REACTOR SAFETY*

Background Information
Revised June 2007

SCOPE

This position statement is applicable to commercial nuclear power plants.

DEFINITION AND IMPORTANCE

The objective of reactor safety is that reactors will be built and operated to pose no undue risk to public health and safety. Since the early days of nuclear reactors, it has been recognized that a society can gain the benefits of nuclear technology only if that society generally understands and accepts the risks from nuclear reactors. Reactor safety, therefore, is an essential prerequisite of reactor operation and must be placed on an equal footing with electricity production and other benefits of nuclear technology. It is further important that nuclear safety experts continue to improve their understanding of the risks from nuclear reactors and communicate that information to the public.

SAFETY ELEMENTS

The international nuclear technology community has developed the fundamentals of reactor safety in great depth and breadth over five decades of nuclear reactor experience. This includes more than 11,000 reactor-years of operating experience. In the early years the primary focus was on development of basic physics and engineering principles, safety system design features, codes and standards, and general design criteria governing such matters as redundancy and diversity of safety systems.

Actual operating experience has shown the importance of human performance aspects of safety, including operator qualifications and training, emergency operating procedures, accident mitigation measures, and emergency planning.

In recent years, the importance of operational safety culture has come into clear focus. A strong safety culture is important to ensure the integrity of the multiple barriers of the entire defense-in-depth safety fabric. That is, the basic safety values, norms, and attitudes of an entire operating organization are just as important as the basic design and construction of the reactor.

The synthesis of this worldwide experience can be summarized in the following basic safety elements:

- a solid foundation of knowledge of the basic physics, chemistry, and engineering of nuclear technology;

- a robust and proven design using established codes and standards that embody design margins, qualified materials, and redundant and diverse safety systems;

- a program for ensuring that the reactors are constructed and tested in accordance with the design specifications and safety analyses;

- highly qualified and trained personnel who operate the reactor, maintain the equipment, and conduct the radiation protection program;

- an operating staff that has a profound respect for the reactor core, radioactive materials, and supporting systems, keeping them under absolute control at all times. The reactivity of the core is changed only in a conservative and controlled manner;

- technical specifications that define and control the safety operating envelope of the reactor;

- a strong engineering function that maintains plant, systems, and equipment in accordance with the plant design basis, analyzes technical issues as they arise, and provides support to operations and maintenance;

- a safety culture that has been instilled throughout the operating organization based on the highest safety values and that fosters an attitude toward conservative operation;

- adherence to a defense-in-depth safety philosophy that rigorously maintains multiple barriers, both physical and procedural, to protect the public and workers from harm;

- probabilistically developed risk insights derived from systems analysis and operational experience;

- effective quality assurance, self-assessment, and corrective action programs;

- a program of operating experience analysis and feedback to operations;

- emergency plans, which have been thoroughly reviewed and tested, to enable operators to take actions to protect both onsite workers and off-site populations in the event of a nuclear accident;

- access to a continuing program of nuclear safety research that is designed to add to our basic knowledge of safety fundamentals;

- a strong management organization that maintains all these activities and makes available adequate financial resources;

- safety regulatory authorities that are responsible for independently assuring that nuclear reactors are designed, built, and operated safely;

- newer reactor designs that can incorporate enhanced safety features such as systems to contain any melted nuclear fuel within the reactor vessel or containment structure, despite the safety of current reactor designs. Newer plant designs also have more passive safety features.

AMERICAN NUCLEAR SOCIETY POSITION

After more than 50 years and more than 11,000 reactor-years of operating experience, the international community of nuclear reactor experts has reached a consensus concerning the essential attributes of reactor safety. If the international reactor community rigorously adheres to the essential elements of reactor safety above, it is the position of the American Nuclear Society that reactors can and will be built and operated safely, with no undue risk to public health and safety.

*See Position Statement 51 at: http://www.ans.org/pi/ps/docs/ps51.pdf.

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Position Statements are the considered opinions and judgments of the Society in matters related to nuclear science and technology. They are intended to provide an objective basis for weighing the facts in reaching decisions on important national issues.