Nuclear Science and Technology Division (094)

STATUS AND RELEVANCE OF ISO STANDARDS WITH OECD NEA WPNCS AND IAEA FCF INITIATIVES

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For submission to

ICNC-2007

May 28-June 1, 2007

St. Petersburg, Russia

* Managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

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Introduction

Within the International Organization for Standardization (ISO), Technical Committee 85 (TC85) on Nuclear Energy, Subcommittee 5 (SC5) on Nuclear Fuel Technology, there is a Working Group 8 (WG8) on Standardization of calculations, procedures, and practices related to criticality safety. WG8 has developed, and is developing, ISO standards within the category of nuclear criticality safety of fissionable materials outside of reactors (i.e., nonreactor fissionable material nuclear fuel cycle facilities). WG8 is comprised of various ISO Member State representatives with strong backgrounds in the theoretical, technical, analytical, administrative, and regulatory aspects of nuclear criticality safety of fissionable material operations, storage, and transport outside of reactors. The extant and developing standards from WG8 are based upon the professional consensus process as required by ISO requirements documents for standards development. These standards represent broad international involvement and consensus that is based upon knowledge and experience. Some of the developing ISO TC85/SC5/WG8 standards reference technical bases that have been developed by Expert Groups within the Organization for Economic and Cooperative Development (OECD) Nuclear Energy Agency (NEA) Working Party on Nuclear Criticality Safety (WPNCS). Other technical and administrative bases have been developed by experts within WG8. The ISO TC85/SC5/WG8 members and products provide a sound resource for international regulatory and standards organizations to use in the development of safety guidance documents and regulations. In that regard, potential and developing interactions among the WPNCS, WG8, and the International Atomic Energy Agency (IAEA) Fuel Cycle Facilities (FCF) Standards Development are identified in this paper. With some formal collaborative planning, support, and assignment among and within organizations, it is anticipated that quality technical and administrative bases for nuclear criticality safety outside of reactors can be produced. The paper will provide background and some examples of extant and developing WG8 standards and personnel that could be a resource for further FCF Safety Standards and Guides development, review, and comment.

Background

Since the 1957 establishment of the “Atoms for Peace” organization within the United Nations, the IAEA has had a substantive history of developing international guides and IAEA standards for the safe, secure, and peaceful application of nuclear technologies. Historically, IAEA Guides and Standards have been adopted, in part or in whole, by Member States’ indigenous regulations for special nuclear material safeguards and safety. Regarding special nuclear materials, those guides and standards have been primarily related to materials safeguard management in fabrication, transportation, reactor operations, and reprocessing, as well as safe reactor operations and criticality safety in transportation. Since the 1999 JCO nuclear criticality accident in Tokai-mura, Japan, the IAEA has expanded its development of safety guides and standards beyond transportation and reactor operations. This expansion has resulted in elaborating on nonreactor special nuclear material facility safety with the development of a “Nuclear Fuel Cycle and Waste Technology” (NFCWT) organization within the “Department of Nuclear Energy.” Various IAEA Safety Standards are being developed in the category of “Fuel cycle facilities.” By name, some IAEA Safety Standards that are under development include “Storage of Radioactive Waste,” “Safety of Fuel Cycle Facilities,” “Safety of Uranium Fuel Fabrication Facilities,” “Safety of MOX Fuel Fabrication Facilities,” “Conversion and Enrichment Facilities,” “Management Systems for Nuclear Facilities,” “Safety of Reprocessing Facilities,” and “Storage of Spent Fuel.”

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In the arena of international trade, there are obvious reasons for the "harmonization" of national standards into international standards. Obvious examples include worldwide progress in trade liberalization, interpenetration of business activities, worldwide communications systems, impact of emerging international technologies, and evolution of developing countries and their economics, regarding

- enhanced product quality and reliability at a reasonable price;
- improved health, safety, and environmental protection, and reduction of waste;
- greater compatibility and interoperability of goods and services;
- simplification for improved usability;
- reduction in the number of models, and thus reduction in costs; and
- increased distribution efficiency, and ease of maintenance.

The scope of ISO standards covers all technical fields except electrical and electronic engineering, which is the responsibility of the International Electrotechnical Commission (IEC). There are approximately 180 ISO Technical Committees that range over technical fields like screw threads, technical drawings, product definition and related documentation, tractors and machinery, agricultural food products, applications of statistical methods, fire safety, quality management and quality assurance, and many others. Participants in WG8 have primarily included representatives from Argentina, Canada, France, Japan, Sweden, United Kingdom, and United States. Consistent with the general ISO objective of encouraging international cognizance and participation in the development of WG8 standards, representatives from the OECD NEA WPNCS and IAEA FCF have also participated by sharing their activity reports with WG8. These exchanges have been useful and have provided the status of developing work by each of the individual organizations. No strong intentions or formal coordinated commitments to collaborate on work items had evolved. However, at the ISO/TC 85 CAG-IAEA liaison officers meeting held in Paris-Saint Denis on 2007-01-31, plans were made to have a common meeting in May 2007 among WG8 and the IAEA Nuclear Safety Standards Committee (NUSSC) to consider avoidance of overlapping standards efforts. Nuclear criticality safety (NCS) is only one of many safety elements to be considered in general IAEA Safety Guides and Standards for FCFs. However, with some administrative consideration, coordination, and collaboration, synergistic normalization among the work products of the WPNCS, WG8, and FCF could produce useful results.

Status of ISO TC5/SC 5/WG8 Standards

Published, initiated, nearly initiated, and considered standards products of WG8 are listed in Table 1.

Table 1. Status of ISO TC 85/SC 5/WG 8 Standards

Designator	Title	Content/Application
	Standards Published	
ISO 1709:1995	Principles of criticality safety in storing, handling, and processing	Specifies the basic principles and limitations that govern operations with fissile materials. Describes general criticality safety criteria for equipment design and for the development of operating controls. Does not cover quality assurance requirements or details of equipment or operational procedures, does not deal with the effects of radiation on man or materials. These criteria apply to operations (i.e., processes, storage, and transportation) with fissile materials outside nuclear reactors but within the boundaries of nuclear facilities. Replaces the first edition, which has been technically revised.
ISO 14943:2004	Administrative criteria related to nuclear criticality safety	Provides criteria for the administration of nuclear criticality safety-related activities for operations (i.e., processes, storage, and transportation) that take place outside of reactors and for which there exists a potential for criticality accidents.

Designator	Title	Content/Application
IEC/ISO 860:1987	Warning equipment for criticality accidents	Applicable to equipment intended to detect ionizing radiation from, and provide warning of, a criticality accident
ISO 7753:1987	Performance and testing requirements for criticality detection and alarm systems	Is applicable to all operations with plutonium, uranium-233, uranium enriched in the 235 isotope, and other fissionable materials. Does not require separate additional instrumentation when the operating instrumentation of the facilities meets its requirements. Is principally concerned with gamma-radiation rate-sensing systems. Annex A refers to the specification of a minimum accident of concern, annex B provides examples of application, and annex C provides guidance for development of emergency plans. Does not include details of administrative steps or specific design and description of instrumentation.
	Standards Initiated	
N 858 NWIP (New Work Item Proposal)	Criticality evaluation methodology for pressurized-water reactor (PWR) burnup credit	Provides a set of general recommendations that identify important areas to ensure that the fuel composition or history considered in calculations provides a safe evaluation of the reactivity of the transport, storage, disposal or reprocessing of the real irradiated fuel. The standard identifies precautions that should be taken in studies considering fuel irradiation and radioactive decay in performing criticality safety of PWR nuclear power plant fuel assemblies.
N 847 NWIP	Recommendations for the safety analysis of a postulated criticality accident	Provides a set of general recommendations that identify areas important to understanding and mitigating the consequences of potential criticality accidents on workers, the public, and the environment. It proposes both an overall approach to and appropriate methodologies for the analysis itself and for detailed definition of associated safety and protection objectives.
	Standards Near Initiation	
PWI (Proposed Work Item)	Critical values for homogeneous mixed plutonium-uranium oxide (MOX) fuels	Establishes standardized critical values for homogeneous MOX fuels
PWI	Nuclear criticality emergency planning and response	Provides criteria for the development and content for nuclear criticality accident emergency planning and response
PWI	Fission yield analysis	Provides acceptable methodology(ies) for performing fission yield analyses
	Standards for Consideration	
—	Fissile material contaminated wastes	Provides fissile material contamination limits and criteria for characterized waste forms and disposal modes
—	Standardization of critical/subcritical special actinide critical masses	Provides consensus critical/subcritical values of special actinide fissionable nuclides.

Relevance of ISO TC5/SC 5/WG8 Standards

As earlier implied, the WG8 standards are of a general and specific nature—meaning that they may have broad applications. For instance, ISO 1709[1] and ISO 14943[2] have relevance for the establishment of criticality safety programs and specifications irrespective of the type of a FCF (e.g., uranium fuel fabrication, MOX fuel fabrication, uranium enrichment). Also, those standards provide requirements and recommendations for developing administrative and technical nuclear criticality safety evaluations/analyses for operations, storage, and transport of fissionable materials outside of reactors. ISO 7753[3] and IEC/ISO 60860[4] have relevance to any FCF in need of nuclear criticality accident detection/warning notification. The currently developing ISO standards on emergency planning, response, and analysis for criticality accidents could be of value to IAEA FCF standards development. Standard consensus values for critical/subcritical systems comprised of MOX fuels could provide reference values for the IAEA draft standard, DS318-Safety of MOX Fuel Fabrication Facilities.

Because international trade and collaborative nuclear contract work is expanding in areas of nuclear safety for fuel fabrication, reprocessing, and waste disposal, opportunities are rapidly developing for collaboration in the development of safety standards by affected countries and industries. The broad and collective experience and knowledge of international research, industry, and regulators provide a sound technical and administrative basis for establishing consensus standards that may be translated into or referenced by regulations or other statutory requirements.

Conceptually, if timely coordination can be achieved among the OECD NEA WPNCS, ISO TC85/SC5/WG8, and the IAEA Fuel cycle facilities Safety Standards development processes, the international community could benefit from the evolution of a standard as shown in Figure 1.

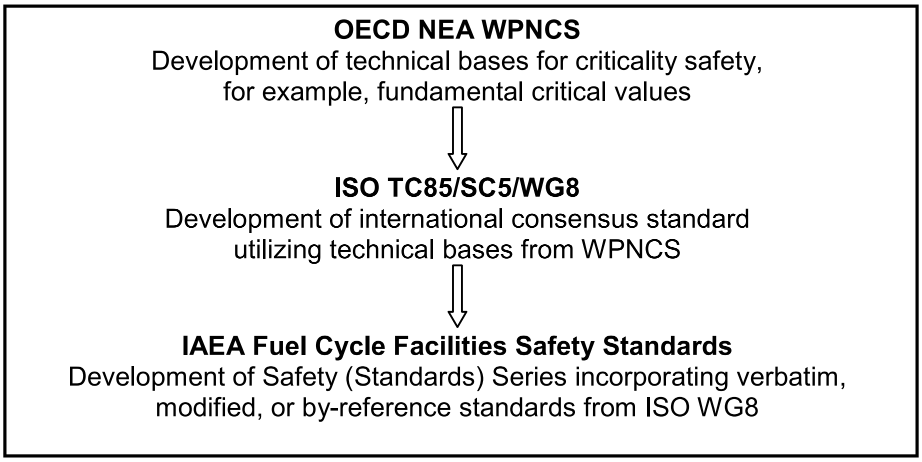

Figure 1. Potential future evolution of IAEA FCF standards

Summary

As can be observed from the above, WG8 is relatively active for a working group of limited membership participation. The WG is responsive to inquiries and suggestions for standard development. Though the development and issuance of an ISO standard can require substantial work and time, there is a process by which individual national standards can be "fast tracked" for adoption as an ISO standard following an ISO affirmative vote. Also, existing national standards can be adapted through ISO TC85/SC5/WG consensus to reduce the developmental time and effort.

Differences in international perspectives relative to the implementation of nuclear criticality safety provide a resource to member nations for consideration of their own standards developments and regulations. Because of the valuable resources and need for additional assistance, other ISO member countries are encouraged to sponsor their subject matter experts to participate in ISO TC85/SC5/WG8 standards development. An individual’s participation is permitted via the ISO Member Bodies (see http://www.iso.org).

References

1. ISO 1709:1995 Ed. 2, Nuclear energy–Fissile materials–Principles of criticality safety in storing, handling, and processing.

2. ISO 14943:2004 Ed. 1, Nuclear fuel technology–Administrative criteria related to nuclear criticality safety.

3. ISO 7753:1987 Ed. 1, Nuclear energy–Performance and testing requirements for criticality detection and alarm systems.

4. IEC/ISO 60860:1987-06 Ed. 1, Warning equipment for criticality accidents.