IAEA SAFETY STANDARDS

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Part I

Why Having Safety Standards
Role of IAEA

• Statute of IAEA

« ...to establish or adopt ...standards of safety for the protection of health and minimization of danger to life and property »

« and to provide for the application of these standards »
Safety standards: what for?

- Harmonization of safety to higher levels
- Revision processes for new knowledge and experience feedback
- References for Conventions
- References for peer safety reviews
- Basis for Legislations and Regulations in countries starting nuclear programmes
Development of Safety Standards

Two periods:
- up to 1996 development of « minimum common requirements »
- from 1996 development of the maximum best practices

Now: continued revision by reviews of previous documents for incorporating new knowledge or new practices
Part II

IAEA Safety Standards
Commission & Committees

Commission on Safety Standards (CSS)

- Nuclear Safety Standards Committee (NUSSC)
- Radiation Safety Standards Committee (RASSC)
- Waste Safety Standards Committee (WASSC)
- Transport Safety Standards Committee (TRANSSC)
Safety Standards Hierarchy

Safety Fundamentals

Safety Requirements

Safety Guides

Reference for a High Level of Nuclear Safety
Hierarchy of Safety Standards

• Safety Fundamental
  • A must for every installation or activity

• Safety Requirements
  • Functional conditions required for safety
  • Stable - but periodic review and revision if necessary

• Safety Guides
  • Guidance to fulfill the requirements
  • User-friendly and up-to-date practical guidance representing good/best practices
Fundamental Safety Principles

Principle 1: Responsibility for Safety
Principle 2: Role of Government
Principle 3: Leadership and Management for safety
Principle 4: Justification of facilities and activities
Principle 5: Optimization of protection
Principle 6: Limitation of risk to individuals
Principle 7: Protection of present and future generations
Principle 8: Prevention of accidents
Principle 9: Emergency preparedness and response
Principle 10: Protective actions to reduce existing of unregulated radiation risk
• OBJECTIVE

1.8. The objective of this publication is to define requirements for establishing, implementing, assessing and continually improving a management system that integrates safety, health, environmental, security, quality and economic elements to ensure that safety is properly taken into account in all the activities of an organization.

1.9. The main objective of the requirements for the management system is to ensure, by considering the implications of all actions not within separate management systems but with regard to safety as a whole, that safety is not compromised.
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6. MEASUREMENT, ASSESSMENT AND IMPROVEMENT

- Monitoring and measurement (6.1)
- Self-assessment (6.2)
- Independent assessment (6.3–6.6)
- Management system review (6.7–6.10)
- Non-conformances and corrective and preventive actions (6.11–6.16)
- Improvement (6.17–6.18)
IAEA SAFETY STANDARDS FOR SAFETY ASSESSMENT

Fundamental

Safety Principles

Requirements

Safety Assessment

Safety Guides (SGs)

- NEW -- Deterministic Safety Analysis for NPPs
- NEW -- Severe Accident Management Programme for NPPs
- NEW -- Development & Application of Level 1 PSA for NPPs
- NEW -- Development & Application of Level 2 PSA for NPPs

- PLANNED - Safety Goals

Other Standards
Safety Analysis Methodologies

**Safety Margins:** Conservative Design & Analyses

- Normal Operating Systems
- Protection Systems, Engineered and Special Safety Features
- Quality Assurance & Safety Culture

**Defence-in-Depth:** Physical BARRIERS and LEVELS of Protection

1. **1st LEVEL:** Maintain Normal Operation
2. **2nd LEVEL:** Control Abnormal Operation
3. **3rd LEVEL:** Control Design Basis Accidents
4. **4th LEVEL:** Accident Management including Containment Protection
5. **5th LEVEL:** Off-site Emergency Response

- **1st BARRIER:** Fuel Matrix
- **2nd BARRIER:** Fuel Cladding
- **3rd BARRIER:** Primary Coolant Boundary
- **4th BARRIER:** Containment
- **Fission Products**
## Levels of Defence-In-Depth

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Deterministic Design Requirements

- **Basic safety aims of the design:**
  - to limit routine exposures and releases
  - to prevent accidents, and
  - to limit and mitigate accident consequences

- **Basic deterministic requirements:**
  - Defense-in-depth
  - Safety margins
  - Diversity and redundancy within and between safety systems
  - Single failure criterion
General Principles of Design

• Elimination or reduction of hazards where possible by choosing inherently safe materials and conditions
• Preference for passive over active systems or their effective combination
• Diversity and redundancy within and between safety systems
• No single component failure can disable a safety function
• Systems which are fail-safe and whose deterioration is visible
• Explicit consideration of human factors, with automation where beneficial, good ergonomics, and robust procedures
Requirement on Risk Assessment

IAEA Safety Fundamental

(SF-1):

• Facilities and activities dealing with radioactive material provide many benefits but at the same time give rise to radiation risks.

• Principle 5 on optimization of protection emphasizes the need to assess and control the inherent risk:

  “3.22. To determine whether radiation risks are as low as reasonably achievable, all such risks, whether arising from normal operations or from abnormal or accident conditions, must be assessed (using a graded approach) a priori and periodically reassessed throughout the lifetime of facilities and activities.”

✓ The tool to assess risk is Probabilistic Safety Assessment (PSA)
Fuel Cycle

IAEA Safety Standards
for protecting people and the environment

Safety of Conversion Facilities and Uranium Enrichment Facilities

Specific Safety Guide
No. SSG-5

-- IAEA International Atomic Energy Agency --

IAEA Safety Standards
for protecting people and the environment

Safety of Uranium Fuel Fabrication Facilities

Specific Safety Guide
No. SSG-6

-- IAEA International Atomic Energy Agency --
Part III

International Nuclear Safety Convention
Nuclear Safety Convention

- **Obligations** based on the first version of the safety fundamentals

- **Objectives:**
  
  - to achieve and maintain a high level of nuclear safety worldwide…;
  
  - to protect individuals, society and the environment from harmful effect of ionizing radiation…;
  
  - to prevent accidents with radiological consequences and to mitigate such consequences should they occur.
Nuclear Safety Convention

• The Convention applies to “the safety of nuclear installations” (civil and land-based)
• Each Contracting Party shall:
  - ensure that the safety of nuclear installations is reviewed as soon as possible…;
  - ensure that all reasonably practical improvements are made to upgrade the safety of the nuclear installation…;
  - shut down the nuclear installation as soon as practically possible, if such upgrading cannot be achieved…
The IAEA shall:
- provide the Secretariat for “review meetings”. •convene, prepare and service the meetings of the Contracting Parties;
- transmit information received or prepared in accordance with the provisions of this convention;
- provide other services in support of the “review meetings” as requested by consensus;
- be the Depository of the Convention.
Feedback on the 4th Review Meeting of the Convention on Nuclear Safety (CNS)

- The 4th Review Meeting (RM) of the Contracting Parties (CPs) to the CNS was held at the Headquarters of the International Atomic Energy Agency (IAEA) in Vienna, 14–25 April 2008.
- 55 out of 61 CPs participated
- OECD/NEA attended as an observer
- 4 CPs (Kuwait, Mali, Nigeria and Sri Lanka) did not submit a National Report
- 6 CPs (Bangladesh, Kuwait, Mali, Republic of Moldova, Sri Lanka and Uruguay) did not attend the Review Meeting
- A number of CPs submitted their reports later than the deadline, and in a few cases the submissions were too late to allow the preparation of written questions by other CPs
- Secured CNS website is now a well established tool: 4270 Questions were asked and 4171 Answers were provided electronically!
Results 4th Review Meeting under nuclear safety convention

• The Review Meeting emphasized 9 issues in the Summary Report:

1. Legislative and Regulatory Framework

• More Contracting Parties are now using, or intend to use, IAEA Safety Standards as the basis for creation or revision of regulatory requirements for nuclear safety
• European countries reported harmonization efforts through the voluntary incorporation of WENRA Reference Levels, which are based on the IAEA Safety Standards.
• IAEA to promote more IRRS missions in the Member States
2. Independence of the Regulatory Body

- In some Contracting Parties, the separation between the functions of the regulatory body and those of bodies or organizations concerned with the promotion or utilization of nuclear energy, may not be fully effective.
- It was noted that regulatory separation and independence requires further attention.
- Safety culture issues are already covered in the Safety Management standards.
3. Safety Management and Safety Culture

- Substantial progress was made regarding safety management and safety culture, in operating organizations and Regulatory Bodies.
- IAEA Safety Requirements (The Management System for Facilities and Activities and supporting safety guides) were frequently referenced.
- Systematic assessment of safety culture exists in some countries and many significant event investigations now include an assessment of safety culture.
- Lessons learned from events and operational experience in general and respective corrective action programmes have significantly contributed to enhance safety performance.
- Regulators and operators plan to further enhance their national systems and related international arrangements.
- IAEA to promote more SCART missions in the Member States.
4. Staffing and Competence

- Maintaining adequate staffing and competence levels for nuclear safety is a significant challenge for operators, regulatory bodies and TSOs.
- Some Regulatory Bodies had increased staffing levels and plan to increase levels even more to deal with life extension and new build.
- Identified as good practices: Proactive measures, such as hiring well in advance of new reactor construction or senior retirements, mentoring and training programmes, competitive remuneration packages and international collaboration.
5. Probabilistic Safety Assessment

- Significant progress made in the use of PSA techniques to support operational and regulatory decisions.
- PSAs are used to supplement deterministic safety analyses.
- PSAs must be continuously updated to maintain their usefulness.
- A common understanding between operators and regulators on its application is important. Some Countries have implemented PSA information systems, which enables staff who are not expert in PSA to use it as a tool for risk informed decision making. Risk informed decision making is a now common practice in many Countries with NPPs and many are adopting a performance based regulatory approach.
7. Ageing Management and Life Extension

- Extensive activities regarding ageing management and life extension of existing NPPs. Specific technical challenges, including procurement of components no longer manufactured and obsolete instrumentation and control systems, were discussed. Ageing management and life extension activities will continue to require substantial operator and regulatory attention.
- The importance of technical cooperation for availability of safety related equipment and services was highlighted.
8. Emergency Management

- Most Countries reported progress regarding emergency management (national emergency plans updated, national exercises held or planned, new emergency operations centres established).
- Substantial progress with Severe Accident Management Programmes.
- Provision of adequate and timely information regarding incidents and emergencies in neighbouring countries remains a challenge. Countries reported increased bilateral and multinational cooperation, including data exchange for effective off site emergency preparedness.
- Emergency management is an area where Contracting Parties without a nuclear power programme have made a strong contribution to the Convention on Nuclear Safety through identifying good practices, challenges and planned activities to improve safety.
9. New NPPs

- Many Countries reported on activities or plans for new NPPs
- A number of them with mature nuclear programmes have established units in their Regulatory Body to deal with the licensing of new NPPs and have updated their regulatory framework in line with IAEA safety requirements.
- The necessary safety infrastructure (technical expertise, legislative and regulatory framework) must be established well in advance, before the construction of an NPP.
- The Review Meeting also invited other countries intending to start a nuclear power programme to join the Convention on Nuclear Safety.
Results 4th Review Meeting under nuclear safety convention

General recommendations:

• Many Contracting Parties reported about their positive experiences with IAEA Missions, especially OSART and IRRS missions, and recognize their importance.
• Contracting Parties that have not received these missions are encouraged to do so.
Nuclear Safety Convention

- Next year 2011: review meeting in Vienna
- 2010: national reports to be submitted and reviewed by Contracting parties, questions to be submitted for answers at the review meeting
- Publication of the main conclusions 2011
Part IV

Safety Review Services
Safety reviews

- Preparatory meeting one year before
- Designation of IAEA team leader and selection of the « peer experts » from different countries
- On site review starting with team bonding and training, standards to be used
- Every day discussion of the findings and recommendations, suggestions and presentation to the management
- First report given to the installation managers and presentation to the personnel (exit meeting in presence of Regulator)
- Two years later on site review of the recommendations implemented
Safety Review Services to assist throughout the lifetime of the reactor

- Concepts
- Site evaluation
- Safety Assessment
- Operation
- Commissioning
- Construction
- Pre-decommissioning
- Decommissioning

Safety Review Services based on IAEA Safety Standards
IAEA Safety Review Services

Regulatory Framework and Activities
- **IRRS** – Integrated Regulatory Review Service

Operational Safety
- **OSART** – Operational Safety Review Team
- **SEDO** – Safety Evaluation of Fuel Cycle Facilities During Operation
- **SCART** – Safety Culture Assessment Review Team
IAEA Safety Review Services

Research Reactors

- **INSARR** – Integrated Safety Assessment of Research Reactors

Engineering and Technical Safety

- **Safety Assessment Services** – Engineering/Safety Assessment Review Services
Take Away Points

• IAEA Safety standards Fundamental Principles are to be applied worldwide
• Not mandatory everywhere but a reference for all
• The Council of European Union and WENRA use them as basis for safety
• Do not hesitate to ask for the IAEA safety reviews