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IAEA Activities in Nuclear Safety and Security following the Fukushima Daiichi accident

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Overview

- IAEA Report on the Fukushima Daiichi Accident;
- IAEA priorities post Nuclear Safety Action Plan;
- IAEA approach to nuclear safety and nuclear security culture.

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IAEA Report on the Fukushima Daiichi Accident

Report on the Fukushima Daiichi Accident

Report by the Director General

Technical Volume 1/5
Description and Context of the Accident

Technical Volume 2/5
Safety Assessment

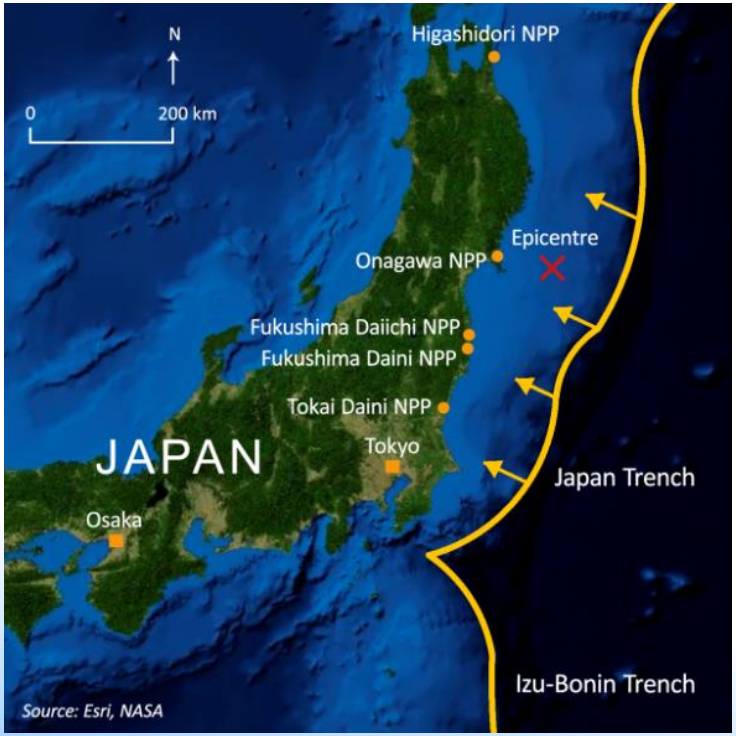
Technical Volume 3/5
Emergency Preparedness and Response

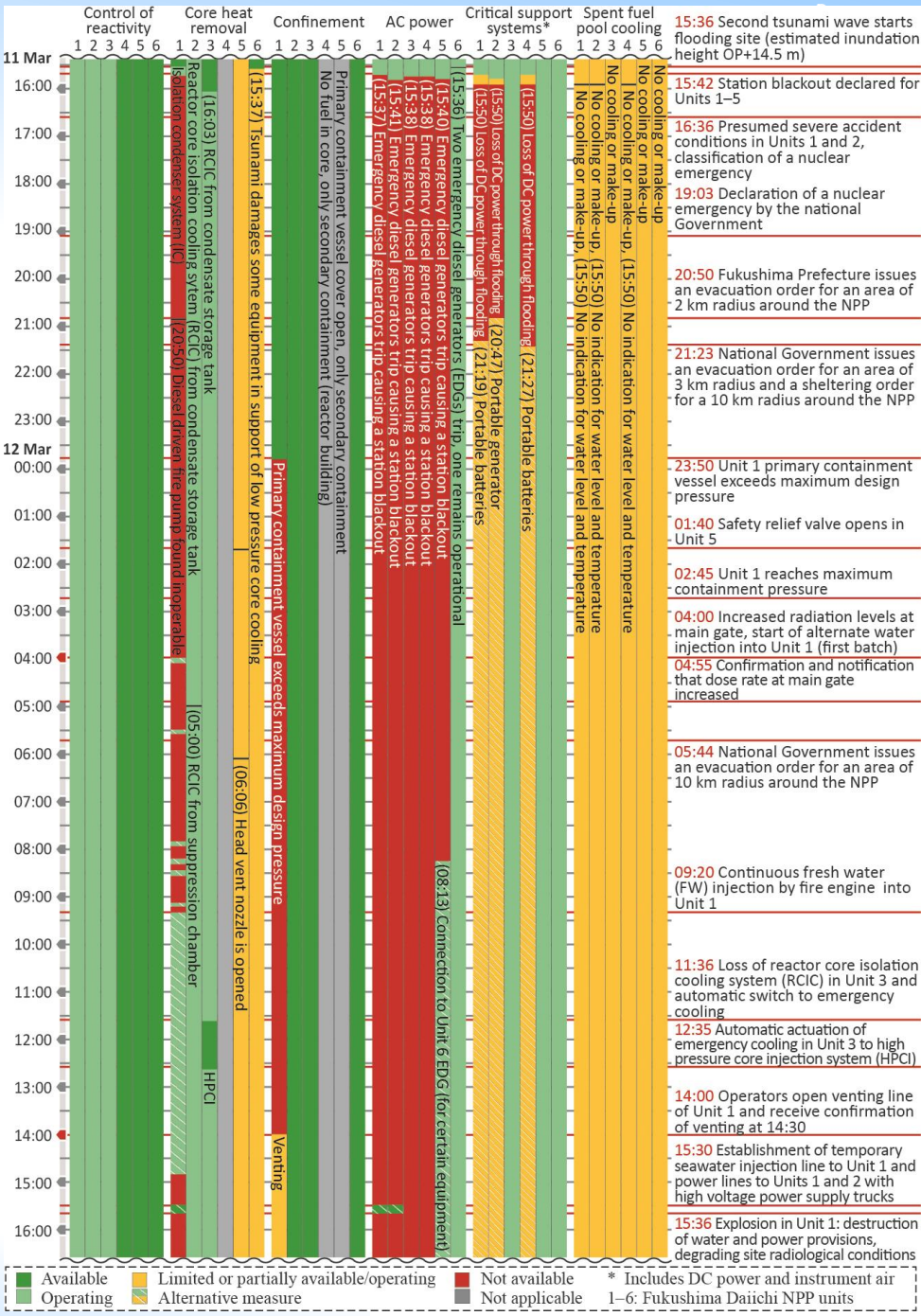
Technical Volume 4/5
Radiological Consequences

Technical Volume 5/5
Post-accident Recovery

The Accident and its assessment

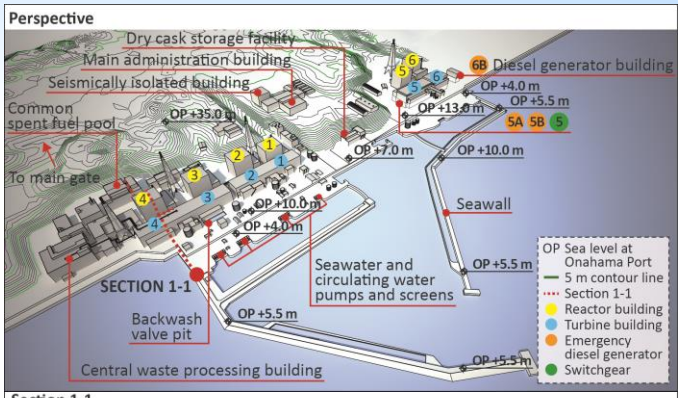
Description of the events presented in chronological order to highlight the integrated response to a multi-unit accident.

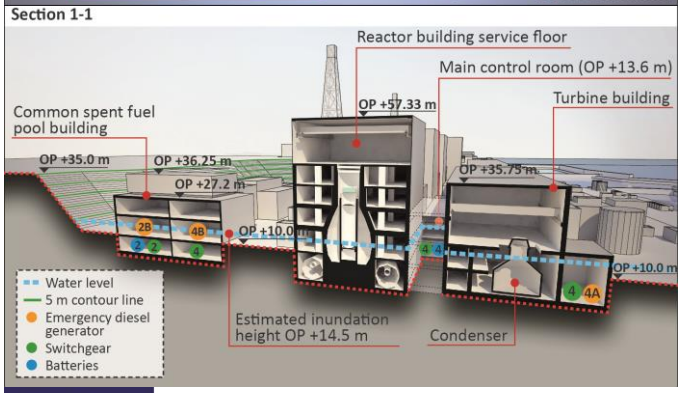


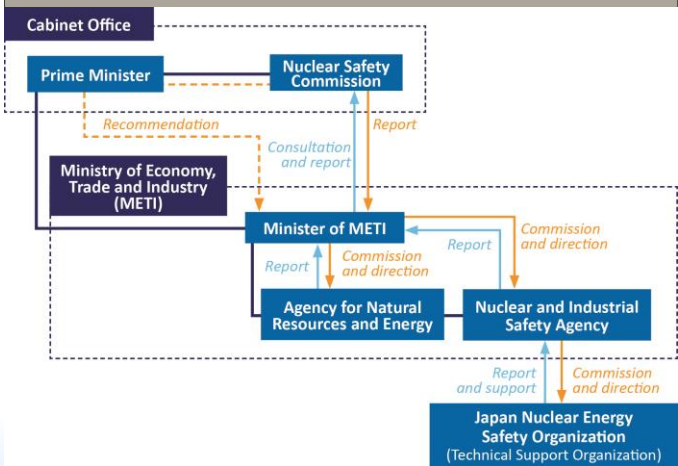


The Accident and its assessment

- **Vulnerability of the plant to external events** (conservative assessment considering prehistoric data, hazards in combination and their effects on multiple NPP units);
- **Application of the defence in depth concept** (strengthening of the implementation);
- **Assessment of the failure to fulfil fundamental safety functions** (robust and reliable I&C, cooling and confinement are necessary);
- **Assessment of beyond design basis accidents and accident management** (comprehensive PSA/DSA and accident management provisions are needed);
- **Assessment of regulatory effectiveness** (independent regulatory body; strong safety culture);
- **Assessment of human and organizational factors** (systemic approach to safety is necessary).

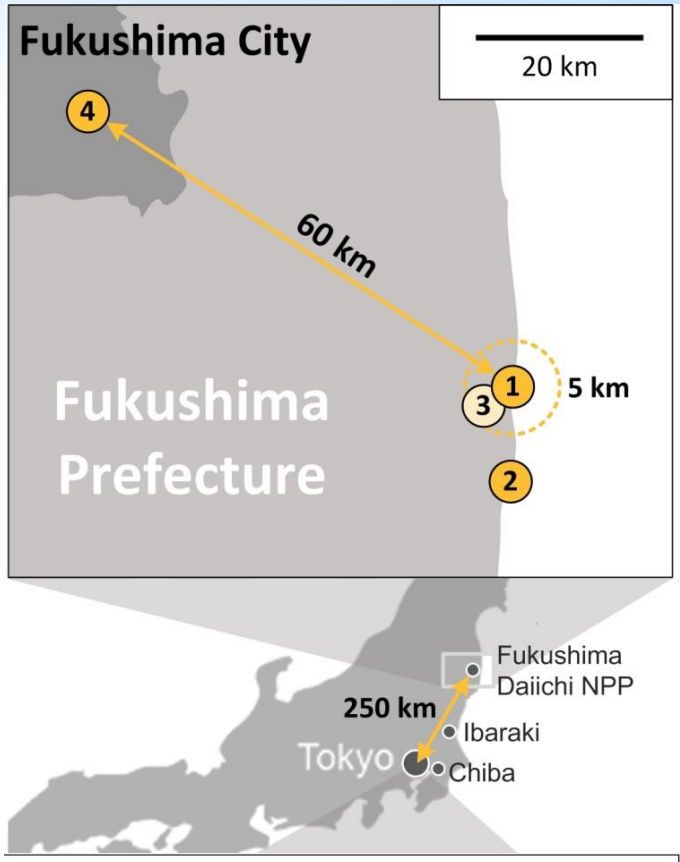






Emergency preparedness and response

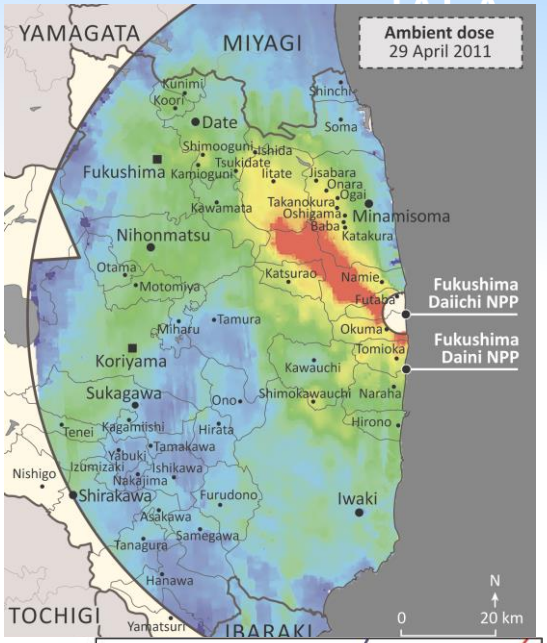
- **Initial response in Japan to the accident** (clearly defined roles and responsibilities and interactions regularly tested; emergency involving multiple units and natural disasters occurring at the same time);
- **Protecting emergency workers** (emergency workers designated and trained in advance, and properly protected);
- **Protecting the public** (decisions on predetermined urgent protective actions to be based on predefined plant conditions);
- **Transition from the emergency phase** (arrangements needed for termination of protective actions and the transition to the recovery phase);
- **International response** (strengthen international arrangements for notification and assistance).

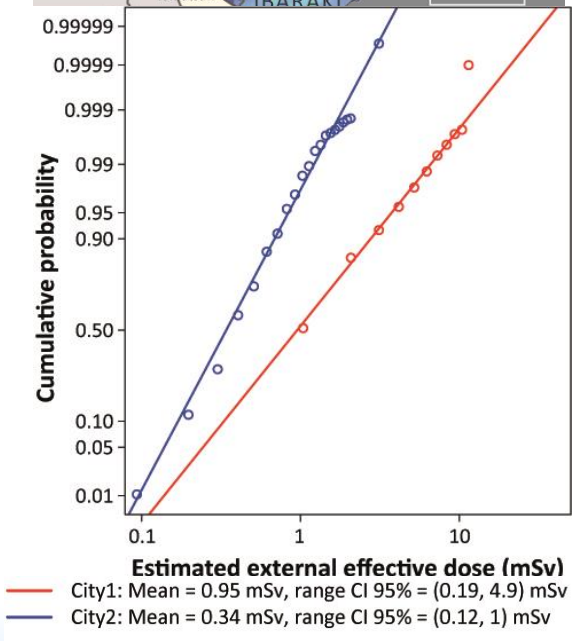


1. **FUKUSHIMA DAIICHI NUCLEAR POWER PLANT**
   - On-site – Emergency Response Centre at the NPP
2. **FUKUSHIMA DAINI NUCLEAR POWER PLANT**
   - On-site – Emergency Response Centre at the NPP
3. **OFF-SITE CENTRE**
   - Local NERHQ – Local Nuclear Emergency Response Headquarters
   - JCNER – Joint Council for Nuclear Emergency Response
   - Local Prefectural NERHQ – Local Prefectural Nuclear Emergency Response Headquarters
4. **FUKUSHIMA PREFECTURAL GOVERNMENT OFFICE**
   - Fukushima Prefecture Headquarters for Disaster Control

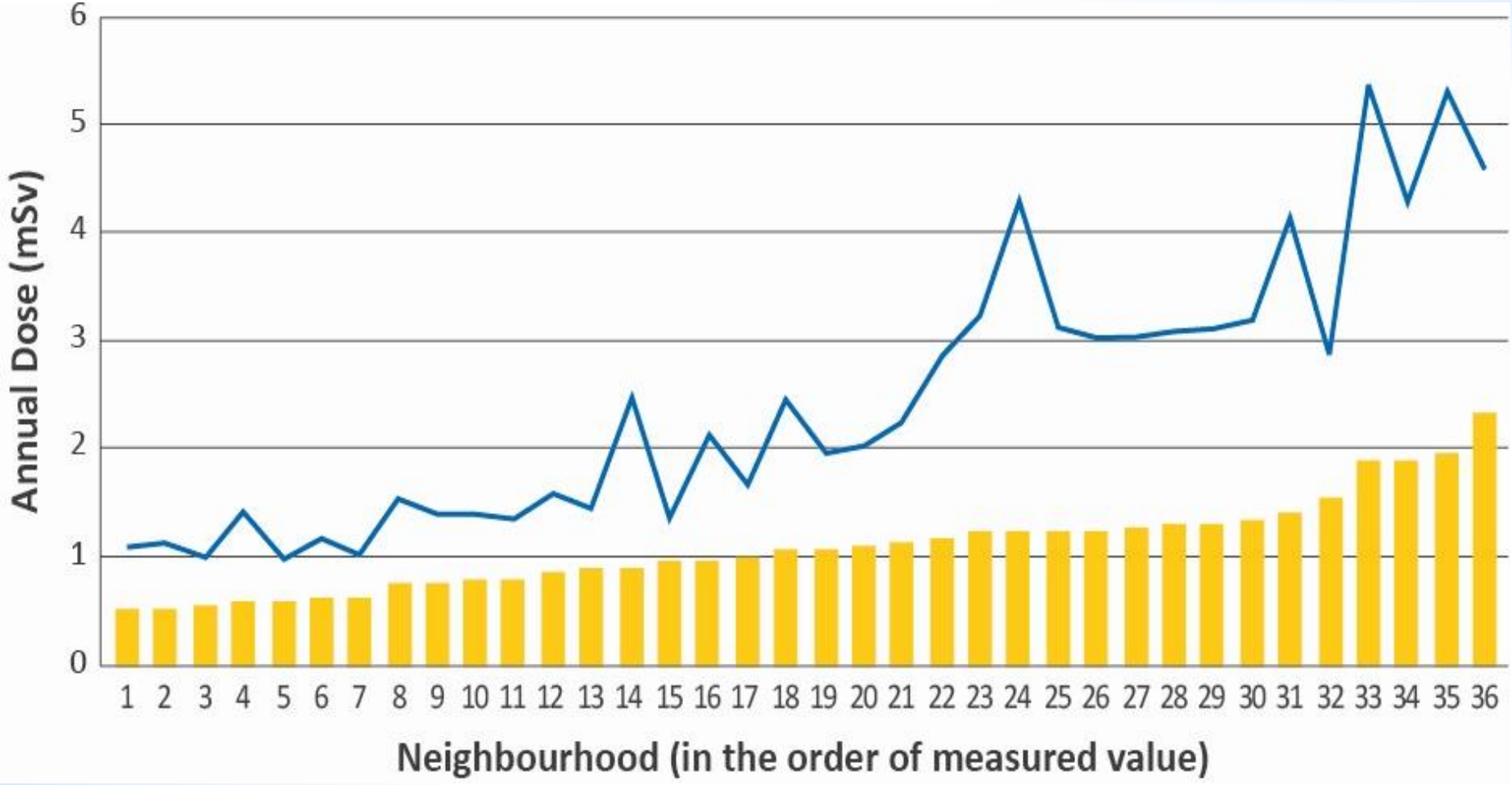
Radiological consequences

- **Radioactivity in the environment** (prompt quantification and characterization of accidental releases of radioactivity is needed);
- **Protecting people against radiation exposure** (conservative decisions on protective measures and actions led to extended restrictions and associated difficulties);
- **Radiation exposure** (personal radiation monitoring of the public is invaluable; restrict the consumption of fresh milk for limiting thyroid doses; a robust system is needed for monitoring and recording emergency worker doses during severe accidents);
- **Health effects** (factual, understandable information on radiation effects needs to be communicated; guidance is needed to address psychological consequences);
- **Radiological consequences for non-human biota** (knowledge of the impacts of radiation on non-human biota needs to be strengthened).



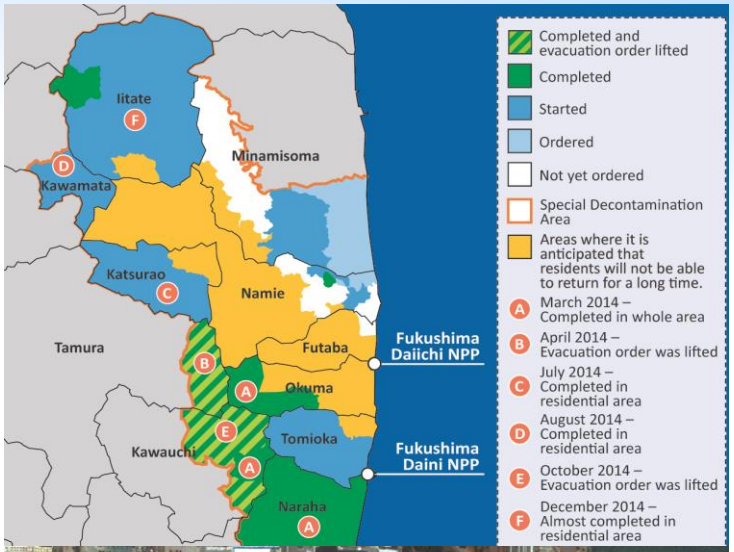


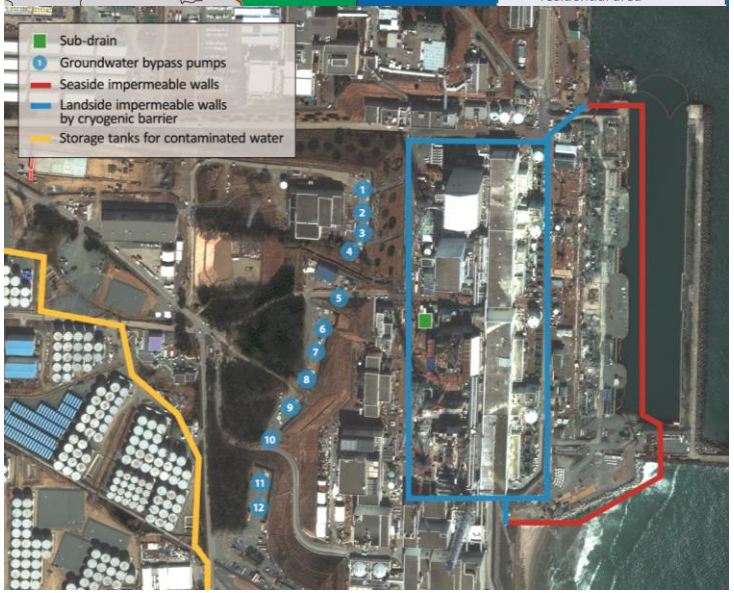
Comparison of external individual dose estimates with measurements for a representative affected city between July 2012 and June 2013.



Post-accident recovery

- **Off-site remediation of areas affected by the accident** (pre-accident planning for post-accident recovery; rigorous testing and controls on food to minimize ingestion doses);
- **On-site stabilization and preparations for decommissioning** (flexible strategic plan for maintaining long term stable conditions and for the decommissioning; solutions for retrieving damaged fuel and fuel debris specific to the accident);
- **Management of contaminated material and radioactive waste** (generic strategy for managing contaminated material and waste, supported by generic safety assessments for discharge, storage and disposal);
- **Community revitalization and stakeholder engagement** (development of revitalization and reconstruction projects that address infrastructure, community revitalization and compensation).





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 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;
- The report was released at the 59th IAEA General Conference in September 2015.

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IAEA priorities post Nuclear Safety Action Plan

Background

IAEA General Conference Resolutions 2015, 2016 and 2017 requested the Agency to continue to build upon

- The 2011 Action Plan on Nuclear Safety (NSAP);
- The experience of States in implementing the Action Plan;
- The observations and lessons contained in the IAEA Fukushima Report;
- The principles of the Vienna Declaration;

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

Many activities undertaken since 2011 under NSAP, focused on NPPs, such as those on extreme natural hazards. Going forward, strengthening safety needs to consider a more comprehensive manner: nuclear, radiation, transport & waste.

Background – cont.

- **GC(60)/INF/11 -** a methodology to systematically analyse all observations and lessons to identify priority safety areas for the Agency's activities.

- Sources of observations and lessons include:
  - Action Plan;
  - The IAEA Fukushima Report;
  - International framework for safety, including the Safety Conventions, Codes of Conduct and the Vienna Declaration;
  - Lessons from the full range of Agency activities in nuclear, radiation, transport and waste safety.

- Analysed the extent to which these aspects are covered by current activities to identify priorities and define the Agency's nuclear safety strategy and its programme of work.

Nuclear Safety Review

- The *Nuclear Safety Review 2018* includes the global trends and the Agency's activities in 2017;
- It also presents priorities for 2018 and beyond, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety as well as EPR;
- 3 parts:
  - Executive overview;
  - Main part – detailed description of trends, activities and priorities;
  - Annex on CSS and Safety Standards.
- Structure:
  - Trends;
  - Activities;
  - Priorities and related activities.
- Submitted to the IAEA BoG for comments;
- The final version of the *Nuclear Safety Review 2018* will be issued for the General Conference in September 2018.

General Safety Areas - Priorities

- The Agency will:
  - Continue strengthening safety standards using lessons from the Fukushima Daiichi accident and other relevant sources, and taking into account the VDNS on Principles for the Implementation of the Objective of the CNS to Prevent Accidents and Mitigate Radiological Consequences;
  - Strengthen peer review and advisory services;
  - Assist MS in the application of safety standards;
  - Strengthen activities to promote universal adherence to the safety conventions and support their effective implementation;
  - Assist MS in strengthening: regulatory effectiveness; leadership and management for the safety of nuclear facilities and activities; efforts to foster and sustain a strong culture for safety; capacity building programmes; processes for communicating radiation risks to the public; and
  - Support R&D for safety and facilitate the exchange of the results.

Radiation, Transport and Waste Safety - Priorities

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- The Agency will assist MS in:
  - Effective implementation of the radiation protection principles of justification and optimization based on the GSR Part 3, with particular emphasis on medical exposures;
  - Management of radioactive sources, particularly by promoting the application of the CoC on the Safety and Security of Radioactive Sources and its 2 supplementary Guidance documents;
  - Building capacity for the safe transport of radioactive material;
  - Safe management of radioactive waste, including geological disposal of high level waste, and the development of decommissioning strategies and plans; and
  - Remediation of contaminated areas, including from post-accident situations and from uranium legacy sites.

Safety in Nuclear Installations - Priorities

- The Agency will assist Member States in:
  - Implementing and improving programmes for ageing management and LTO;
  - Facilitating the exchange of operating experience;
  - Application of safety standards relating to the evaluation of safety of nuclear installations (e.g. design requirements and periodic safety reviews);
  - Sharing knowledge and experience to strengthen SAMGs and will further develop technical documentation in this area;
  - Activities related to SMRs (e.g. develop safety requirements, build capacity for design and safety assessment, share good practices);
  - Performing safety assessments of research reactors, managing the ageing of research facilities, enhancing regulatory supervision and strengthening application of the CoC on the Safety of Research Reactors;
  - Performing safety assessments and implementing safety upgrades for nuclear fuel cycle facilities; and
  - Developing safety infrastructure for new nuclear power and research reactor programmes.

Emergency Preparedness and Response - Priorities

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- The Agency will:
  - Further develop operational arrangements for notification, reporting and requesting assistance in a nuclear or radiological incident or emergency;
  - Assist MS in the implementation of GSR Part 7 and develop associated Safety Guides; and
  - Implement an active exercise programme to test EPR at the international level and support national EPR exercise programmes.

Management of the Safety and Security Interface

- Priorities:
  - The Agency will ensure that safety standards and nuclear security guidance take into account the implications for both safety and security whenever appropriate, recognising safety and security are different.

Civil Liability for Nuclear Damage

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- Priorities:
  - The Agency will facilitate the establishment of a global nuclear liability regime and assist MS, upon request, in their efforts to adhere to and implement the international nuclear liability instruments.

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IAEA approach to nuclear safety and nuclear security culture

Background

- Safety and security culture and leadership recognized as highly important:
  - INSAG-4 (1991)
  - Agency Safety Fundamentals
  - New Safety Requirement GSR Part 2 on Leadership and Management for Safety
  - General Conference Safety and Security Resolutions
  - Lessons learnt from the Fukushima Daiichi Accident
  - Identified as one of the priorities through the implementation of the methodology to strengthen nuclear safety
  - Conclusions from Agency Technical Meetings and Conferences (e.g. IC on Effective Nuclear Regulatory Systems 2016)
  - Specific request of the MSs through the Steering Committee on Regulatory Capacity Building and Knowledge Management

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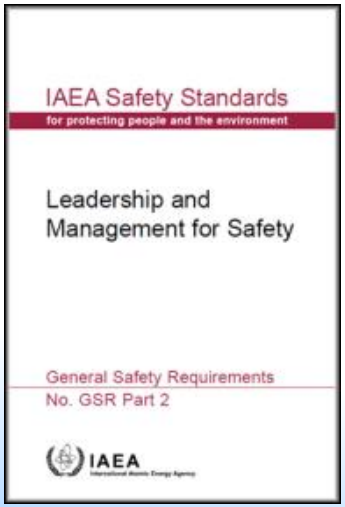
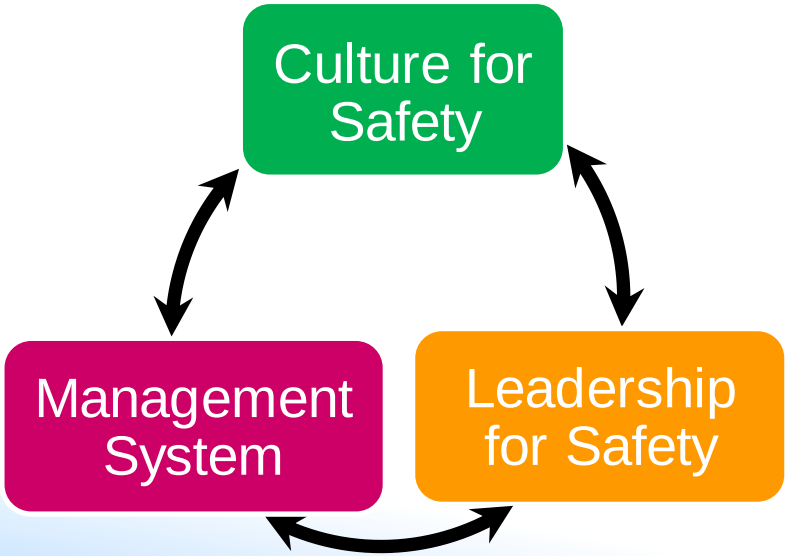
Nuclear Safety Culture

IAEA Approach to Nuclear Safety Culture

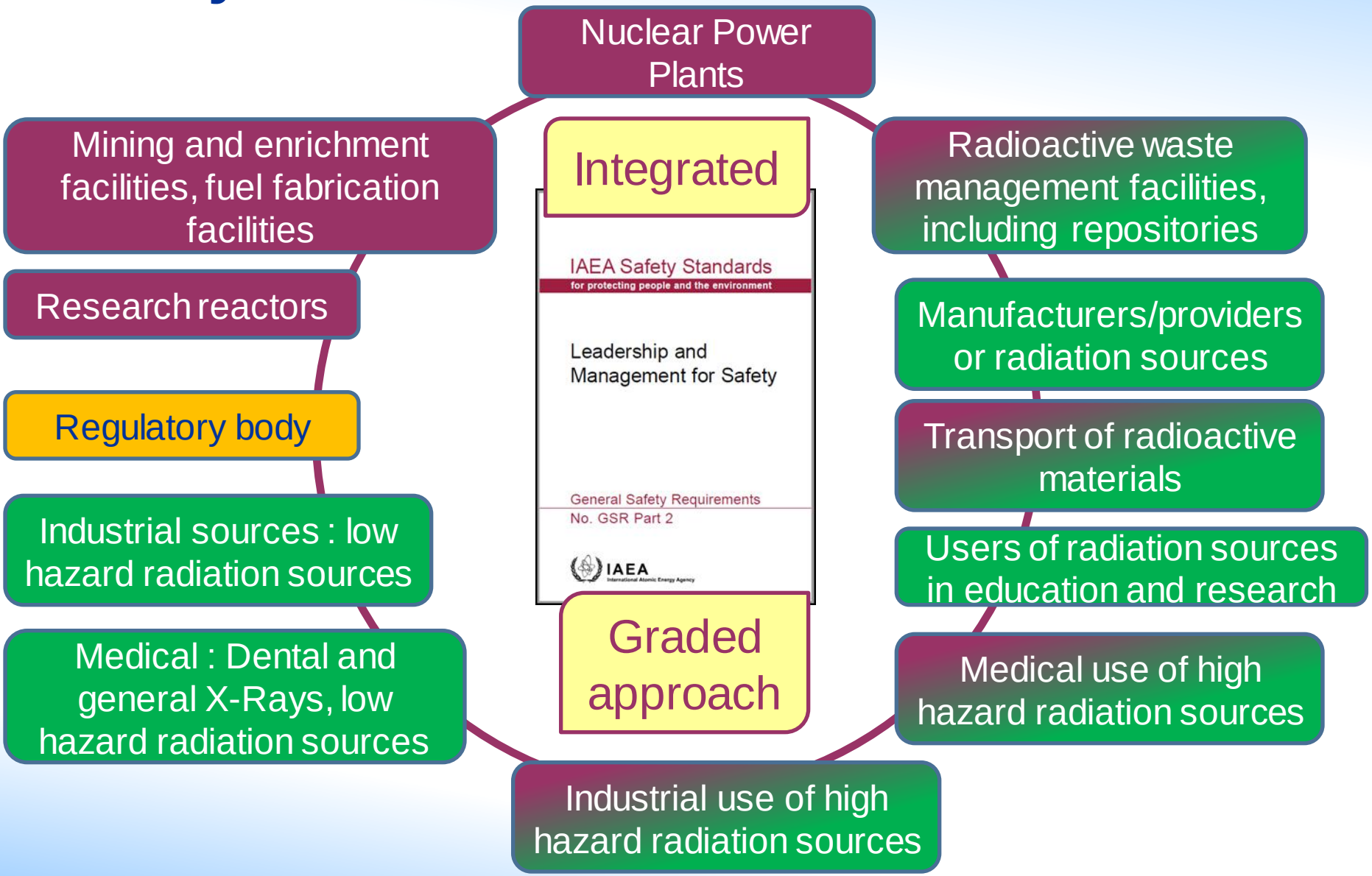
- INSAG-4 defines safety culture as: “the assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance.”

Leadership and Management for Safety
GSR Part 2
http://www-pub.iaea.org/MTCD/publications/PDF/Pub1750web.pdf

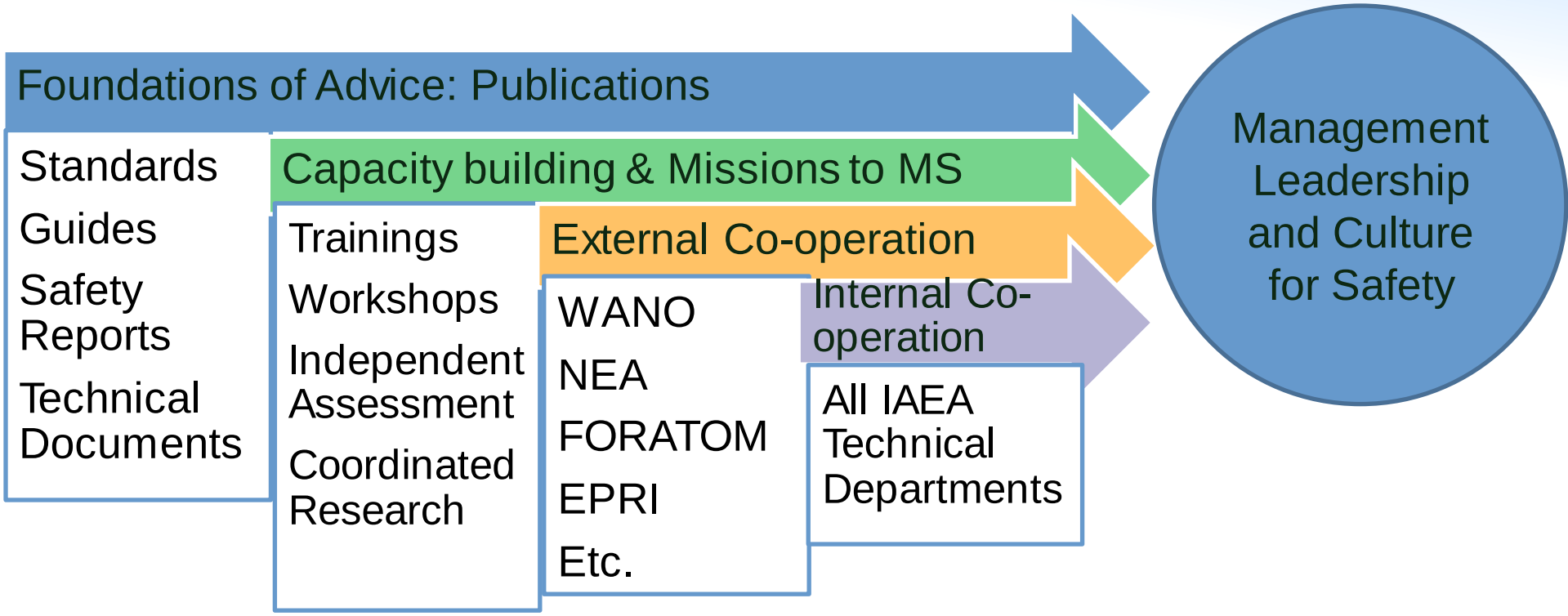




GSR Part 2- Type of Facility and Activity



IAEA Work on Safety Culture



Topics Covered

- Safety Culture
- Leadership for Safety
- Management for Safety
- Human Technology Organization Interfaces
- Human Factors Engineering
- Human Performance
- Organizational Safety Performance

Including:

- Learning Culture
- Systemic Approach
- 'Organizational Defence in Depth'
- Safety and Security Culture

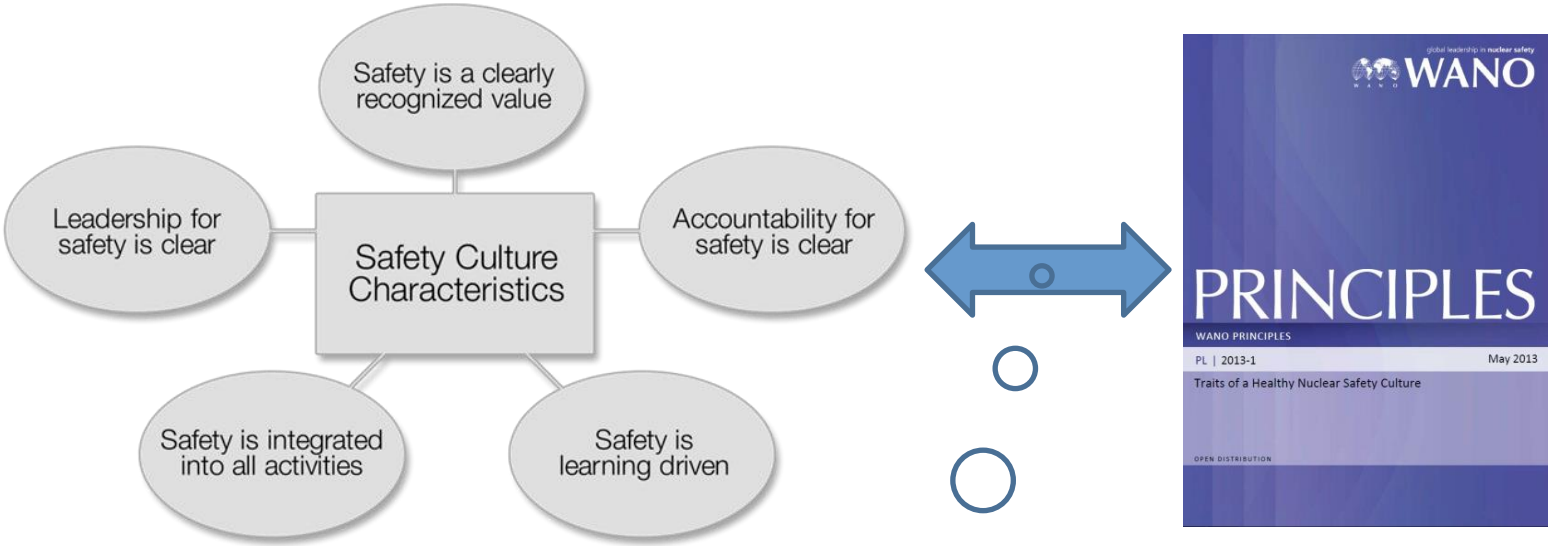
How we assist Member States: Missions, Workshops, Training

At the IAEA HQ

At the workplace

In the field

Safety Culture Framework: Harmonization Project – IAEA, WANO, Nuclear Organizations



Common International Language
Application wider than NPPs

Leadership Development Model (LeaD)

- A leadership development model that has Safety Leadership as a fundamental part;
- Development with MS experts;
- Part of a resource website going live early 2018.

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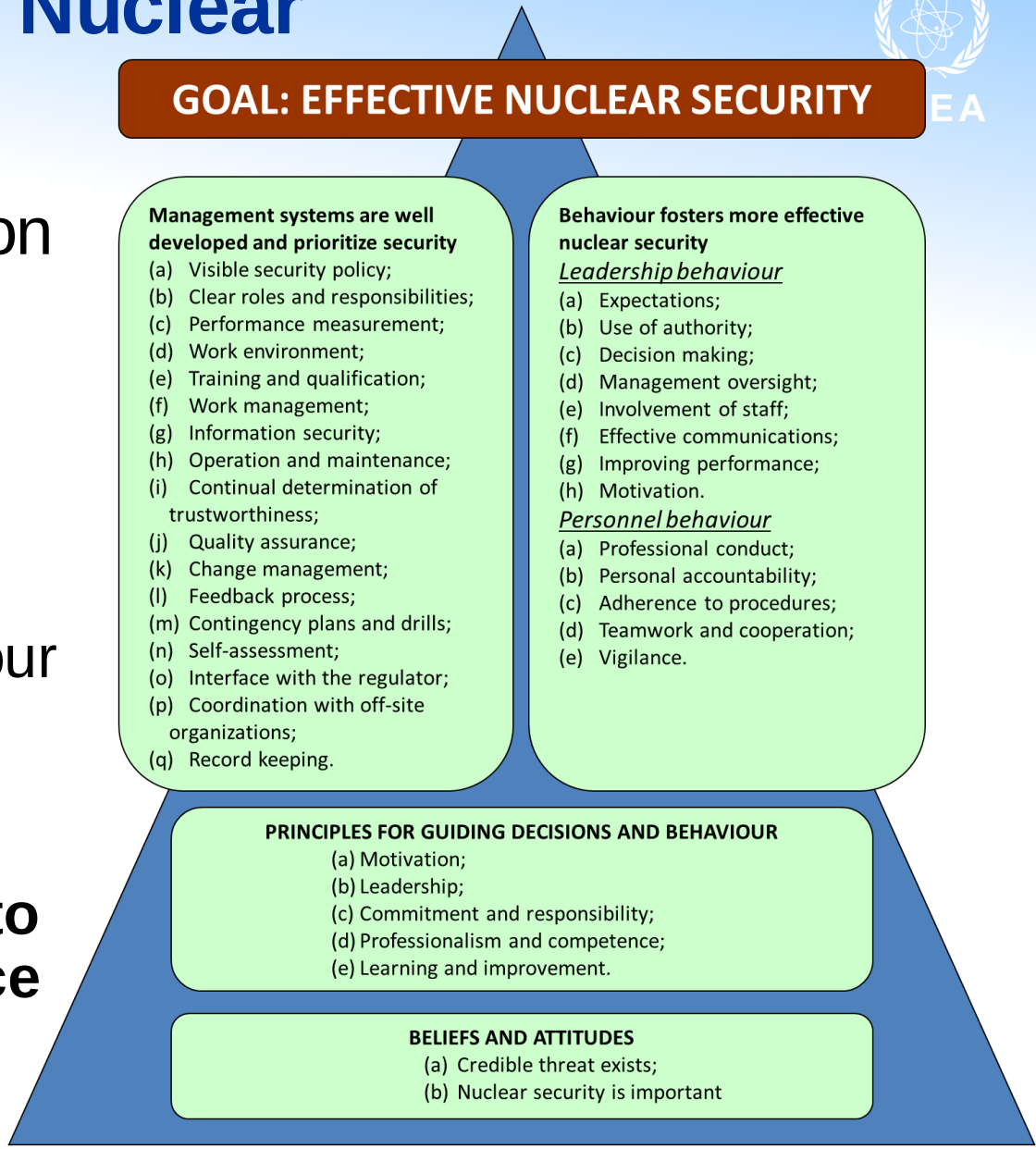
Nuclear Security Culture

IAEA Approach to Nuclear Security Culture

- Implementing Guide on Nuclear Security Culture (NSS No.7) defines NSC as:
  - "The assembly of characteristics, attitudes and behaviour of individuals, organizations and institutions, which **serves as a means to support and enhance nuclear security**"



Model of IAEA Nuclear Security Culture

IAEA Work on Security Culture

- The IAEA aims at facilitating applications of the nuclear security culture concept to organizations responsible for nuclear security by:
  - Developing practical guidance, methodologies and tools;
  - Raising the awareness of MSs on the importance of the human factor in achieving effective nuclear security;
  - Promoting the understanding of MSs on what characteristics, attitudes and behaviour could serve to achieve effective nuclear security and in what ways to do so; and
  - Supporting MSs' effort to promote, enhance, and sustain an effective nuclear security culture.

Development of Practical Guidance, Tools, Methodologies

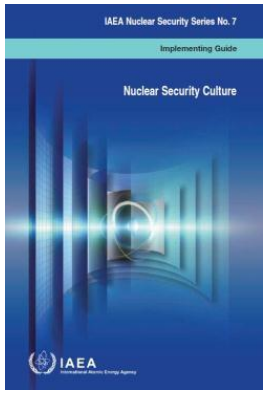
- Technical guidance on self-assessment and enhancement
- Tool development and sharing under the framework of Coordinated Research Project
- Cooperation for educational curriculum development (INSEN)

Fundamentals

Recommendations

Implementing Guides

Technical Guidance



Practical Solutions

IAEA Nuclear Security Series No. 28-T Technical Guidance on "Self-Assessment of Nuclear Security Culture in facilities and activities" *published in November 2017*

NST027 – in preparation "Enhancing Nuclear Security Culture in facilities and activities that use nuclear and/or radioactive material"

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Fundamentals

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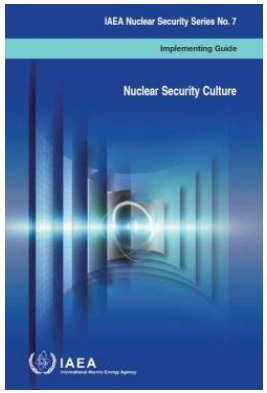
Implementing Guides

Technical Guidance



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Support to MS's Effort for Nuclear Security Culture

- Assist with and provide advisory services on the implementation of nuclear security culture programs;
- Assist in the implementation of nuclear security culture self-assessment;
- Involvement in the nuclear security culture self-assessment practice;
- Provide experience-sharing opportunities on self-assessment and enhancement efforts to assist and facilitate the initiative to move forward.

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New Approach to Safety and Security Culture

Common Framework

Recognising safety and security culture have different groups of stakeholders. There are can be a common framework that recognises commonalities and interfaces (GC(60)RES/9, GC(60)/RES/10 and GC(61)/RES/8), requests to consider common areas)

IAEA Approach

- Based on the previous work, the IAEA approach is to:
  - Enhance integration and coordination of activities and approaches for nuclear and radiological applications;
  - Build on previous knowledge on safety and security culture, drawing from conferences and MSs expertise (170 MSs with different needs and an enormous collective knowledge);
  - More focus on leadership for nuclear, radiological safety and security, which includes safety and security culture.
- Identifying, filling the gaps (previously not offered to junior professional);
- Efficient regional implementation;
- IAEA coordination role for international implementation, including periodic assessment and continuous improvement.

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The IAEA International School of Nuclear and Radiological Leadership for Safety

The School

- In support of the young generation of professionals, the IAEA has developed the International School for Nuclear and Radiological Leadership for Safety
  - *The overarching objective of the School is for early to midcareer professionals to develop their safety leadership potential through a better understanding of what leadership means in practice in nuclear and radiological working environments with their inherent complexities and often competing considerations.*

- Broad & holistic approach: looking at nuclear and radiological environments during normal and emergency conditions;
- Bottom up support: future leaders recognising their leadership for safety in daily work creating a network for the future.

How the School Works

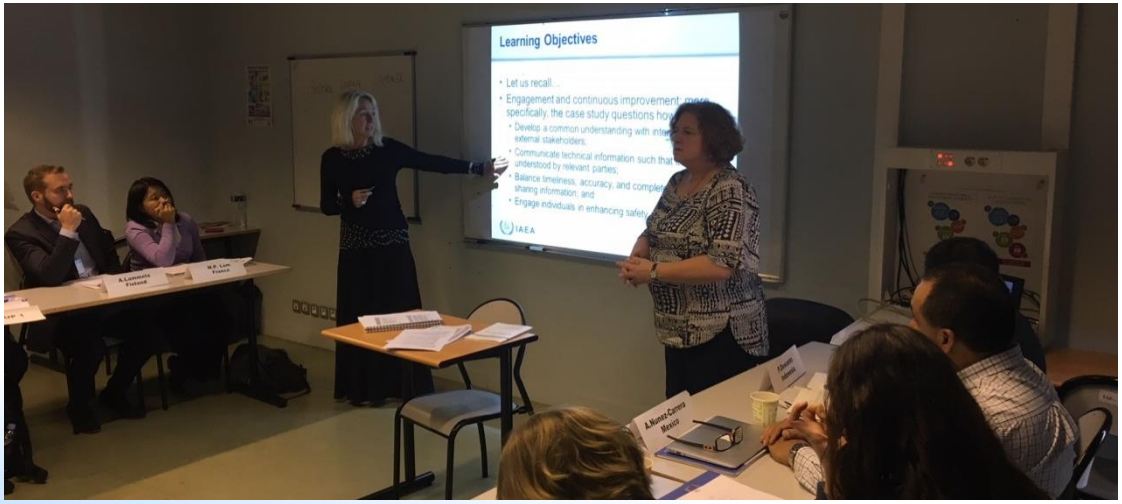
- This school is based on experiential learning including a pedagogic progression through the week on the key learning objectives
  - In line with the IAEA safety standards;
  - Class led by expert facilitators with knowledge of the nuclear and radiological industries, safety culture, and leadership for safety;
  - Case studies simulating real-life scenarios with increasing complexity.

The Case Studies

- 4 Case Studies walk participants through real-life leadership for safety scenarios
  - Each case has its own learning objectives based on GSR Part 2;
  - Conclude by asking students to reflect on the various aspects of leadership.
- Topics:
  1. Medical application - misapplication of radiotherapy treatments;
  2. Nuclear power plant - hoisting event in the reactor building during an outage;
  3. Emergency preparedness and response - release to the environment from a nuclear waste treatment process;
  4. Summary case - updating facilities in response to regulatory requirements, focus on all leadership aspects, including an element of nuclear security.

The Pilot School

- Conducted in October-November 2017 at the University of Nice in France:
  - Big interest based on the number of applicants (>150);
  - 20 students were selected from a variety of professional backgrounds in the nuclear and radiological field;
  - Evaluation shows that the School was a success and identified opportunities for improvement to further optimize the methodology and instructional materials.



Thoughts on the Pilot

- Some of the Students who took part in the Pilot School said:
  - *"After this training course I have obtained the knowledge on Leadership for safety, especially I learnt more practical knowledge via case studies. It helps me to understand more about leadership for safety, how I we engage it in our work."* – Viet Nam
  - *"As a leader for safety, recognise that values and attributes are at times more important than just simply following procedures and processes. When there are competing goals, one needs to learn to negotiate and be able to influence in a positive way."* – South Africa
  - "*I have learned that safety culture can transcend local or national cultures through transparency and communication - that safety truly can be its own culture and can be encouraged from all levels. I have also been empowered to understand that there are always choices and options to be considered that are within my control."* – Canada

Next Steps

Phase 1 - completed
Pilot Project
(1 Year)

Phase 2 (3 Years) and
Phase 3 (5-10 Years)

2018 – onwards

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Thank you!