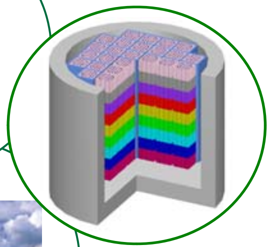
STATUS AND VALUE OF INTERNATIONAL STANDARDS FOR NUCLEAR CRITICALITY SAFETY



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ISO is (as a reminder*)

- The recognized International Organization for Standardization (ISO)
- The international consensus body for developing standards about all technical fields – from "nuts-to-bolts" (except electrical and electronic standards that are addressed by the International Electrotechnical Commission)
- Comprised of experts from ISO member states representing indigenous expertise from
  - Business/industry
  - Government/regulators
  - Stakeholders and interested or affected parties

* C. M. Hopper, "Status and Relevance of ISO Standards with OECD NEA WPNCS and IAEA FCF Initiatives," *International Conference on Nuclear Criticality Safety (ICNC 2007)*, St. Petersburg, Russia, May 28–June 1, 2007.

ISO standards for nuclear criticality safety are developed by

- ISO Technical Committee (TC) 85, Subcommittee (SC) 5, Working Group (WG) 8
  - TC85, *Nuclear energy*
  - SC5, *Nuclear fuel technology*
  - WG8, *Standardization of calculations, procedures and practices related to criticality safety* – better recognized as simply

ISO TC85/SC5/WG8, *Criticality safety*

Discussion topics about ISO TC85/SC5/WG8 standards

- Published prior to ICNC 2007
- Published between ICNC 2007 and ICNC 2011
- Under development for publishing after ICNC 2011
- Value of
  - Standards
  - Participation in development

Prior to ICNC 2007

- ISO 1709:1995 (R2011-06-14), Nuclear energy – Fissile materials – Principles of criticality safety in storing, handling and processing – revision in progress (not formalized yet)
- ISO 7753:1987 (R2011-06-14), Nuclear energy – Performance and testing requirements for criticality detection and alarm systems
- IEC/ISO 60860:1987, Warning equipment for criticality accidents - revision in progress (formalized for completion in 2013)
- ISO 14943:2004 (R2007), Administrative criteria related to nuclear criticality safety

Between ICNC 2007 and ICNC 2011

- ISO 27467:2009-06-02, Nuclear criticality safety – Analysis of a postulated criticality
- ISO 11311:2011-06-14, Nuclear criticality safety – Critical values for homogeneous plutonium–uranium oxide fuel mixtures outside of reactors
- ISO 27468:2011-06-14, Nuclear criticality safety – Evaluation of systems containing PWR UOX fuels – Bounding burnup credit approach

After ICNC 2011

(formally under development)

- ISO/FDIS 11320, Nuclear criticality safety – Emergency preparedness and response (final ballot likely "yes" 2011-09-14)
- ISO/DIS 16117, Nuclear criticality safety – Criticality accident fission numbers estimates (projected for 2013)
- IEC/ISO 60860:1987, Warning equipment for criticality accidents - revision in progress (formalized for completion in 2013)

After ICNC 2011 (cont.)

(informally under exploration/development)

- ISO 1709 revision
- Waste disposal (in collaboration with ISO TC85/SC5/WG5, Waste characterization)

(continuing considerations for)

- *Special actinide critical masses*
- *Use of neutron absorbers*
- *Verification and validation of computational methods*
- *Others?*

Regarding new 2007 – 2011 standards

ISO 27467:2009-06-02, Nuclear criticality safety – Analysis of a postulated criticality, scope

- Required for all considered credible criticality accidents
- Specialist to be knowledgeable of the process evaluation
- Does not apply to
  - Any criteria for justifying the accident criticality analysis
  - Public authority administrative measures
  - Nuclear power plants

Regarding new 2007 – 2011 standards (cont.)

ISO 11311:2011-06-14, Nuclear criticality safety – Critical values for homogeneous plutonium–uranium oxide fuel mixtures outside of reactors

- Provides common reference critical (k_{eff} = 1) values for homogeneous water-moderated plutonium-uranium oxide mixtures based upon the lowest values of inter-code comparisons (*not absolute values*)
- Applicable to operations with unirradiated mixed uranium–plutonium oxide (MOX) outside nuclear reactors

Regarding new 2007 – 2011 standards (cont.)

ISO 27468:2011-06-14, Nuclear criticality safety – Evaluation of systems containing PWR UOX fuels – Bounding burnup credit approach

- Establishes an evaluation methodology for applying burnup credit to PWR fuel by identifying
  - Important parameters, requirements, recommendations, and precautions in such evaluations
  - Technical fields to ensure proper specifications of fuel compositions
- Is applicable to transport, storage, disposal, or reprocessing of fuels that initially contain uranium oxide
- Does not specify requirements related to overall criticality safety evaluation or eventual implementation of burnup credit

Regarding after ICNC 2011 standards (cont.)

ISO/FDIS 11320, Nuclear criticality safety – Emergency preparedness and response (final ballot likely "yes" 2011-09-14)

- Applicable to facilities that contain significant quantities and concentrations of fissile materials
- Provides criteria for emergency preparedness and response
- Does not apply to
  - Off-site transport and transit storage of fissile material packages
  - Sites with operating nuclear power plants
  - Research reactors that are licensed to become critical or near-critical

Regarding after ICNC 2011 standards (cont.)

ISO/DIS 16117, Nuclear criticality safety – Criticality accident fission numbers estimates (projected for 2013)

- Provides a methodology and guidance for estimating the number of fissions from a postulated criticality accident
- Applies to
  - Nuclear facilities
  - Plants
  - Laboratories
  - Storage
  - Transportation of fissile material
- Does not apply to
  - Nuclear power reactor cores
  - Establishing bounding accident scenarios
  - Criticality accident detection

Regarding after ICNC 2011 standards (cont.)

IEC/ISO 60860:1987, Warning equipment for criticality accidents - revision in progress (formalized for completion in 2013)

- Applicable to
  - Equipment intended to detect ionizing radiation from, and provide warning of, a criticality accident
  - Equipment design
- Not applicable to
  - Indicating or recording instruments
  - Equipment and assemblies used to control nuclear reactor safety systems

Value of ISO standards

- Address
  - Enhanced product quality, reliability, cost
  - Improved health, safety, environmental protection and reduction of waste
  - Simplification for improved usability
  - Increased distribution efficiency and ease of maintenance
- Harmonize national and international standards for
  - Progress in liberalized world trade
  - Interpretation and quality of business activities
  - Worldwide communications systems
  - Emerging international technologies
  - Developing countries and their economies
- International trade and collaborative nuclear contract work is expanding in areas of NCS for fuel cycle facilities and waste disposal

Value of participating in the development of ISO standards

Diverse international experiences and perceptions about the application of nuclear criticality safety

- **Argentina (IRAM)**
- **Belgium (NBN)**
- **Bulgaria (BDS)**
- **Canada (SCC)**
- **China (SAC)**
- **France (AFNOR)**
- **India (BIS)**
- **Islamic Republic of Iran (ISIRI)**
- **Japan (JISC)**
- **Kenya (KEBS)**
- **Republic of Korea (KATS)**
- **Netherlands (NEN)**
- **Russian Federation (GOST R)**
- **Spain (AENOR)**
- **Sweden (SIS)**
- **Switzerland (SNV)**
- **United Kingdom (BSI)**
- **United States of America (ANSI)**
- **Ukraine (DSSU)**

Value of participating (cont.)

- **Interaction with other experts**
- **Harmonization of technological safety approaches**
- **Organizational and professional networking opportunities**
- **Possible utilization of safety concepts for domestic standards/regulations**
- **Potential influence with IAEA guides and standards**

Invitation to participate in ISO TC85/SC5 Working Group 8

- **Through your organization/employer, offer your expertise to your ISO Participating domestic standards development organization (e.g., AENOR, etc.) as an**
  - **Expert to participate in the proposal, development, and voting on the progression of ISO WG8 standards**
  - **Delegated Expert to attend annual face-to-face ISO WG8 meetings for the purpose of expeditiously resolving voting comments**

Further details

Much information about ISO TC85/SC5/WG8 standards development can be obtained at:

Processes and procedures –
http://www.iso.org/iso/standards_development/processes_and_procedures.htm

TC 85/SC 5 – Nuclear fuel cycle –
http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee_participation.htm?commid=50328

Conclusions

- **Development of ISO WG8 standards are valuable to**
  - Enhance international trade and understandings
  - Broaden the perspectives of domestic standards developers
  - Assist countries in the safe and economic development of nuclear energy resources
  - Encourage collaboration in technological developments for nuclear criticality safety
- **Development of ISO WG8 standards would benefit from greater active international participation by all mature and developing ISO member states with nuclear energy programs**

Work to participate in the development of

ISO TC85/SC5 Working Group 8 standards development

THE END