGULATION

International framework of radiological protection

Atomic Energy Basic Law (1955)

Use atomic energy only for peaceful aim through democratic administration, autonomous accomplishment and results disclosure in the public.

Article 12

- Regulation concerning Nuclear Fuel Materials
- Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (1957)
  - *Enforces the necessary regulations on manufacture, processing, storage, reprocessing and disposal activities of nuclear source materials, fuel materials and nuclear reactors.*

Article 20

- Protective Measures of Radiation Hazards
- Act on Prevention of Radiation hazards due to Radioisotopes, etc. (1957)
  - *Regulates the use, sale, lease, disposal and other handling of radioisotopes, the use of radiation generating equipment, and the disposal and other handling of the articles contaminated by radioisotopes to prevent radiation hazards.*

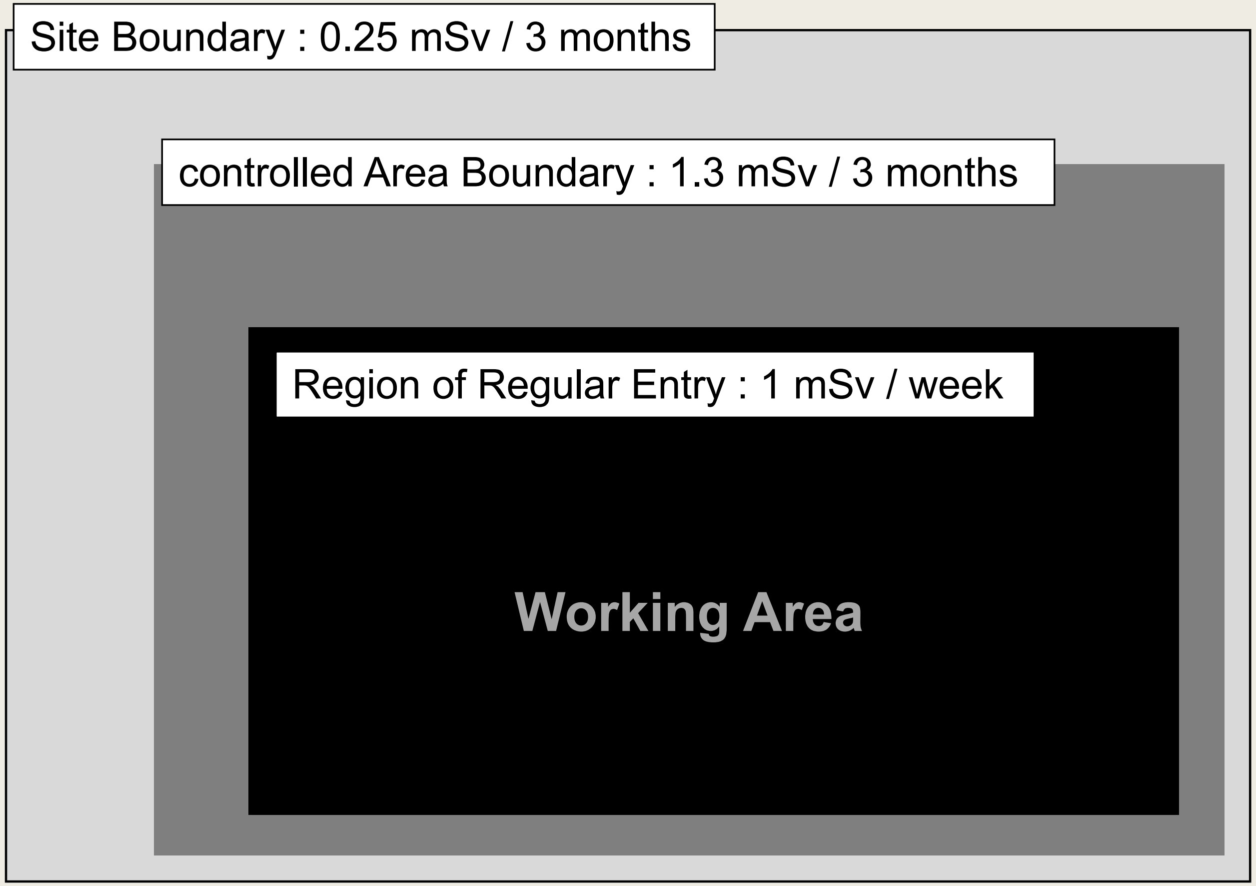
Radiation controlled area

- At any facility handling radiation or radioisotopes, any area where there is a possibility that **the level of radiation or the concentration of radioisotopes might rise above a certain level** is designated a controlled area, and access to that area is restricted.

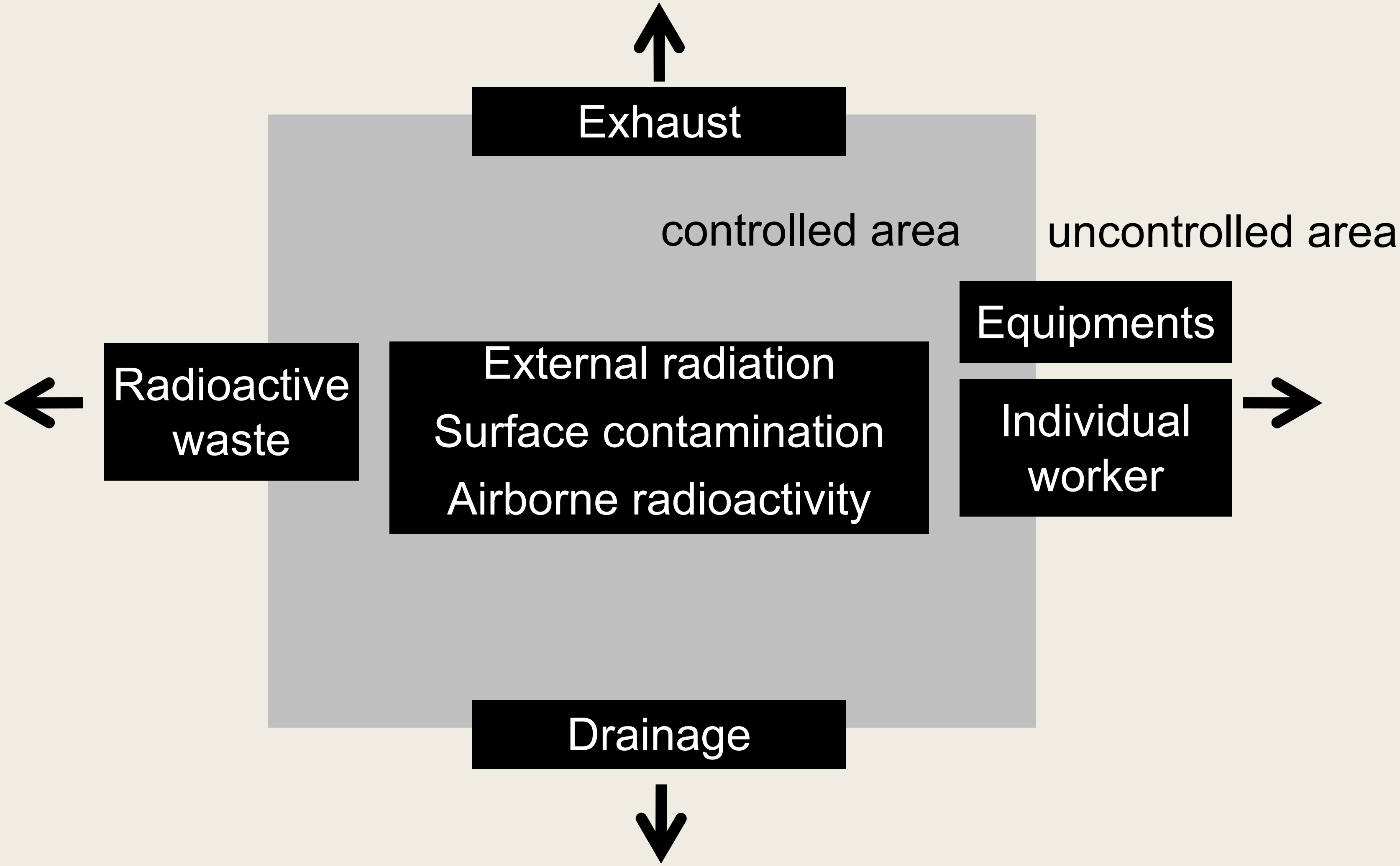
- Standards for radiation levels and radioisotopes concentrations within controlled areas are also prescribed.

- When unsealed radioisotopes are used, they must be used in a “working room”.

Effective dose limit at each site



Radiation safety monitoring



Radiation workers

- Legal definition
  - *workers **who enter the controlled area** for use of radioisotopes and radiation generator*

- Obligations
  - *education and training*
  - *medical examination*
  - ***personal monitoring***

Radiation dose limits for occupational exposure

<table>
<tr><td rowspan="5">Effective dose</td><td rowspan="3">radiation worker</td><td>men</td><td>100 mSv/5years
not exceed 50 mSv in any single year</td></tr>
<tr><td>women</td><td>5 mSv/3month</td></tr>
<tr><td>women in pregnancy</td><td>1mSv for internal exposure until delivery</td></tr>
<tr><td colspan="2">emergency worker</td><td>250 mSv</td></tr>
<tr><td colspan="2">temporal visitor</td><td>100 μSv</td></tr>
<tr><td rowspan="3">Equivalent dose</td><td colspan="2">lens of the eye</td><td>150 mSv/year</td></tr>
<tr><td colspan="2">skin</td><td>500 mSv/year</td></tr>
<tr><td colspan="2">abdomens of pregnant women</td><td>2 mSv until delivery</td></tr>
</table>

Annual effective dose of radiation workers in radiation facilities

under the Low concerning Prevention of Radiation hazards due to Radioisotopes, etc.

(external exposure. April, 2015 - March, 2016)

Occupation	Collective dose (man mSv)	Average dose (mSv)	ND	0.10-1.00	1.01-5.00	5.01-10.00	10.01-20.00	20.01-50.00	over 50.00	Total
Medical	130.596.65	**0.38**	246,524 **(71.75)**	64,786 (18.86)	27,246 (7.93)	3,635 (1.06)	1,157 (0.34)	233 (0.07)	**14 (0.00)**	343,595 (100.00)
Education	1,691.08	**0.03**	64,666 **(96.58)**	1,857 (2.77)	389 (0.58)	34 (0.05)	6 (0.01)	2 (0.00)	**0 (0.00)**	66,953 (100.00)
Non-destructive exam	1,379.86	**0.46**	2,486 **(66.15)**	837 (22.27)	362 (9.63)	60 (1.60)	9 (0.24)	4 (0.11)	**0 (0.00)**	3,758 (100.00)
Industry	4,094.67	**0.06**	63,653 **(94.04)**	2,956 (4.37)	953 (1.41)	101 (0.15)	19 (0.01)	7 (0.01)	**0 (0.00)**	67,689 (100.00)
Total (incl. others)	139,169.55	**0.27**	413,231 **(79.55)**	71,712 (13.81)	29,218 (5.62)	3,844 (0.74)	1,196 (0.23)	259 (0.05)	**14 (0.00)**	519,460 (100.00)

Disclosed by the Council on Personal Dosimetry Services in Japan, 2017

Annual effective dose of radiation workers in nuclear power plants

under the Low for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors

(total exposure. April, 2014 - March, 2015)

age range	Collective dose (man mSv)	Average dose (mSv)	1.00 and under	1.01 - 5.00	5.01 - 10.00	10.01 - 20.00	20.01 - 30.00	30.01 - 40.00	over 40.00	Total
under 30	14,370.4	**1.08**	11,271 **(85.03)**	1,131 (8.53)	385 (2.90)	375 (2.83)	**58 (0.44)**	**35 (0.26)**	0 (0.00)	13,255 (100.00)
30 - 39	22,144.4	**1.33**	13,606 **(81.97)**	1,643 (9.90)	664 (4.00)	525 (3.16)	**101 (0.61)**	**60 (0.36)**	0 (0.00)	16,599 (100.00)
40 - 49	32,856.7	**1.63**	16,012 **(79.26)**	2,191 (10.85)	906 (4.48)	793 (3.93)	**210 (1.04)**	**89 (0.44)**	0 (0.00)	20,201 (100.00)
50 - 59	29,776.7	**1.74**	13,440 **(78.46)**	1,899 (11.09)	789 (4.61)	712 (4.16)	**187 (1.09)**	**102 (0.60)**	0 (0.00)	17,129 (100.00)
60 and over	13,375.9	**1.79**	5,852 **(78.45)**	860 (11.53)	308 (4.13)	282 (3.78)	**84 (1.13)**	**74 (0.99)**	0 (0.00)	7,460 (100.00)
total	112,494.0	**1.64**	60,181 **(80.62)**	7,724 (10.35)	3,052 (4.09)	2,687 (3.60)	640 (0.86)	360 (0.48)	0	74,644

Disclosed by Radiation Effects Association, 2017

Effective dose in emergency work

(Total exposure. April, 2010 - March, 2015)

age range	Collective dose (man mSv)	Average dose (mSv)	1.00 and under	1.01 - 10.00	10.01 - 50.00	50.01 - 100.00	100.01 - 150.00	150.01 - 250.00	over 250	Total
under 30	20,676.3	18.7	170 (15.4)	429 (38.9)	375 (34.0)	116 (10.5)	8 (0.7)	3 (0.3)	2 (0.2)	1,103 (100.00)
30 - 39	46,770.0	14.8	621 (19.7)	1,241 (39.3)	1,068 (33.9)	193 (6.1)	26 (0.8)	4 (0.1)	1 (0.0)	3,154 (100.00)
40 - 49	70,653.9	12.5	1,321 (23.5)	2,354 (41.8)	1,671 (29.7)	236 (4.2)	39 (0.7)	8 (0.1)	2 (0.0)	5,631 (100.00)
50 - 59	71,912.7	13.1	1,440 (26.2)	2.094 (38.1)	1,658 (30.2)	238 (4.3)	52 (0.9)	14 (0.3)	1 (0.0)	5,497 (100.00)
60 and over	38,390.4	9.8	1,188 (30.5)	1,551 (39.8)	1,065 (27.3)	81 (2.1)	12 (0.3)	2 (0.1)	0 (0.0)	3,899 (100.00)
total	247,403.2	12.8	4,740 (24.6)	7,669 (39.8)	5,837 (30.3)	864 (4.5)	137 (0.7)	31 (0.2)	6 (0.0)	19,284

Disclosed by Radiation Effects Association, 2017

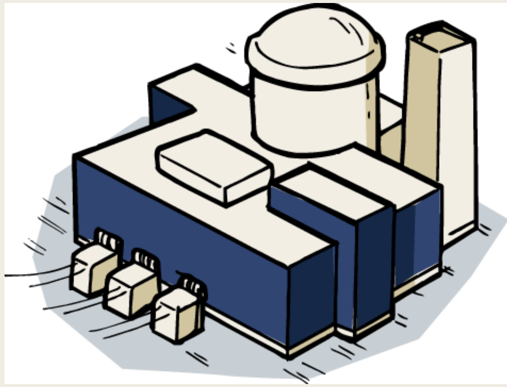
Effective dose in emergency work

age range	Apr 2010 – Mar 2011	Apr 2011 – Mar 2012	Apr 2012 – Mar 2013	Apr 2013 – Mar 2014	Apr 2014 – Mar 2015	Apr 2015 – Mar 2016
under 50	3,569 (89.90)	17,384 (99.00)	651 (99.85)	795 (100.00)	758 (100.0)	673 (100.0)
50 - 100	294 (7.41)	166 (0.95)	1 (0.15)	0 (0.00)	0 (0.00)	0 (0.00)
101 - 250	101 (2.50)	**1 (0.01)**	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Over 250	6 **(0.16)**	0 **(0.00)**	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
total	3,970 (100.00)	17,551 (100.00)	652 (100.00)	795 (100.00)	758 (100.0)	673 (100.0)

Disclosed by Radiation Effects Association, 2017

AFTER THE FUKUSHIMA

Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors



Nuclear Power Plant

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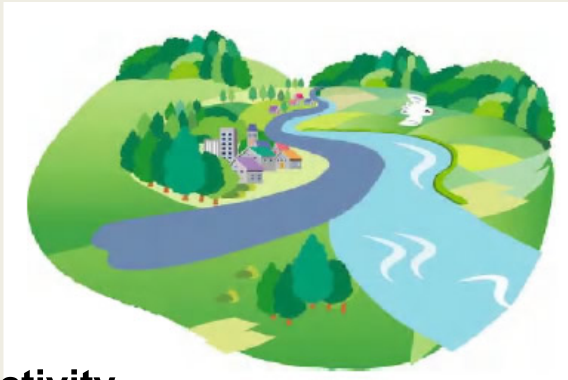
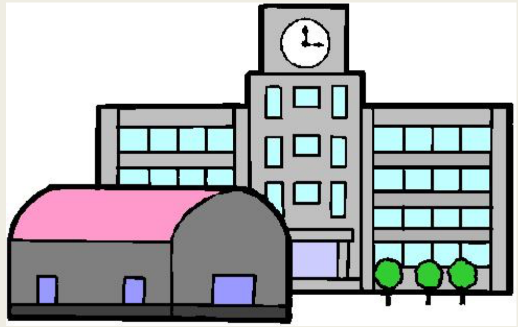
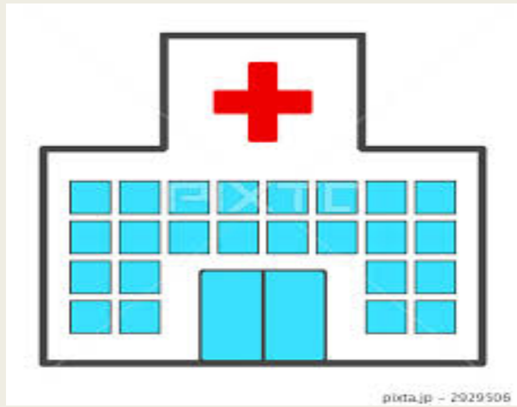


Radioactivity
I-131
Cs-134
Cs-137….

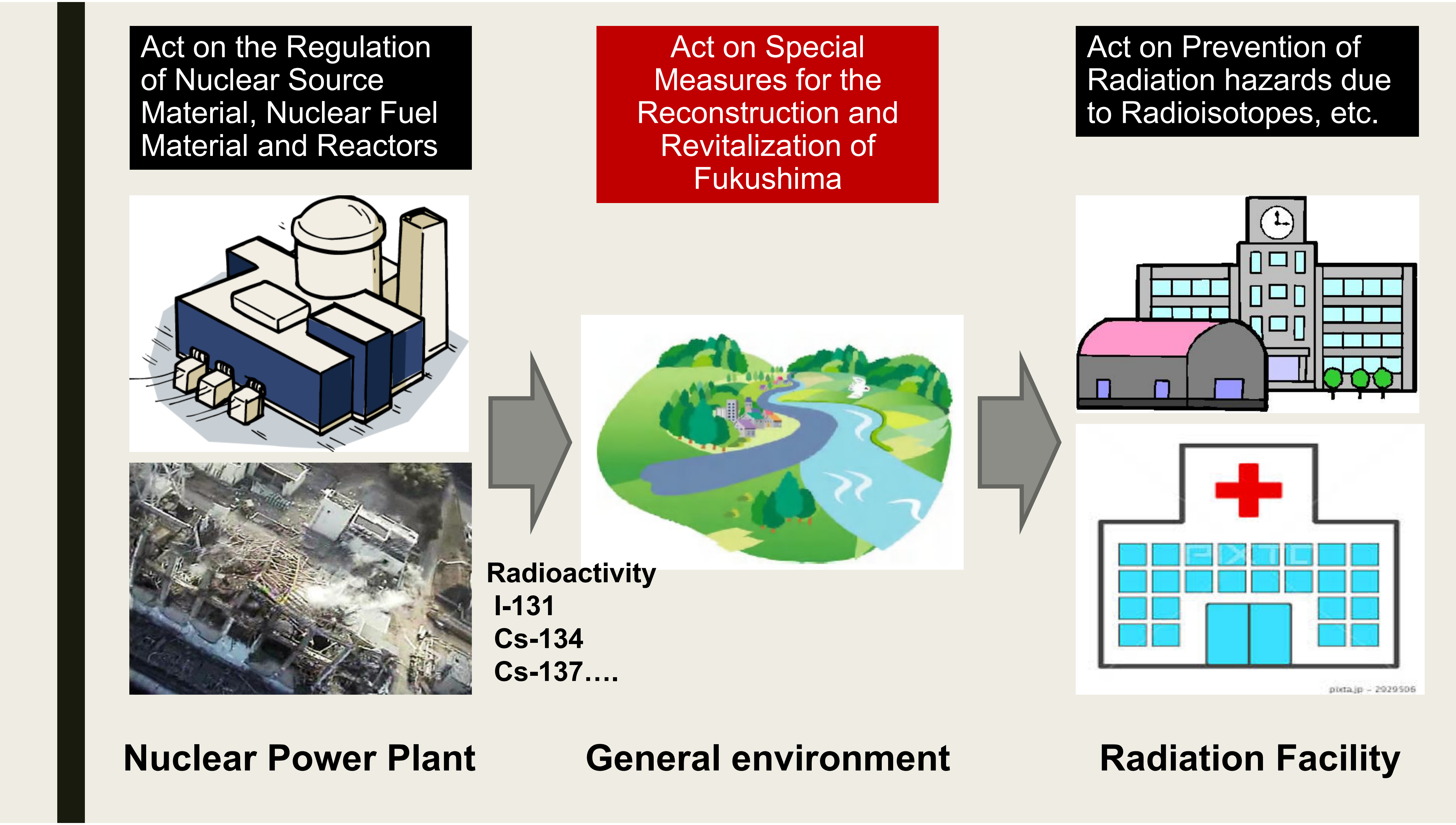
General environment

Act on Prevention of Radiation hazards due to Radioisotopes, etc.





Radiation Facility


Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors
Act on Special Measures for the Reconstruction and Revitalization of Fukushima
Act on Prevention of Radiation hazards due to Radioisotopes, etc.
Radioactivity
I-131
Cs-134
Cs-137….
Nuclear Power Plant
General environment
Radiation Facility

Effective dose of decontamination workers (Oct 2015 - Sep 2016)

Period / Dose(mSv)	October–December 2015	January–March 2016	April–June 2016	July–September 2016
Dose ≤1	29,046	23,339	24,142	24,250
1<Dose ≤2	166	83	43	135
2<Dose ≤3	5	2	11	6
3<Dose ≤4	0	0	0	0
4<Dose ≤5	0	0	0	0
5<Dose ≤7.5	0	0	0	0
7.5<Dose ≤10	0	0	0	0
10<Dose ≤15	0	0	0	0
15<Dose ≤20	0	0	0	0
20 <Dose	0	0	0	0
Total number of workers	29,217	23,424	24,196	24,391
Mean dose (mSv)	0.2	0.2	0.2	0.2
Max dose (mSv)	2.9	2.1	2.5	2.5
Number of projects	104	95	79	89

Disclosed by Radiation Effects Association, 2017

Effective dose of decontamination workers

(Total exposure. April, 2015 - March, 2016)

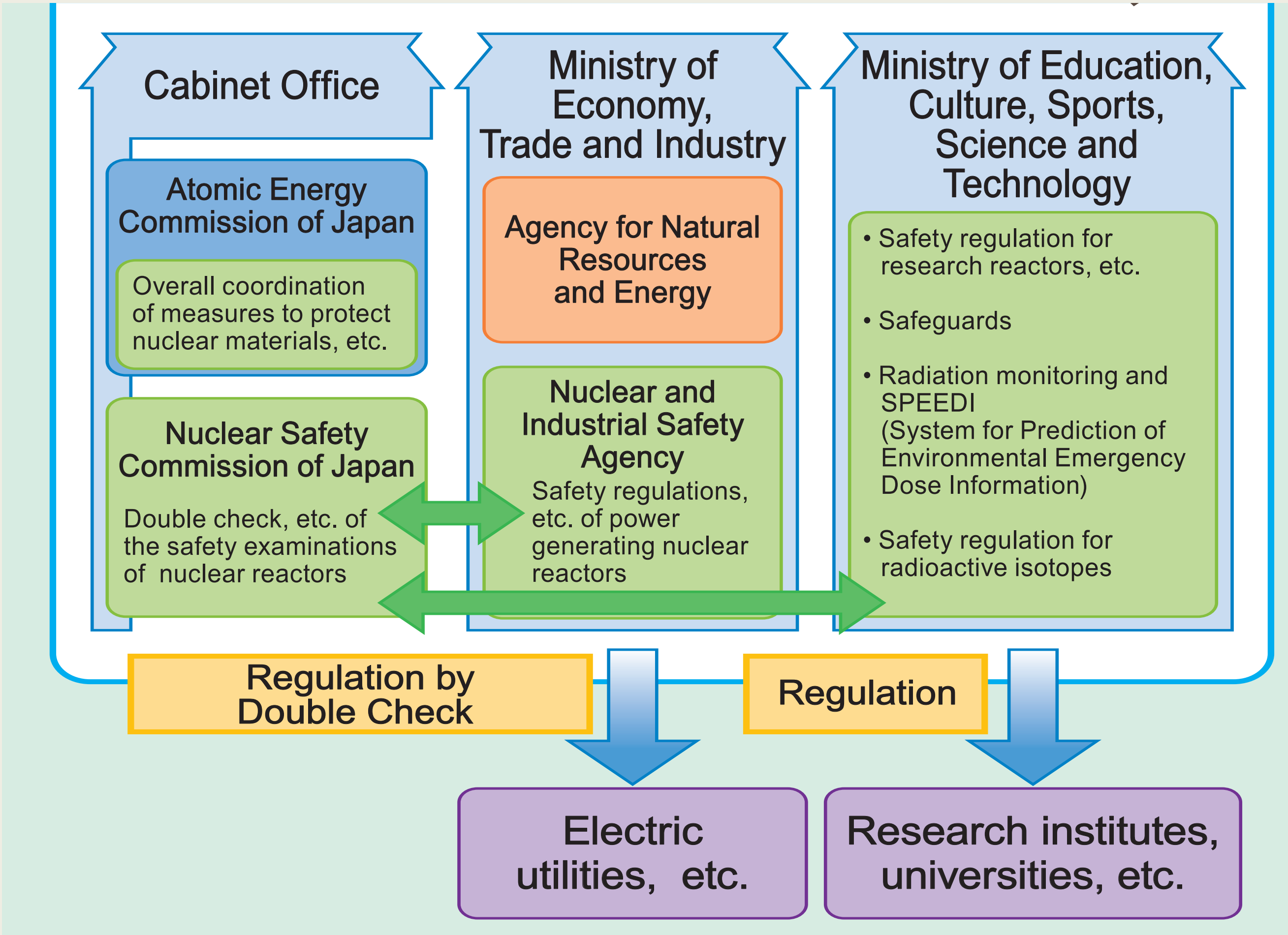
Dose range (mSv)	Iidate Kawamata Minamisoma Namie	Katsurao Tamura Futaba Okuma	Kawauchi Tomioka Naraha	Others	Total
Under 1.0	27,743	5,094	9,275	439	42,551
1.1 - 2.0	3,918	567	2,097	0	6,582
2.1 - 3.0	153	159	255	0	567
3.1 - 4.0	3	49	4	0	56
4.1 - 5.0	0	17	0	0	17
5.0 - 7.5	0	20	0	0	20
7.6 - 10.0	0	1	0	0	1
Over 10.0	0	0	0	0	0
Total number	31,817	5,907	11,631	439	49,794
Average dose	0.5	0.4	0.6	0.1	0.5

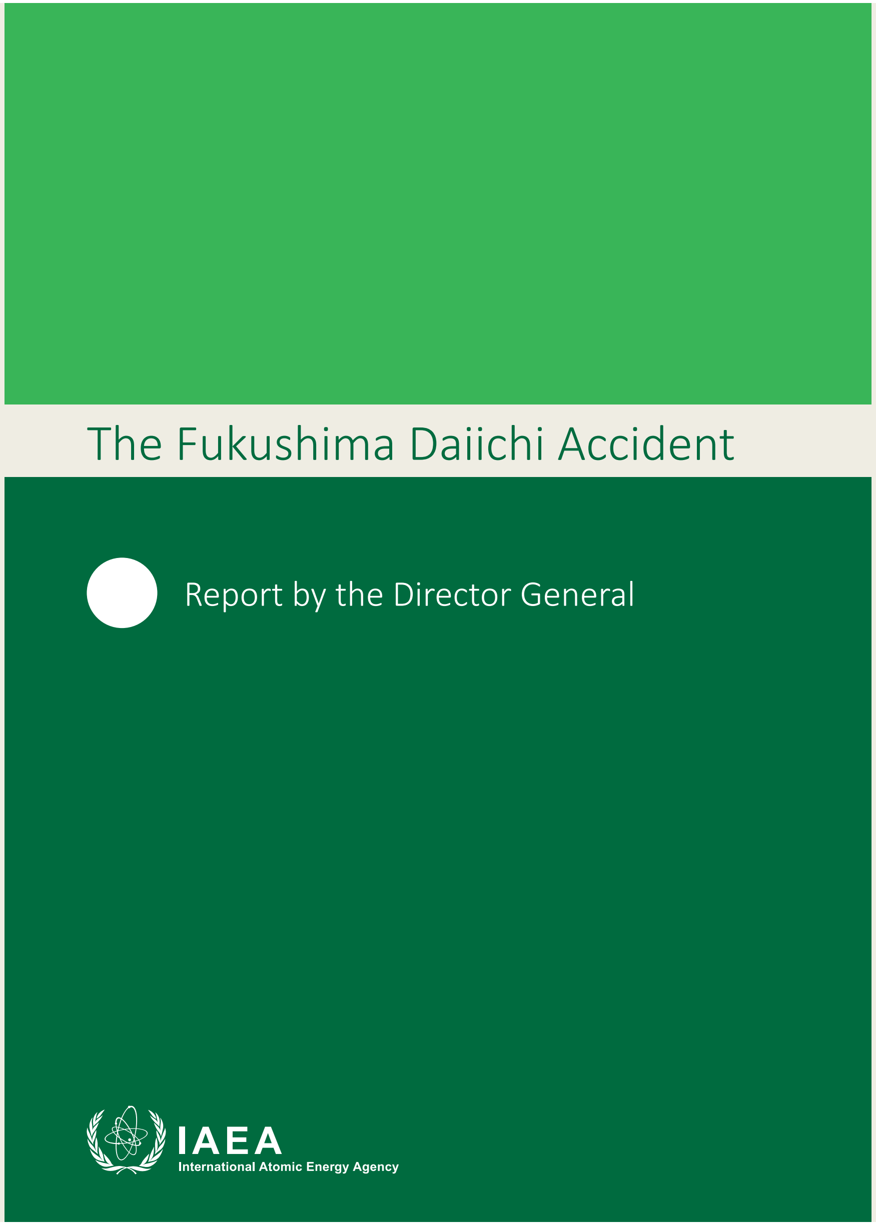
Disclosed by Radiation Effects Association, 2017

Mixture of promotion and regulation

Promotion of NPP

Regulation of radiation

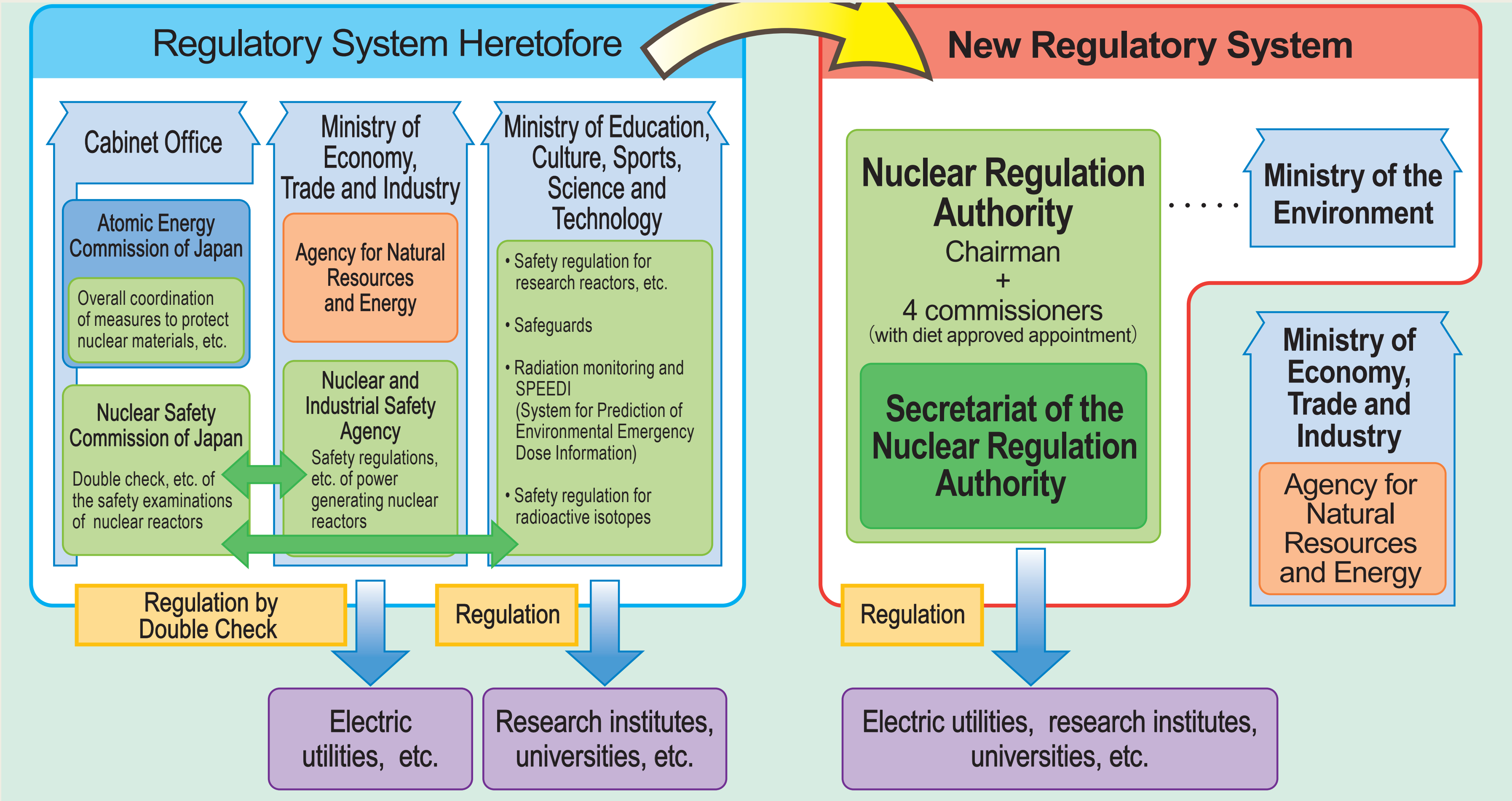


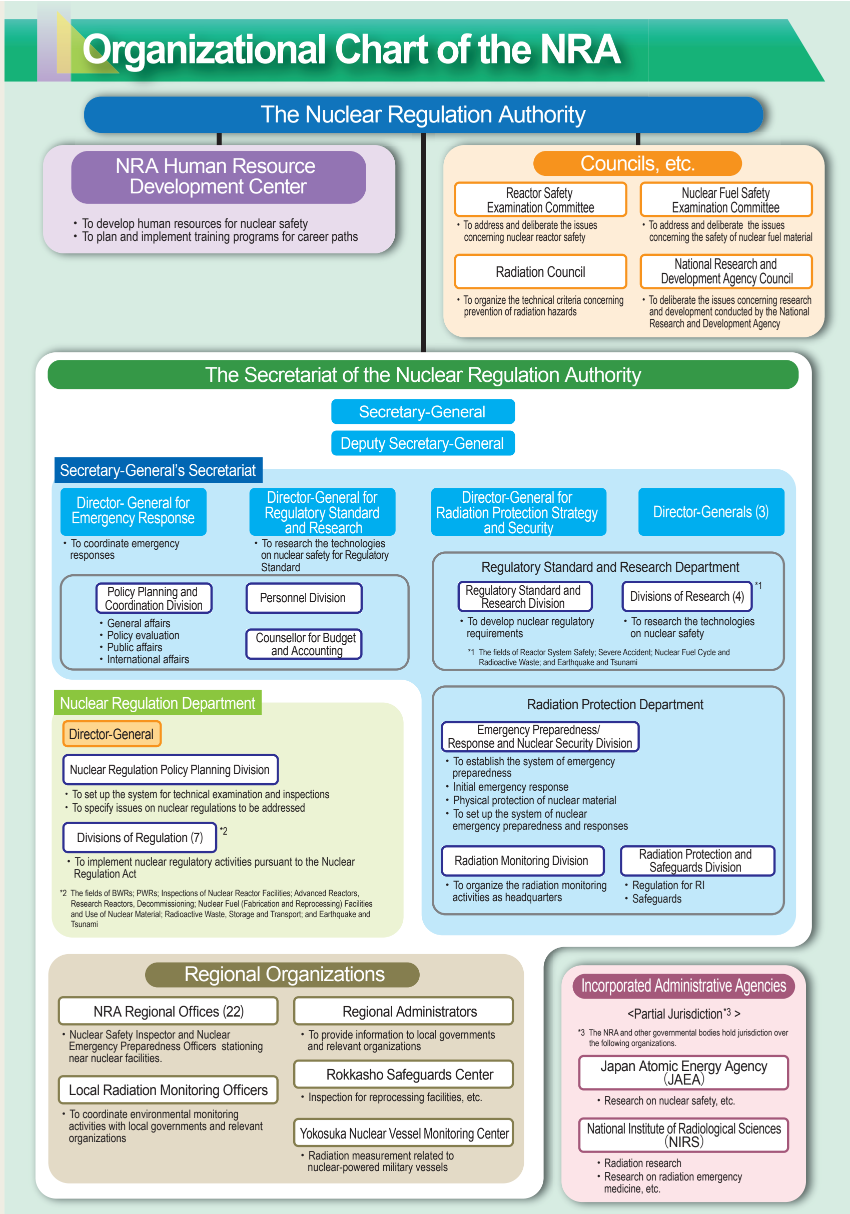


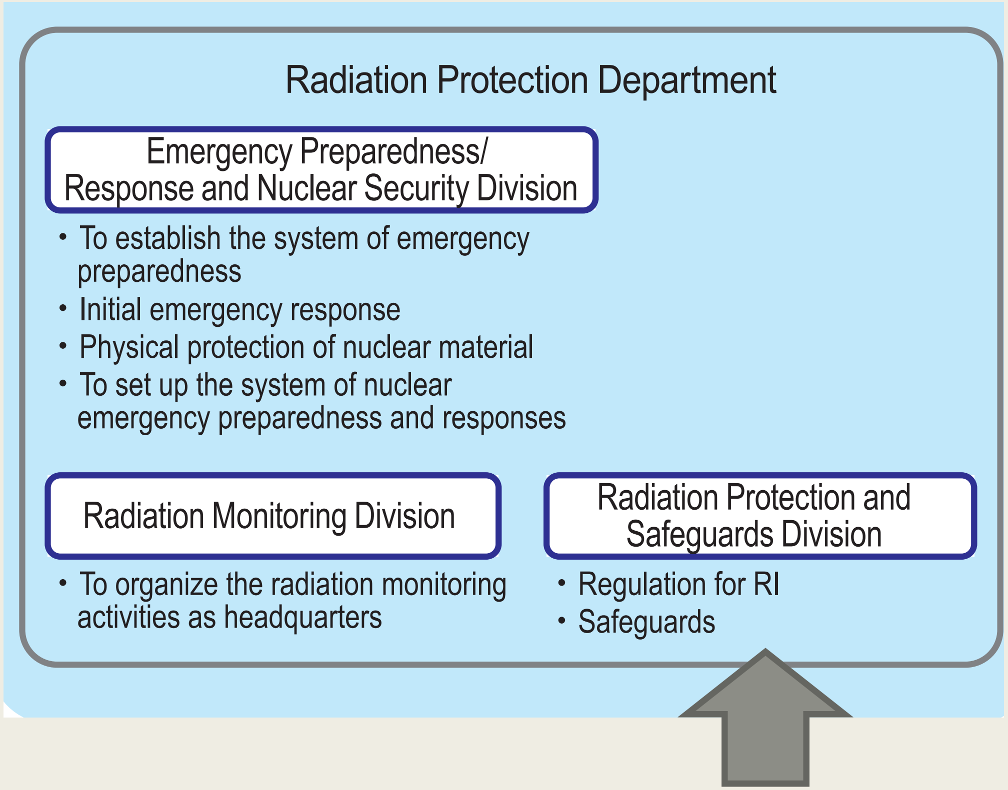
The regulation of nuclear safety in Japan at the time of the accident was performed by a number of organizations with different roles and responsibilities and complex inter-relationships.

It was not fully clear which organizations had the responsibility and authority to issue binding instructions on how to respond to safety issues without delay. (IAEA, 2015)

Separation of promotion and regulation







Regulations of radioisotopes and nuclear fuel materials

IAEA-NSNI-IRRS-2007/01
20 December 2007
ORIGINAL: English

IAEA

INTEGRATED REGULATORY REVIEW SERVICE (IRRS)

TO

JAPAN

Tokyo, Japan

25 to 30 June 2007

DIVISION OF NUCLEAR INSTALLATION SAFETY
DEPARTMENT OF NUCLEAR SAFETY AND SECURITY

IAEA IRRS 2007

i

COMMENTS

There are no legal regulations for the consideration of beyond the design basis, as Japanese plants are considered to be adequately safe as ensured by preventive measures.

SUGGESTIONS

NISA (former Nuclear and Industrial Safety Agency) should continue to develop the systematic approach to investigate the consideration beyond design basis accidents, and the complementary use of probabilistic safety management (PSA) and severe accident management in the assessment process for risk reduction purposes.

The Fukushima Daiichi Accident

Report by the Director General

IAEA
International Atomic Energy Agency

Prior to the accident, there was not sufficient consideration of low probability, high consequence external events which remained undetected.

This was in part because of the basic assumption in Japan, reinforced over many decades, that the robustness of the technical design of the nuclear plants would provide sufficient protection against postulated risks.

In some cases, regulations were not updated or complex emergency drills were not carried out because of a concern that the public might get the impression that NPPs were not safe, in contrast to the basic assumption.

The Fukushima Daiichi Accident

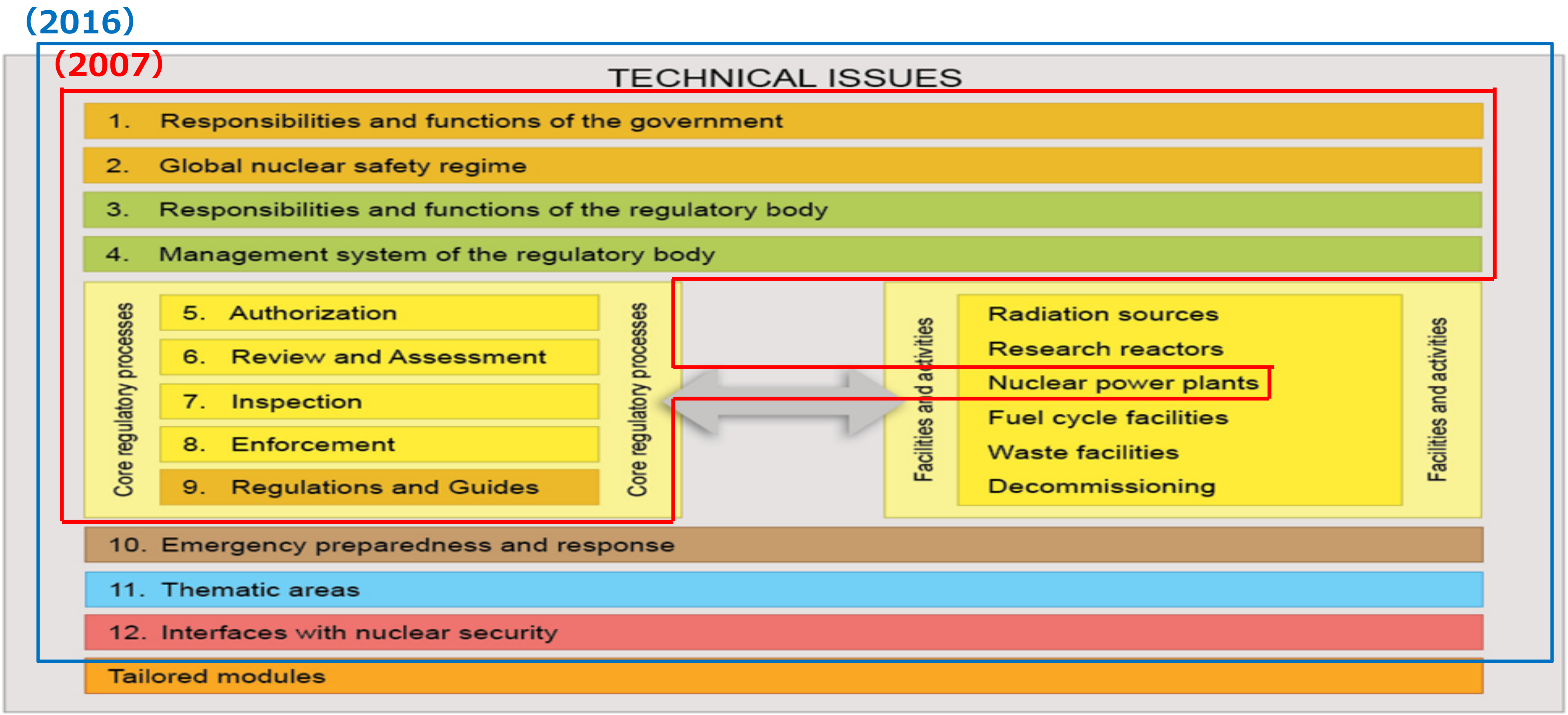
Report by the Director General

IAEA
International Atomic Energy Agency

In order to ensure effective regulatory oversight of the safety of nuclear installations, it is essential that the regulatory body is independent and possesses legal authority, technical competence and a strong safety culture.

In order to promote and strengthen safety culture, individuals and organizations need to continuously challenge or re-examine the prevailing assumptions about nuclear safety and the implications of decisions and actions that could affect nuclear safety.

IRRS in 2016


(2016)
(2007)
TECHNICAL ISSUES
1. Responsibilities and functions of the government
2. Global nuclear safety regime
3. Responsibilities and functions of the regulatory body
4. Management system of the regulatory body
Core regulatory processes
5. Authorization
6. Review and Assessment
7. Inspection
8. Enforcement
9. Regulations and Guides
Core regulatory processes
Facilities and activities
Radiation sources
Research reactors
Nuclear power plants
Fuel cycle facilities
Waste facilities
Decommissioning
Facilities and activities
10. Emergency preparedness and response
11. Thematic areas
12. Interfaces with nuclear security
Tailored modules

IAEA-NS-IRRS-2016
ORIGINAL: English

INTEGRATED REGULATORY REVIEW SERVICE (IRRS) MISSION TO JAPAN

Tokyo, Japan
10-22 January 2016

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY

Integrated Regulatory Review Service
IRRS

IAEA IRRS 2016

2	Good Practices
13	Suggestions
13	Recommendations

NRA and other authorities having jurisdiction for radiation sources should develop a single set of requirements and guidance for emergency preparedness response in relation to radiation sources including requirements related to emergency plans, arrangements for timely notification and response, and quality assurance program using graded approach.

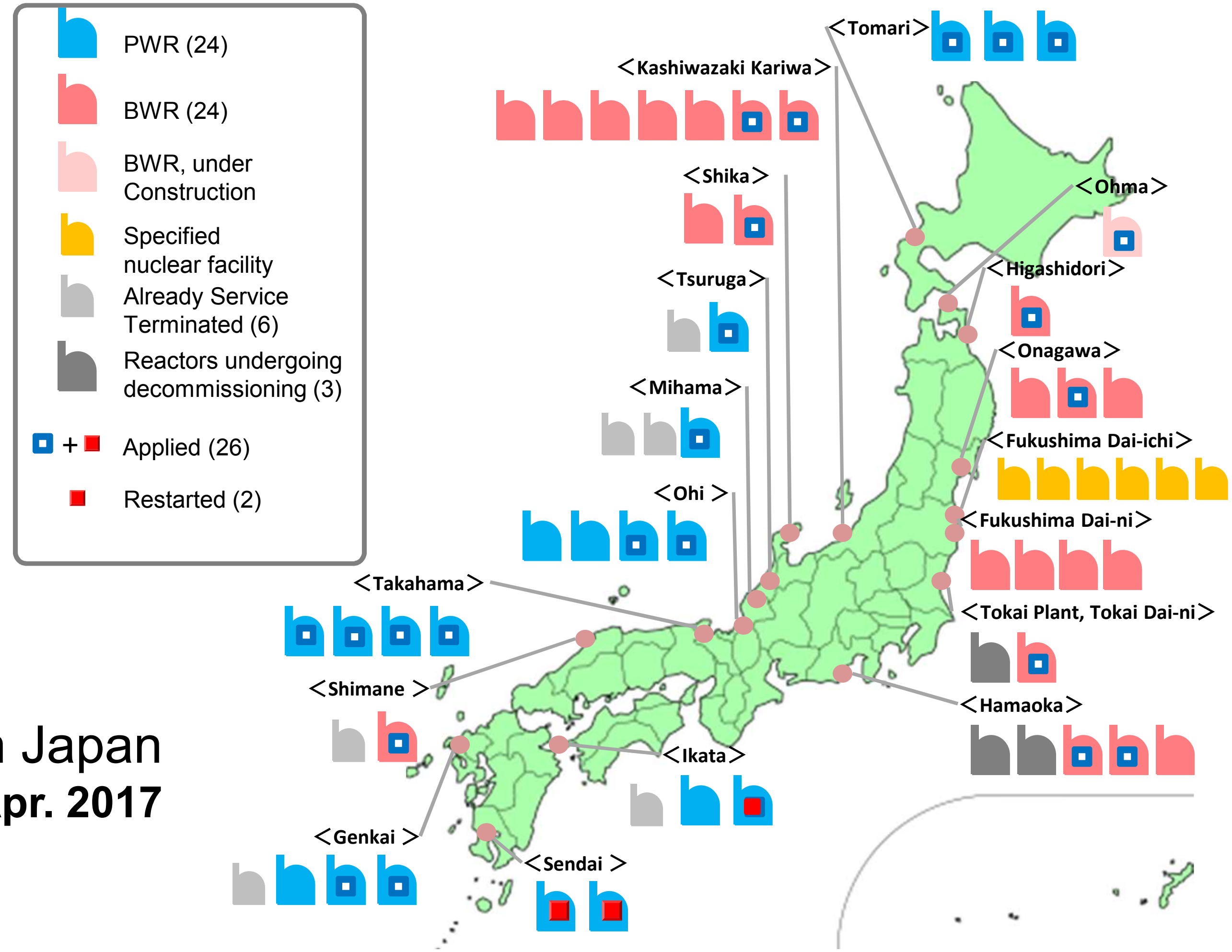
NRA should consider expediting improvements in the arrangements to asses oversee and enforce nuclear safety and security in an integrated manner

Amendment of regulations

Act on Prevention of Radiation hazards due to Radioisotopes, etc.

- Based on recommendations from IAEA Integrated Regulatory Review Service, 2017
- NRA study team on regulation of radioisotopes（Jun 2016-Mar 2017)
- Cleared by the Diet on April 7, 2017
- Major points
  - Safety
    - IAEA GS-G-2.1
    - 1Gy/h
  - Security
    - IAEA D-value
  - Quality assurance and safety culture

EMERGENCY RESPONSES / RADIATION EDUCATION



Nuclear power plants in Japan

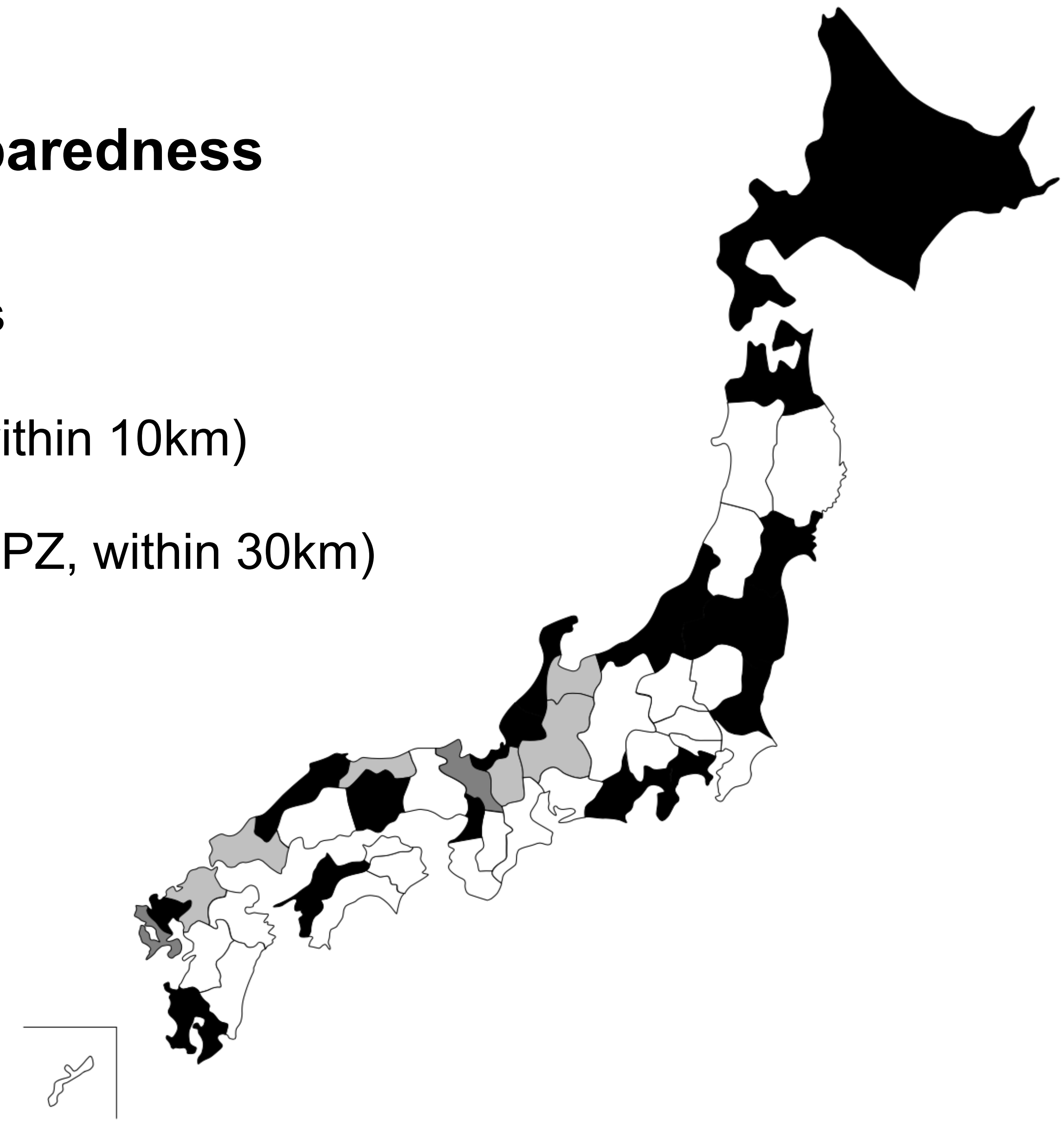
Apr. 2017

Nuclear emergency preparedness

16 NPP siting prefectures

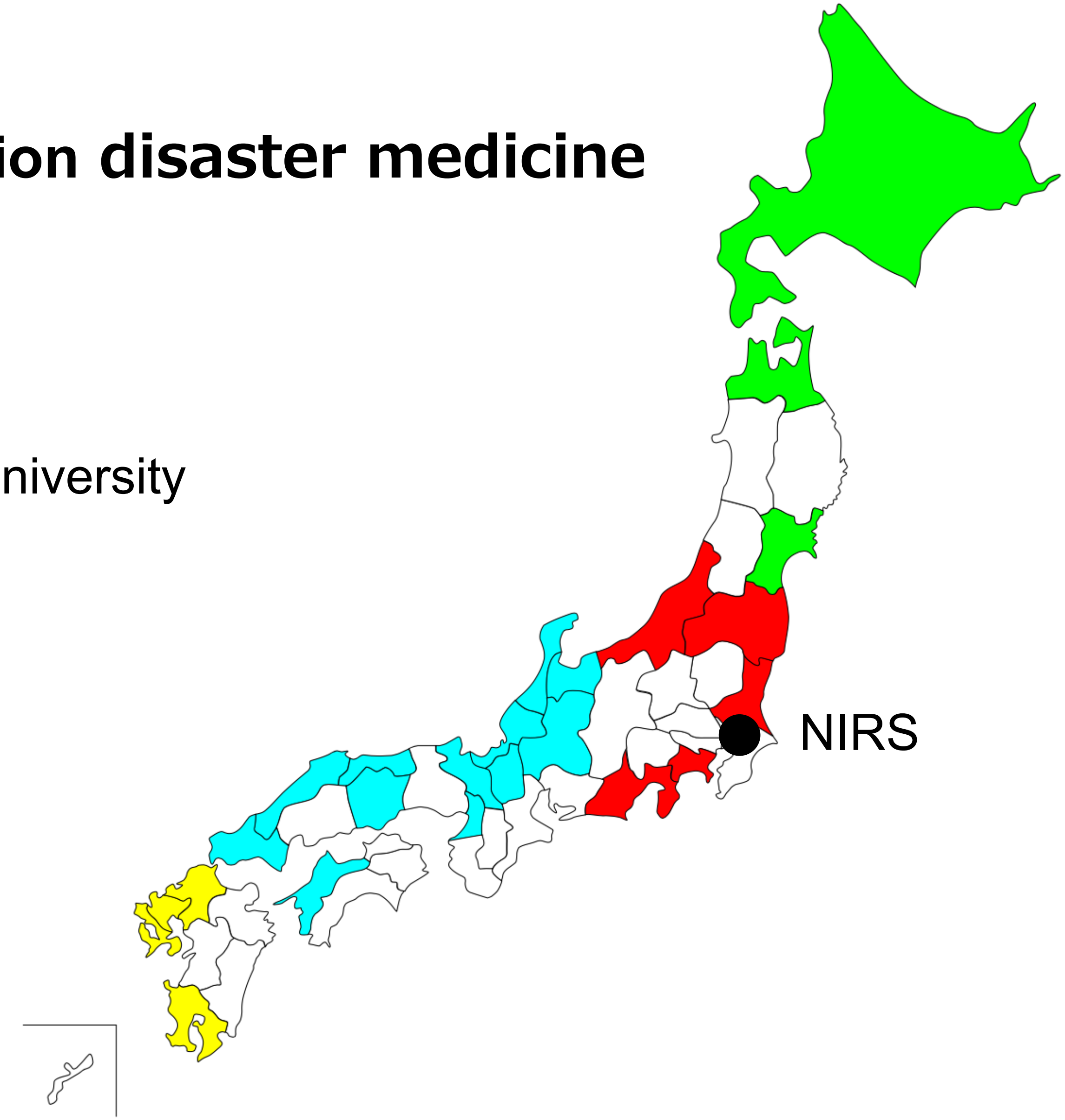
2 adjacent prefectures (within 10km)

6 adjacent prefectures (UPZ, within 30km)



Cover area of radiation disaster medicine

- Hirosaki University
- Fukushima Medical University
- Hiroshima University
- Nagasaki University



Research and Education Program for Organized Emergency Monitoring Platform by Radiation Facilities

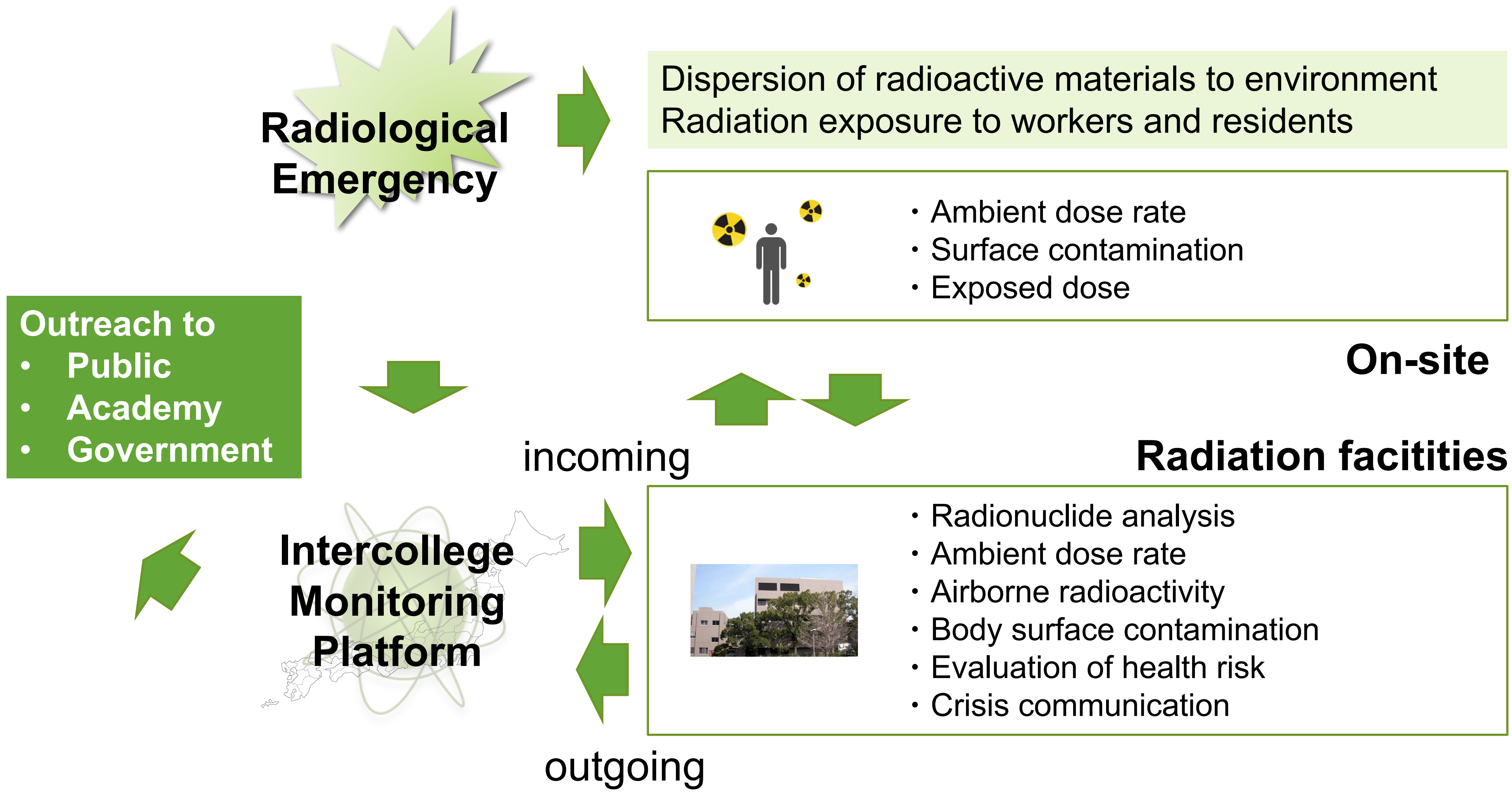
SUPPORTED BY THE HUMAN RESOURCE DEVELOPMENT PROJECT FOR NUCLEAR REGULATION BY NRA

Educational radiation facilities

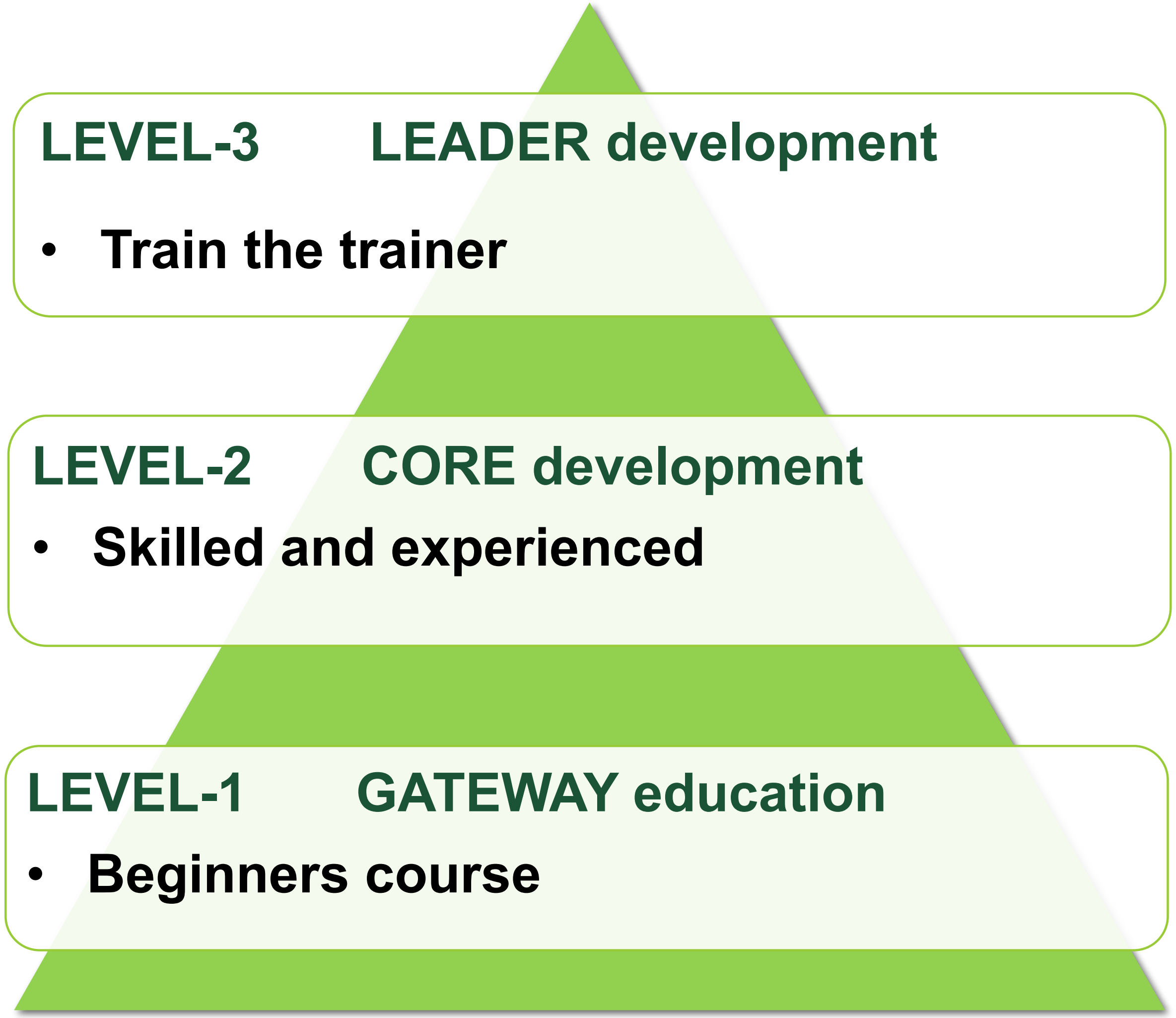
Safety management of
- Radiological environment
- Radiation sources
- Radiation workers

Radiation monitoring
Communication and education

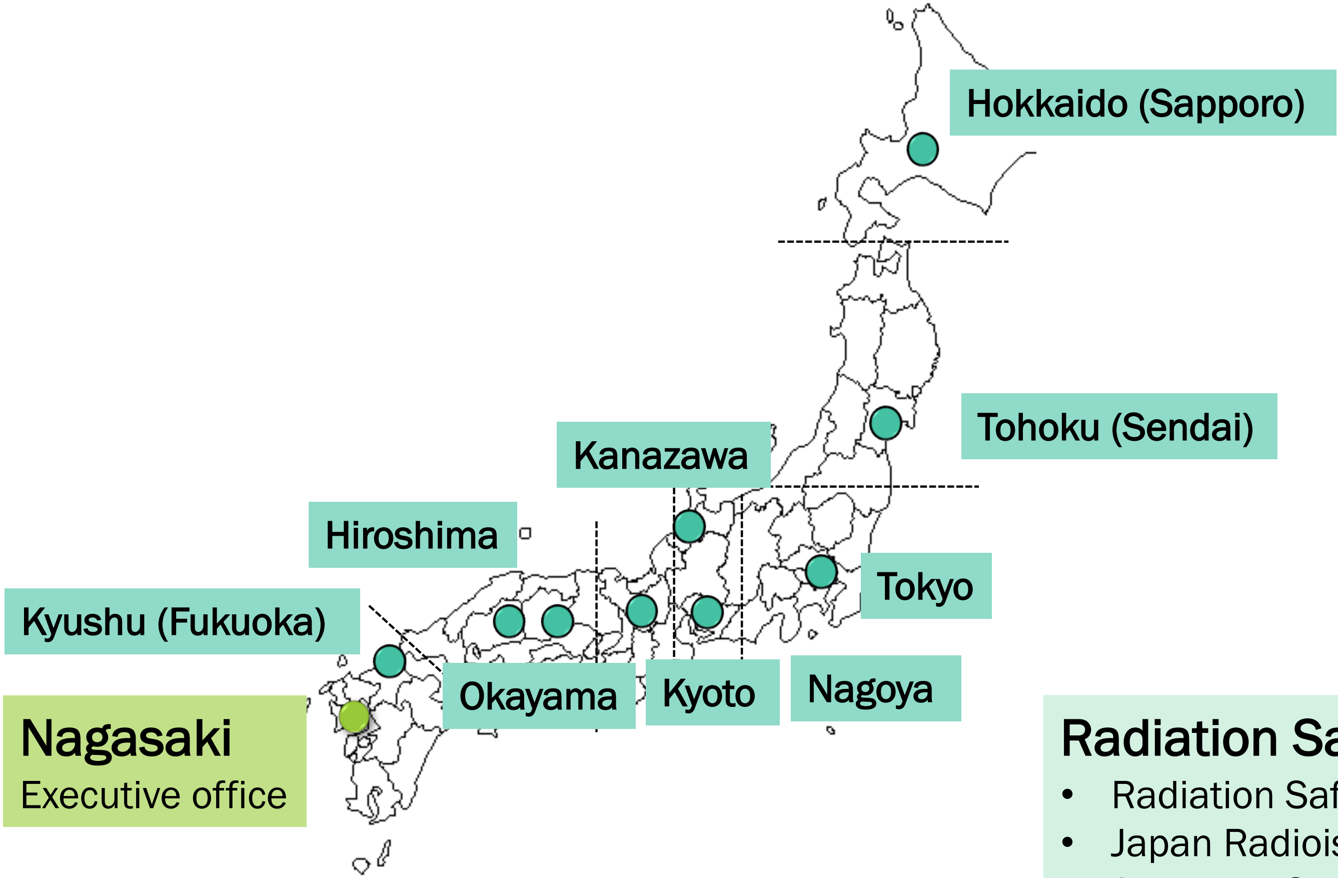
Functions of Radiation Facilities Available in Emergency Settings



Exchange of information on emergency monitoring platform



Graded Development of Human Resources



Expand to 30 facilities
Cover all prefectures - goal

Radiation Safety Organizations

- Radiation Safety Council of Universities in Japan
- Japan Radioisotope Association
- Japanese Society of Radiation Safety Management
- Japan Health Physics Society

Program-engaged Universities

Medical staffs' correct knowledge on radiation is an important aspect in radiation emergency

提言

医学教育における必修化をはじめとする
放射線の健康リスク科学教育の充実

平成２６年（２０１４年）９月４日

日 本 学 術 会 議

臨床医学委員会

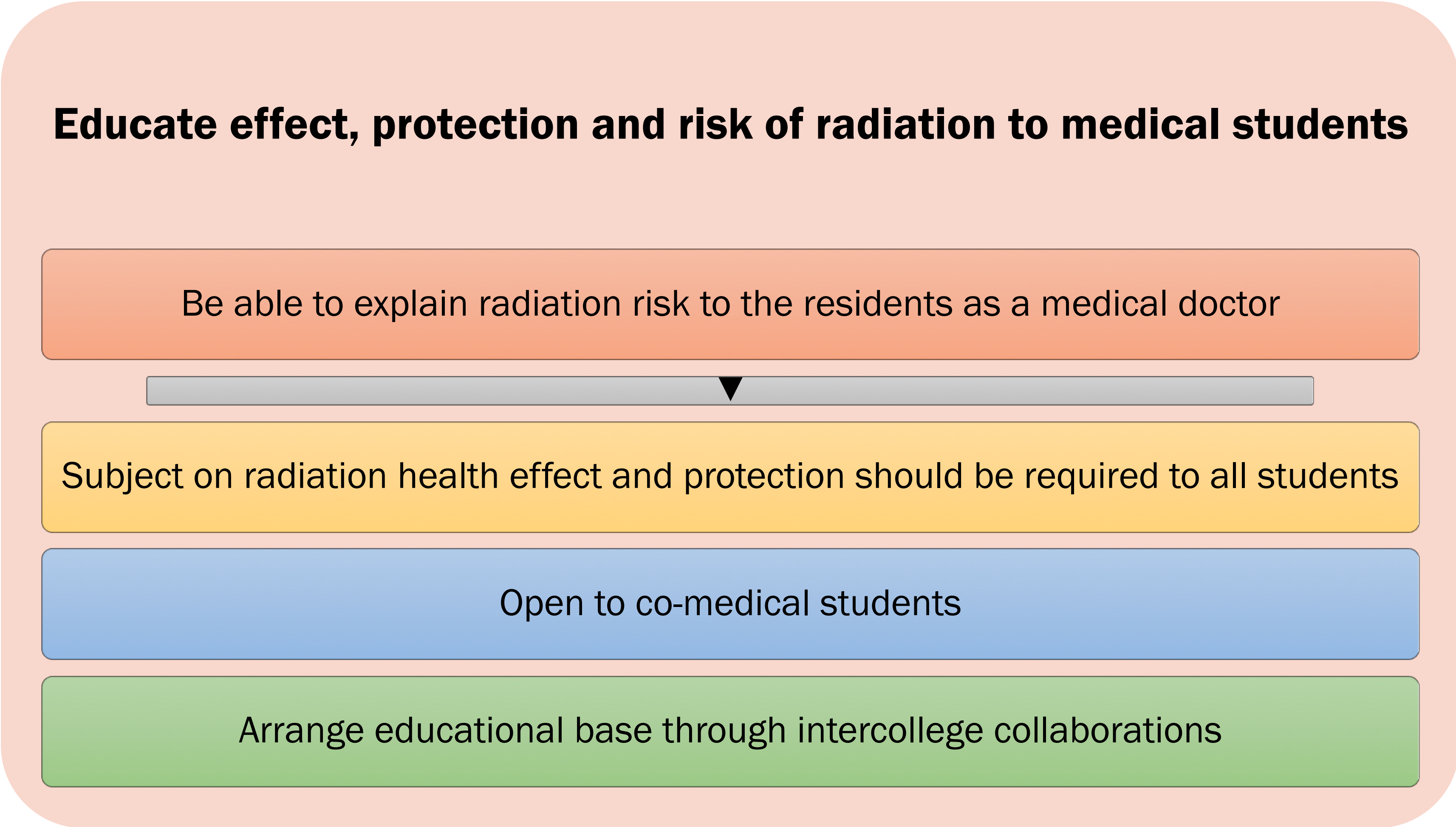
放射線防護・リスクマネジメント分科会

Policy recommendation to the government

Improvement of radiation health risk education in curriculum for medical-related students

September 4, 2014

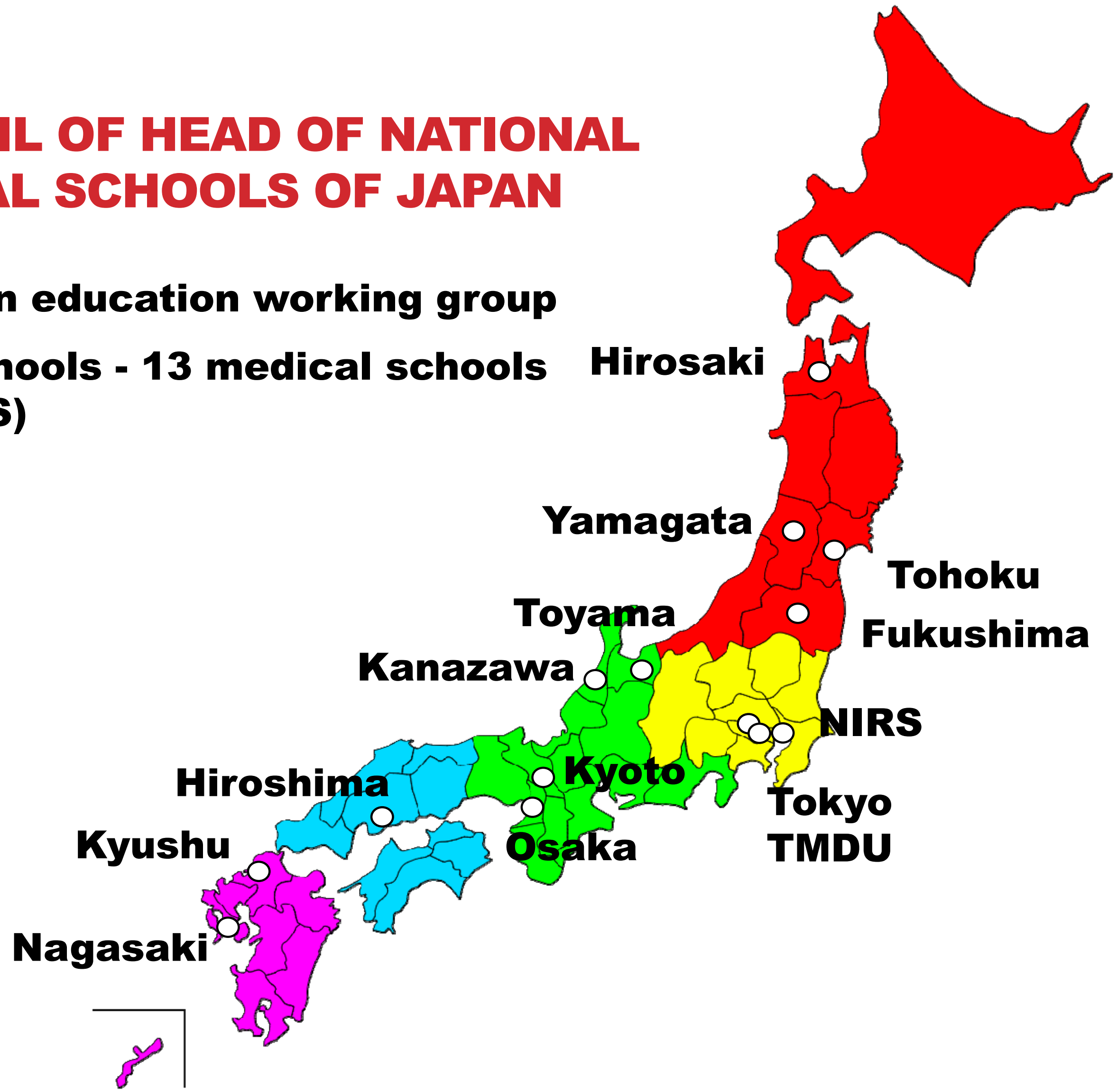
The Science Council of Japan
Committee of Clinical Medicine
Subcommittee of radiation protection and risk management


Educate effect, protection and risk of radiation to medical students
Be able to explain radiation risk to the residents as a medical doctor
Subject on radiation health effect and protection should be required to all students
Open to co-medical students
Arrange educational base through intercollege collaborations

COUNCIL OF HEAD OF NATIONAL MEDICAL SCHOOLS OF JAPAN

Radiation education working group

(core schools - 13 medical schools and NIRS)



RANGE OF RADIATION HEALTH RISK SCIENCE

Health effect

- Biological effect
- Radiation protection and management

Risk communications

- Mutual understanding and agreement between
  - doctor and patients
  - doctor and victims of nuclear disaster
  - government and victims of nuclear disaster

Nuclear disaster medicine

- Radiation emergency medicine covering mental health
- Examples of nuclear/radiation accidents

PROBLEM-SOLVING DEVELOPMENT PROGRAM FOR HIGH-LEVEL MEDICAL PROFESSIONALS (MEXT)

Development of Professionals on Radiation Health Risk Science

Collaboration of

- Nagasaki University
- Hiroshima University
- Fukushima Medical University

Development of Professionals on Radiation Disaster

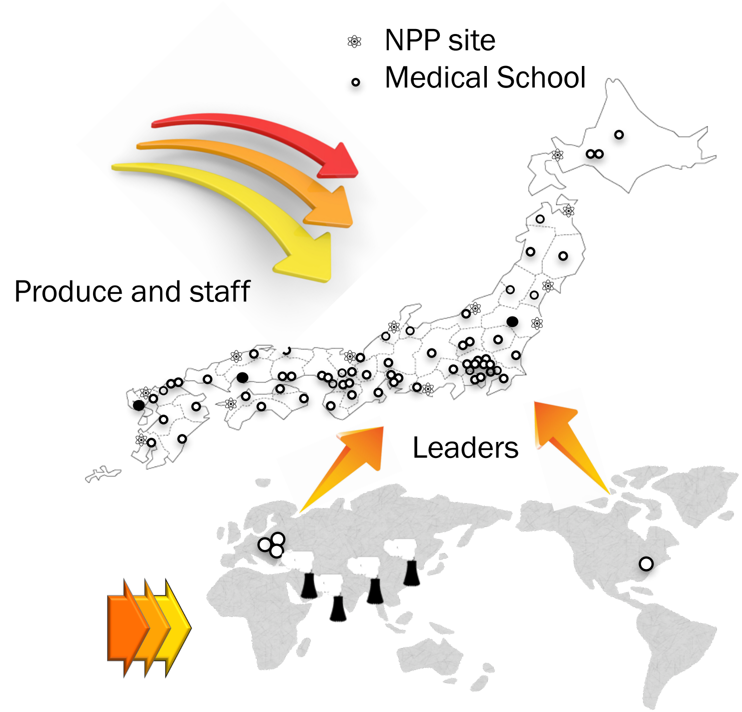
Tsukuba University

Development of Professionals on Radiation Health Risk Science

Nagasaki Hiroshima Fukushima

By the collaboration of three Universities who have suffered from radiation disaster and possess the educational resources in radiation health risk science, this program provides stepwise, systematic and realistic education to develop medical professionals for promotion of global health.

Undergraduate	Subject on Radiation Health Risk in medical school - Regular course and Intensive course
Graduate	Nagasaki-Fukushima Joint Course on Disaster and Radiation Medical Sciences Hiroshima Leading Program for Renaissance from Radiation Disaster
Research Professionals	Hiroshima-Nagasaki-Fukushima Research Base for Radiation Accidents and Medical Science
Radiation Disaster Professionals	Centers for Advanced Radiation Emergency Medicine and Radiation Disaster Medicine



Contribution to international organizations
Preparedness to global radiation risk due to increasing energy demand

謝謝您的聆聽

Radiation Protection in Japan

Naoki Matsuda

Nagasaki 2017