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Emergency Preparedness and Response in Japan

Reorganization of a Nuclear Emergency Preparedness in Japan after the Fukushima Daiichi Nuclear Power Plant Accident

Director General for Nuclear Emergency, Cabinet Office

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Director for International Cooperation

Fukushima Lessons - Large Scale Evacuation/Sheltering Order

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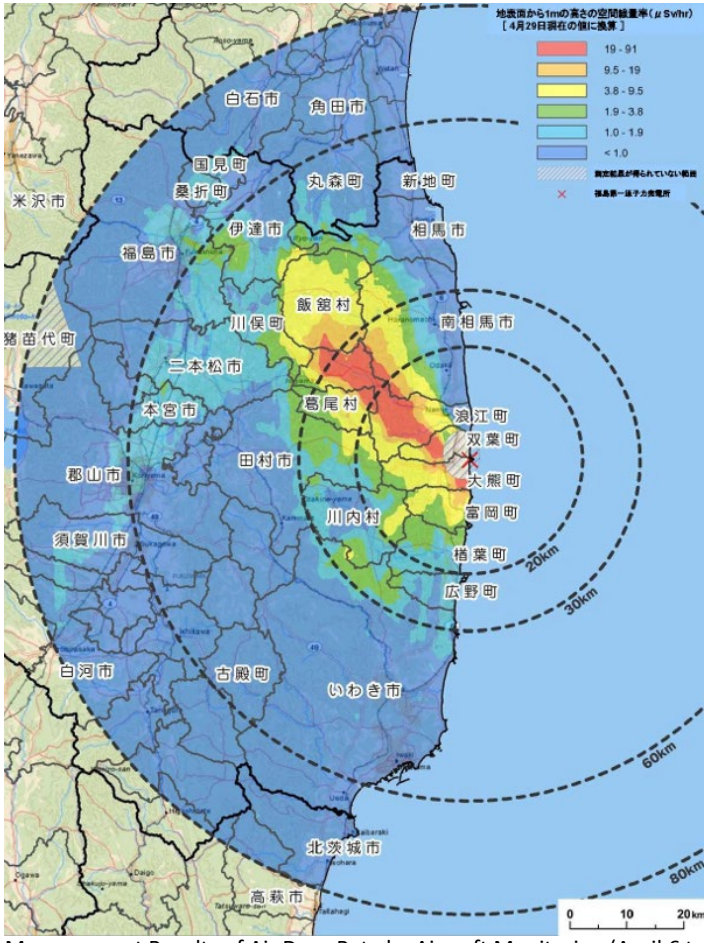
Areas under evacuation orders gradually and unexpectedly expanded due to the rapid progress of the Fukushima Daiichi NPP Accident.

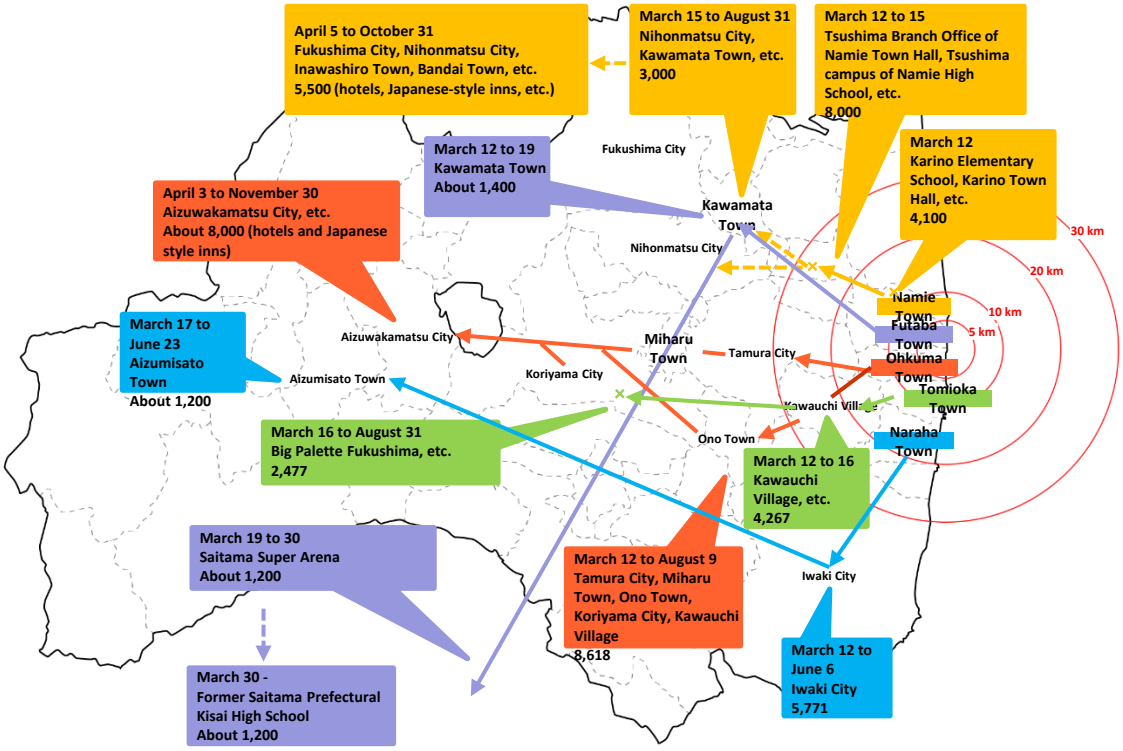
Evacuees had to move around many times and stay for long periods in a shelter

→ A great burden on residents



Measurement Results of Air Dose Rate by Aircraft Monitoring (April 6 to 29, 2011)

Source: Regarding the Measurement Result of Aircraft Monitoring by Aircraft of the Ministry of Education, Culture, Sports, Science and Technology and United States Department of Energy



Source: Report of Surveys by Local Governments Affected by Nuclear Disaster Damage by the Fukushima Daiichi Nuclear Power Plant Accident

Fukushima Lessons - Repatriation/Revitalization of communities

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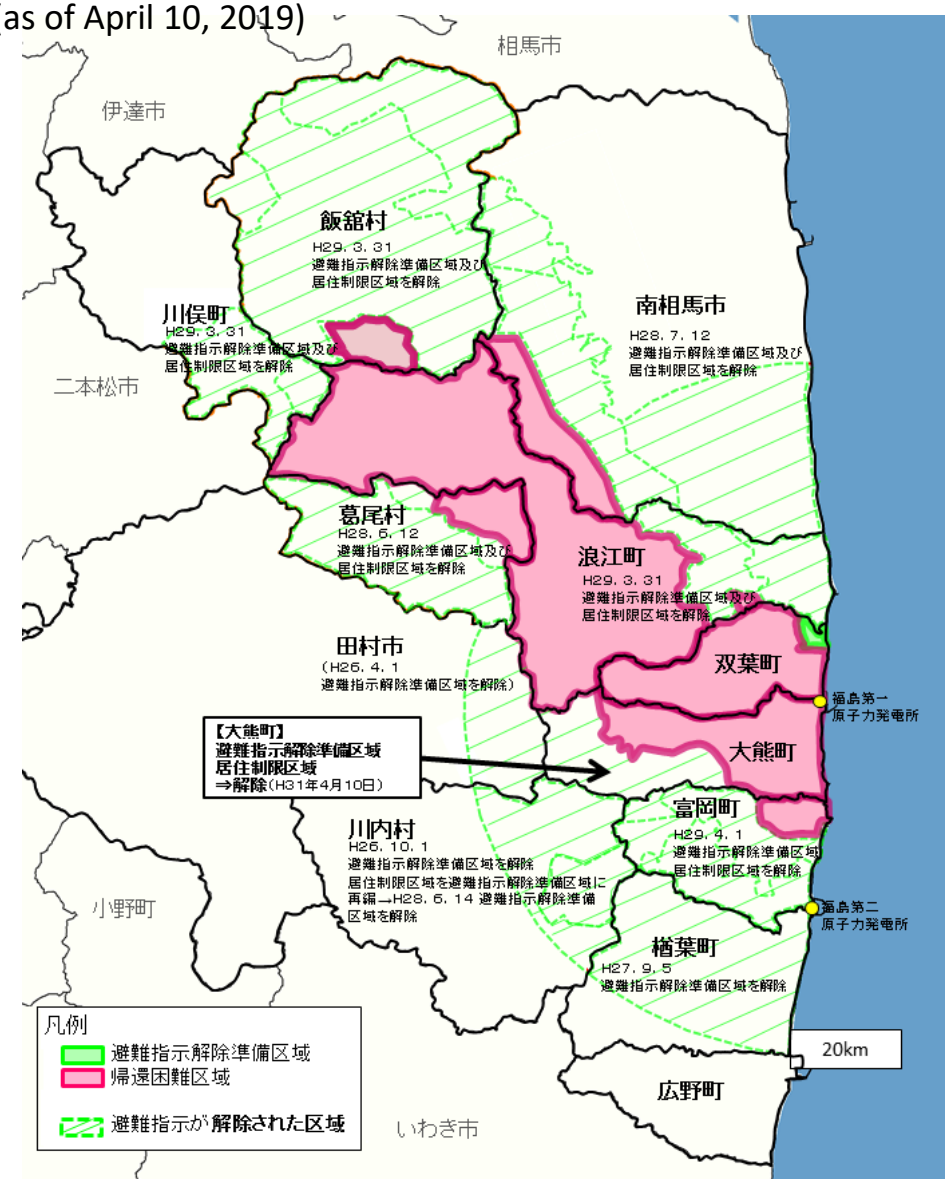
Conceptual diagram of designated evacuation zones
(as of April 10, 2019)

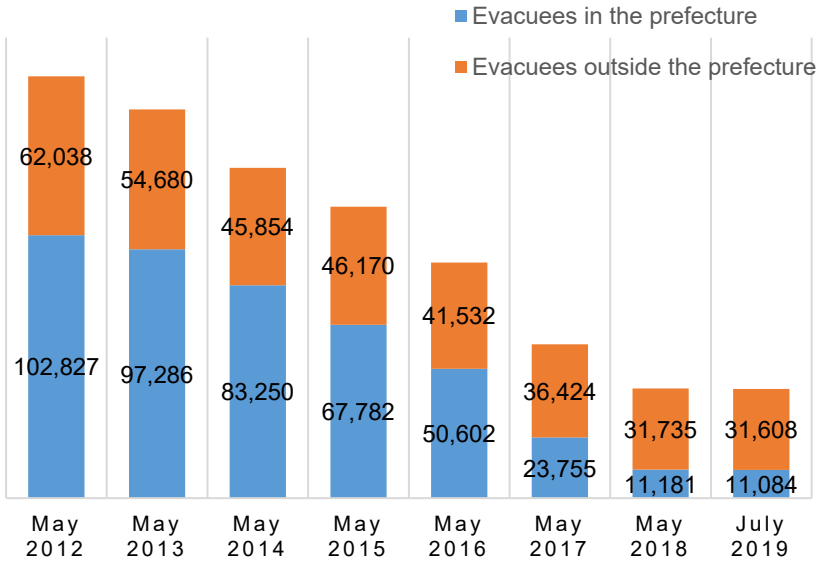


Source: Fukushima Prefectural Government (Fukushima Restoration Station)

Designated evacuation zones - lifted

April 1, 2014	Tamura City
October 1, 2014	Part of Kawauchi Village
September 5, 2015	Naraha Town
June 12, 2016	Part of Katsurao Village
June 14, 2016	Kawauchi Village (cancelled all)
July 12, 2016	Part of Minamisoma City
March 31, 2017	Part of Iitate Village
March 31, 2017	Kawamata Town
March 31, 2017	Part of Namie Town
April 1, 2017	Part of Tomioka Town
April 10, 2019	Part of Ohkuma Town

Changes in the number of evacuees



Source: Prepared based on the documents released by the Fukushima Prefecture (Steps for Revitalization in Fukushima)

Fukushima Lessons - Public Acceptance of Iodine Thyroid Blocking

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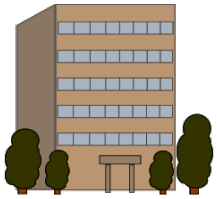
Problems related to taking stable iodine tablets

National government

Failure to understand instructions for taking stable iodine tablets

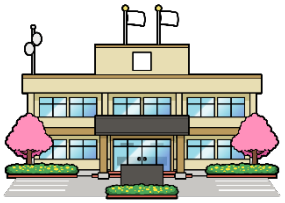
There were no instructions about taking stable iodine tablets.

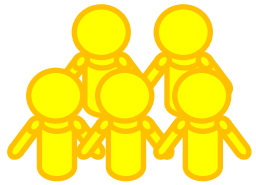
Fukushima prefectural government (Disaster Response HQ)



A Town (within a 10-km radius)

Although the Town had stable iodine tablets, it did not issue instructions for taking them

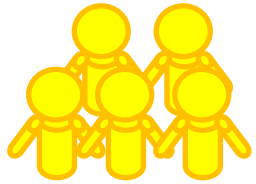




Residents did not take tablets.

B Town (40 km)

The Town urgently procured stable iodine tablets (residents went to the prefectural office to get them) and instructed Town residents to take the tablets.



Residents took tablets.

- Fukushima prefectural government could not confirm whether the Safety Commission's advice on taking stable iodine tablets reached each related municipality.
- Local governments were divided into two: those that distributed stable iodine tablets and had their residents take them, and the those that waited for more instruction to come without distributing the tablets.

Fukushima Lessons - Evacuation of Hospitals

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Patients were forced to bear excessive burdens when the hospital evacuated them.
These were circumstances peculiar to nuclear disasters.

1) Shortage of medical staff	• Medical staff were evacuated, which caused a shortage of medical staff.
2) Limited means of evacuation and rescue	• Since surrounding residents needed ways to evacuate, the transportation infrastructure was stretched to the limit, and few means of evacuation were available. • The greatest problem each hospital faced was the transportation of seriously ill patients.
3) Long-distance evacuation took a long time	• Very wide areas were designated as evacuation areas, forcing patients to evacuate over long distances, taking a long time to reach places outside the evacuation zones. • There were patients who had to start evacuation even when their evacuation destination (hospital) was still undecided.
4) Securing primary destination for evacuation	• Evacuation shelters had to be sought afterward and quickly decided with their evacuation destination undecided. • Some hospitals evacuated their patients to a place without sufficient medical equipment as their primary evacuation destination.

A long line of vehicles taking evacuees from Tomioka Town to Kawauchi Village
Source: Memory and Record of the Great East Japan Earthquake and Nuclear Disaster (Tomioka Town)

Fukushima Lessons - Evacuation of Hospitals

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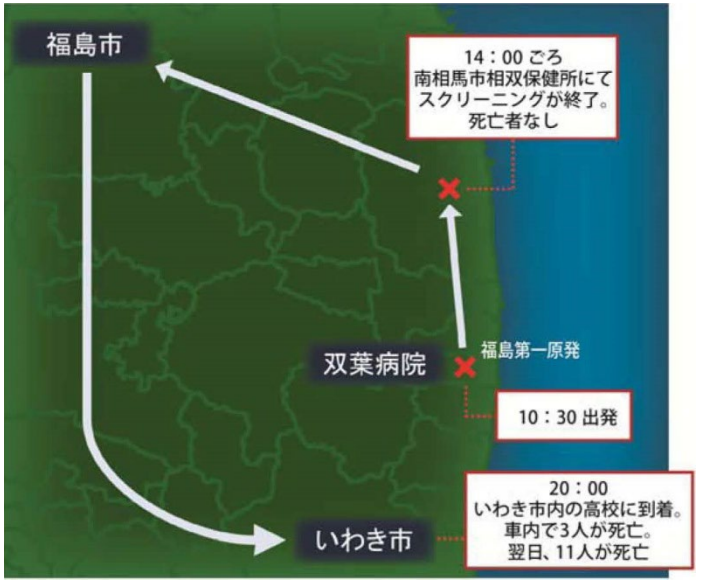
A case of evacuating patients: Futaba Hospital (Ohkuma Town, 4.5 km from the power plant)

- The hospital was unassisted in finding means of evacuation and a place to take shelter.
- 339 hospital patients were left unevacuated in an area within a 20-km radius of the nuclear power plant.
- It took a lot of time to rescue those people due to the lack (difficulty) of information sharing and cooperative action.

Source: Records of the Great East Japan Earthquake and the Progress of Restoration from It (Fukushima prefecture)

- Patients evacuation started with their evacuation destination (hospital) undecided.
- Patients traveled for a long distance (230 km) and for a long time (10 hours), posing great burdens on them (three died in the car) (March 14, 2011).
- The place they evacuated to (high school gymnasium) had no medical equipment. Some patients became very ill, and 11 had died by the following morning.
- A total of 40 patients had died by the end of March.

Source: Official Report of NAIIC



Source: Official Report of NAIIC

Fukushima Lessons - Hospital Function and Mortality

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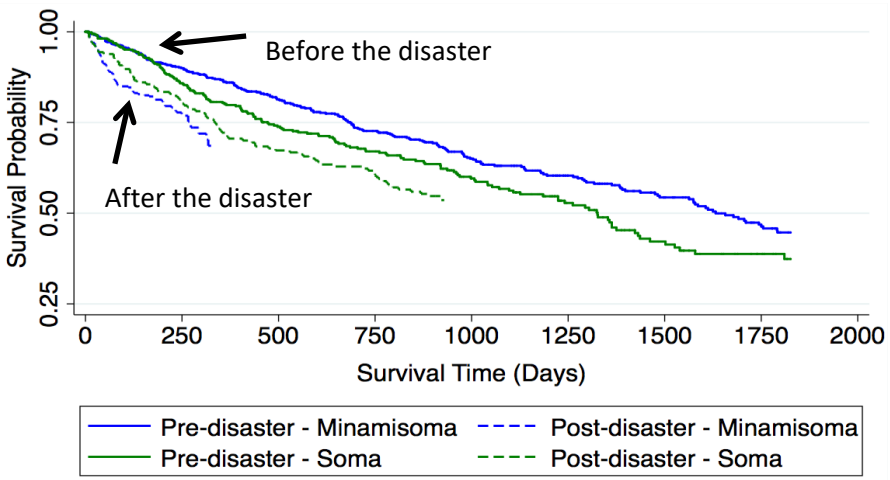
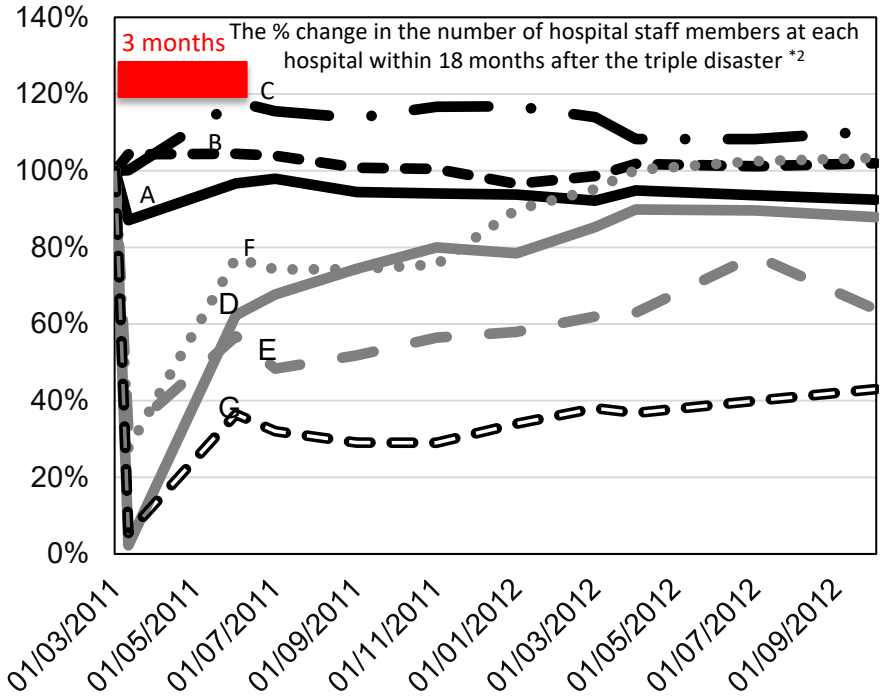
Maintaining the number of staff at the hospital is vital to manage the function at the beginning of the incident, thus save vulnerable population

The 20-30km radius became the indoor restriction zone after the second explosion of the Reactor No.3
No. of medical staff: 274 → 90 *1





- The decrease in staff was most severe in the first three months of the accident. *2
- The disruption of supply from outside had an acute impact on the maintenance of hospital functions and not the destruction of infrastructure. *3
- The major reason the staff could not stay was not radiation, but because they could not maintain their daily lives due to closing schools and companies. *4

1. Kodama, Tsubokura et al. DMPHP 2014.
2. Ochi, Tsubokura et al. Plos One 2016.
3. Abeysinghe, Tsubokura et al. SSM 2017.
4. Hirohara, Tsubokura et al. BMC PHR 2019.

- Immediate evacuation without sufficient preparation and assistance may become one of the causes of deaths.

- Shelter-in-place order became a burden in maintaining lifelines and social functions in a broad area, causing increase in mortality of hospitalized patients, voluntary evacuation, etc.

- Certified disaster-related-deaths in Fukushima exceeds direct deaths due to the earthquake and tsunami in 2011, while other two prefectures have less disaster-related-deaths.

- Prolonged evacuation affected psychosocially and severely to the local community. New immigrants and temporary workers, as well as former residents, should be considered for better recovery plan and approaches.

- Physical barricades will eventually be removed as radiation decays, but psychosocial barricades will keep dividing the stakeholders of communities.

- The socio-economic problems and reputational damages in the affected areas further complicates the challenges of the affected peoples.

< personal observation by the speaker >

EPR Prescriptions after the Fukushima Daiichi NPP Accident

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- Unexpected expansion of the evacuation zone
- Multiple changes in evacuation destinations
- Unexpected extension of the evacuation period
- Lack of concept of a precautionary action
- Limitations of the prediction system
- Progress of the severe accident
- Occurrence of a complex disaster
- Confusion about evacuation instructions
- Vague grounds for decision-making
- Delays in judgment and decision-making

1 Lack of a response that considers the perspective of residents

- Introduce the international standard
- Implement precautionary actions
- Distribute stable iodine tablets in advance

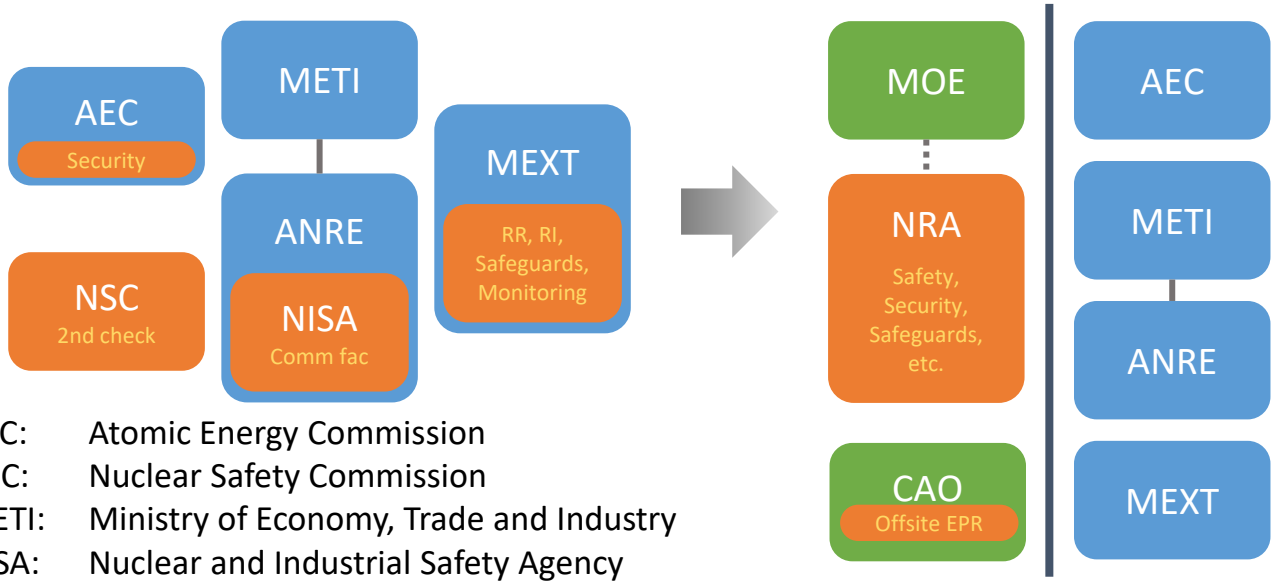
2 Shortage of education and training, including measures to deal with complex disasters or severe accidents

- Improve training programs
- Enhance general disaster preparedness drills
- Enforce mandatory operators' nuclear disaster drills

3 Uncertainness of decision-making about various measures

- Introduce the concept of timelines for emergency management
- Create Emergency Planning Zone
- Set Emergency Action Level (EAL)
- Set Operational Intervention Level (OIL)

Actions – Reform of Nuclear Regulatory Body



AEC: Atomic Energy Commission
NSC: Nuclear Safety Commission
METI: Ministry of Economy, Trade and Industry
NISA: Nuclear and Industrial Safety Agency
ANRE: Agency for Natural Resources and Energy
MEXT: Ministry of Education, Culture, Sports, Science and Technology
MOE: Ministry of Environment*
CAO: Cabinet Office (Nuclear Disaster Management Bureau)*

* MOE and Nuclear Bureau of CAO are lead by the same Minister

NRA Guiding Principles

1. **Independent Decision Making**
   - Based on the latest scientific and technological information, free from any outside pressure or bias
2. **Effective Actions**
   - Stress the importance of a field-oriented approach
3. **Open and Transparent Organization**
   - Avoid both self-isolation and self-righteousness
4. **Improvement and Commitment**
   - Assiduous in learning and absorbing the latest regulatory know-how and best practices
5. **Emergency Response**
   - Fully effective response system in always in place to swiftly respond all emergency situations

Legal Framework for Nuclear Emergency Management

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Basic Arrangements for Emergency Strategy not only Nuclear Emergency

○ **Basic Act on Disaster Management**
- *Implementation and promotion of comprehensive disaster management*

etc.

Legend
- ⬇ : based on Act
- ⇩ : as reference

Special Arrangements for Nuclear facility Emergency

○ **Act on Special Measures Concerning Nuclear Emergency Preparedness**
- *Article6-2: NRA shall establish NRA EPR Guide*
- *Article7: Nuclear Operators shall establish Nuclear Operator's EPR Plans*
- *Article13: National Plan Concerning Disaster Prevention Drills (every year)*

etc.

Technical and Professional Matters

○ **Guide for Emergency Preparedness and Response (NRA EPR Guide)**
- *Protective actions in emergency: EAL/OIL*
- *Emergency Planning Zones : PAZ/UPZ*

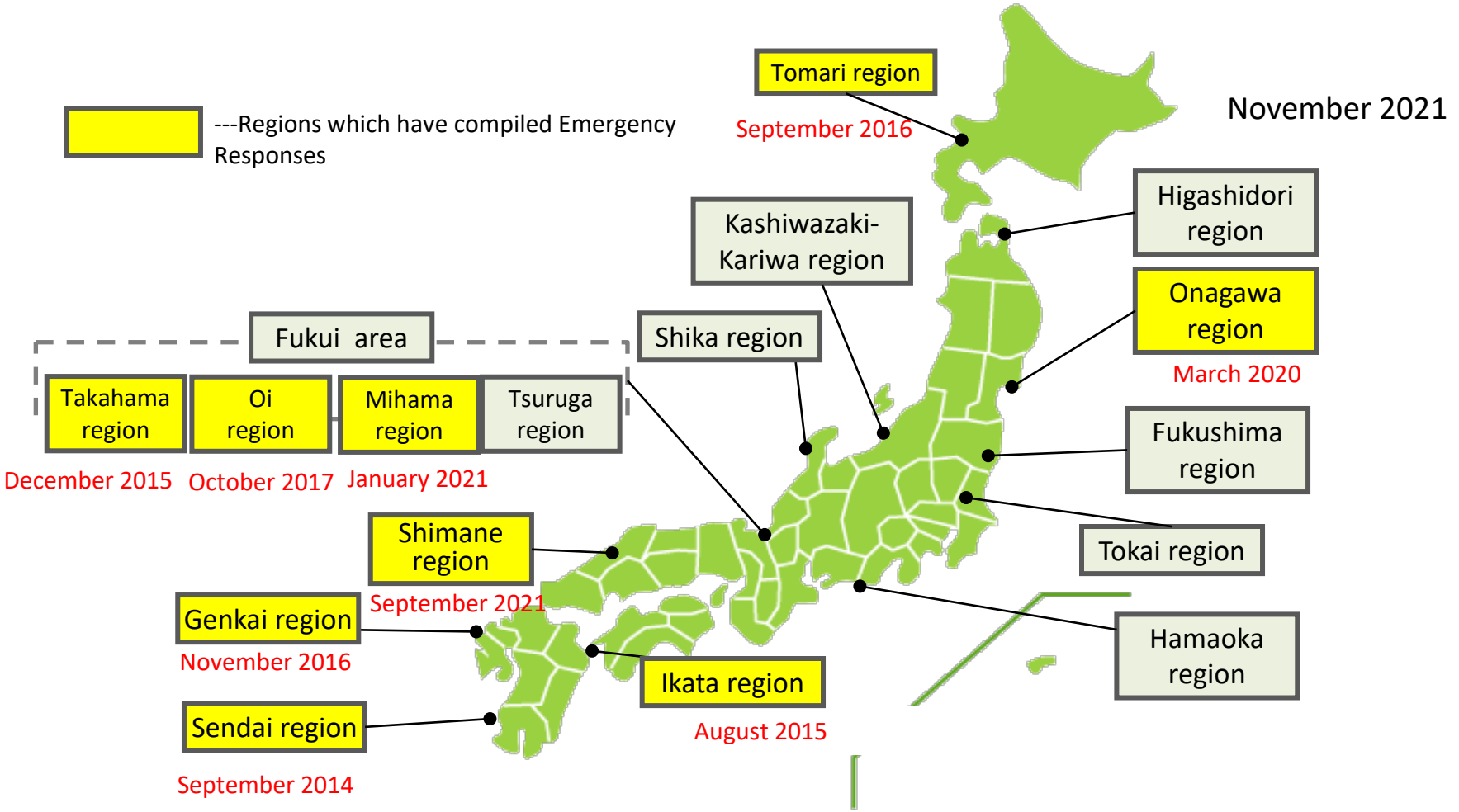
etc.

Basic Disaster Management Plan

Organization	Emergency Preparedness and Response
Ministry and Agency	Manual for Nuclear Disaster Preparedness
Prefectures and Municipalities	Local Disaster management Plan
Designated Public Institutions	Disaster management Operation Plan

Status of “Regional Emergency Responses”

- Regional Nuclear Disaster Management Councils installed in regions have compiled Emergency Responses for the Sendai region, Ikata region, Takahama region, Tomari region, Genkai region , and Oi region (6 regions). Lessons are extracted from training conducted at individual regions to further improve and strengthen Emergency Responses.
- The compilation of Emergency Responses will be accelerated for other regions by reinforcing connections with local governments.



Sheltering facilities with radiological protections

Although radiological protection measures concerning sheltering in place for residents requiring assistance and residents as well as emergency off-site center etc. differs depending upon the form, scale and other features of a facility, the principal points of radiological protection measures are as follows.

Emergency generating equipment

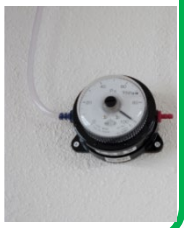
Emergency generating equipment which actuates positive pressurization equipment even in case of loss of commercial electric source.

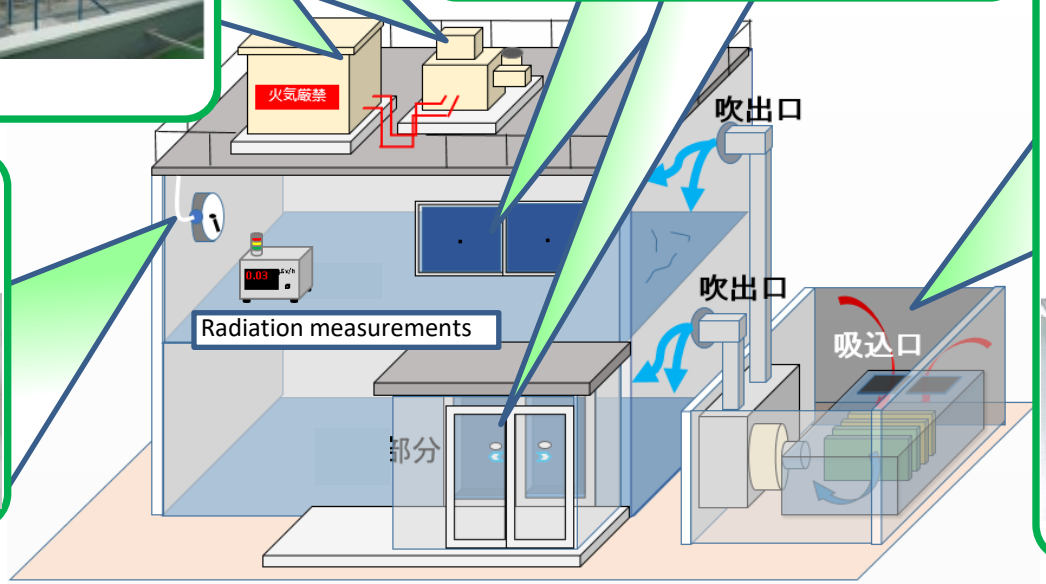
Ensuring airtight

Double-entry doors for entrances (as measures against cracks etc.) and strengthening of window frames.

Differential pressure gauge

Grasp the operation status of positive pressurizatio n equipment.





Pressurization equipment

- Removal of dust etc. through pretreatment filter.
- Removal of radioactive cesium, radioactive iodine etc. through main filter.
- Supply of clean air within the facility after said process.

Iodine Thyroid Blocking

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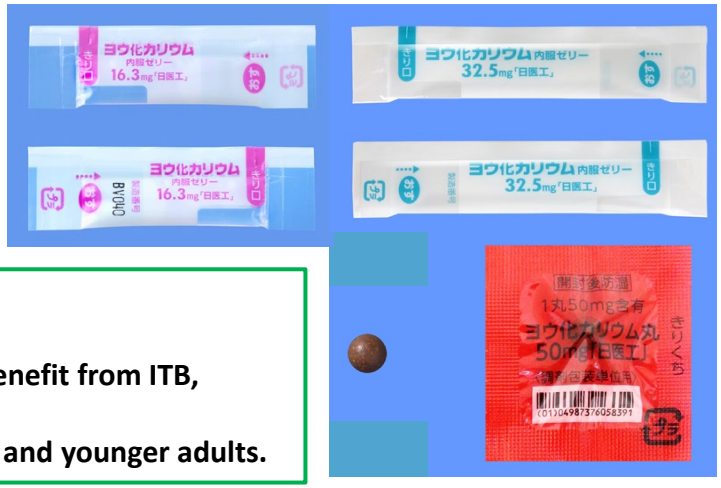
Jelly type

- **Under 1month of age：16.3 mg/1 pack**
- **Over 1month ～ under 3 years old : 32.5 mg/1 pack**

Pill type（50 mg/pill）

- **Over 3 years ～ under 13 years old：50 mg （1 pill）**
- **Over 13 years old ： 100 mg（2 pills）**

‘mg’ is the amount of potassium iodine



- **People who have difficulty taking pills take the equivalent amount of jelly.**
- **Taking overdose doesn’t increase efficacy of potassium iodine.**
- **Children, adolescents, pregnant and breastfeeding women are most likely to benefit from ITB, whereas individuals over 40 years of age are less likely to benefit from it.**
- **Should the supply of iodine be limited, priority should be given to the children and younger adults.**

	PAZ (Pre-distribution)	UPZ (Urgent Distribution)
Preparation during peacetime	Distribute iodine to residents in advance. ・Physicians explain preventive effects, side effects and intake timing of iodine. ・Pharmacists at a pharmacy designated by the local government can hand out the iodine.	Local governments store iodine for distribution in emergency. ・It is allowed to distribute in advance to residents apart from stock place.
General Emergency	Take the distributed iodine at the beginning of evacuation. ・NRA determines dosing within PAZ then Nuclear Emergency Response Headquarters or local governments instruct to take.	Taking iodine won’t be conducted at this timing because radioactive materials has not released yet and it is more than 5km from the site.
Beyond	**Outside UPZ** **The government stocks 2 million (pill type) and 100,000 (jelly type) iodine in five regions.** **If necessary, the government will give instructions to distribute and take it.**	According to situation of nuclear facilities and air dose rate, iodine would be distributed for taking during evacuation or temporary relocation. ・NRA determines dosing within UPZ then Nuclear Emergency Response Headquarters or local governments instruct to take.

Drill and Training

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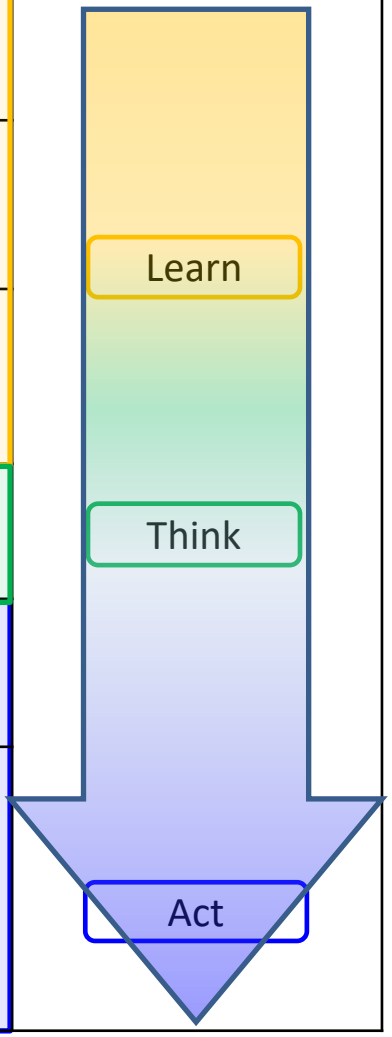
Drills and Trainings Planned and Conducted by the National Government

- National Disaster Prevention (NDP) staff of the related ministries and agencies of the Japanese government (about 700 from 18 ministries and agencies) participate in the drills, exercises and training so that they will be capable of taking appropriate actions in the event of emergency situations.
- Personnel of the related organizations, such as the national government, local governments, and nuclear power plant operators, participate in the drills and training depending on the type and purpose of the drill or training.

Training	Training to develop the basic capability of nuclear disaster response staff	○ Nuclear disaster management basic training ○ Nuclear disaster response staff training ○ Nuclear disaster management seminar
	Training to develop staff who will play a core role in each organization	○ Core staff training (Elementary Class—National staff) (Elementary Class—Prefectural staff) (Elementary Class—Municipal staff)
	Training to develop practical personnel for local operation	○ Practical personnel training (Including preparing an implementation policy for each situation) (Contamination screening, etc.) (Evacuation of residents by bus, etc.)
	Exercise to develop the ability of understanding the situation and judgment	○ Core staff training (Intermediate Class—National staff) ○ Map exercise for local nuclear emergency response HQ
Drill	Step-by-step drills up to Nuclear Energy Disaster Preparedness Drill (NEDPD)	○ Preparatory drill (NEDPD) ○ Off-site center operation and cooperation drill ○ NEDPD
	Exercises to get ready for the "present"	○ Preparatory drill ○ Exercise by the function unit ○ Initial response exercise ○ Function unit exercise connected to the nuclear operator's disaster management exercise ○ Emergency communication exercise ○ Off-site center operation exercise



The FY 2019 Nuclear Energy Disaster Prevention Drill (NEDPD)

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- Political leaders' involvement
  Prime Minister, Ministers,
  Governors and Mayors
- General public participation
- Partnership with media
- Large scale drill with thousands of participants
- Coordination of EOC command and Field activities
- Open scenario
- Assume combined disaster with natural emergency

FY2019 Nuclear Energy Disaster Prevention Drill (NEDPD)

NEDPD is the annual comprehensive drill, conducted by the national government (lead by the Prime Minister), local governments, nuclear power plant operators, relevant organizations and private sectors, and local citizens.
One region is selected for NEDPD each year, and a series of preparatory drills and exercises will cover the components of the NEDPD, so as to equip the personnel of participating organizations with the skills to perform NEDPD.

Occurrence of an event

Alert Situation → Site Area Emergency → State of General Emergency

○Exercise to quickly establish an initial response system

- Assembling personnel, understanding current situations
- Sharing information between related organizations, etc. using a video conference system, etc.

○Decision-making exercise with regard to a plan for implementing protective measures, etc. in collaboration with the central and local organizations

- Information sharing, decision-making, etc. by the headquarters of the both authorities concerning complex disasters combining nuclear and natural disasters
- Emergency transportation of government employees and experts to the sites

○Monitoring of emergencies

○Field exercise to evacuate local residents within and outside the prefecture, take shelter, etc.

- Evacuation of residents in the PAZ
- Sheltering of residents in the UPZ
- Identification of areas for temporary relocation based on monitoring results, etc.
- Temporary relocation of residents in the UPZ, etc.

Disaster Management Headquarters

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Shimane Prefecture

Matsue City (Municipal Level)

Nuclear Disaster Medical Drill

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JGSDF Helicopters to deploy DMAT/to transfer patients

JGSDF Mobile Operation Theaters

Off-Site Center (Local EOC)

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Declaration of General Emergency by the Prime Minister (video-connected)

Evacuation of PAZ Residents beyond UPZ

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Setting up of evacuation camp: leaders of communities discussing housekeeping rules and management

Greetings by local leadership: Drills as public communication opportunities

Acute Radiation Medical Care Ward

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Tottori University Hospital
Pressurized and air-tightened facilities for screening and decontamination

Actions upon COVID-19 Pandemic

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Protective Actions

- June 2020 “Basic Concept of Protective Measures in Case of Nuclear Disasters during and Epidemic of Infectious Diseases Due to the Spread of the Novel Coronavirus”
  - Urging local governments to implement both infection prevention control and radiological protective actions
  - No changes on NRA-NPP-EPR Guide

- NPP Site “Regional Emergency Response” plans revised
  - Separating public into four groups (those infected with COVID-19, close contacts, symptomatic people, and others) during transportation, evacuation and relocation

- November 2020 “Guidelines for the Implementation of Protective Actions for a Nuclear Emergency Occurring during the Spread of an Infectious Disease such as the Novel Coronavirus Infection”
  - Pay attention to vulnerable population to infection
  - Advising local governments to ventilate transportation buses and evacuation camps in case before possible release of radiological plume

Actions upon COVID-19 Pandemic

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Response Capabilities

- Exercises and trainings almost fully implemented as planned
  - Some through remote communication
  - Infection prevention control and surveillance
  - The full scale Nuclear Energy Disaster Prevention Drill postponed

- Remote pre-distribution of stable iodine tablets
  - CAO advised local governments to remotely conduct town hall meetings
  - Two prefectures started remote meeting and mailing stable iodine

- NRA's BCP incorporated COVID-19

- October 2020 "Actions at each EOC during nuclear emergency under the spread of the Coronavirus"
  - IPC measures when using EOCs
  - Supplementary staff to maintain capacity from the central government

Lessons

- Surge capacities
- Balancing various risks and socioeconomic impact
- Communication, stigmatization, trust, fairness, etc.

Thank you for your kind attention !!

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1. **Governance from Technocracy**
   - Response based on scientific and technological excellences
   - Community engagement through precise communication
2. **Overcome Assumptions**
   - Preparedness beyond what we can imagine and plan
   - Avoid being shackled by the previous disasters
3. **Action upon Reality**
   - Limitation of Simulation and Estimation
   - Decision making based on monitoring and evaluation
4. **Non-Radiological Health Impact**
   - Dilemma of “stay” or “move”
   - Susceptibility to radiation v.s. physical/mental health risks due to protective actions
5. **Aftermath of the Accident and Protective Actions**
   - Social disruption impeding community revitalization
   - Stigmatization and behavioral changes
6. **Lessons Reaffirmed by COVID-19 pandemic**
   - Interventions to balance with other public health/psycho-socio-economic impact
   - Communication and governance for public trust
7. **No Complacency for Emergency Response**

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