



IAEA

International Atomic Energy Agency

Atoms for Peace and Development

Recommendations towards implementation of the benchmark problem on accident consequence assessment

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“Food for Thought”: Some Key Questions



- What **role** could the work of ASEAN-NPR play in supporting nuclear safety within the region?
 - *How can the expertise of Technical Support Organizations (TSOs) support safety as part of national nuclear safety frameworks and how can this then be extended to support regional safety?*
- What are the **common issues**, areas of interest and objectives of ASEAN countries and how can the network serve to address them?
- How can the work being done by the ASEAN-NPR network be **leveraged with other complementary initiatives** that are being undertaken?
 - i.e., “1+1=3”

INSAG: International Nuclear Safety Advisory Group



The International Nuclear Safety Advisory Group (INSAG) is an advisory group to the Director General of the International Atomic Energy Agency, whose main functions are:

- To provide a **forum for the exchange** of information on generic nuclear safety issues of international significance;
- To identify important **current nuclear safety issues** and to draw conclusions on the basis of results of nuclear safety activities within the IAEA and other information;
- To give **advice on nuclear safety issues** in which an exchange of information and/or additional efforts may be required;
- To formulate, where possible, **commonly shared safety concepts**.

INSAG-27: Ensuring Robust National Nuclear Safety Systems

- Need for “*suitably qualified and experienced staff to ensure safety*”
- Need for “*technical, design or operational capability including sub-contractors and TSOs*”
- Need for “*peer pressure*” and “*peer review*” to adopt accepted standards

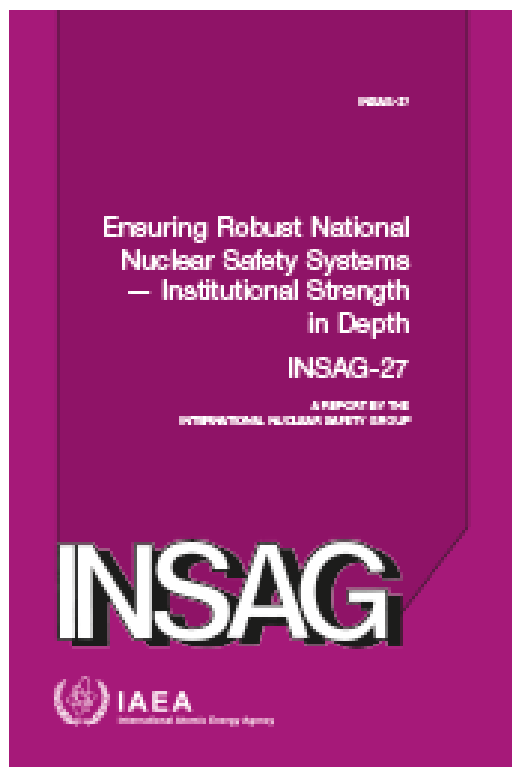
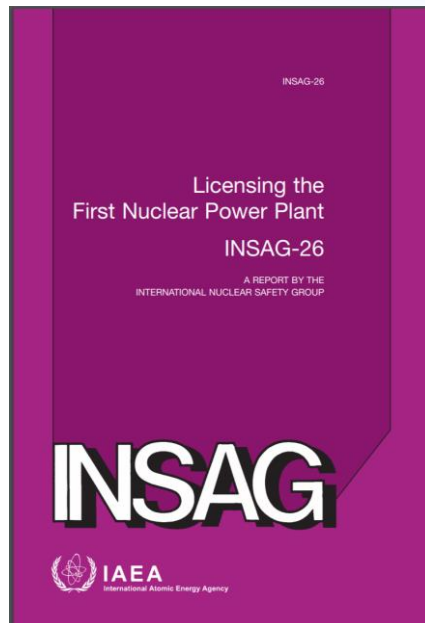


FIG. 1. A simple model of a robust national nuclear system. (Note: ‘Regulation’ includes all regulatory activities and controls, but a prime method of interaction and feedback is regulatory inspection activities.)

INSAG-26: Licensing the First Nuclear Power Plant



- “The regulatory body should also identify outside organizations that will act as its technical support organizations (TSOs).” *[but must be independent]*
- “Notwithstanding this, the regulatory body still requires a core technical group in the key disciplines to be able to understand and compile the information from the site evaluation reports as input to the site licensing process.”
- “The regulatory body will require substantial assistance from an experienced regulator for a quality review of the data on various plant parameters and results of commissioning tests conducted at different power levels. Such assistance will also be necessary for a thorough review of the technical specifications for operation proposed by the operator and their comparison with those for the reference nuclear power plant.”

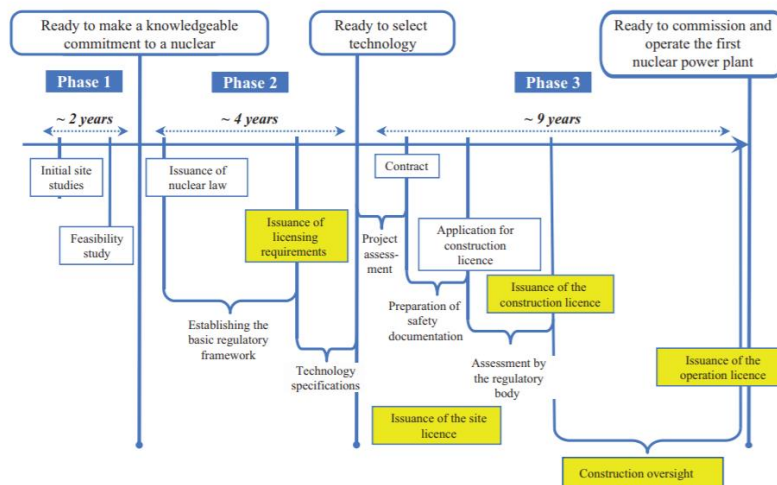
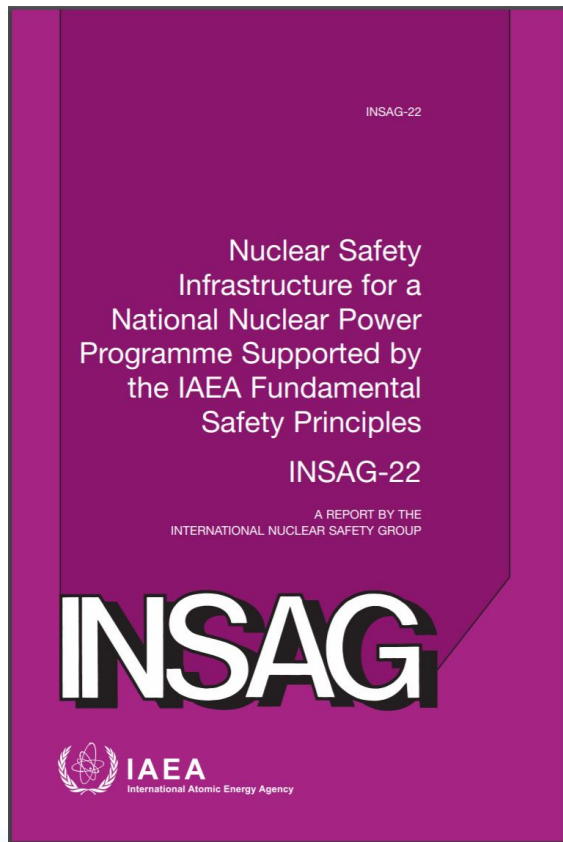


FIG. 1. The first three phases of a nuclear power programme. Note that the timelines for specific activities are not necessarily to scale. This diagram is based on Fig. 3 of SSG-16 [4].

The TSO that supports the Regulatory Body would also benefit from international interaction with experts.

INSAG-22: Nuclear Safety Infrastructure for a National Nuclear Power Programme



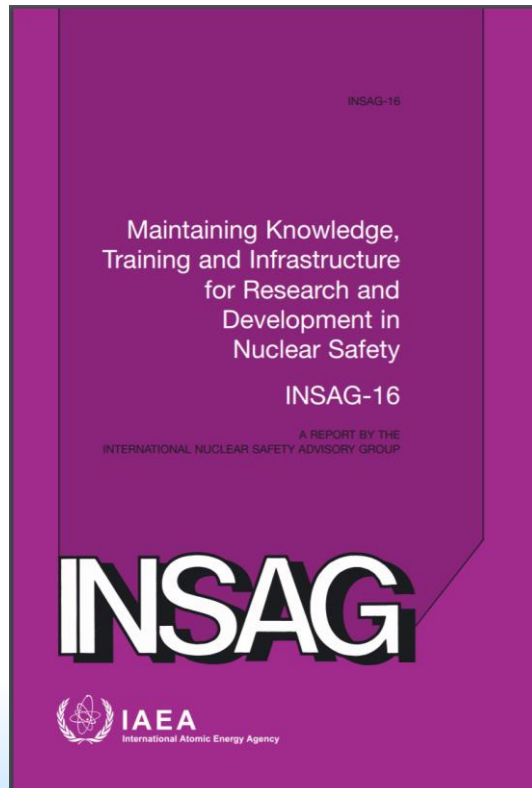
Safety is a Team Effort.

- “Nuclear safety infrastructure is defined as the set of institutional, organizational and **technical elements and conditions** established in a Member State to provide a sound foundation for ensuring a sustainable and high level of nuclear safety.”
- “Knowledge and experience should be used for **training reactor personnel and regulatory staff**, as well as for the staff of **technical support organizations**.”
- Useful knowledge and experience can also be gained by participating in **regional and international training and international nuclear safety research and safety related computer code development and validation activities**.
- INSAG-16 stresses the importance of maintaining knowledge, training and infrastructure for **research and development in nuclear safety**.”

INSAG-16: Maintaining Knowledge, Training and Infrastructure for R&D in Nuclear Safety

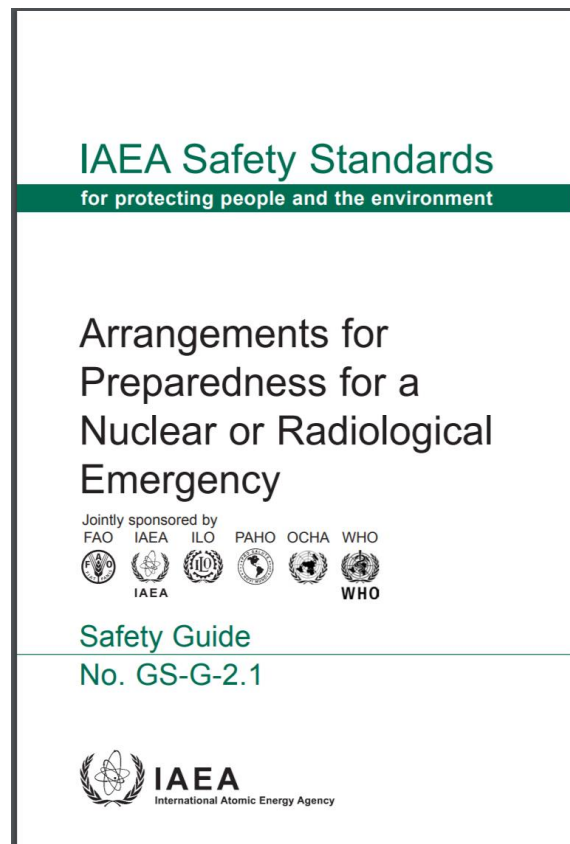


“Safety research by both industry and regulatory organizations can only develop and thrive where several conditions are satisfied. Although the challenges may be changing, these requirements remain critical to maintaining the necessary research infrastructure”:



- Maintenance of **technical expertise**
- **Analytical tools and techniques** to better quantify safety margins and facilitate better decisions
- Maintenance of **experimental facilities** to provide data on basic physical processes, to **confirm and validate mathematical models**, and to respond to new issues
- Development of a **pool of safety experts**
- Major nuclear **research** projects
- Achieving **public confidence** in regulatory body and operating organizations

GS-G-2.1: Arrangements for Preparedness for a Nuclear or Radiological Emergency



Para. 4.27

- *“The decision support systems, including those using computer models, may not be able to predict:*
 - Size and timing of a radioactive release (the **source term**)
 - **Movements of plumes**
 - **Deposition levels** or
 - **Resulting doses***sufficiently quickly or accurately during an emergency that they could provide the sole basis for deciding on initial urgent protective actions.*
 - *Particularly true for emergencies for which protective actions must be initiated before or shortly after a release to be effective or for which a release is by an unmonitored pathway.*
- Consequently, for such emergencies:
- ✓ Immediate protective actions should be implemented out to a **predetermined distance from the facility** in all directions when severe conditions are detected in the facility.
 - ✓ The protective actions and the distance should be **determined in advance** and should be consistent with Appendix II [of GS-G-2.1], or should be determined on the basis of site specific analysis.

Key Findings in the DG's Report on the Fukushima Daiichi Accident

“Arrangements need to be in place to allow decisions to be made on the implementation of predetermined urgent protective actions for the public, based on predefined plant conditions.”

- Decision support systems, including those using computer models, may not be able to predict the size and timing of a radioactive release (the ‘source term’), the movements of plumes, deposition levels or resulting doses **sufficiently quickly** or **accurately** in an emergency to be able to provide the sole basis for **deciding on initial urgent protective actions**.
- At the preparedness stage, there is a need to **develop an emergency classification system** based on observable conditions and measurable criteria (emergency action levels).
- This system:
 - Enables the **declaration of an emergency** shortly after the detection of conditions at a plant that indicate actual or projected damage to the fuel and initiation of predetermined, urgent protective actions for the public (in the predefined zones) promptly following classification of the emergency by the operator.
 - Needs to cover a **full range of abnormal plant conditions**.



Relationship between Deterministic and Probabilistic Safety Analysis.

Key Findings in the DG's Report on the Fukushima Daiichi Accident

“Arrangements need to be in place to enable urgent protective actions to be extended or modified in response to developing plant conditions or monitoring results.”

- Arrangements are also needed to enable early protective actions to be initiated on the basis of monitoring results.
- At the preparedness stage, there is a need to establish arrangements to, among other things:
 - Define **emergency planning zones** and areas;
 - Establish **dose and operational criteria** (levels of measurable quantities) for taking urgent protective actions and other response actions
 - Enable **urgent protective actions** to be taken before or shortly after a release of radioactive material
 - Enable **prompt establishment of access controls** in areas where urgent protective actions are in place;
 - **Extend protective actions beyond the established emergency planning zones** and areas if necessary;
 - Establish dose and operational criteria for taking early protective actions and other response actions (e.g. relocation and food restrictions) that are **justified and optimized**, taking into account a range of factors such as radiological and non-radiological **consequences**
 - Establish arrangements for revision of operational criteria for taking early protective actions on the basis of the **prevailing conditions**



Linkage to existing ASEAN TC project on monitoring.

Linkage to Safety Assessment:

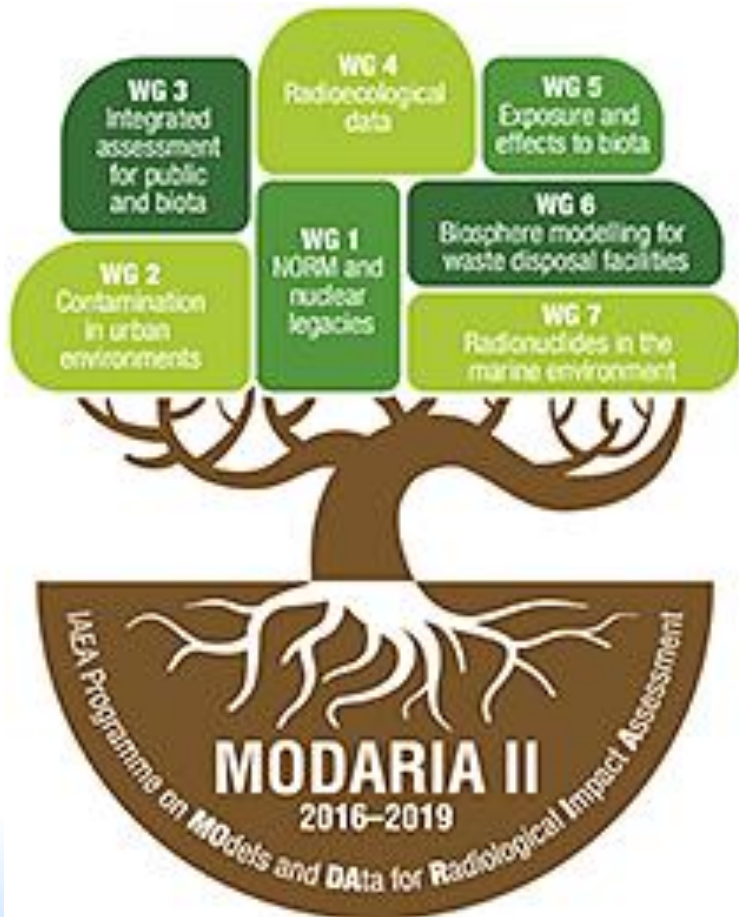
GSR Part 4 on “Safety Assessment for Facilities and Activities”



- GSR Part 4 describes the generally applicable requirements to be fulfilled in safety assessments for facilities and activities, with special attention paid to:
 - Defence in depth
 - Quantitative analyses
 - Application of a graded approach to facilities and activities.

Establishment of benchmark problems in support of Safety Assessment?

“Formal” Linkage of ASEAN-NPR with MODARIA II WG2 through participation?



- Contribution of benchmark problem as scenario within WG2?
- Benchmark testing by other international experts
- Input from others
- Formalization of time-line for progress of benchmark testing
- Possible testing of tools, such as RASCAL 3.0 (which is listed in the IAEA Safety Standards on EPR)

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***Development of ASEAN-NPR
workplan in context of broader
regional Action Plan?***



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Thank you!

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