WHO's response to the Fukushima Daiichi NPP accident

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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)*
1948
International Classification of Disease (ICD) is developed.

1952–1964
Global polio eradication campaign.

1954
First successful heart transplant.

1974
First successful heart transplant.

1979
First global polio eradication campaign.

2008
World Health Assembly resolves 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"

  - 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 radionuclar 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 Emergency Medical Preparedness and Assistance Network (REMPAN)**, 40+ centers worldwide

- **WHO/FAO INFOSAN network (2004)**
  - **International Food Safety Authorities Network (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

<table>
<thead>
<tr>
<th>Advice or assistance (on request directly from a State or through international organization)</th>
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<tr>
<td>To offer good offices</td>
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<td>To send request for advice or assistance to relevant international organizations</td>
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<td>To arrange for advice or assistance on</td>
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<td>- potential radiological hazards, assessment of facility conditions and accident mitigation</td>
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<td>- weather information (observations, forecasts, and warnings)</td>
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<td>- atmospheric transport and dispersion predictions</td>
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<td>- physical dosimetric measurement services</td>
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<td>- radiological assessment and application of international standards</td>
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<td>- public health risk assessment and response</td>
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<td>- biological and clinical dosimetry</td>
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<td>- re-establishing disrupted police services</td>
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<td>- radiation protection support, personnel and equipment for operations in affected areas</td>
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<td>- emergency medical response including diagnosis and treatment of radiation casualties</td>
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<td>- longer term medical follow-up</td>
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<td>- mitigation of mental health impact</td>
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<td>- agricultural countermeasures</td>
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<td>- environmental monitoring and sampling programmes for interventions related to food</td>
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<td>- implementation and enforcement of control measures for imported and exported food/feed</td>
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<td>- control of food and feed</td>
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<td>- investigating crimes and seeking international suspects</td>
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<td>- environmental monitoring and sampling programmes and assessment of long term impact</td>
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<td>- relocation, resettlement</td>
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<td>- decontamination, waste management</td>
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<td>- response on a vessel at sea or in port</td>
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Outline

• WHO's mandate

• Early response after March 11
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

Western Pacific Regional Office (WPRO, Manila)

Kobe Centre
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

One year has passed since Japan suffered a nearly catastrophic triple nuclear reactor accident, followed by a major tsunami on 11 March 2011. The scope of the event was a result of the melting and destruction of the three reactors and the subsequent release of radioactive material into the atmosphere on 11 March 2011. The complex event involved a multi-disciplinary, multi-agency united

NOTE

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

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2 Department of Food Safety and Zoonoses, World Health Organization, Geneva, Switzerland
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
Preliminary dose estimation
from the nuclear accident after the 2011 Great East Japan Earthquake and Tsunami

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:
Assessed exposure pathways

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

Other locations in Japan
0.1 to 1 millisievert

Miyagi Pref.

Iitate, Namie municipalities
10 to 50 millisieverts

Iitate

Namie

Fukushima Pref.

Fukushima No. 1 nuclear power plant

Tochigi Pref.

Gunma Pref.

Ibaraki Pref.

Chiba Pref.

Other Fukushima Prefecture locations
1 to 10 millisieverts

Miyagi, Ibaraki, Tochigi, Gunma, Chiba prefectures
0.1 to 10 millisieverts
Health Risk Assessment

Hazard Identification → Dose-response Relationship → Exposure Assessment → Risk Characterization

Published 28 February 2013
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

Health statistics → Organ dose → Cancer risk model (thyroid, breast, leukaemia, all-solid cancers) → Attributable Risk (over lifetime and after 15-year)
Organ Doses
General population

Health statistics

Organ dose

Cancer risk model
(thyroid, breast, leukaemia, all-solid cancers)

Attributable Risk
(over lifetime and after 15-year)

First-year effective and thyroid dose
WHO dose report

Calculated first-year organ dose
Chapter 4

Calculated lifetime organ dose (location dependent)
Chapter 4, Annex F
Organ Doses
Emergency workers

Health statistics

Organ dose

Cancer risk model
(thyroid, breast, leukaemia, all-solid cancers)

Attributable Risk
(over lifetime and after 15-year)

Emergency workers

First-year effective and thyroid dose
TEPCO data

Calculated first-year organ dose
Chapter 4, Annex H
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)**
  - \( LFR = \frac{LAR}{LBR} \)

- **Cumulative risk for a segment of life (AR_{15})**
  - for the 15-year period of life after radiation exposure
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
  - 

IEM on Radiation Protection after the Fukushima Daiichi Accident, 17 February, Vienna, Austria
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