Cornerstone Technical Bases

The overall mission of the U.S. Nuclear Regulatory Commission (NRC) is to ensure that licensees use licensed materials in a manner that ensures adequate protection of public health and safety, promote the common defense and security, and protect the environment. The Commission established strategic outcomes to meet this mission in the NRC Strategic Plan (NUREG-1614, Vol. 4).[1] The strategic outcomes for nuclear fuel cycle facility safety and security goals are:

- Prevent the occurrence of any inadvertent criticality events.
- Prevent the occurrence of any acute radiation exposures resulting in fatalities.
- Prevent the occurrence of any releases of radioactive materials that result in significant radiation exposures.
- Prevent the occurrence of any releases of radioactive materials that cause significant adverse environmental impacts.
- Prevent any instances where licensed radioactive materials are used domestically in a manner hostile to the United States.

In addition to these radiation-related strategic outcomes, because of the hazardous chemicals at fuel cycle facilities, NRC regulations require licensees to control the potential impacts on workers and the public from certain chemicals used at their facilities that are associated with processes involving radioactive materials. This responsibility was clarified in a memorandum of understanding with the Occupational Safety and Health Administration (OSHA).[2]

NRC staff used these strategic outcomes to identify the fundamental building blocks for the regulatory oversight process. These fundamental building blocks are identified as cornerstones of a licensee's safety and security programs that must be effectively implemented to ensure safe and secure use of licensed materials. Acceptable licensee performance in each cornerstone provides reasonable assurance that the NRC's mission is met.

In developing the cornerstones, the staff:

- defined the objective;
- identified the desired results;
- identified key attributes of licensee performance necessary to achieve the results;
- identified the scope of what the NRC needs to assess to ensure that the objectives are met; and
- identified the metrics used to evaluate performance in the cornerstone.

Safety cornerstones were developed recognizing the requirements for the development of an Integrated Safety Analysis (ISA) under Title 10 of the Code of Federal Regulations (10 CFR) Part 70[3] and the criteria for worker and public exposure in 10 CFR Part 20.[4] An ISA's principal safety functions are identifying accidents and a set of items relied on for safety (IROFS) so that management measures are applied sufficient to assure that IROFS' safety functions support meeting the performance requirements of 10 CFR 70.61. The staff has proposed, in "A Comparison of Integrated Safety Analysis and Probabilistic Risk Assessment" that ISAs could

also be used as a key element in assessing the risk of NRC inspection findings. The approach outlined in that paper for assessing significance of findings would be considered in the development of a significance evaluation process in the future.

The safety cornerstones proposed differ from those used in the Reactor Oversight Process (ROP). The proposed Fuel Cycle Oversight Process (FCOP) cornerstones include the substance of the ROP cornerstones of initiating events, mitigating systems, and barrier integrity, because these are generally integral to ISA development. ISAs might not identify the components of the analysis using these terms, but the substance of the concepts are part of the development of an ISA. Fuel cycle facilities do not have barriers in the sense of barriers at power reactors (fuel cladding, reactor coolant system, and containment), but rather barriers or controls to limit process upsets that could lead to accidents and/or to mitigate the consequences of accidents.

Gaseous diffusion plants perform safety analyses in support of their operations under 10 CFR Part 76,[5] and the one licensed uranium conversion plant conducted an ISA to support licensing under 10 CFR Part 40.[6] Two operational safety cornerstones that derived from these analyses are Criticality Safety and Chemical Process Safety. (Since the uranium conversion facility does not process enriched uranium, the Criticality Safety cornerstone does not apply to it.)

The Criticality Safety cornerstone was derived from the strategic outcome, "Prevent the occurrence of any inadvertent criticality events." The Chemical Process Safety cornerstone was derived from the strategic outcomes, "Prevent the occurrence of any acute radiation exposures resulting in fatalities," "Prevent the occurrence of any releases of radioactive materials that result in significant radiation exposures," and "Prevent the occurrence of any releases of radioactive materials that cause significant adverse environmental impacts" in that certain chemical releases could lead to inability to implement radiological controls. This cornerstone was also based on limiting high and intermediate consequence events as required by 10 CFR Part 70.

The staff considered cornerstones for other areas used in the development of ISAs, such as public and worker radiation protection and fire protection, but concluded that these areas were initiators of, or consequences from, accidents in the two key operational safety areas, Criticality Safety and Chemical Process Safety.

Licensees' programs to mitigate the consequences of an accident were identified as the cornerstone of Emergency Preparedness. The two cornerstones related to routine operation radiological controls were identified as Public Radiation Safety and Occupational Radiation Safety.

NRC staff developed an overall oversight process based on fuel cycle processes in general. Because of the significant differences in operations and processes at different fuel cycle facilities, not all of the cornerstones, desired results, scope, key attributes, what the NRC needs to assess, or metrics will be the same. These will be applied to each facility based on the actual operations and processes.

The safety cornerstones are:

<u>Criticality Safety</u> - The objective of this cornerstone is to ensure that nuclear criticality safety (NCS) IROFS and controls protect worker and public health and safety by preventing criticalities. This includes ensuring adequate NCS analyses and ensuring the availability,

reliability, and capability of NCS controls and IROFS.

Chemical Process Safety - The objective of this cornerstone is to ensure that chemical process safety IROFS and controls protect worker and public health and safety by preventing and or controlling chemical releases (for those chemicals under NRC jurisdiction per the Memorandum of Understanding with OSHA) that could cause intermediate or high consequences (as defined in 10 CFR Part 70). This includes ensuring adequate chemical process safety analyses and ensuring the availability, reliability, and capability of chemical process safety controls and IROFS.

Emergency Preparedness - The objective of this cornerstone is to ensure that the license is capable of implementing adequate measures to protect public health and safety in the event of a radiological or chemical emergency (for those chemicals under NRC jurisdiction).

Public Radiation Safety - The objective of this cornerstone is to ensure adequate protection of public health and safety from exposure to radioactive effluents from normal (non-accident) plant operations..

Worker Radiation Safety - The objective of this cornerstone is to ensure adequate protection of worker health and safety from exposure to radiation and radioactive materials during normal (non-accident) fuel cycle facility operation.

The proposed security cornerstone has three proposed key attributes and these are Physical Protection, Material Control and Accounting, and Information Security. Because of ongoing rulemaking in the Security area, the staff has deferred development of Security Objectives and elements until the rulemaking is completed.

A detailed analysis of each safety cornerstone is provided in Appendices A – E.

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[1] "Strategic Plan, Fiscal Years 2008-2013," NUREG-1614, Volume 4, February 2008.

[2] "Memorandum of Understanding between the Nuclear Regulatory Commission and the Occupational Safety and Health Administration; Worker Protection at NRC-licensed Facilities," 53 Fed. Reg. 43950, October 31, 1988 and "Memorandum of Understanding With Respect to the Gaseous Diffusion Plants," 61 Fed. Reg. 40249, August 1, 1996.

[3] Code of Federal Regulations, Title 10, Part 70, "Domestic Licensing of Special Nuclear Material," U.S. Government Printing Office, Washington, DC.

[4] Code of Federal Regulations, Title 10, Part 20, "Standards for Protection Against Radiation," U.S. Government Printing Office, Washington, DC.

[5] Code of Federal Regulations, Title 10, Part 76, "Certification of Gaseous Diffusion Plants," U.S. Government Printing Office, Washington, DC.

[6] Code of Federal Regulations, Title 10, Part 40, "Domestic Licensing of Source Material," U.S. Government Printing Office, Washington, DC.