THE IAEA FUKUSHIMA REPORT AND THE IMPLICATIONS FOR NUCLEAR SAFETY AND EMERGENCY PREPAREDNESS

Nordic Perspectives of Fukushima
Stockholm
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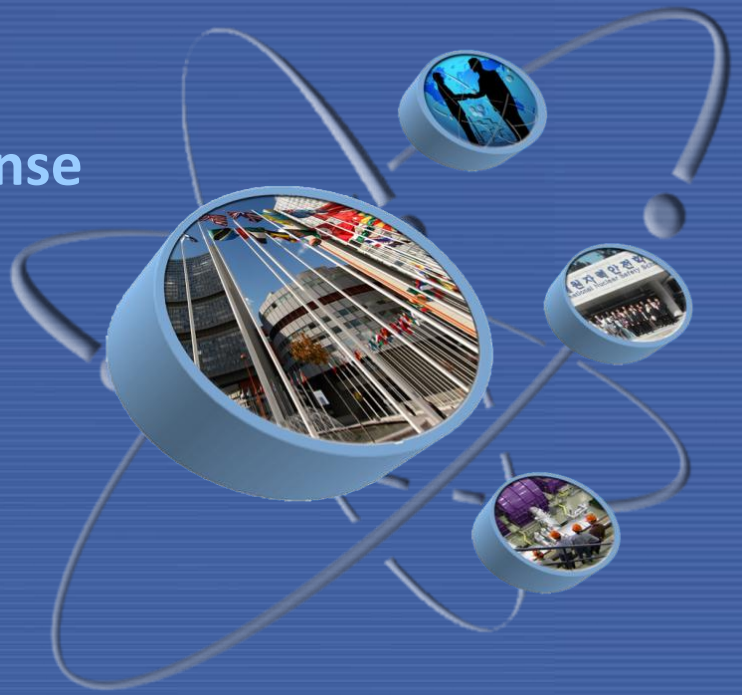
International Atomic Energy Agency

OVERVIEW

- IAEA Report on the Fukushima Daiichi accident
  - Nuclear Safety
  - Emergency Preparedness and Response
- Other relevant activities
  - IAEA Action Plan on Nuclear Safety
- The way forward



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KEY FACTS

GENERAL

- September 2012 – announcement by DG Amano
- 3 years work
- September 2015 – report released
- DG Report + 5 Technical Volumes
- What happened + why

REPORT BY THE DIRECTOR GENERAL

- Executive Summary + Summary Report
- ~200 pages drawn from Technical Volumes
- 45 key observations and lessons
- Most not new
- IAEA activities + CNS Review Meetings

5 TECHNICAL VOLUMES

- 5 Working Groups
- 180 Experts 40 Member States
- Geographical representation
- ~1000 Pages + Annexes
- 102 observations and lessons
- IAEA website

WORKING METHODS

- 6 rounds of 5 Working Group meetings
- Consultancy meetings
- Expert missions to Japan
- Bilateral meetings in Japan
- Information received from Japan
- Independent advice
- Safety standards extant in 2011

THE FUKUSHIMA DAIICHI ACCIDENT

Report by the Director General

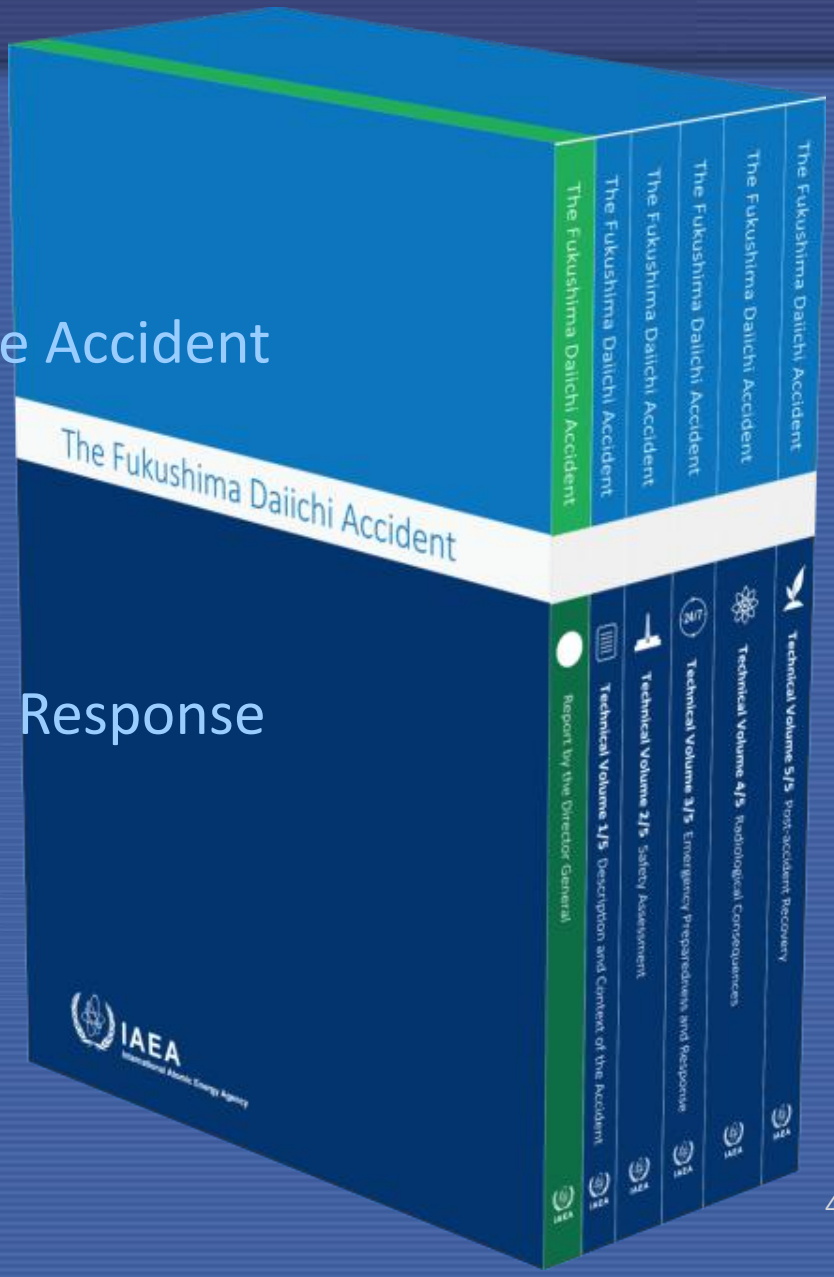
Technical Volume 1
Description and Context of the Accident

Technical Volume 2
Safety Assessment

Technical Volume 3
Emergency Preparedness and Response

Technical Volume 4
Radiological Consequences

Technical Volume 5
Post-accident Recovery



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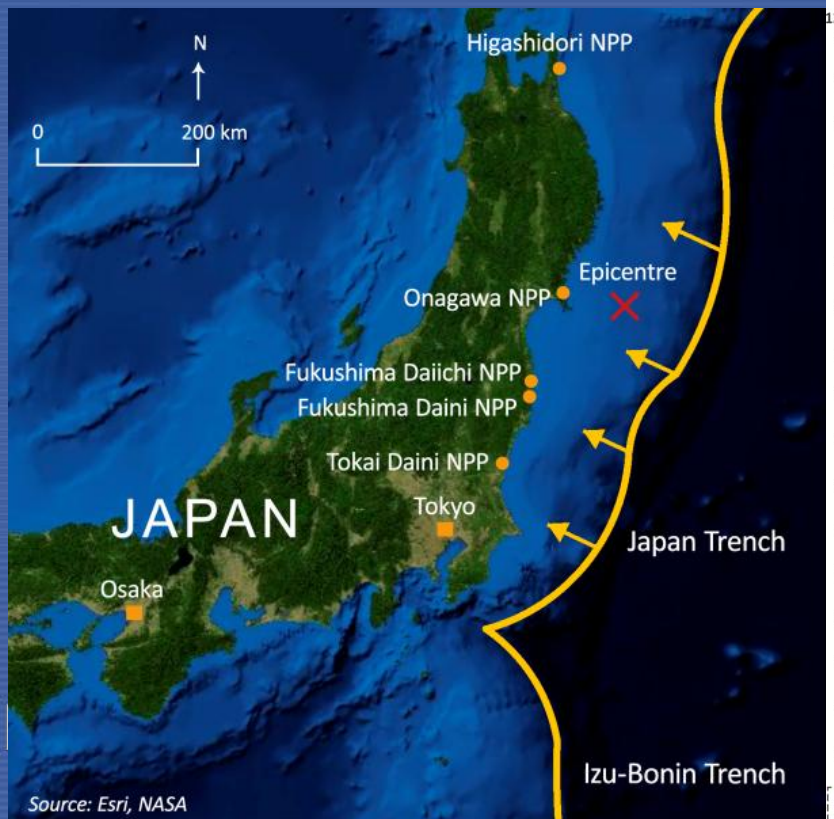
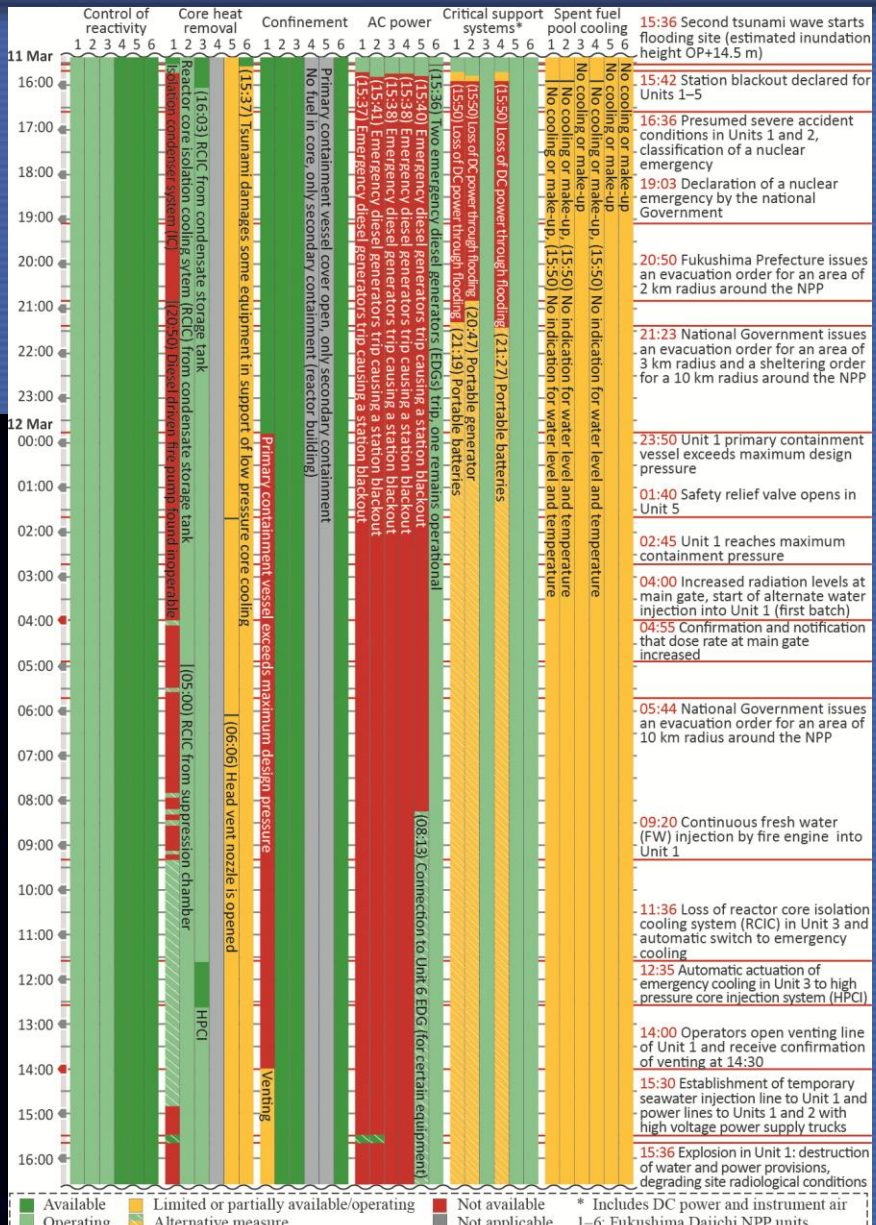
Section 1: Introduction	The Report on the Fukushima Daiichi Accident					
Section 2: The accident and its assessment	Description of the accident	Nuclear safety considerations	Technical Volumes 1 & 2			
Section 3: Emergency preparedness and response	Initial response in Japan to the accident	Protecting 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			

WHAT HAPPENED

Description of the events presented in chronological order to highlight the integrated response to a multi-unit accident





WHY IT HAPPENED

- Vulnerability to external events
- The defence in depth concept
- The fundamental safety functions
- Beyond design basis accidents and accident management
- Regulatory effectiveness
- Human and organizational factors

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VULNERABILITY TO EXTERNAL EVENTS

FINDINGS

- No apparent damage to SSC's from earthquake
- Tsunami far exceeded design basis causing major damage
- Major conclusion : the treatment of external hazards was not fully in line with international practice

OBSERVATIONS AND LESSONS

- Need for periodic update of external hazards assessment
- Appropriate conservatism to account for uncertainties
- Predictions that challenge current assumptions need prompt corrective actions need to be taken promptly
- Multi-unit and multi-site accidents need to be assessed

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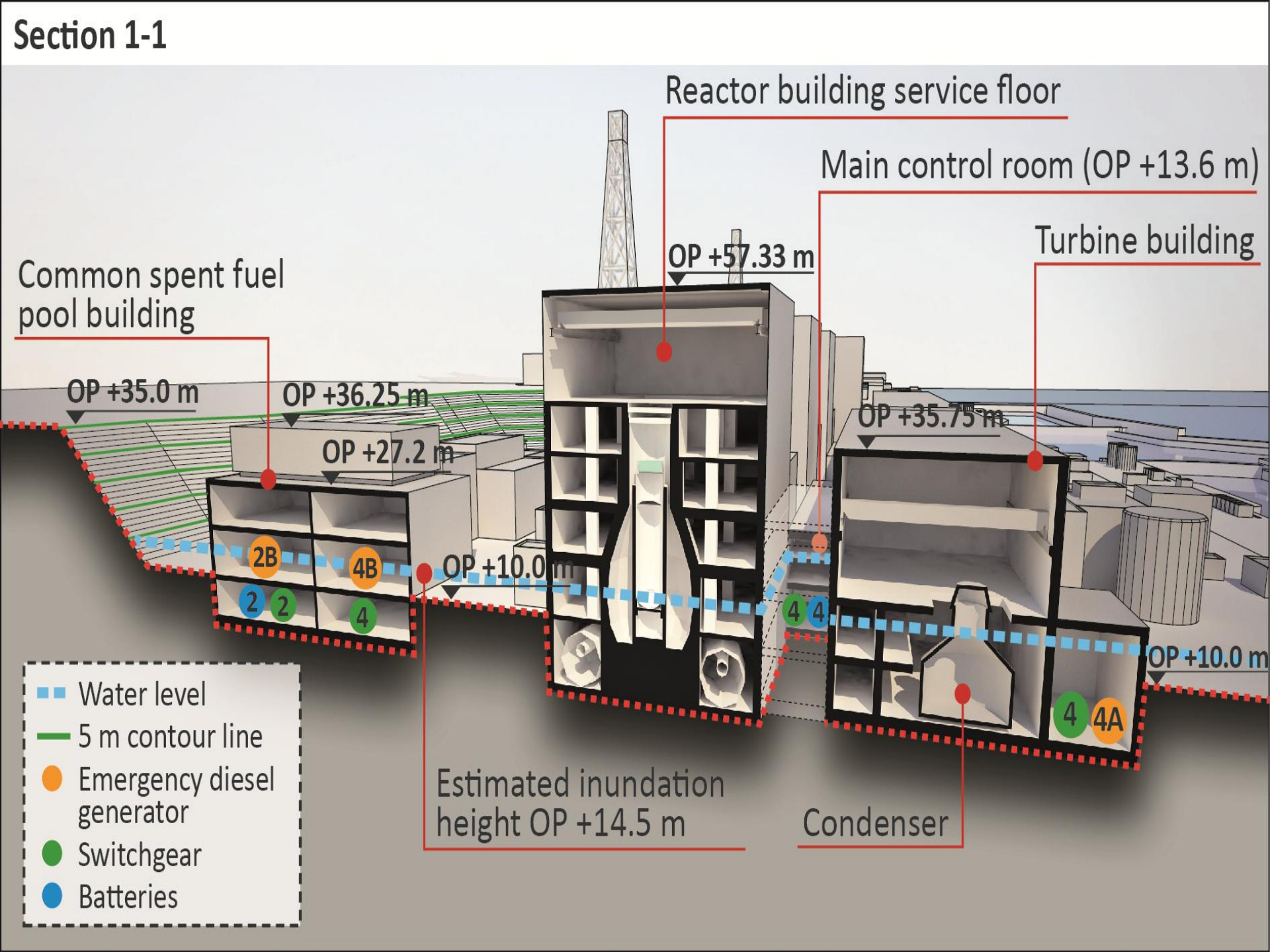
Section 1-1
Reactor building service floor
Main control room (OP +13.6 m)
Turbine building
OP +57.33 m
Common spent fuel pool building
OP +35.0 m
OP +36.25 m
OP +27.2 m
OP +35.75 m
2B
4B
2
2
4
OP +10.0 m
4
4
OP +10.0 m
4
4A
Water level
5 m contour line
Emergency diesel generator
Switchgear
Batteries
Estimated inundation height OP +14.5 m
Condenser

BEYOND DESIGN BASIS ACCIDENTS AND ACCIDENT MANAGEMENT

FINDINGS

- Deterministic and probabilistic treatment of beyond design basis accidents was not in line with international best practices
- Limited scope PSA did not identify plant vulnerability to flooding
- PSA results for Fukushima Daiichi NPPs were several orders of magnitude lower than similar plants in other Member States
- Limited scope deterministic analyses contributed to weaknesses in accident management procedures
- Incomplete knowledge of potential accident sequences and consequences led to inadequate procedural guidance

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BEYOND DESIGN BASIS ACCIDENTS AND ACCIDENT MANAGEMENT

OBSERVATIONS AND LESSONS

- Deterministic and probabilistic analyses need to be comprehensive and account of internal + external events
- Extremely low PSA numbers need to be reviewed as they can impact decision making + lead to unidentified plant vulnerabilities
- Accident management provisions need to be clear, comprehensive and well designed
- Training/exercises to be based on realistic accident conditions.
- Regulatory bodies need to ensure that adequate accident management provisions are in place

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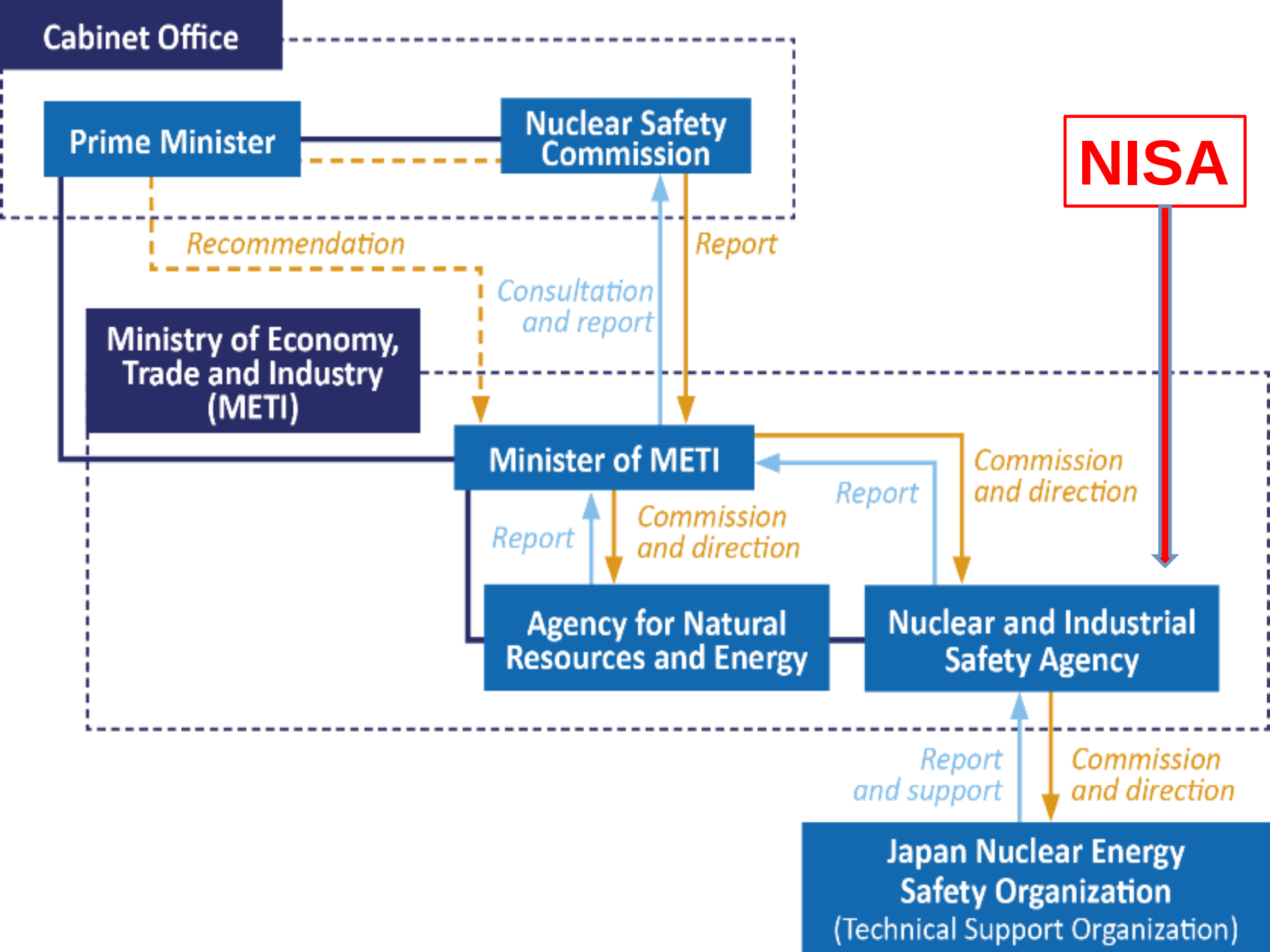
REGULATORY EFFECTIVENESS

FINDINGS

- Complex regulatory system - several different organizations
- Distribution of regulatory authority decision making was unclear
- Some practices were not in line with international best practices
- Inspection program was overly limited in scope and influence
- Periodic safety reviews lacked effective regulatory oversight

OBSERVATIONS AND LESSONS

- Where several bodies have responsibilities for safety, government coordination is needed
- Clear lines of authority and decision making ability so that all stakeholders understand the process
- Regulator needs an effective inspection program and effective enforcement authority + access to independent technical expertise


Cabinet Office
Prime Minister
Nuclear Safety Commission
NISA
Recommendation
Report
Consultation and report
Ministry of Economy, Trade and Industry (METI)
Minister of METI
Commission and direction
Report
Report
Commission and direction
Agency for Natural Resources and Energy
Nuclear and Industrial Safety Agency
Report and support
Commission and direction
Japan Nuclear Energy Safety Organization
(Technical Support Organization)

HUMAN AND ORGANIZATIONAL FACTORS

FINDINGS

- Basic assumption that plants were safe
- All stakeholders shared and mutually reinforced this belief

OBSERVATIONS AND LESSONS

- Individuals + organizations need to continuously question their basic assumptions and implications on actions that impact safety.
- The need to be prepared for the unexpected
- A systemic approach to safety needs to be taken in event and accident analysis, considering all stakeholders and their interactions over time.
- Regulatory authorities should provide oversight and independent review of safety culture programs

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EMERGENCY PREPAREDNESS AND RESPONSE

- Initial response in Japan to the accident
- Protecting emergency workers
- Protecting the public
- Transition from the emergency phase
- International response

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PROTECTING THE PUBLIC

FINDINGS

- The criteria for protective actions were not expressed in terms of measurable quantities
- No predetermined criteria for relocation
- Evacuees were relocated several times during the first 24 hours

OBSERVATIONS AND LESSONS

- Decisions on urgent protective actions based on predefined plant conditions or monitoring results
- Protective actions need to do more good than harm
- Medical staff need to be trained in basic medical response to a nuclear emergency and in adequate management of (possibly) contaminated patients

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TRANSITION FROM THE EMERGENCY PHASE

FINDINGS

- Specific policies, guidelines, criteria and arrangements for the transition from the emergency phase to the recovery phase were not developed before the accident
- In developing these arrangements, the Japanese authorities decided to apply the latest recommendations of ICRP

OBSERVATIONS AND LESSONS

- Arrangements need to be developed at the preparedness stage for termination of protective actions and other response actions, and 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

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INTERNATIONAL RESPONSE

FINDINGS

- Assistance Convention was not invoked and RANET not used
- Different States either recommended different protective actions for their nationals in Japan in response to the accident
- These differences were generally not well explained to the public and occasionally caused confusion and concern

OBSERVATIONS AND LESSONS

- The implementation of international arrangements for notification and assistance needs to be strengthened
- There is a need to improve consultation and sharing of information among States on response actions.
- IAEA assessment and prognosis

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THE IAEA ACTION PLAN ON NUCLEAR SAFETY

KEY FACTS

- 12 key actions, 39 sub-actions
- Unanimously adopted in September 2011
- EBP funded projects:
  - 52 from Japan
  - 10 from USA
  - 7 from Russia
- Over 900 activities completed
- ~ 40 Million euro since September 2011

TRANSPARENCY

- Mission calendar of peer reviews
- International experts missions reports
- International Experts Meetings reports

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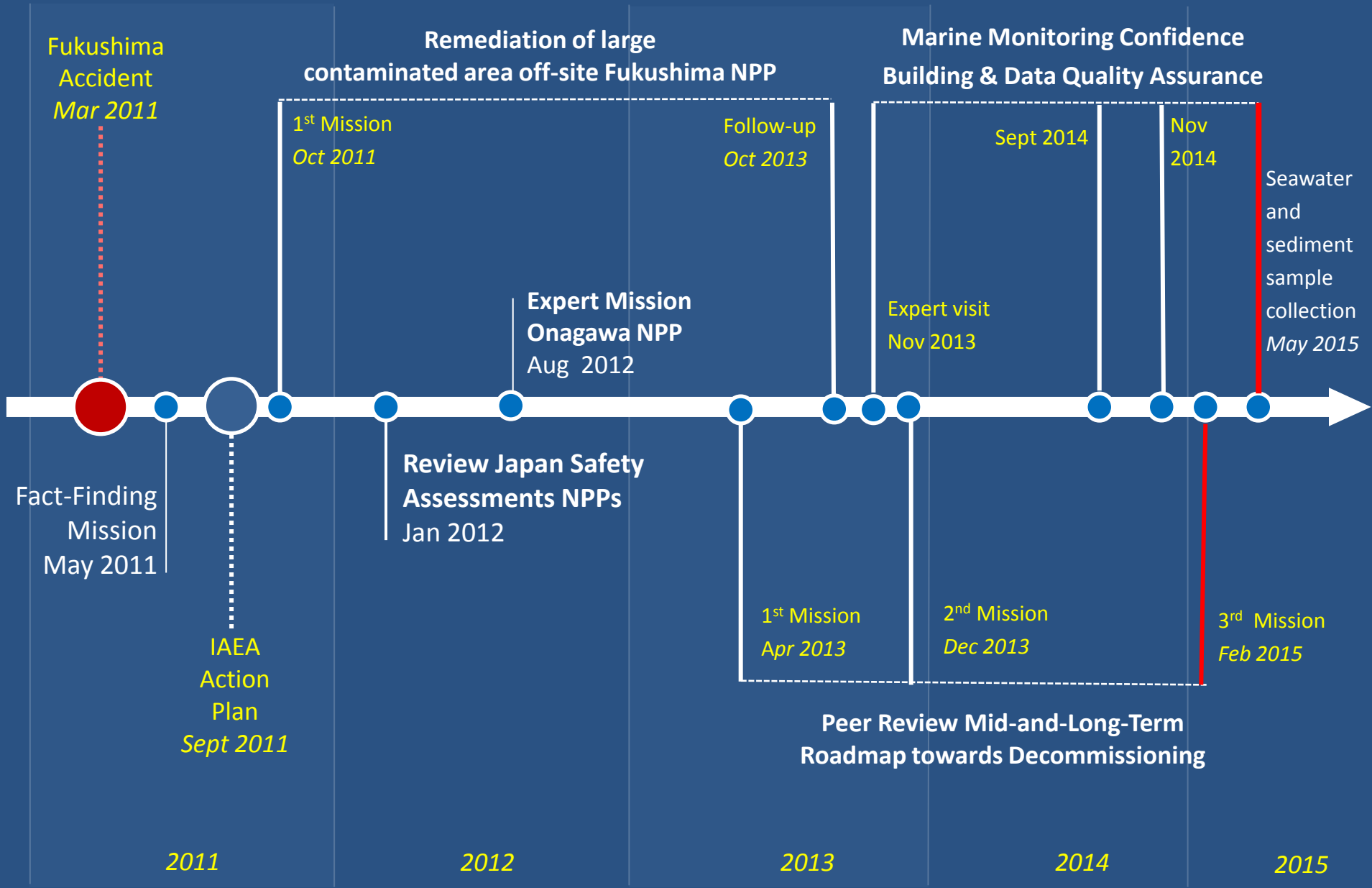
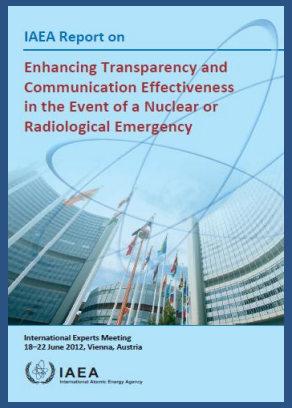
THE IAEA EXPERT MISSIONS TO JAPAN

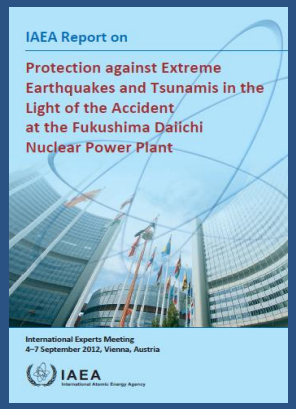


IAEA REPORTS - LESSONS LEARNED

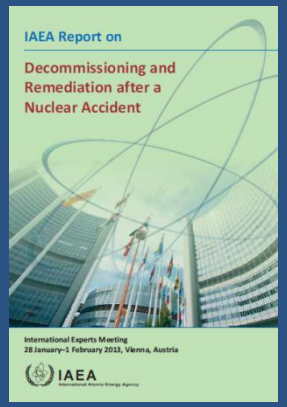
Reactor and Spent Fuel Safety 2012



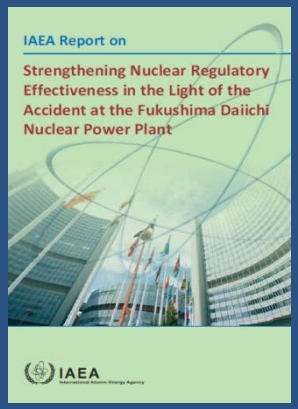
Transparency & Communication 2012



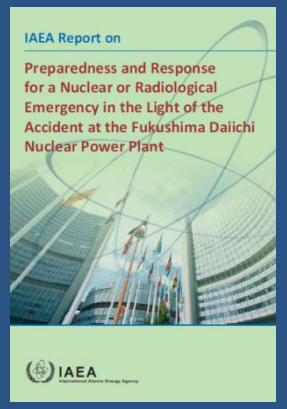
Protection Against External Events 2012



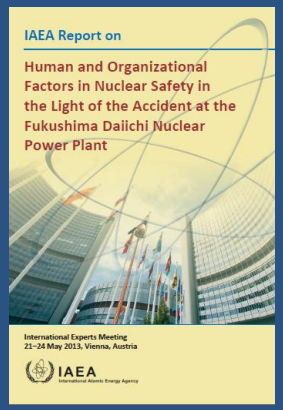
Decommissioning and Remediation 2013



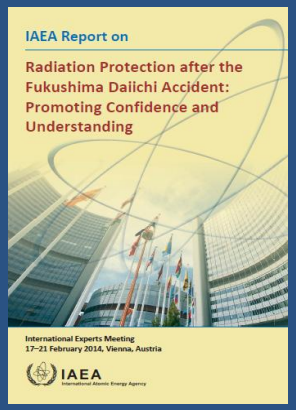
Strengthening Nuclear Regular Effectiveness 2013



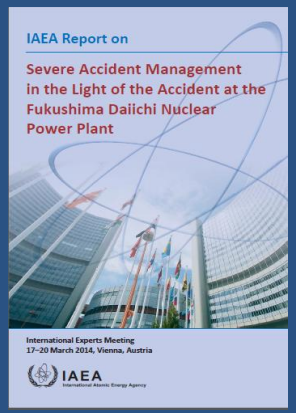
Preparedness and Response 2013



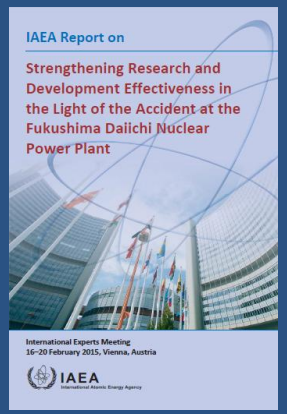
Human & Organizational Factors 2014



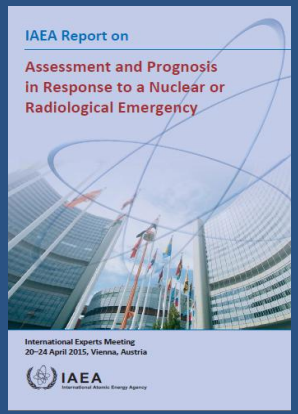
Radiation protection 2014



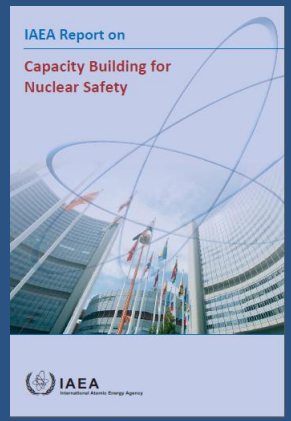
Severe accident management 2015



Research & Development 2015



Assessment & Prognosis 2015



Capacity Building 2015

THE WAY FORWARD

MEMBER STATES RESPONSE

- **Board of Governors + 2015 General Conference**

- **Wide support for the Action Plan activities the publication of the IAEA Fukushima Report**

"Important to follow up to ensure the Action Plan and IAEA Report contribute to a continuous improvement in nuclear safety worldwide"

"It is essential that the IAEA ensure that the momentum to improve global nuclear safety is improved and further increased building on the Fukushima report"

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IAEA General Conference 2015

Resolution GC(59)/RES/9 September 2015

- **Welcomes** the publication of the IAEA Report on the Fukushima Daiichi accident, consisting of the Director General's Report and five technical volumes
- **Requests** the Secretariat, in close consultation with Member States, to integrate actions arising from the Observations and Lessons in the Report into the Agency's regular programme;
- **Requests** the Secretariat to continue follow-up on the projects/activities arising from the Action Plan and to build upon the findings, lessons learned, and measures implemented from the Fukushima Daiichi accident;
- **Requests** the Agency to continue to build upon:
  - the Action Plan on Nuclear Safety,
  - the experience of States in implementing the Action Plan,
  - the observations and lessons contained in the IAEA Fukushima Report and
  - the principles of the Vienna Declaration,

  and use them for defining its nuclear safety strategy and its programme of work.

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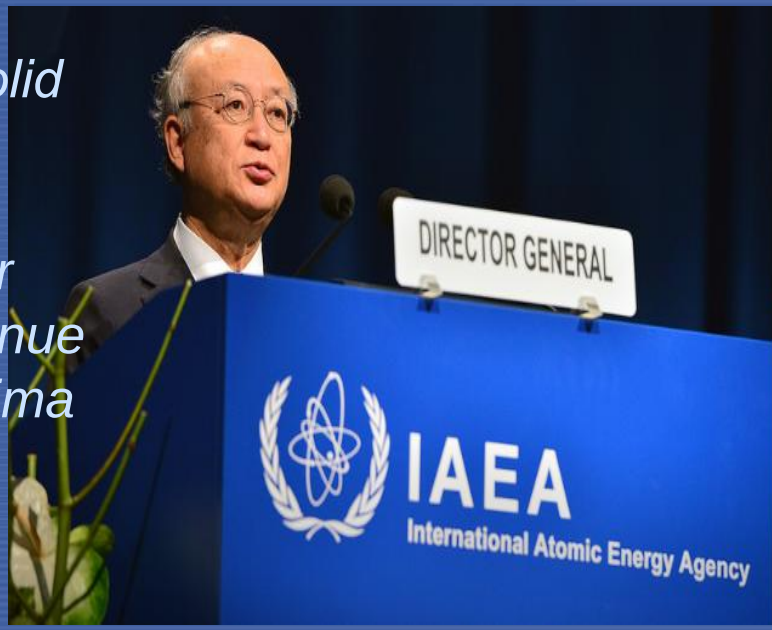
IMPLEMENTATION

- **The Agency is developing an implementation plan to facilitate the transition of the relevant activities into its regular work programme**
- **The aim of the implementation plan is to establish the framework for the work of the relevant Departments and Divisions of the Agency for the coming years**

"I believe that this IAEA report will provide a solid knowledge base for the future and will help to improve nuclear safety throughout the world. I hope that governments, regulators and nuclear power plant operators in all countries will continue to act on the lessons learned from the Fukushima Daiichi accident."

Director General Amano



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Thank you for your attention

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