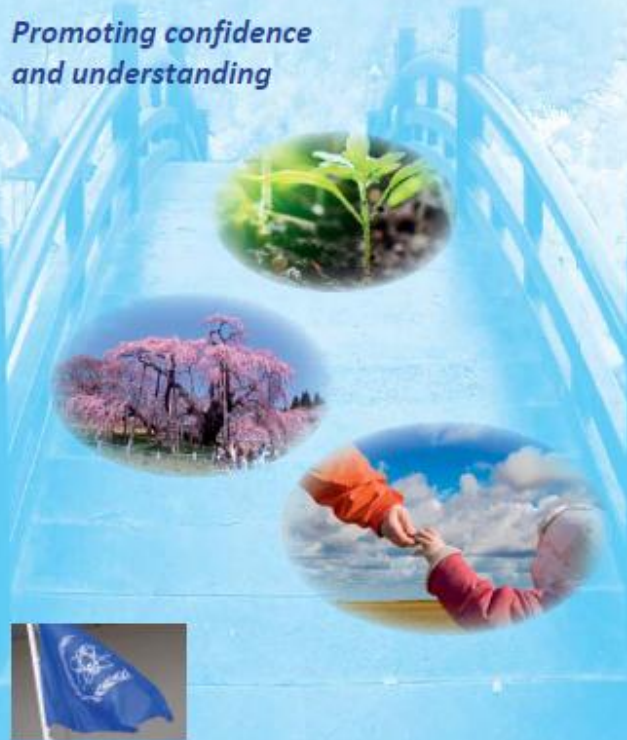


International Experts Meeting on  
**Radiation Protection  
after the Fukushima Daiichi  
Nuclear Power Plant  
Accident**

*Promoting confidence  
and understanding*



**IAEA Action Plan on Nuclear Safety**  
**IAEA Headquarters**  
**17–21 February 2014**  
**Vienna, Austria**



CN-224

# WHO's response to the Fukushima Daiichi NPP accident



**Dr E. van Deventer**

*Radiation Programme*

*Department of Public Health, Environmental and Social Determinants of Health*



**World Health  
Organization**

# Outline

- WHO's mandate
- Early response after March 11
- WHO's public health risk assessment
- Discussion



# World Health Organization

- **Function:** act as the UN directing and coordinating authority on international health work
- **Objective:** "the attainment by all peoples of the highest possible level of health"
- **Definition:** "HEALTH is a state of COMPLETE physical, mental and social well-being and not merely the ABSENCE of disease or infirmity"  
(*Constitution, 1948*)

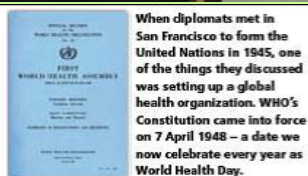






## PEOPLE

Last but not least, WHO is people. Over 8000 public health experts including doctors, epidemiologists, scientists, managers, administrators and other professionals from all over the world work for WHO in 147 country offices, six regional offices and at the headquarters in Geneva, Switzerland.



When diplomats met in San Francisco to form the United Nations in 1945, one of the things they discussed was setting up a global health organization. WHO's Constitution came into force on 7 April 1948 – a date we now celebrate every year as World Health Day.

## 1948

**International Classification of Disease**  
WHO took over the responsibility for the International Classification of Disease (ICD), which dates back to the 1850s and was first known as the International List of Causes of Death. The ICD is used to classify diseases and other health problems and has become the international standard used for clinical and epidemiological purposes.

**1952** Dr Jonas Salk (US) develops the first successful polio vaccine.



## 1952–1964

**Global yaws control programme**  
One of the first diseases to claim WHO's attention was yaws, a crippling and disfiguring disease that afflicted some 50 million people in 1950. The global yaws control programme, fully operational between 1952–1964, used long-acting penicillin to treat yaws with one single injection. By 1965, the control programme had examined 300 million people in 46 countries and reduced global disease prevalence by more than 95%.

**1967** South African surgeon Christiaan Barnard conducts the first heart transplant.

**1974** The World Health Assembly adopts a resolution to create the Expanded Programme on Immunization to bring basic vaccines to all the world's children.

**1977** The first Essential Medicines List appeared in 1977, two years after the World Health Assembly introduced the concepts of "essential drugs" and "national drug policy". 156 countries today have a national list of essential medicines.

## 1974 Onchocerciasis control programme



WHO worked for 30 years to eliminate onchocerciasis – or river blindness – from West Africa. 600 000 cases of blindness have been prevented and 18 million children spared from the disease. Thousands of farmers have been able to reclaim 25 million hectares of fertile river land that had been abandoned because of the risk of infection.

## 1979

### Eradication of smallpox

The eradication of smallpox – a disease which had maimed and killed millions – in the late 1970s is one of WHO's proudest achievements. The campaign to eradicate the deadly disease throughout the world was coordinated by WHO between 1967 and 1979. It was the first and so far the only time that a major infectious disease has been eradicated.



Mr Ali Mouslin (left), from Somalia, was the last person known to be infected with smallpox. Here he stands with the doctor who treated him more than 25 years ago. Ali has since worked on polio eradication campaigns.

**1983** Institut Pasteur (France) identifies HIV.

## 2003

### WHO Framework Convention on Tobacco Control

21 May 2003 was a historic day for global public health. After nearly four years of intense negotiations, the World Health Assembly unanimously adopted WHO's first global public health treaty. The treaty is designed to reduce tobacco-related deaths and disease around the world.

**2004** Adoption of the Global Strategy on Diet, Physical Activity and Health.



**1978** The International Conference on Primary Health Care, in Alma-Ata, Kazakhstan sets the historic goal of "Health for All" – to which WHO continues to aspire.



**1988** Global Polio Eradication Initiative established

Since its launch in 1988, the Global Polio Eradication Initiative has reduced the number of cases of polio by more than 99% – from more than 350 000 per year to 1956 in 2006. Spearheaded by national governments, WHO, Rotary International, the US Centers for Disease Control and Prevention and UNICEF, it has immunized more than two billion children thanks to the mobilization of more than 20 million volunteers and health workers. As a result, five million children are today walking, who would otherwise have been paralysed, and more than 1.5 million childhood deaths have been averted.

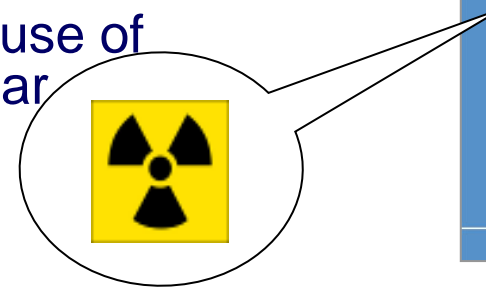
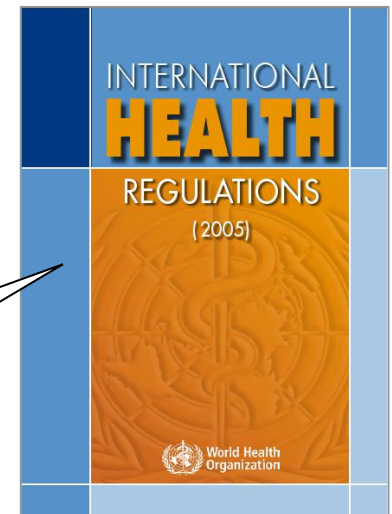
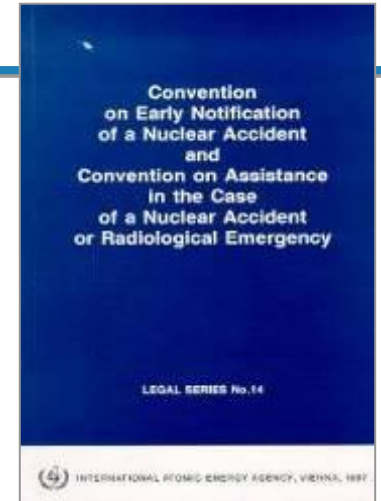
**THE GOAL IS TO ERADICATE POLIO WORLDWIDE SO THAT NO CHILD WILL EVER AGAIN BE PARALYZED BY THIS DISEASE.**

**2003** Severe Acute Respiratory Syndrome (SARS) first recognized and then controlled.

**2005** World Health Assembly revises the International Health Regulations.

# WHO's role in Radiation Emergency Response

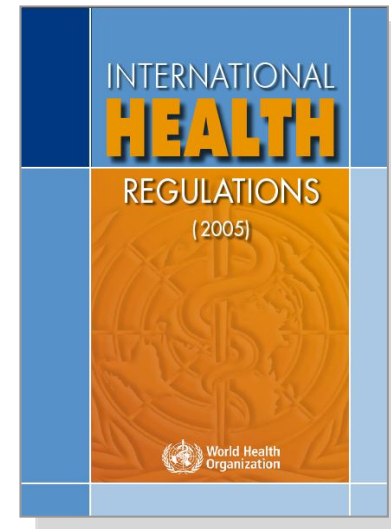
- **WHO Constitution (1948)**
  - Article 2 (d): "...to furnish appropriate technical assistance and, in emergencies, necessary aid upon requests of Government."
- **Emergency Conventions (1986)**
  - "Early Notification" and "Assistance"
- **Joint Radiation Emergency Management Plan (since 2000)**
  - currently in its 6th edition
- **WHA Resolution 55.16 (2002)**
  - "Global public health response to natural occurrence, accidental release or deliberate use of biological and chemical agents or radionuclear material that affect health"
- **International Health Regulations (2005)**





# IHR (2005) and Radiation Emergencies

- IHR: complementary notification to the Emergency Conventions
  - Health surveillance (e.g. unknown origin outbreaks) in addition to radiological monitoring
  - Reporting through National Focal Points in 191 State Parties
  - Updated information on Event Information Site (EIS)
  - Ongoing monitoring of travel and trade measures
- IHR Expert Roster includes radiation emergency management experts
- Mechanisms and tools for assessment, monitoring, and assistance to strengthen preparedness and response capacity of Member States



# WHO's Relevant Emergency Networks

- WHO REMPAN network (1987)

- Radiation **E**mergency **M**edical **P**reparedness and **A**ssistance **N**etwork (**REMPAN**), 40+ centers world wide

[http://www.who.int/ionizing\\_radiation/a\\_e/rempan/en/](http://www.who.int/ionizing_radiation/a_e/rempan/en/)

- WHO/FAO INFOSAN network (2004)

- International **F**ood **S**afety **A**uthorities **N**etwork (**INFOSAN**)

[http://www.who.int/foodsafety/fs\\_management/infosan/en/](http://www.who.int/foodsafety/fs_management/infosan/en/)



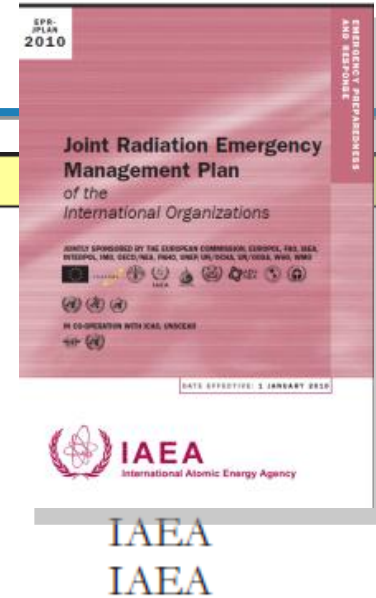
- WHO BioDoseNet (2007)

- Global network of 60+ biodosimetry laboratories

[http://www.who.int/ionizing\\_radiation/a\\_e/biodosenet/en/](http://www.who.int/ionizing_radiation/a_e/biodosenet/en/)



# Joint Radiation Emergency Management Plan (2010)



Advice or assistance (on request directly from a State or through international organization)

To offer good offices

To send request for advice or assistance to relevant international organizations

To arrange for advice or assistance on

- potential radiological hazards, assessment of facility conditions and accident mitigation
- weather information (observations, forecasts, and warnings)
- atmospheric transport and dispersion predictions
- physical dosimetric measurement services
- radiological assessment and application of international standards
- public health risk assessment and response
- biological and clinical dosimetry
- re-establishing disrupted police services
- radiation protection support, personnel and equipment for operations in affected areas
- emergency medical response including diagnosis and treatment of radiation casualties
- longer term medical follow-up
- mitigation of mental health impact
- agricultural countermeasures
- environmental monitoring and sampling programmes for interventions related to food
- implementation and enforcement of control measures for imported and exported food/feed
- control of food and feed
- investigating crimes and seeking international suspects
- environmental monitoring and sampling programmes and assessment of long term impact
- relocation, resettlement
- decontamination, waste management
- response on a vessel at sea or in port

WHO, PAHO

WHO, PAHO, LAEA

## INTERPOL

IAEA

WHO, PAHO, IAEA

WHO, PAHO

WHO, PAHO

FAO

IAEA, FAO

FAO

FAO, WHO

INTERPOL

IAEA, UNEP, FAO

IAEA, UNEP

IAEA

IMO



# Outline

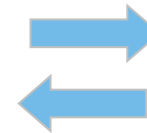
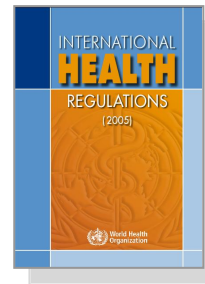
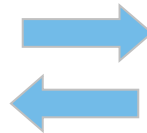
- WHO's mandate
- Early response after March 11



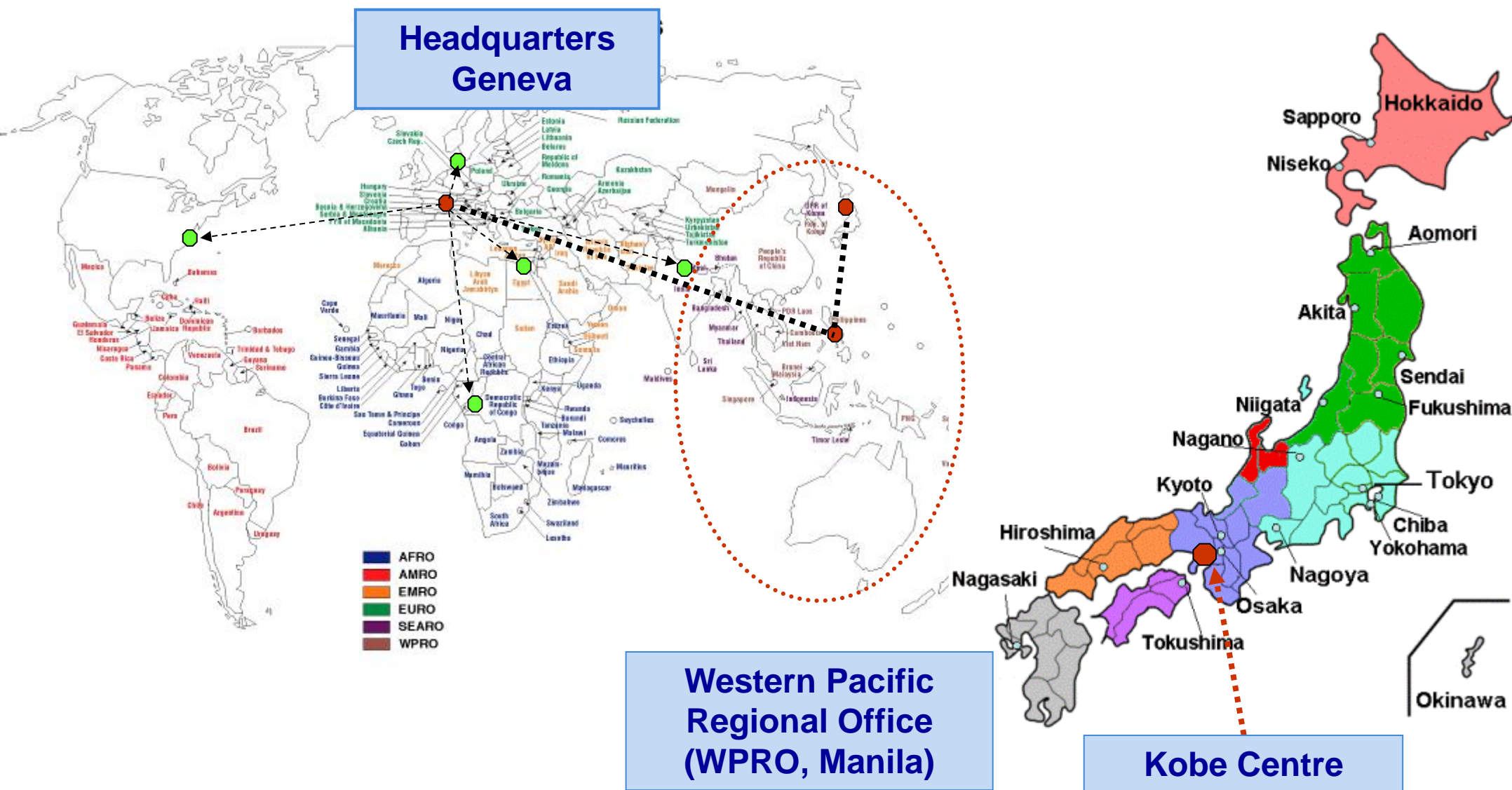
# IHR communication

## Fukushima Daiichi NPP accident

- On March 11 2011, the Ministry of Health, Labour and Welfare of Japan notified the situation at the Fukushima Daiichi Nuclear Power Plant through the National IHR Focal Point within a few hours
- WHO immediately communicated the event to all Member States in the region through its National IHR Focal Points



# WHO Response to Fukushima accident





# Immediately after the Fukushima Daiichi NPP accident WHO activated its emergency response plan



# WHO's short-term actions

- **Monitor situation** (WPRO, Kobe, ENAC, social media,...)
- **Assess health risks** (IHR, PHE, FOS, other programs, relevant experts)
- **Provide technical advice** to national authorities (food, water, travel, transport, trade, mental health, ...)
- **Activate relevant expert networks** (REMPAN, INFOSAN)
- **Implement** inter-agency coordination (IAEA, WMO, FAO, ILO, UNSCEAR, ICAO, EC, CTBTO, OECD/NEA...)
- **Provide information to the public** (dedicated website, media statements, press conferences, Fact Sheets and Q&As, social media)
  - To inform decision-making (*e.g. travel, trade*), prevent risky reactions (*e.g. potassium iodide*), allay unnecessary fears (*e.g. travel, breastfeeding*), and promote healthy behaviours (*e.g. pregnancy*), ....





## Effective communication in emergencies

The importance of inter-agency collaboration during the Japan disasters

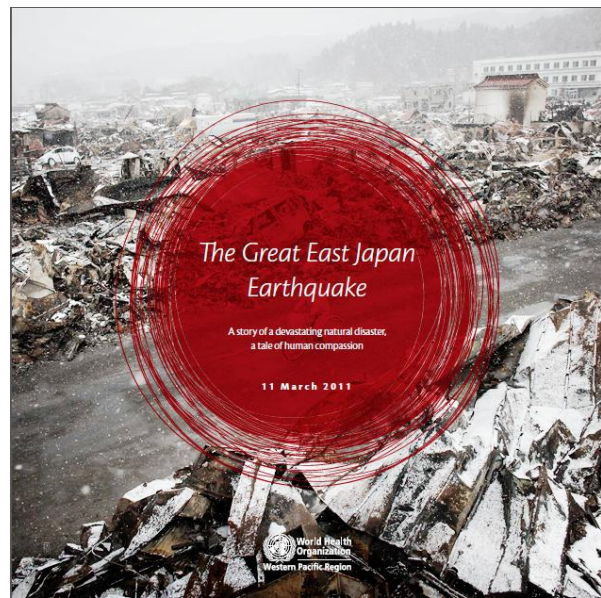
by MARGARET CHAN  
Director-General of the  
World Health Organization



One year has now passed since Japan suffered a nearly unimaginable triple catastrophe: an earthquake and a tsunami, followed by a nuclear disaster at the Fukushima Daiichi nuclear power plant, which caused the release of radioactive isotopes into the atmosphere on 11 March 2011.

nature of the event was a result of the resilience and resourcefulness of the Japanese people, in addition to the early response actions of many national and local agencies, working together. This complex event demanded a multi-hazard, multi-agency collabora-

advice quickly about those matters and many others, including urgent issues of daily living, such as evacuation, relocation, trade and travel, maternal health and breastfeeding, and mental health. Effective communication was necessary to inform decision-making, prevent risky actions, allay fears



### NOTE

## WHO's public health agenda in response to the Fukushima Daiichi nuclear accident

Emilie van Deventer<sup>1</sup>, Maria del Rosario Perez<sup>1</sup>, Angelika Tritscher<sup>2</sup>, Kazuko Fukushima<sup>2</sup> and Zhanat Carr<sup>1</sup>

<sup>1</sup> Department of Public Health and Environment, World Health Organization, Geneva, Switzerland

<sup>2</sup> Department of Food Safety and Zoonoses, World Health Organization, Geneva, Switzerland

**World Health Organization**

Health topics | Data and statistics | Media centre | Publications | Countries | Programmes and projects | About WHO

Search [ ] Advanced search

### Health action in crises

**Japan: radioactive contamination of seafood limited**

May -- Radioactive contamination of the Pacific Ocean following the nuclear incident has raised public concerns about seafood safety. Based on currently available information, only one fish species (sand lance) in the direct vicinity of the nuclear power plant has been found to be contaminated at levels above the regulatory limits set by the Japanese Government, and control measures are in place to prevent its distribution. Radionuclide contamination, if any, in seafood outside these areas, is expected to be significantly below any public health concern, even in Pacific islands with high seafood consumption. Any additional radiation levels will contribute only a small amount to natural background radiation exposure.

[FAQs: Japan nuclear concerns](#)

**Frequently asked questions**

FAQs: Japan nuclear concerns  
12 May 2011  
[FAQs: Japan nuclear concerns \(in Japanese\)](#)

FAQs: Japan tsunami concerns  
21 March 2011

**General information**

Update 5: Information on drinking water safety released  
25 March 2011  
[Complete list of updates](#)

[WHO's country profile for Japan](#)

**Technical guidance - nuclear crisis**

Use of potassium iodide for thyroid protection  
Publication date: 29 March 2011

[INFOSAN Note Radionuclides and food](#)  
pdf, 194kb  
Publication date: 30 March 2011

[Manual for First Responders to a Radiological Emergency](#)  
Publication date: October 2005

[Generic procedures for medical response during a nuclear or radiological emergency](#)  
Publication date: 2005

More information: ionizing radiation  
More publications: technological incidents - chemical and radionuclear incidents

**Contact information**

For more information,  
E-mail: [mediajapan@who.int](mailto:mediajapan@who.int)

**Related links**

Environmental health in emergencies web site  
[Ionizing radiation web site](#)  
[Radiation accidents health topic page](#)  
[WHO's WHO Western Pacific Region office](#)  
[Section on the crisis in Japan](#)  
[WHO's Centre for health development](#)  
Kobe, Japan  
[International Atomic Energy Agency \(IAEA\)](#)





# Outline

- WHO's mandate
- Early response after March 11
- WHO's public health risk assessment



# Health Risk Assessment

## Purpose

- Fulfil WHO's role and responsibilities under the *Joint Radiation Emergency Management Plan*
- Provide information for policy makers and health professionals in WHO Member States, as well as international organizations
- Give an indication of the health implications of the accident



# Health Risk Assessment

## The classical steps

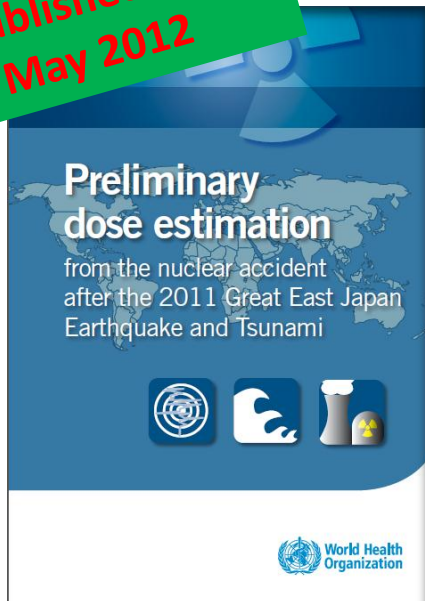
**Hazard  
Identification**

**Dose-response  
Relationship**

**Risk  
Characterization**

**Exposure  
Assessment**

**Published  
23 May 2012**





# Preliminary dose estimation

from the nuclear accident  
after the 2011 Great East Japan  
Earthquake and Tsunami



World Health  
Organization

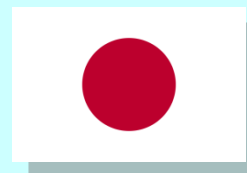


## Independent experts

Lynn Anspaugh  
Mikhail Balonov  
Carl Blackburn  
Florian Gering  
Stephanie Haywood  
Jean-René Jourdain  
Gerhard Proehl  
Shin Saigusa  
Jane Simmonds  
Ichiro Yamaguchi

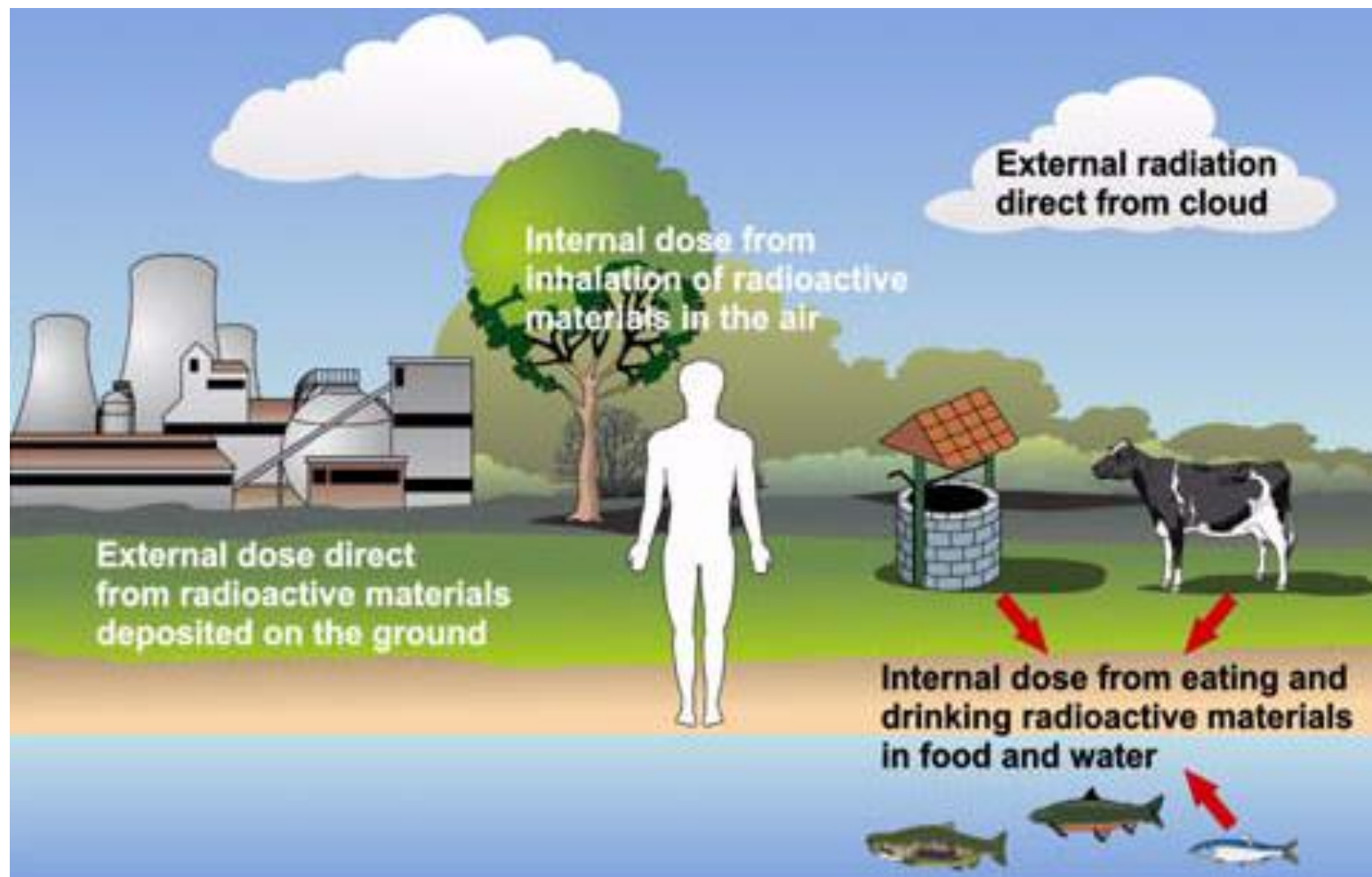
*and other contributors listed in the report*

## Observers:



World Health  
Organization

# Assessed exposure pathways



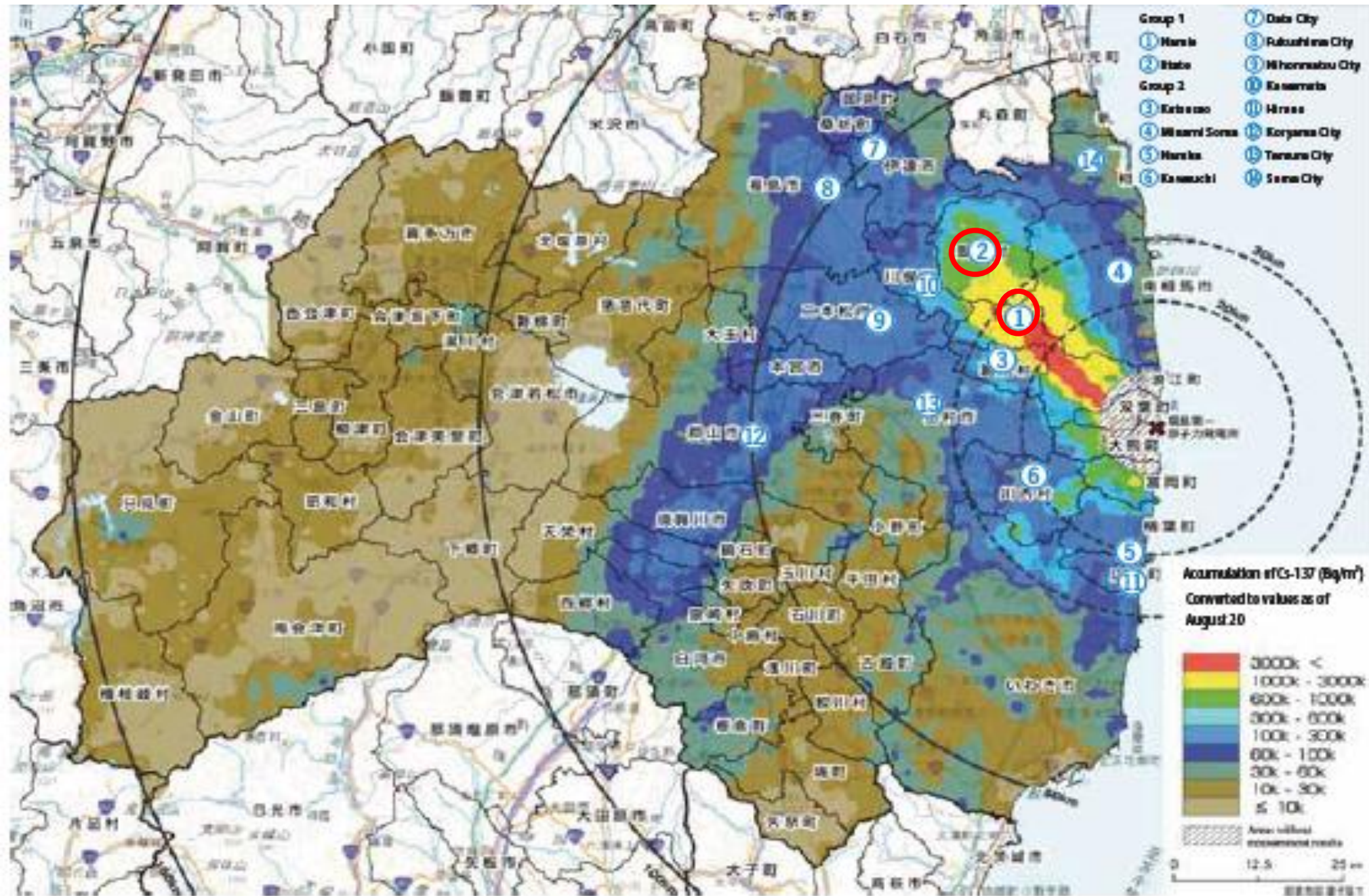
IAEA report on Environmental consequences of the Chernobyl accident and their remediation: twenty years of experience (2006)

# Dosimetric endpoints

- **Effective doses** and **equivalent doses to the thyroid** for the first year after the accident
- Populations considered: 1 year old infants, 10 year old children and adults
  - These age groups provide a sufficient level of detail to characterize radiological impact with consideration of younger, more sensitive population

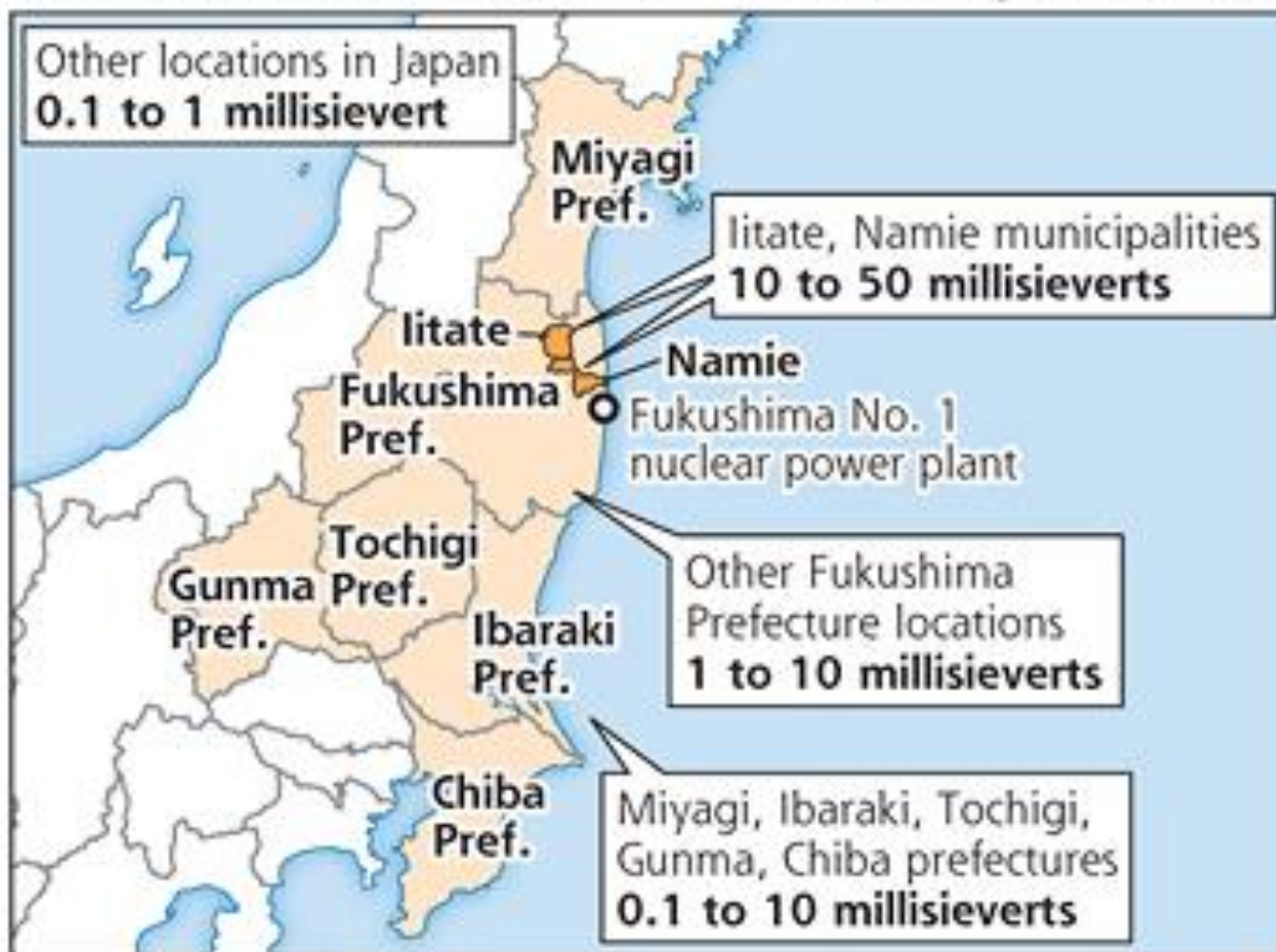








## WHO preliminary radiation dose estimates after the Fukushima No. 1 nuclear plant crisis



DAILY YOMIURI ONLINE | THE DAILY YOMIURI

# Health Risk Assessment



**Published  
28 February 2013**

**Hazard  
Identification**

**Dose-response  
Relationship**

**Exposure  
Assessment**

**Risk  
Characterization**



# Health risk assessment

from the nuclear accident  
after the 2011 Great East Japan  
Earthquake and Tsunami

*based on a preliminary dose estimation*

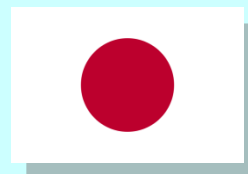


## Independent experts

Makoto Akashi  
Billy Amzal  
Lynn Anspaugh  
Anssi Auvinen  
Nick Gent  
Peter Jacob  
Dominique Laurier  
Charles Miller  
Otsura Niwa  
Roy Shore  
Richard Wakeford  
Linda Walsh  
Wei Zhang

*and other contributors listed in the report*

## Observers:





# Scope

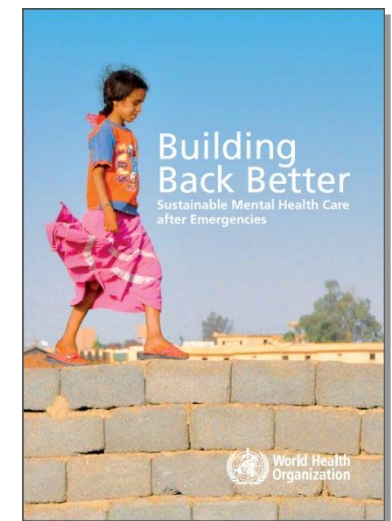


- **Radiation doses and risks to the public and emergency workers**  
*(dose estimations provided by TEPCO were used to assess workers' risks)*
- **Different age groups**
  - *Public: 1y infants, 10y children and 20y adults (females and males)*
  - *Workers: 20, 40, 60 year olds (males)*
- **Global geographical coverage** *(excluding the evacuation zone within 20 km of the NPP)*
  - *Fukushima Prefecture, other prefectures in Japan, countries neighbouring Japan, and rest of the world*



# Psychological impact

- Although psychological impact was beyond the scope of the assessment, it is addressed in the report because
  - It is a challenge to the medical community and health authorities, in particular due to the nature of the triple disaster
  - the psychosocial impact can outweigh direct radiological consequences (lesson from Chernobyl)
- Communicating risk to the affected target groups (e.g. emergency workers, evacuees, parents of young children) and conveying clear messages is key to reduce mental health impact of a radiation emergency
- Soon after the accident, WHO recommended improving availability and access to community mental health services in the affected areas of Japan

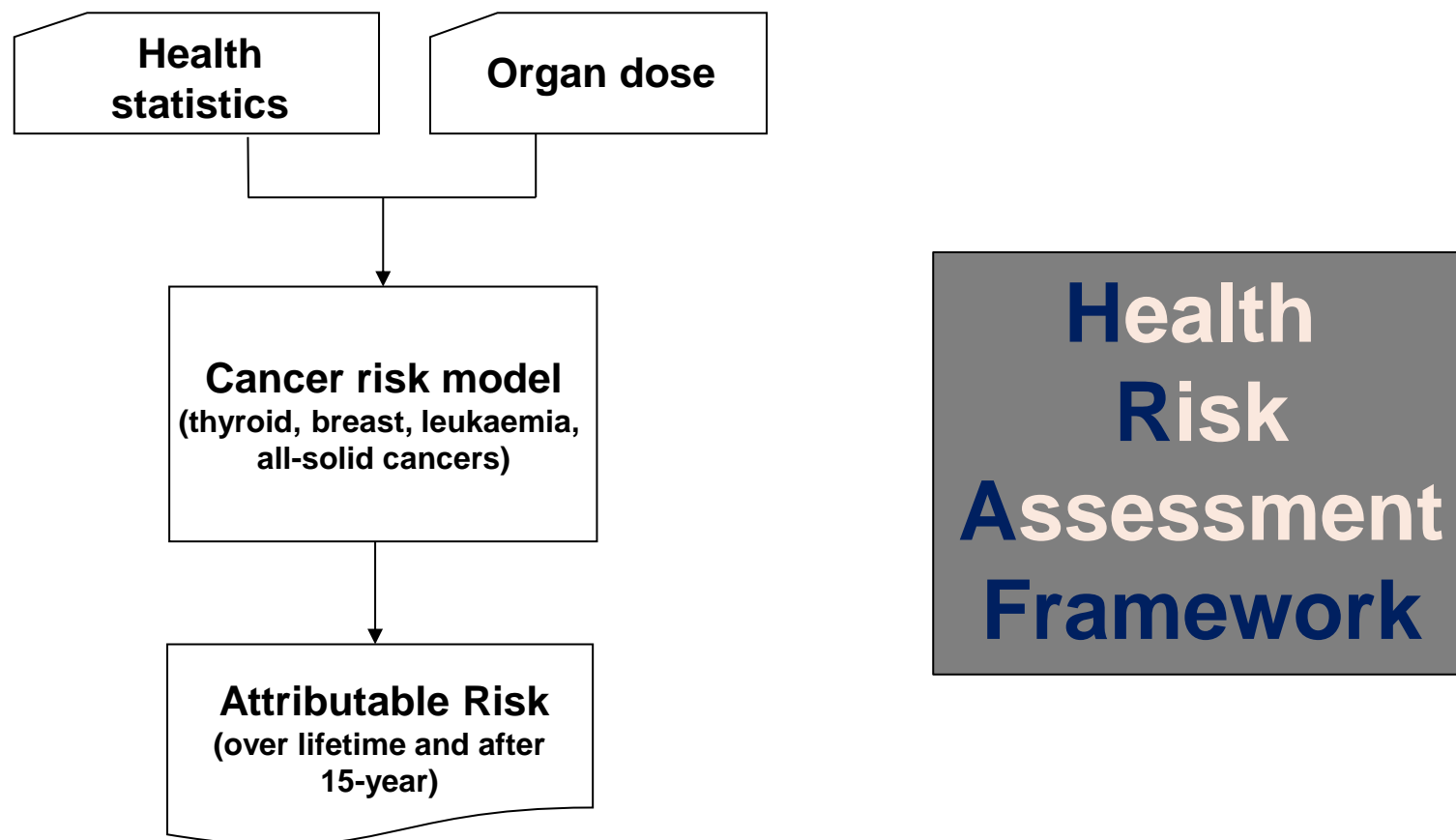


# Health endpoints considered

- **Cancer risks** were estimated by using risk models for:
  - all-solid cancers incidence
  - leukaemia incidence
  - thyroid cancer incidence
  - female breast cancer incidence
- **Non-cancer risks** were considered but not modeled
  - thyroid nodules, thyroid dysfunction, visual impairment, circulatory diseases, reproductive dysfunctions, risk to embryo and fetus



# General approach for characterizing cancer risks





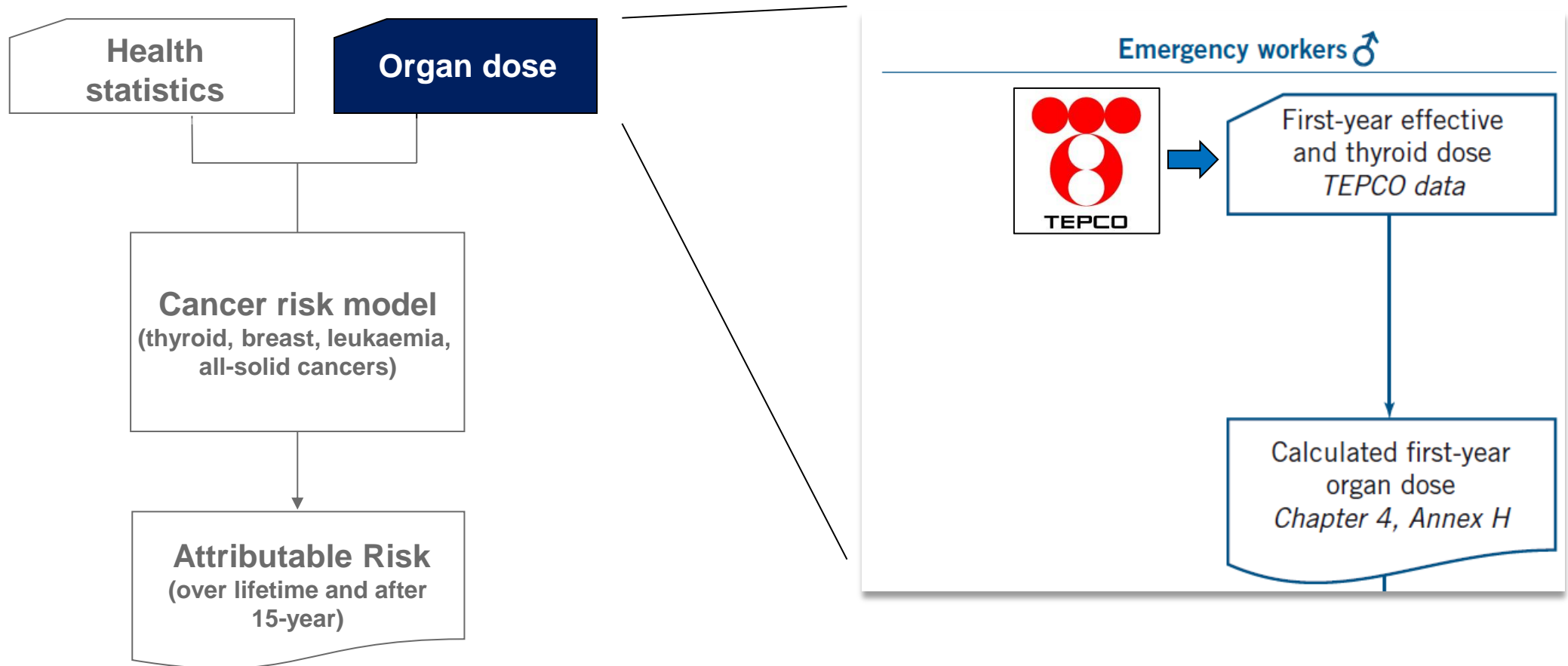
# Organ Doses

## General population

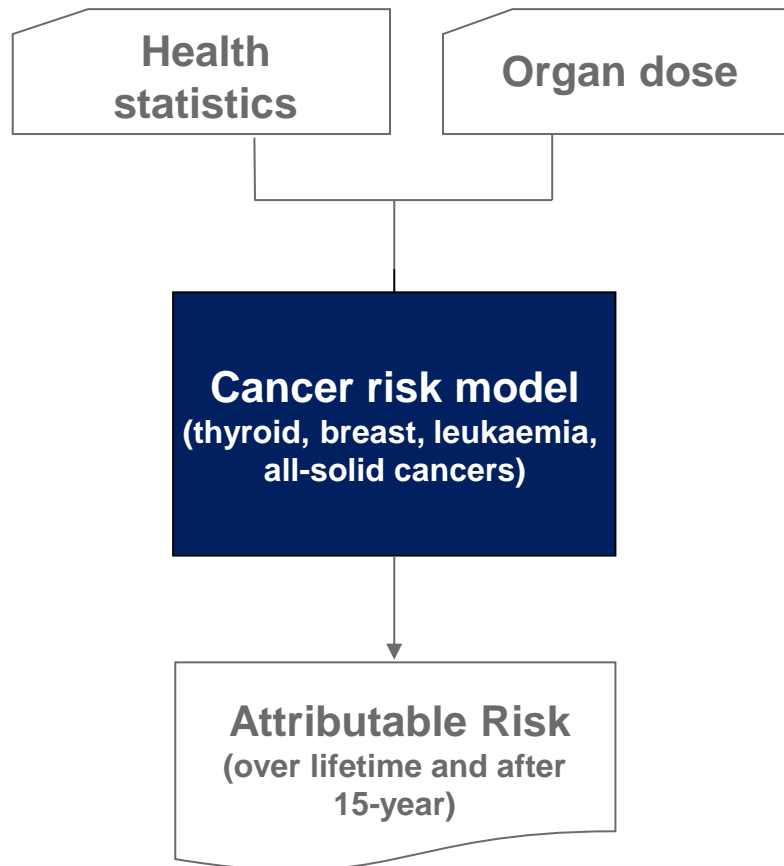


# Organ Doses

## Emergency workers

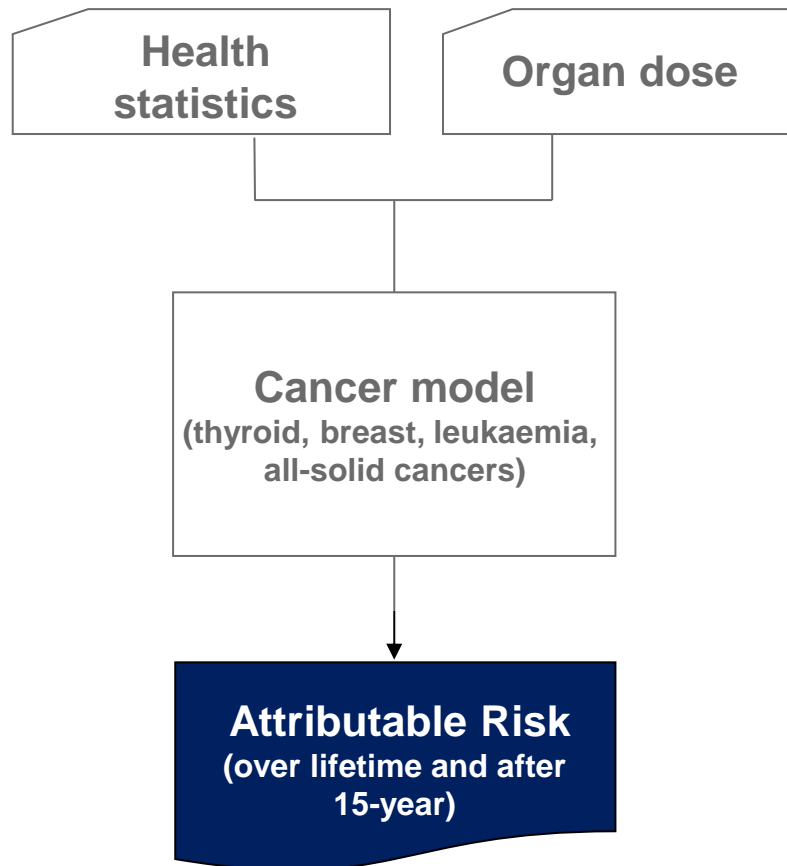


# Cancer risk models used in the report



- **Dose-response relationship for the site-specific cancer**
  - Life Span Study cohort of Japanese atomic bomb survivors
  - UNSCEAR 2006 report
- **Whenever available, incidence models were chosen over mortality models**

# Measures of lifetime risks

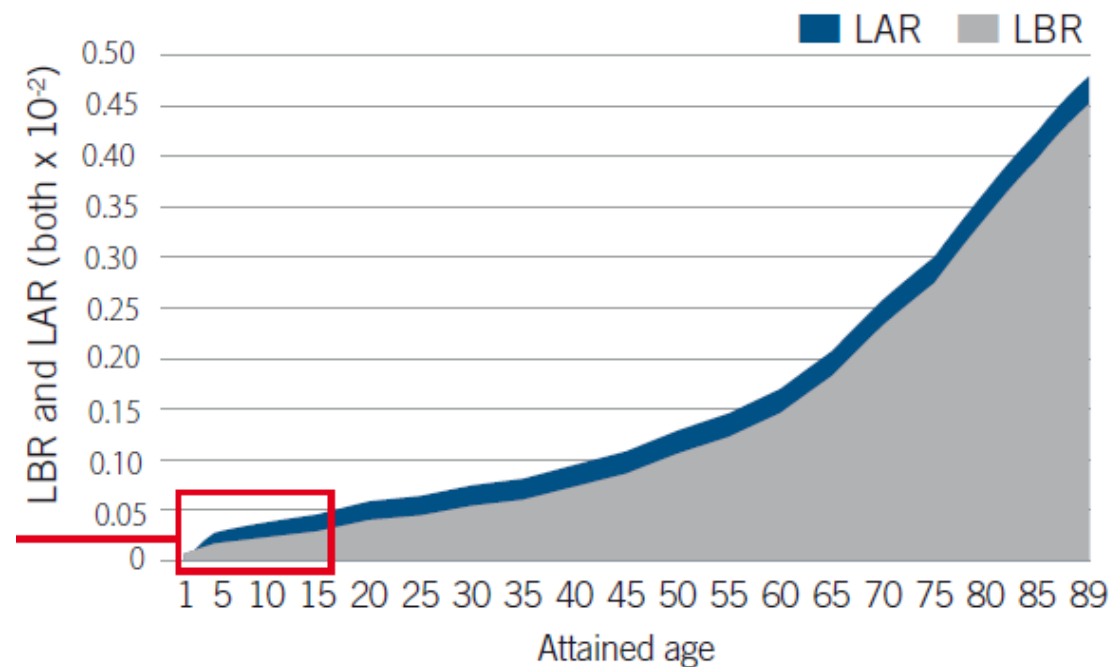


- **Lifetime Attributable Risk (LAR)**
  - probability of a premature incidence of a cancer related to radiation exposure
- **Lifetime Baseline Risk (LBR)**
  - cumulated baseline probability of having a specific cancer over the lifetime
- **Lifetime Fractional Risk (LFR)**
  - $LFR = LAR / LBR$
- **Cumulative risk for a segment of life ( $AR_{15}$ )**
  - for the 15-year period of life after radiation exposure



# Attributable risk

**Figure 16.** Lifetime attributable risk (LAR) for leukaemia as a function of attained age for a female, one year age-at-exposure, in Location ①.



over a lifetime ...

# Key choices in the HRA

## ● Selection of **input data**

- Exposure data
- Lifetime dose
- Health statistics data
- Incidence vs. mortality data
- International classification of diseases (ICD)
- Assumed exposure scenarios for workers
- .....

## ● Selection of **models and approaches**

- Non-threshold models (LNT)
- DDREF
- Selection of cancer sites
- Latency periods
- Selected age at exposure
- Adopted risk quantity
- Models based on atomic bomb survivors vs. nuclear accident
- Transfer weights
- .....



# Final considerations

- The assumptions used in this assessment were deliberately chosen to minimize the possibility of underestimating eventual health risks. The results can be seen as
  - upper-bounds of health risks
  - inferences of the magnitude of health risks (not health effects)
- This HRA provides information for setting priorities in the coming years for population health monitoring, as has already begun with the *Fukushima Health Management Survey*
- When more precise dose estimations become available (e.g. UNSCEAR study), the WHO HRA framework can be used to refine the risk estimates





**Thank You**