Applicability of the ANSI/ANS-58.16 on Pyroprocessing Facilities

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1. Introduction

KAERI is being developed pyroprocessing technology for spent fuel recycling. For this it is necessary to develop a facility with hot cells, which can handle the processes safely [1]. In this paper the ANSI/ANS-58.16-2014 for nonreactor nuclear facilities, included fuel cycle facilities, was introduced and also studied for its applicability on pyroprocessing facilities developing in KAERI.

2. ANSI/ANS-58.16-2014 [2]

2.1 Scope and Purposes

The American National Standard Institute (ANSI)/American Nuclear Society (ANS) American National Standard ANSI/ANS-58.16-2014 provides criteria for the categorization of structures, systems, and components (SSCs) and specific administrative controls (SACs) as hazard controls, for nonreactor nuclear facilities. Standards for the design of hazard controls are identified based on a safety category (SC).

The safety categorization criteria specified in the standard will

(1) establish an objective and technically based rationale for the determination of safety categorization;

(2) ensure that all hazard controls required by the safety design basis are appropriately categorized;

(3) establish a basis for consistency (i.e., minimize categorization differences among similar items in a facility).

The purpose of the standard is the following:

(1) Specify criteria for categorization of safety SSCs;

(2) Select industry codes and standards for reliable design, construction, and operations commensurate with the safety categorization.

2.2 General safety criteria for safety categorization of controls

Safety Category	Unmitigated Consequences		
	Facility Worker	Collocated Worker	Public
SC-1 (Low Consequence)	Radiological/toxicological exposures to workers less than that in SC-2, but above regulatory limits for normal operations (i.e., defense-in-depth).	Radiological/toxicological exposures to workers less than that in SC-2, but above regulatory limits for normal operations (i.e., defense-in-depth).	Radiological/toxicological exposures to an individual of the public less than that in SC-2, but above regulatory limits for normal operations (i.e., defense-in-depth).
SC-2 (Intermediate Consequence)	Significant radiological/ toxicological exposures and potentially serious effects (may place workers' long-term health in question).	Significant radiological/ toxicological exposures and potentially serious effects (may place collocated workers' health in question).	Radiological/toxicological exposures to an individual of the public would not be expected to cause health consequences, but may require emergency response actions.
SC-3 (High Consequence)	Radiological/toxicological exposures that potentially endanger life if not limited.	Radiological/toxicological exposures that potentially endanger life if not limited.	Radiological/toxicological exposures that may cause long-lasting health effects to an individual of the public.

2.3 Design Criteria

Once the safety functions and SCs needed for protection of the public, collocated workers, and facility workers are identified, this information shall be translated into selected hazard controls (SSCs and/or SACs) and design requirements for SC-2 and SC-3 hazard controls as discussed below categories.

- General Design Criteria
- Civil-structural
- Mechanical

• process system; ventilation system; handling equipment; fire safety equipment; explosion safety equipment
- Electrical, instrumentation, and controls
- Quality assurance
- Specific administrative controls

3. Applicability of the ANSI/ANS-58.16 on Pyroprocessing Facilities

In Korea SF recycling facilities are regulated as one of fuel cycle facilities under the Korean nuclear safety law [3]. The law describes the safety requirements for the license and operation of fuel cycle facilities. Although the safety requirements for fuel cycle facilities are a little different compared with those of nuclear power plants, but a large parts of the requirements use the same technical criteria with nuclear power plants. The Korean nuclear safety law for fuel cycle facilities does not require some different safety classifications and industrial standard codes, which are different from those of nuclear power plants.

The United States also did not have a standard safety classification and the adaptable industrial standard codes for fuel cycle facilities. US NRC and DOE regulate fuel cycle facilities to use some safety classification and analysis methods different with nuclear reactors. In 2014 the ANSI/ANS published the standard, ANSI/ANS-58.16-2014, for the nonreactor nuclear facilities. As introduced in the section 2, the ANSI/ANS-58.16-2014 requires the safety classification and adaptable industrial codes of the nonreactor nuclear facilities different from those of the nuclear reactor facilities. In the future US NRC and DOE will be expected to change the regulation methods and criteria following to the ANSI/ANS-58.16-2014.

Korea has the same regulation structures with US NRC for the most parts of nuclear power plants, and the regulations of the fuel cycle facilities are the same with nuclear power plants. The Korean safety classification and adaptable industrial standard codes for fuel cycle facilities, therefore, are nearly the same with those of US NRC for nuclear power plants.

If Korean nuclear safety law for fuel cycle facilities will be changed to refer or to follow the ANSI/ANS-58.16-2014, the regulatory bodies can check and test by using more specific safety criteria for fuel cycle facilities. This will be able to increase a total and some detail safeties of fuel cycle facilities including pyroprocessing facilities.

4. Conclusions

Korea has nearly the same nuclear regulation structures with those of the US NRC adaptable for nuclear power plants. The Korean regulations for fuel cycle facilities are also the same with nuclear power plants. The Korean safety classification and adaptable industrial standard codes for fuel cycle facilities, therefore, are nearly the same with those of the US NRC for nuclear power plants.

In 2014 the ANSI/ANS published the standard, ANSI/ANS-58.16-2014, for the nonreactor nuclear facilities as introduced in the Section 2.

If Korean nuclear safety law for fuel cycle facilities will be changed to refer or to follow the ANSI/ANS-58.16-2014, it is expected that the safety of pyroprocessing facilities also will be increased.

REFERENCES

[1] Gil-Sung You, et al., “Concept and safety studies of an integrated pyroprocess facility, Nuclear Engineering Design,” No. 241, pp. 415～424 (2011)
[2] ANSI/ANS, “Safety categorization and design criteria for nonreactor nuclear facilities,” ANSI/ANS 58.16-2014 (2014)
[3] Korean Nuclear Safety Law