The Code of Conduct on the Safety of Research Reactors

W. Kennedy

Research Reactor Safety Section
Division of Nuclear Installation Safety

Rabat, Morocco

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International Atomic Energy Agency

Contents

- History of the Code
- Preparation of the Code
- Nature of the Code
- Principal Source Documents for the Code
- Structure of the Code
- Feedback from the 2014 International Meeting on the Code
- Potential benefits from application of the Code
- Concluding remarks

The Code of Conduct on the Safety of Research Reactors is online at:
http://www-pub.iaea.org/MTCD/publications/PDF/CODEOC-RR_web.pdf

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History of the Code of Conduct

- In 1998, INSAG expressed concerns for safety of research reactors (RRs):
  - Ageing of facilities and staff;
  - RRs neither operating nor decommissioned (extended shutdown);
  - Lack of appropriate regulatory supervision.
- GC(44)/RES/14 (2000): The General Conference requested the Secretariat " Within its available resources to continue work on exploring options to strengthen international nuclear safety arrangements for civil RRs…"

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History of the Code of Conduct

- GC(45)/RES/10.A (2001) endorsed a Board request that the Secretariat develop and implement, in conjunction with Member States, an International Research Reactor Safety Enhancement Plan.
- This plan included development of a Code of Conduct on the Safety of Research Reactors.

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Preparation of the Code of Conduct

- A draft Code was developed at two meetings of legal and technical experts in 2002 (22 MS).
- At the request of the March 2003 Board it was circulated to all Member States for comment.
- The Secretariat and an expert working group (15 members from 11 MS) considered the comments at a meeting in October 2003. A revised draft was circulated to all Member States for review.
- The Code was adopted by the Board in March 2004. General Conference 48 (2004) endorsed the Code.

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The Nature of the Code of Conduct

- The Code of Conduct:
  - Is a non-binding international legal instrument that stands alone and apart from other documents, to which a State may make a non-binding political commitment. (discussed during the 2014 Triennial Meeting on the Code in Vienna)
  - Provides guidance to States for the development and harmonization of policies, laws and regulations on the safety of research reactors, and offers “best practice” guidance for management of research reactor safety.
  - Includes technical provisions based upon consensus documents, primarily the Safety Fundamentals and Safety Requirements of the IAEA Safety Standards Series.

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The Nature of the Code of Conduct

- The Code is not a safety standard, but the Code and underlying Safety Standards are complementary. Both are intended to enhance safety of RRs, but the two documents are fundamentally different.
- The technical content of a safety standard is much more detailed than the Code.
- The Code provides a summary of the desirable attributes for safety management of RR, in a form and a level of detail that are useful for decision makers of the State, the regulatory body, and the operating organization.

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Principal Source Documents for the Code of Conduct

- IAEA Safety Fundamentals
  - The Safety of Nuclear Installations, SS No. 110, 1993 (superseded by SF-1, Fundamental Safety Principles, 2006).
- IAEA Safety Requirements
  - Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety, GS-R-1, 2000 (revised 2010);
  - Safety of Research Reactors, NS-R-4, 2005 (superseded by SSR-3 in 2016);
  - Predisposal Management of Radioactive Waste, Including Decommissioning, WS-R-2, 2000 (superseded by GSR-5 (2009) and WS-R-5 (2006).

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Structure of the Code of Conduct

- Scope
- Objective
- Application of the Guidance
- Role of the State
- Role of the Regulatory Body
- Role of the Operating Organization
- Role of the IAEA

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Scope of the Code of Conduct

The Code of Conduct:

- Applies to RRs at all stages in their lifetime from siting to decommissioning;
- Does not apply to the physical protection (nuclear security) of RRs;
- Does not apply to RRs in military or defense programmes.

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Objective of the Code of Conduct

- To achieve and maintain a high level of safety through enhancement of national measures and international co-operation.
- Achieved by:
  - Proper operating conditions;
  - Prevention of accidents;
  - Mitigation of accident consequences;
- In order to protect workers, the public and the environment from undue radiation hazards.

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Application of the Guidance in the Code of Conduct

States should:

- Apply the Code through national safety regulations;
- Make appropriate use of IAEA Safety Standards (relevant to RRs, legal and governmental infrastructure for nuclear, radiation, radioactive waste and transport safety);
- Apply a graded approach commensurate with the hazard potential;
- Communicate any difficulties faced and assistance required in application of the Code to the IAEA.

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Role of the State

The State should:

- Establish and maintain a legislative and regulatory framework governing safety of RRs;
- Place the prime responsibility for safety on the operating organization;
- Have an independent regulator with authority and resources to establish regulations, authorize activities, assess safety, and inspect and enforce regulations;

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Role of the State

The State should:

- Have a functioning regulatory body in place before building or importing a RR;
- Take appropriate steps to ensure that the safety of existing RRs is reviewed and upgraded as necessary;
- Ensure that the operating organization has a financing system for safe operation, extended shutdown, and decommissioning;
- Establish an effective system of governmental emergency response and intervention;

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Role of the State

The State should:

- Provide information, if requested, to States in the vicinity for emergency planning and response; and
- If deemed necessary, define how the public is involved in the regulatory process.

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Role of the Regulatory Body and the Operating Organization

The Code provides separate guidance for the regulatory body and for the operating organization based on the IAEA Safety Standards. This guidance addresses:

- Safety Culture
- Assessment and Verification of Safety
- Financial and Human Resources
- Quality Assurance (Integrated Management System)
- Human Factors
- Radiation Protection
- Emergency Preparedness
- Siting
- Design, Construction, and Commissioning
- Operation, Maintenance, Modification, and Utilization
- Extended Shutdown
- Decommissioning

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Role of the Regulatory Body

The Regulatory Body should:

- Establish a process of issuing authorizations;
- Inspect and ensure corrective action for deficiencies;
- Take enforcement actions in the event of violations;
- Review and assess safety.

Regulations and guidance should:

- Require clear management arrangements and encourage a strong safety culture;

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Role of the Regulatory Body

- Assessment and verification of safety:
  - Require a SAR and authorization for siting, construction, commissioning, operation, modification, extended shutdown or decommissioning;
  - Require periodic safety reviews with proposals for necessary upgrades;
- Financial and human resources:
  - Require the operating organization to demonstrate sufficient financial and human resources;
  - Require appropriate training of operators and experimenters.

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Role of the Regulatory Body

- Quality Assurance: Require an effective quality assurance programme (Integrated Management System);
- Human factors: require the operating organization to take human factors into account throughout the life of the RR;
- Radiation protection:
  - Require radiation doses to be ALARA;
  - Provide guidance on the protection of the environment from the harmful effects on ionizing radiation;
- Emergency preparedness: Establish criteria for intervention in emergencies;
- Siting: Establish criteria for siting research reactors;

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Role of the Regulatory Body

- Design, construction, and commissioning:
  - Require defense in depth, diversity and redundancy;
  - Require construction be carried out in accordance with applicable codes and standards, specifications;
  - Commissioning programme be carried out to ensure that the reactor meets the design requirements;
- Operation, maintenance, modifications, and utilization:
  - Require authorized OLCs;
  - Require reports of incidents; require classification, review and maintaining records of modifications and changes;

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Role of the Regulatory Body

- Extended shutdown: Establish criteria for RRs in extended shutdown;
- Decommissioning: Establish criteria for the clearance from regulatory control of decommissioned RRs.

Role of the Operating Organization

The operating organization should:

- Assessment and verification of safety: Conduct an initial assessment, periodic re-assessment and continuous verification of safety;
- Financial and human resources:
  - Ensure an overall effective financing system for safe operation, extended shutdown and decommissioning;
  - Provide training for staff and experimenters;
- Quality assurance: Provide effective quality assurance (Integrated Management System);

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Role of the Operating Organization

- Human factors: take into account the capabilities and limitations of human performance throughout the life time of the reactor, including accidental conditions and experiments;
- Radiation protection:
  - Ensure radiation exposure is ALARA;
  - Respond to any guidance that is provided by the regulatory body in relation to protection of the environment;
- Emergency preparedness: Establish, maintain, and test emergency plans.

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Role of the Operating Organization

- Siting: Conduct site evaluation and periodic re-evaluation to ensure continued safety acceptability;
- Design, construction, and commissioning:
  - Design the RR and any modifications using defence-in-depth principles and proven technology;
  - Construct the RR and any modifications in accordance with approved designs;
  - Demonstrate that safety design objectives have been achieved in a commissioning programme.

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Role of the Operating Organization

- Operation, maintenance, modifications, and utilization:
  - Conduct the operations, maintenance and utilization programme in accordance with approved OLCs and procedures;
  - Provide for availability of technical support;
  - Provide for incident reporting and analysis;
  - Subject modifications to design, construction, and commissioning and appropriately assess experiments;
  - Establish a safety committee, as a part of the OO;
  - Provide for radioactive waste management;
  - Maintain documentation in a secure and organized manner throughout the life of the RR.

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Role of the Operating Organization

- Extended Shutdown: If necessary the operating organization should implement a technical preservation programme including:
  - Criticality control or core offload;
  - Modified SAR and OLCs;
  - Surveillance, testing and maintenance;
  - Emergency preparedness;
  - Maintain adequate, knowledgeable RR staff.

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Role of the Operating Organization

- Decommissioning:
  - Consider decommissioning in siting, design, construction, operation, maintenance and utilization;
  - Maintain documentation in a secure, organized, up-to-date condition;
  - Prepare a decommissioning plan addressing options, techniques, radiation protection, spent fuel and radioactive waste management;
  - Establish a decommissioning funding programme.

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Role of the IAEA

- The IAEA Secretariat should:
  - Disseminate the Code of Conduct;
  - Assist Member States in its application;
  - Collect and disseminate information on RR safety, provide review services, develop and establish safety standards, and assist in their application;
  - Advise and assist on all aspects of safe management of research reactors.

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Feedback from the 2014 International Meeting

- International Meeting on Application of the Code of Conduct on the Safety of Research Reactors, IAEA Vienna, June 2014;
- 40 Member States in attendance;
- Self-assessment questionnaire covering application of the provisions of the Code;

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Self-Assessment Questionnaires

- Developed by the IAEA in preparation for the meeting;
- The objectives were to:
  - Identify areas of satisfactory application of the Code and areas needing improvement;
  - Highlight the status of management of safety of research reactors and identify needs for IAEA assistance;
  - Identify opportunities for international cooperation on the safety of research reactors.

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Self-Assessment Questionnaires

- The status of application of the Code is determined on the basis of four qualitatively-defined general levels:
  - Level 3: The guidance in the Code is fully applied.
  - Level 2: The guidance in the Code is partially applied with satisfactory progress. Some work remains to fully apply the guidance in the Code.
  - Level 1: There is incomplete application of the guidance in the Code, with significant gaps or limitations. Substantial work remains to fully apply the guidance in the Code.
  - Level 0: The guidance in the Code is not applied.
- More specific descriptions for each of the levels 0 to 3 (for every Paragraph of the Code) were are also provided.

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Self-Assessment Questionnaires

- The analysis of the responses also considered the results of the self-assessments provided to the International Meeting on the Code of Conduct in 2008 and 2011, with due consideration of the differences in the:
  - Number of the responses (number of Member States);
  - Organizations/individuals who provided the responses;
  - Developments since 2008 of the understanding of the intentions of the Code's provisions.
- Consideration was also given to the revision of the self-assessment questionnaires, which did not have a significant impact on the results.

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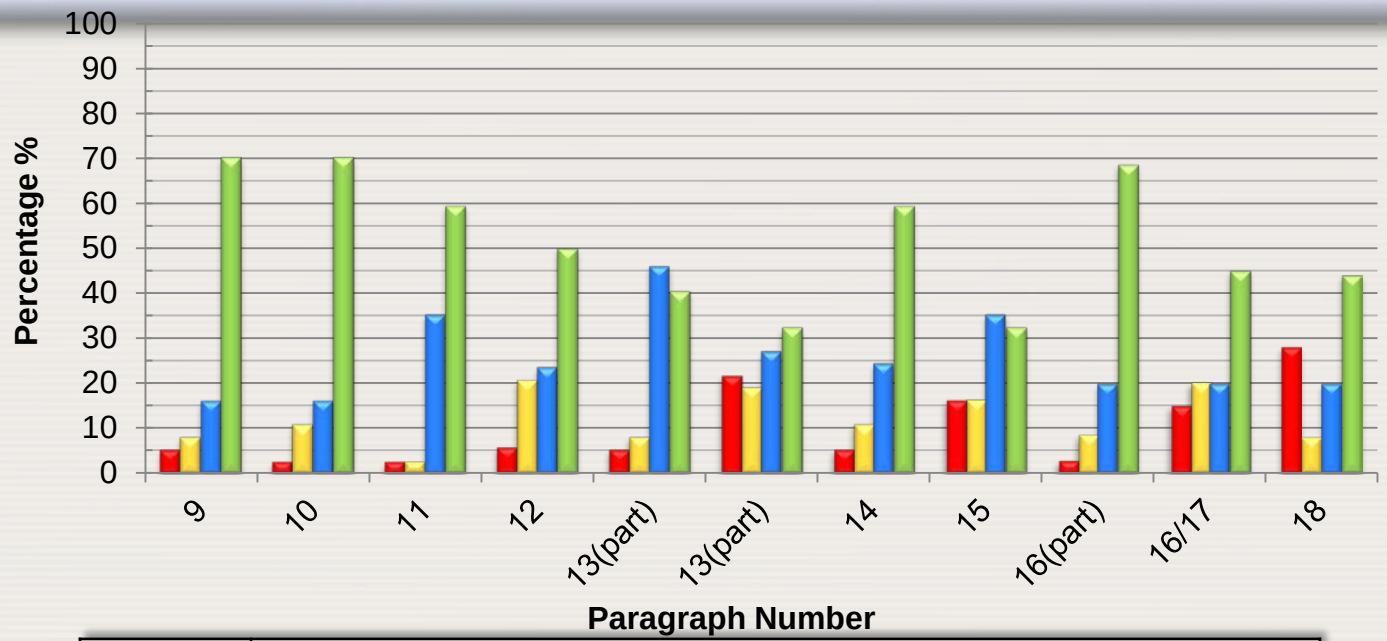
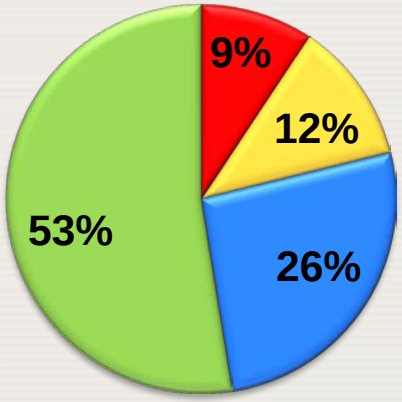
Role of the State: Percentage of Implementation



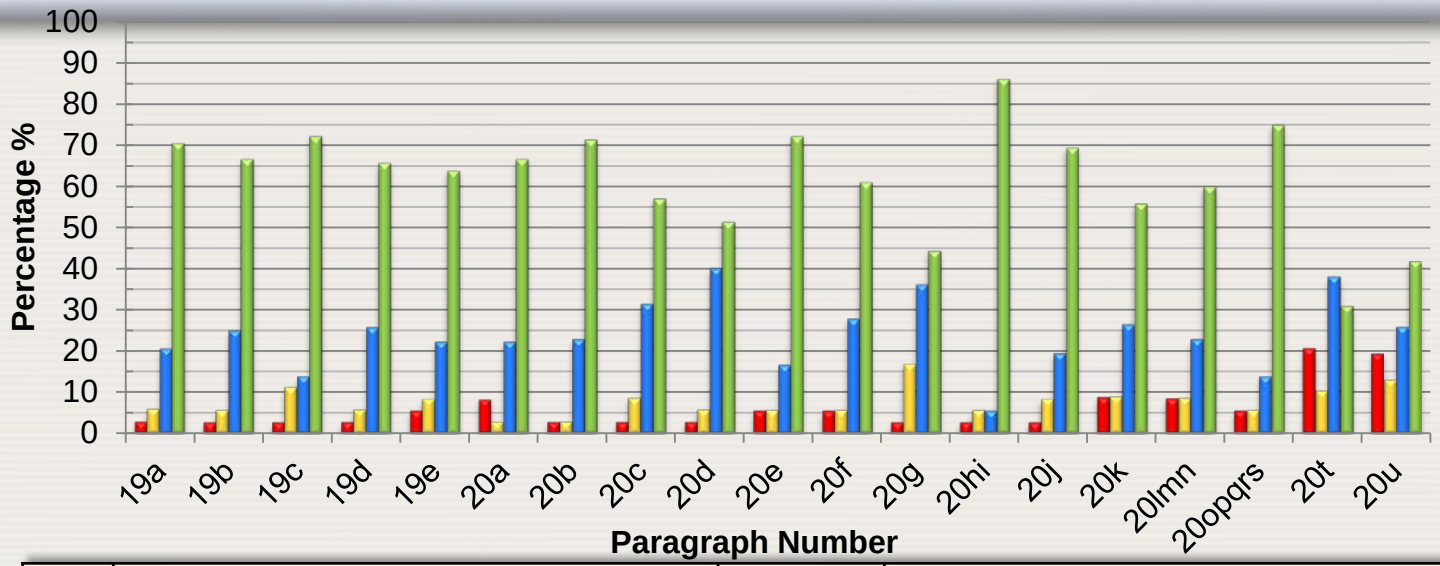


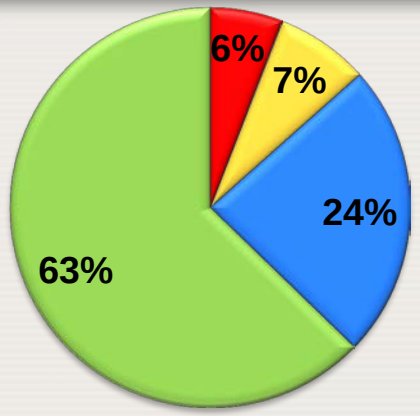
- Level 0: Not implemented
- Level 1: Incomplete
- Level 2: Partially implemented
- Level 3: Fully implemented

9	Legal and regulatory framework.
10	Establishment, functioning and independence of regulatory body.
11	Authority and resources of the regulatory body.
12	Involvement of public and other bodies in regulatory process.
13 (part)	Resources for safe operation and/or for safe extended shutdown state.
13 (part)	Financing system for decommissioning.
14	Governmental emergency response system.
15	Legal and infrastructure arrangements for decommissioning.
16 (part)	Safety review of operating research reactors.
16/17	Extended shutdown safety, if applicable.
18	Information for neighbouring states, if applicable.

Data from 38 Member States.

Role of the Regulatory Body: Percentage of Implementation



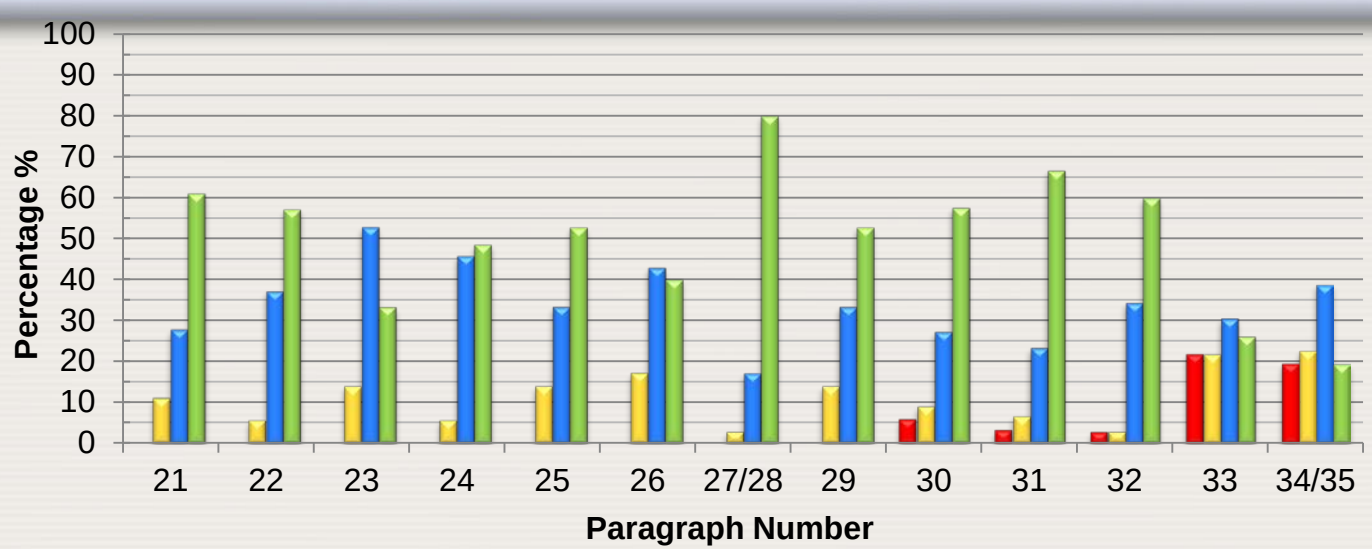


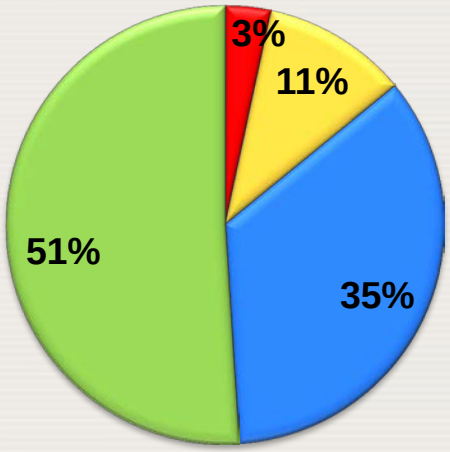
- Level 0: Not implemented
- Level 1: Incomplete
- Level 2: Partially implemented
- Level 3: Fully implemented

19a	Process of issuing authorizations.	20f	Requirement for quality assurance program.
19b	Regulatory inspections and assessments.	20g	Requirement to take human factors into account.
19c	Enforcement of regulations and authorizations.	20h,i	Requirements for radiation protection .
19d	Review and assessment of safety submissions during lifetime of reactor.	20j	Criteria for emergency preparedness .
19e	Availability of regulatory requirements and decisions.	20k	Criteria for siting research reactors.
20a	Requirement for management of safety.	20l,m,n	Requirements for design, construction and commissioning.
20b	Requirement to prepare and maintain SAR and obtain authorization.	20o,p,q,r,s	Requirement for operation, maintenance, modification and utilization.
20c	Requirements to undertake periodic safety reviews and make proposals for upgrading and refurbishment.	20t	Criteria for safety in extended shutdown.
20d	Requirement for financial and human resources to support safe operation.	20u	Criteria for release from regulatory control of decommissioned research reactors.
20e	Requirement for personnel training.		

Data from 38 Member States.

Role of the Operating Organization: Percentage of Implementation



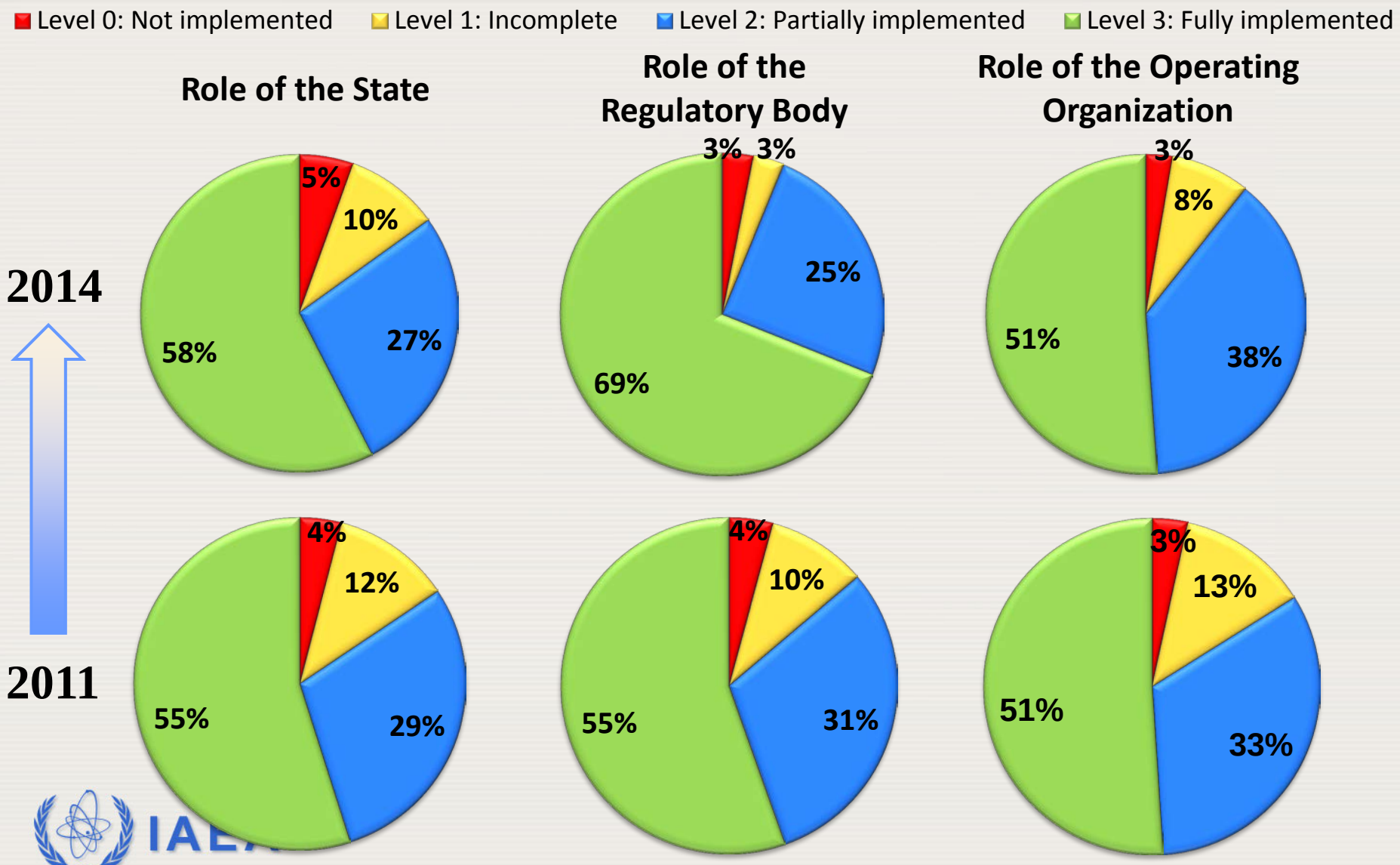


21	Management of safety.
22	Assessment and verification of safety.
23	Financial resources.
24	Qualified human resources.
25	QA programmes.
26	Human factors.
27/28	Radiation protection.
29	Emergency preparedness.
30	Siting.
31	Design, construction and commissioning.
32	Operation, maintenance, modification and utilization.
33	Extended shutdown.
34/35	Decommissioning.

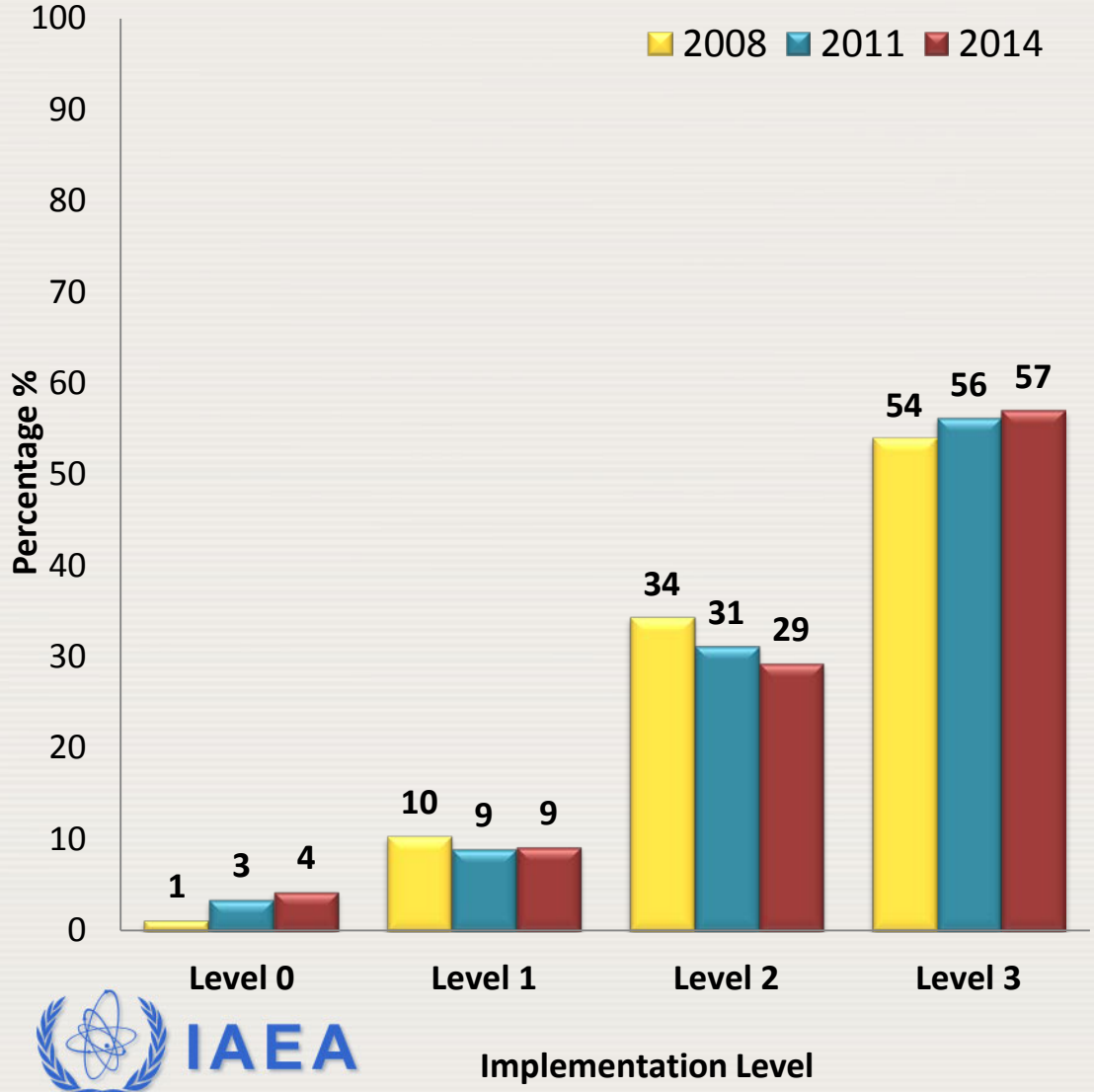
- Level 0: Not implemented
- Level 1: Incomplete
- Level 2: Partially implemented
- Level 3: Fully implemented

Data from 38 Member States.

Percentage of Implementation Levels (2014 vs. 2011, for 21 common MSs)



Role of the State: Percentage of Implementation Level (2008-2014, for 17 common MSs)



- The data confirms the need for re-addressing awareness of the decision makers of the provisions of extended shutdown and decommissioning legal framework and funding.
- The data from the 17 MSs that participated in all three meetings shows a similar trend to that reported by all participating MSs.

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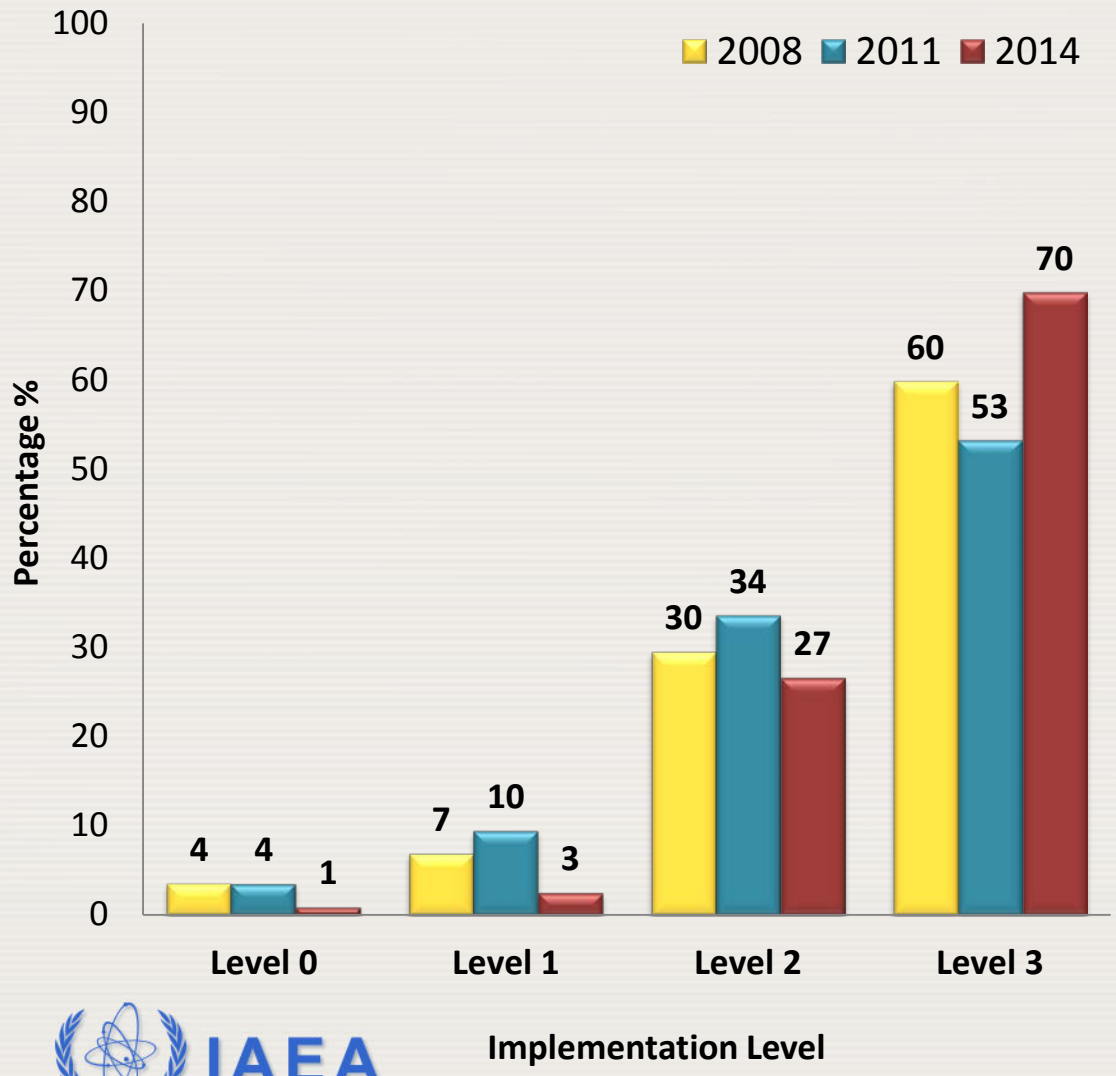
Role of the Regulatory Body: Percentage of Implementation Level (2008-2014, for 17 common MSs)



- Generally, the data indicates relatively consistent responses with some improvements from 2008 – 2014.
- *Insights from the graphs on less implemented Codes' provisions in the 2014 responses can not be ignored.*
- The data from the 17 MSs that participated in all three meetings shows a similar trend to that reported by all participating MSs.

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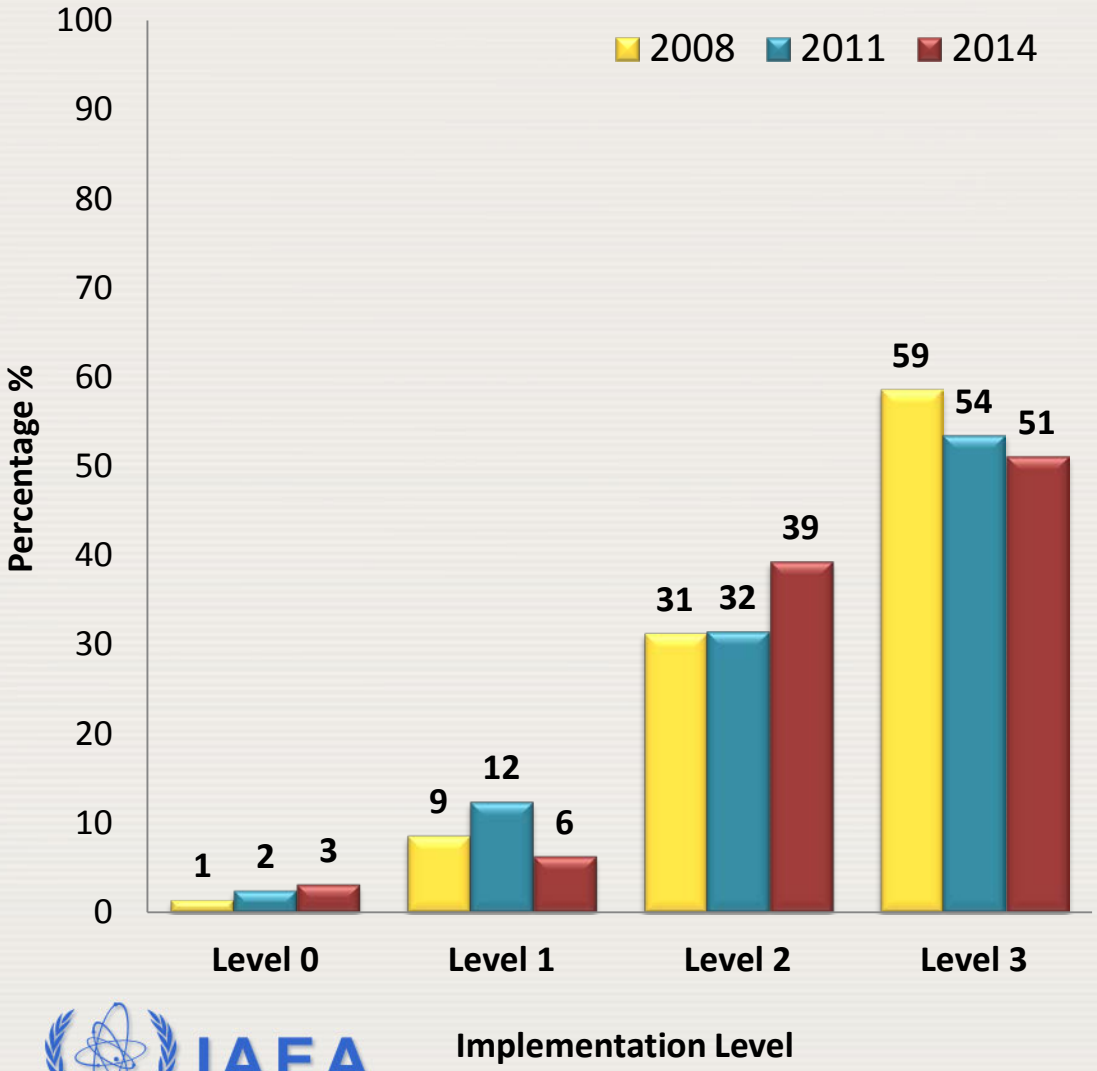
Role of the Operating Organization: Percentage of Implementation Level (2008-2014, for 17 common MSs)



- Generally, the data indicates better assessment in 2014.
- Possible indication of a better understanding the provisions of the Code and what is needed to fully implement them.
- This does not exclude the need to verify responses on specific provisions: safety reassessment, including ageing, siting, emergency preparedness and SAR, in addition to extended shutdown and decommissioning.

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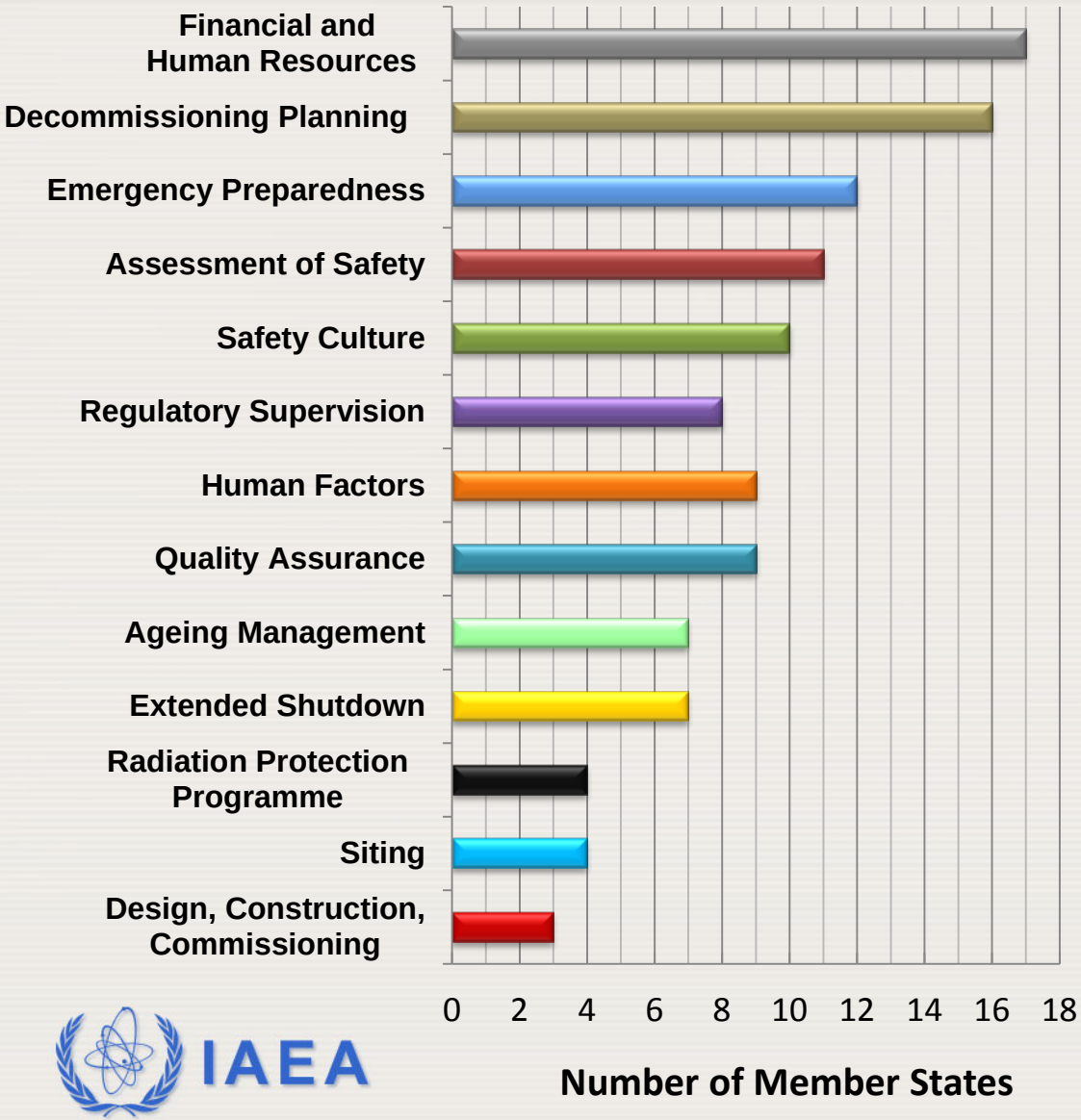
Specific Safety Areas Needing Improvements as Indicated by Member States (2014 self-assessment responses)



- Inconsistencies in some responses were identified.

- This suggests better consistency with the insights provided by the previous slides.

- Areas needing improvements (or suggesting verification of responses) are:

- Resources (human and financial);
- Decommissioning;
- Safety reassessment, including ageing and siting;
- Emergency preparedness.

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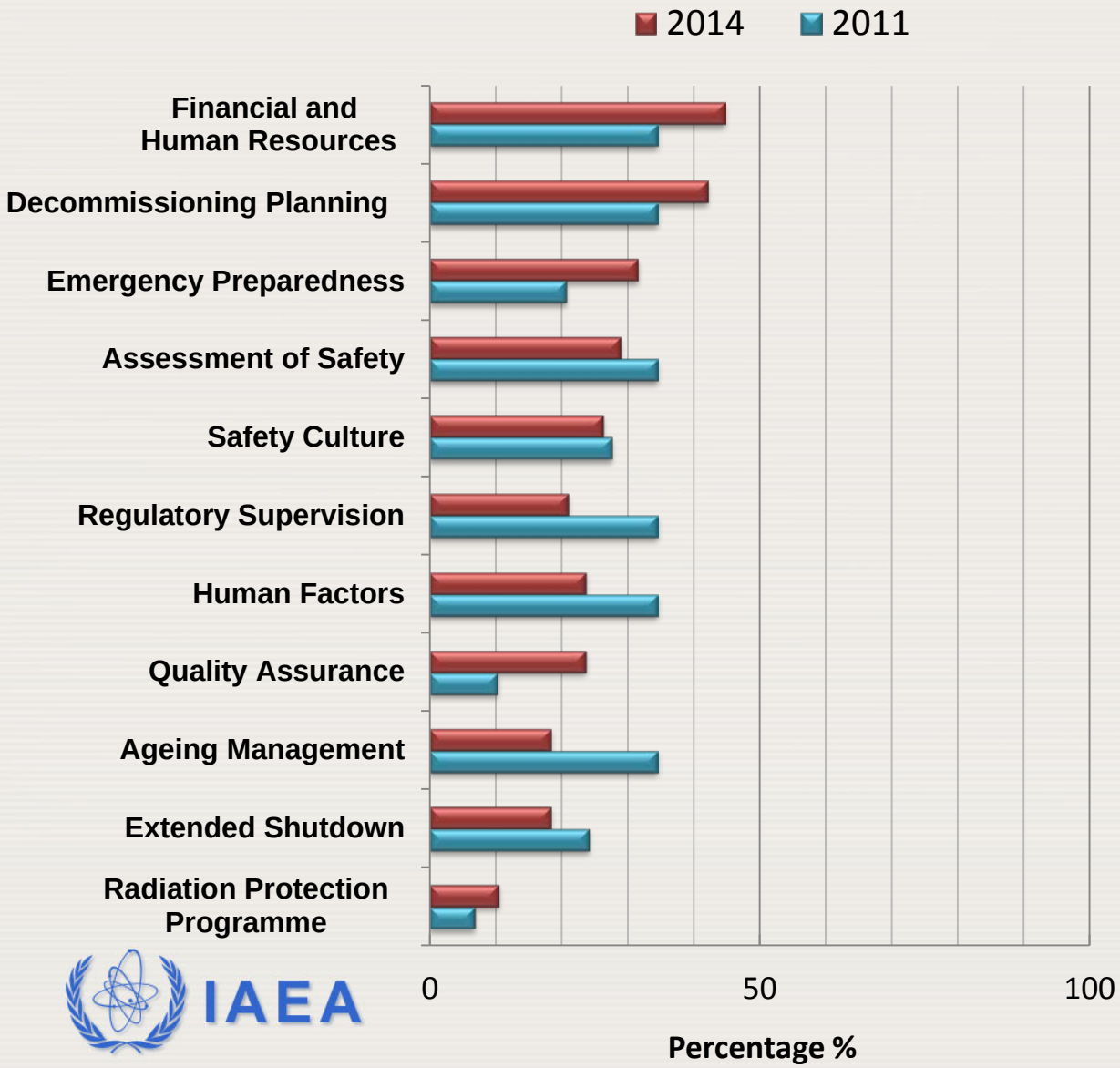
2011 → 2014: Safety Areas Needing Improvement as Indicated by Participating Member States



- Main areas needing improvements remain similar.

- Improvements are reported in some important areas, but more attention is still needed to fully address them:
  - Ageing management;
  - Regulatory supervision;
  - Consideration of human factors.

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Feedback from the 2014 International Meeting

Conclusions and recommendations from the meeting:

- Results of the Self-assessment;
- Continuing and Strengthening the Self-assessment Process;
- Commitment to Application of the Code;
- Enhanced Application to Extended Shutdown;
- Continued Support of the Code by the Secretariat;
- INSARR Missions;
- Application of the Code in Developing Safety Infrastructure;
- Consideration of Suggestions for Revisions to the Code;
- Continuation of International and Regional Meetings on the Code. (Next International Meeting in May 2017 in Vienna.)

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Potential Benefits from Application of the Code

Benefits to the State:

- Commitment to application of the Code signifies recognition of the importance of safety, State responsibility and commitment to RR safety, and a statement that they are discharging this responsibility using internationally endorsed management practices.
- It is a statement of top-level commitment to safety, which is the first step to develop a strong safety culture.

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Potential Benefits from Application of the Code

Benefits to Operating Organizations and Regulatory Bodies:

- The implementation of the Code by the State will ensure for the RB and the OO:
  - The same benefits as for the state;
  - A commitment to provide the resources needed to ensure safety;
  - A clear statement from the top of the expectations for management and oversight of RR safety by OO and RB.
- Provides basis for self-assessment of management practices and provides a uniform set of expectations for the organizations involved.
- The Code is a basis for domestic and international peer review and comparison of practices.

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Concluding Remarks

- A State wishing to enter into an agreement with the IAEA concerning any form of Agency assistance is required to apply the guidance in the Code.
- The Code derives its principal technical guidance from the IAEA Safety Standards.
- States should apply the guidance in the Code through national safety regulations.
- States should make appropriate use of IAEA Safety Standards.
- States should adopt a graded approach to application of the guidance in the Code.

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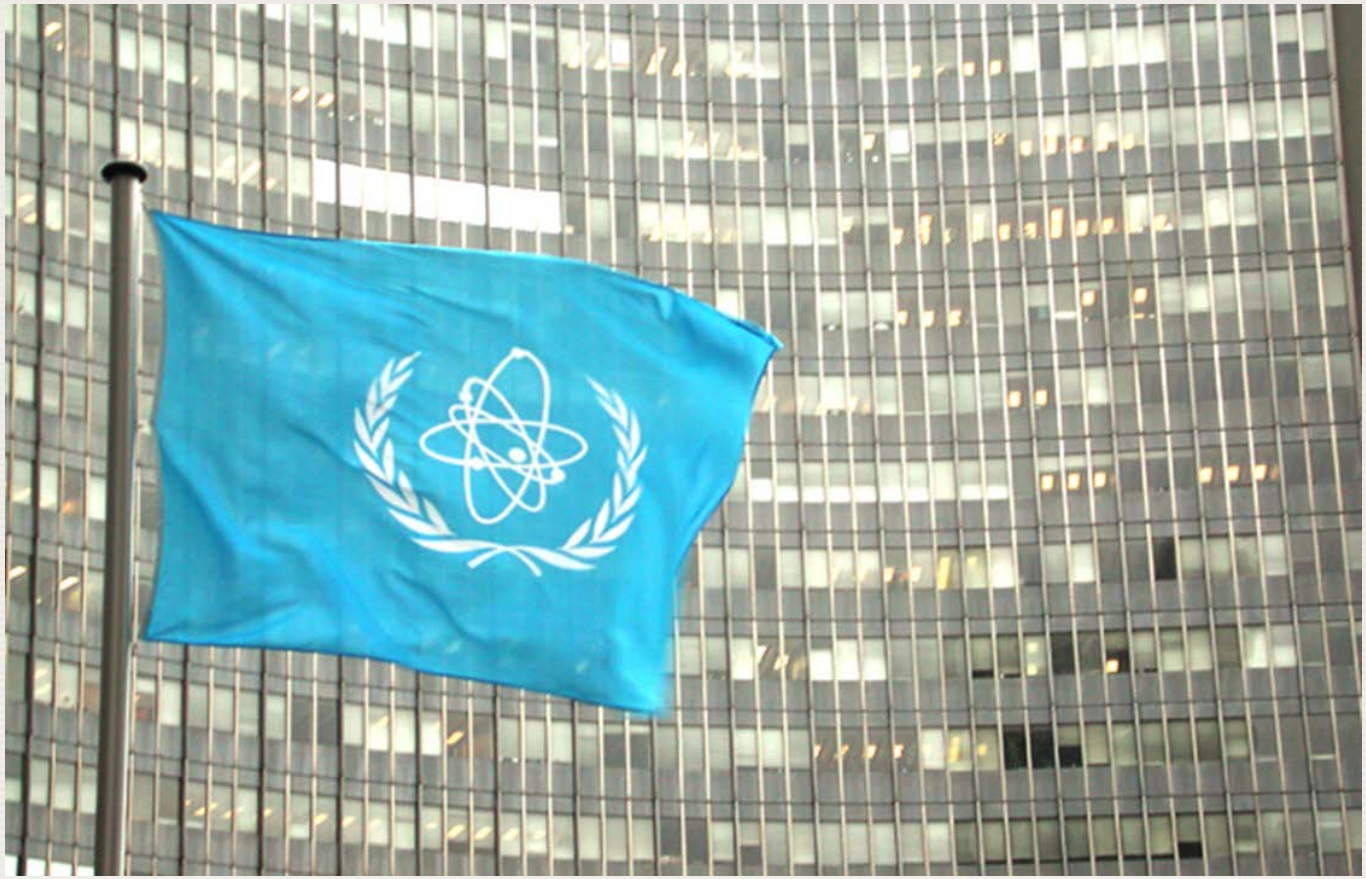
Concluding Remarks



Thank you for your attention.

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