

# ***Fukushima Daiichi Accident***

## ***Report by the Director General***

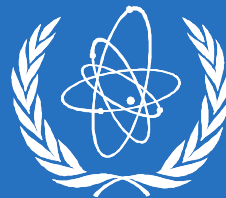
***GC-59 Side Event***

***17 September 2015, Vienna***

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**IAEA**

International Atomic Energy Agency

# *The Report on the Fukushima Daiichi Accident*

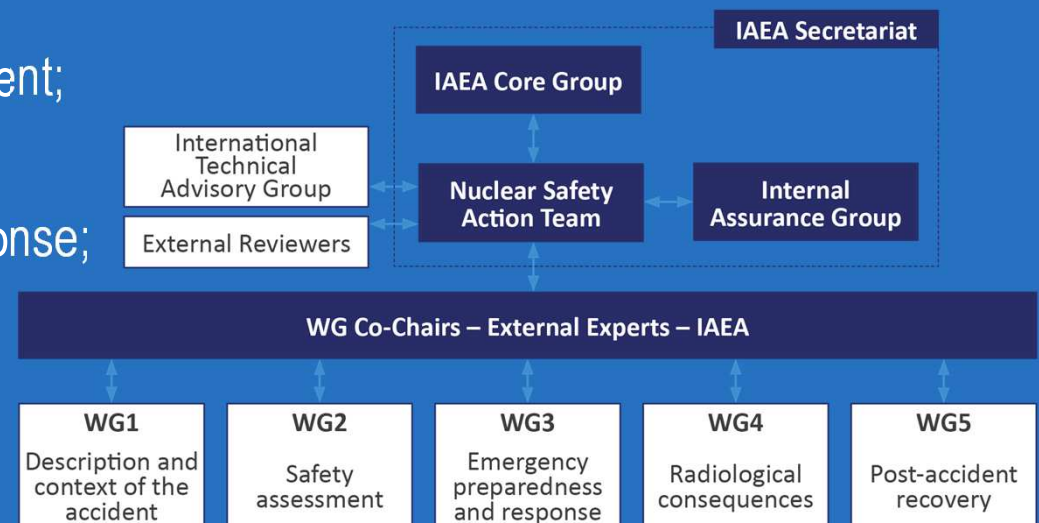
## ■ Report by the IAEA Director General:

- ✓ Executive Summary;
- ✓ Summary Report;
  - Bold italics;
  - Bold lessons and observations;
  - Uses safety standards in place at the time of the accident as reference.



## ■ Technical Volumes:

- ✓ Description and context of the accident;
- ✓ Safety assessment;
- ✓ Emergency preparedness and response;
- ✓ Radiological consequences;
- ✓ Post-accident recovery.



Section 1: Introduction	The Report on the Fukushima Daiichi Accident					
Section 2: The accident and its assessment	Description of the accident	Nuclear safety considerations	Technical Volumes 1 & 2			
Section 3: Emergency preparedness and response	Initial response in Japan to the accident	Protecting emergency workers	Protecting the public	Transition from the emergency phase to the recovery phase and analyses of the response	Response within the international framework for emergency preparedness and response	Technical Volume 3
Section 4: Radiological consequences	Radioactivity in the environment	Protecting people against radiation exposure	Radiation exposure	Health effects	Radiological consequences for non-human biota	Technical Volume 4
Section 5: Post-accident recovery	Off-site remediation of areas affected by the accident	On-site stabilization and preparations for de-commissioning	Management of contaminated material and radioactive waste	Community revitalization and stakeholder engagement		Technical Volume 5
Section 6: The IAEA response to the accident	IAEA activities	Meetings of the Contracting Parties to the Convention on Nuclear Safety	Technical Volumes 1 & 3			

# INFORMATION SOURCES

- ✓ 341 reference documents;
- ✓ 180 experts from 42 Member States and several international bodies;
- ✓ 6 rounds of Working Groups meetings in Vienna
- ✓ IAEA missions and bilateral meetings in Japan;
- ✓ Various consultancy meetings;
- ✓ Information received via the Permanent Mission of Japan;
- ✓ International reports, such as: ICRP, UNSCEAR, WHO, WMO, OECD/NEA
- ✓ Several national reports.

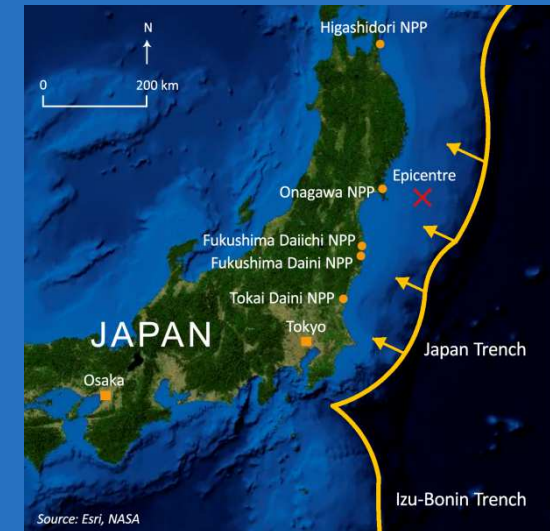
## Japanese reports:

- Diet;
- Government Investigation Committee;
- Independent Investigation Commission;
- TEPCO;
- Atomic Energy Society of Japan.

# THE ACCIDENT AND ITS ASSESSMENT

## Vulnerability of the plant to external events

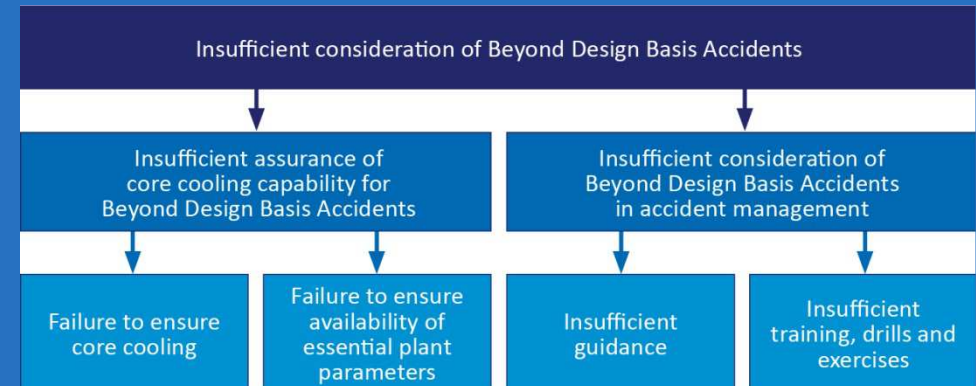
- ✓ Seismic and tsunami hazards (historical records);
- ✓ Assessment of extreme natural hazards (JSCE, HERP, Compensatory measures);
- ✓ Multi-units sites;
- ✓ Operating experience - consequences from flooding.



- **Large uncertainties** remain in the prediction of natural hazards and their assessment needs to be **sufficiently conservative** and consider:
  - ✓ prehistoric data;
  - ✓ hazards in combination, either simultaneously or sequentially, and their combined effects on an NPP; and
  - ✓ their effects on multiple NPP units.
- NPP safety needs to be **periodically re-evaluated**, **operating experience** programmes need to include both **national and international** sources and necessary actions or compensatory measures need to be **implemented promptly**.

# Assessment of beyond design basis accidents and accident management

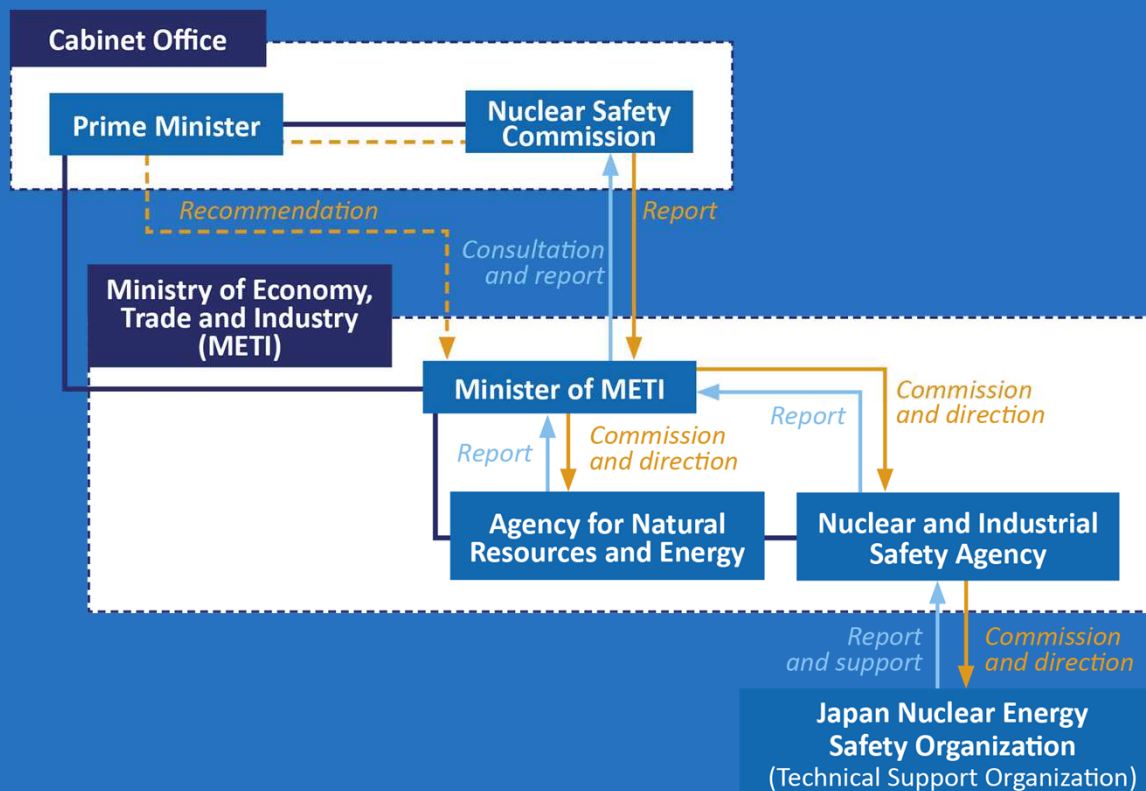
- ✓ Safety analysis;
- ✓ Beyond design basis accident including severe accidents;
- ✓ Accident management (Training, contingency plan for I&C);
- ✓ Training.



- **Comprehensive PSA/DSA** are needed to confirm the capability to withstand applicable BDBAs and provide confidence in the **robustness of the design**.
- **Accident management** provisions need to be comprehensive, well designed and take account of accidents at multiple units.
- **Training, exercises and drills** need to include postulated severe accident conditions to ensure that **operators are well prepared**.

## Assessment of regulatory effectiveness

- ✓ Regulatory effectiveness;
- ✓ Inspections;
- ✓ Regulations.
- ✓ NRA, 2012



- It is essential that the **regulatory body** is **independent**, possesses **legal authority**, technical **competence** and a strong **safety culture**.



## Assessment of human and organizational factors

- ✓ The basic assumption in Japan;
- ✓ Regulator (lack of regulatory Framework);
- ✓ Operator (confident);
- ✓ Application of the IAEA safety standards;
- ✓ Systemic approach to safety.

- A **systemic** approach to safety needs to consider the **interactions** between **human, organizational and technical factors**.
- **Individuals** and **organizations** need to **continuously challenge** the **prevailing assumptions** to strengthen safety culture.

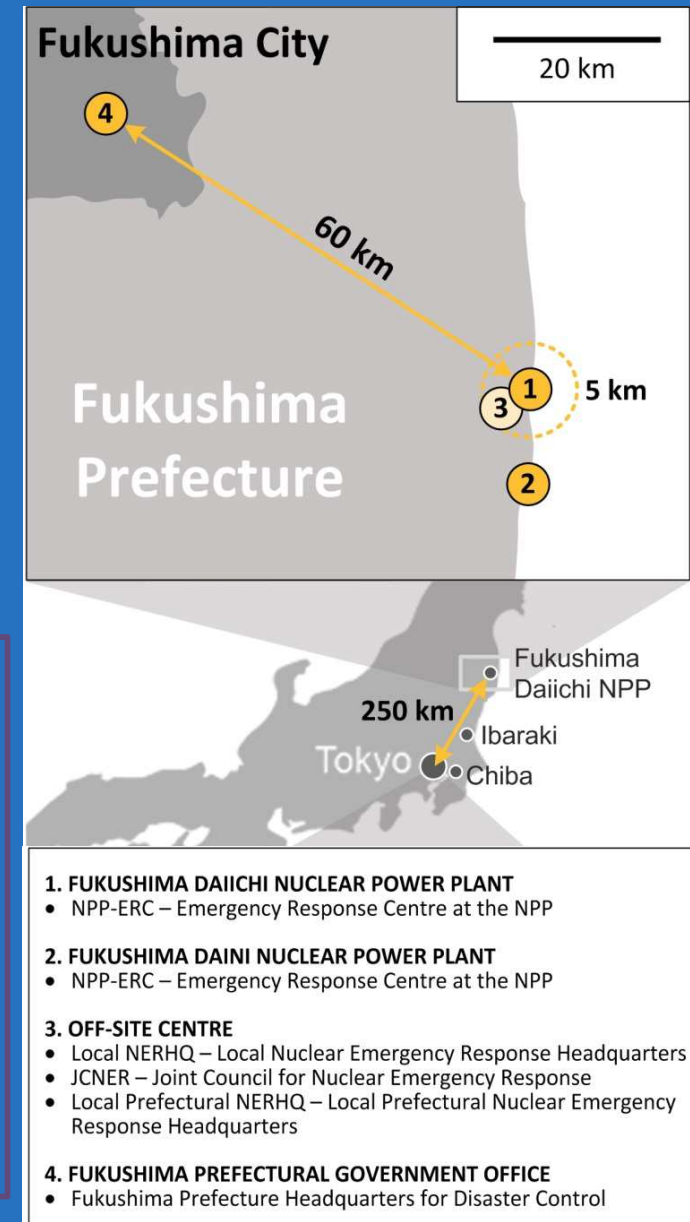
# EMERGENCY PREPAREDNESS AND RESPONSE



## Initial response in Japan to the accident

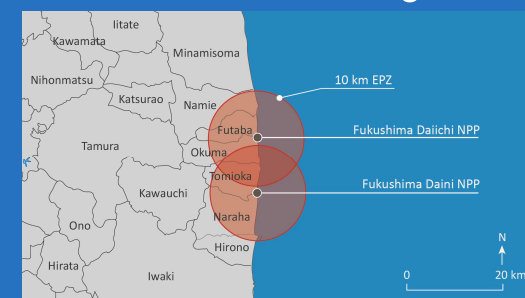
- ✓ Notification (tsunami – 15:36 hrs, initial notification – 15:42 hrs, nuclear emergency declared – 19:03 hrs);
- ✓ Mitigatory actions (separate arrangements, KK experience, NPPs);
- ✓ Management of the emergency – involvement of the Government, core entities.

- The emergency management system needs **clearly defined roles and responsibilities** and interactions between operators and regulators needs to **be regularly tested** in exercises.
- Need to consider emergencies involving **multiple units** also occurring at the same time as a **natural disaster**.



## Protecting the public

- ✓ Urgent protective actions and relocation – dose projections vs. plant conditions;
- ✓ Protective actions – evacuation, sheltering, iodine thyroid blocking through the administration of stable iodine, restrictions on the consumption of food and drinking water, relocation; and provision of information;
- ✓ International trade – certification system for export products (reassuring and advising).



- Arrangements are needed for **extending or modifying** urgent protective actions in response to developing plant conditions or monitoring results.
- Decisions on **predetermined urgent protective actions** for the public need to be based on **predefined plant conditions**.
- A comprehensive approach to decision making is needed to ensure protective actions do **more good than harm**.
- Decision makers, the public and others need to **understand radiological hazards** in a nuclear emergency to make **informed decisions** on protective actions.

## Transition from the emergency phase

- ✓ Transition from the emergency phase to the recovery phase – application of ICRP recommendations in the development of policy and guidelines;
- ✓ Analyses of the response and subsequent modification of the EPR arrangements (lessons learned).

- Arrangements needed for **termination of protective actions** and the **transition** to the **recovery** phase.
- Timely analysis of an emergency and the response to it, **drawing out lessons and identifying possible improvements**, enhances emergency arrangements.

## International response

- ✓ International framework for EPR for a nuclear or radiological emergency at the time of the accident (prognosis, missions, JPLAN, IACRNE);
- ✓ The Assistance Convention and RANET;
- ✓ Third states recommendations for their nationals in Japan.

- Need to strengthen implementation of international arrangements for notification and assistance.
- Need to improve consultation/information sharing among States on protective actions and other response actions.

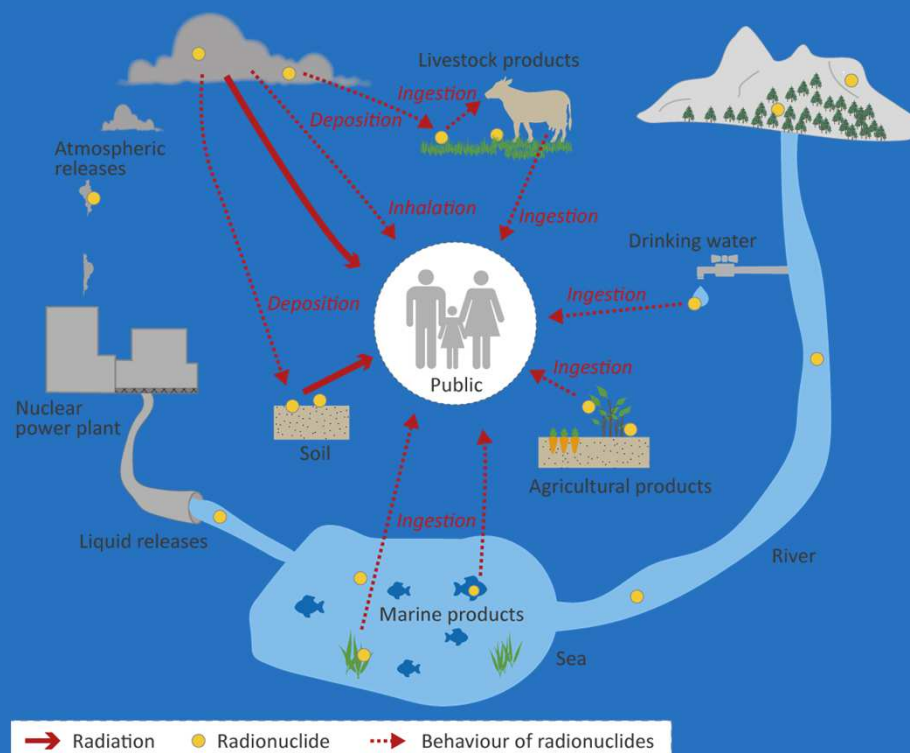
# RADIOLOGICAL CONSEQUENCES



## Protecting people against radiation exposure

- ✓ 1996 Basic Safety Standards and 2007 ICRP recommendations;
- ✓ Restriction of public exposure (20-100 mSv);
- ✓ Restriction of occupational exposure including exposure of emergency workers – dose criterion temporarily increased to 250 mSv (BSS:100mSv, 500 mSv).

- **Understandable** radiation protection principles and criteria need to be developed **for non-specialists** to make their application clearer for decision makers and the public.
- **Conservative decisions** on protective measures and actions led to **extended restrictions** and associated **difficulties**.





# POST-ACCIDENT RECOVERY



## Off-site remediation of areas affected by the accident

- ✓ Establishment of a legal and regulatory framework for remediation;
- ✓ Remediation strategy – priority to reduction of external doses in residential areas, low ‘reference level’ as a target level of dose for the overall remediation strategy;
- ✓ Progress in remediation.

Pre-accident planning for post-accident recovery is necessary to improve decision making.

National strategies for recovery need to be prepared in advance and include:

- ✓ a legal/regulatory framework;
- ✓ generic strategies and criteria for doses and contamination levels;
- ✓ a plan for stabilization and decommissioning; and
- ✓ a generic strategy for managing contaminated material and waste.

Remediation strategies need to take account of the effectiveness and feasibility of measures and the amount of contaminated material generated.

Further international guidance is needed on the practical application of safety standards for radiation protection in post-accident recovery situations.

Implementation of rigorous testing and controls on food is necessary to prevent or minimize ingestion doses.

Before



After





## On-site stabilization and preparations for decommissioning

- ✓ Strategic planning;
- ✓ Preparations for decommissioning;
- ✓ Management of contaminated water;
- ✓ Removal of spent fuel and fuel debris;
- ✓ Decommissioning end state for the site.



- A **flexible** strategic plan for maintaining **long term stable conditions** and for the **decommissioning** is essential.
- Retrieving damaged fuel and fuel debris necessitate **solutions** that are **specific** to the accident.

# THE IAEA RESPONSE TO THE ACCIDENT



## IAEA ACTIVITIES

- ✓ Initial activities
- ✓ IAEA missions to Japan
- ✓ IAEA Ministerial Conference on Nuclear Safety
- ✓ The IAEA Action Plan on Nuclear Safety
- ✓ Cooperation with Fukushima Prefecture
- ✓ Fukushima Ministerial Conference on Nuclear Safety

## MEETINGS OF THE PARTIES TO THE CONVENTION ON NUCLEAR SAFETY

- ✓ Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety;
- ✓ Sixth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety;
- ✓ Diplomatic Conference and the Vienna Declaration on Nuclear Safety.

## FINAL REMARKS

- 45 key observations and lessons are highlighted in the report;
- The legacy of the accident will be a sharper focus on nuclear safety everywhere;
- The IAEA safety standards embody an international consensus on what constitutes a high level of safety;
- The IAEA peer reviews have a key role in further strengthening global nuclear safety;
- The accident underlined the vital importance of effective international cooperation;
- The IAEA has reviewed its own arrangements to respond to a nuclear emergency;
- Continuous questioning and openness to learning from experience are key to safety culture and are essential for everyone involved in nuclear power. Safety must always come first;
- Summary Report and Technical Volumes are available on IAEA Public Web Sites.





*Thank you!*

