

NUCLEAR SAFETY

A Safer Nuclear Enterprise

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The global nuclear enterprise, the activities and infrastructure that support both weapons and civil energy programs, is facing significant challenges. In the 26 years since Chernobyl, the nuclear power industry has strengthened its safety practices, yet Fukushima demonstrates the fragility of the civil nuclear enterprise. Despite an admirable record and firm commitment to make safety a primary criterion in weapons design, production, handling, and deployment, and to ensure that nuclear material is protected against theft, there is growing apprehension about terrorists acquiring weapons or nuclear material. We outline key principles and recommendations aimed at weak points in the world's nuclear enterprises.

Active nuclear diplomacy has grown out of Cold War efforts to regulate testing and reduce nuclear arsenals and roll back and prevent the proliferation of nuclear weapons. The Nunn-Lugar program, started in 1991 to reduce the nuclear arsenal of the former Soviet Union, has led to greater investment by the United States and other governments in better security for nuclear weapons and material globally, including billions of dollars through the G8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction. In 2010, 47 world leaders committed to improve the security of all dangerous nuclear material on the globe within 4 years, an agreement reconfirmed in March 2012 at the Nuclear Security Summit in Seoul (1).

Successful leadership in nuclear enterprise policy will require continuous, diligent, and multinational assessment of emerging risks and consequences. We suggest three guiding principles that must be recognized in order to reduce global risks (2).

First, calculations used to assess nuclear risks in both military and civil sectors are fallible. Governments, industry, and concerned citizens must regularly reexamine the assumptions on which safety and security measures, emergency preparations, and nuclear energy production are based. Second, there is growing risk of accidents, mistakes, or miscalculations, and of regional wars or

nuclear terrorism. States new to the nuclear enterprise may not have effective safeguards to secure nuclear weapons and materials or the capability to safely manage and regulate civil reactors. Third, no nation is immune from risks involving nuclear weapons and nuclear power. Since 1945, there have been >30 acknowledged serious accidents involving U.S. nuclear weapons (3). The United States has had an admirable safety record in civil nuclear power since the 1979 Three Mile Island accident, yet some reactors have a short window for restoring power following an accident. The Fukushima disaster demonstrates the urgent need to address this issue.

In light of these principles, we offer the following recommendations. First, reduction of nuclear risks requires every enterprise and related military and civilian organization to embrace the overarching importance of safety and security. This is not easy. Increasing the safety and security of a nuclear power plant can mean greater regulation and higher costs. For both weapons and civil programs, enforcing accountability is essential.

Second, independent regulation is crucial to setting and enforcing the safety and security rule. In the United States, the nuclear regulatory system—in particular, the Nuclear Regulatory Commission (NRC)—is credited with setting a high standard for independent regulation of the civil nuclear power sector. But careful attention is required to protect against regulatory capture by vested interests in government and industry; the latter funds a high percentage of the NRC budget. Strong, independent regulatory agencies are not the norm in many countries. Strengthening the International Atomic Energy Agency (IAEA) so that it can play a greater role in civil nuclear safety and security would help reduce risks. This will require greater authorities to address both safety and security, as well as resources for an agency whose annual budget is only €333 million (U.S. \$421 million), with just 1/10th of that allocated for nuclear safety and security (4).

Third, independent peer review should be incorporated into all aspects of the nuclear enterprise. Independent experts in the United States, both within and outside the weapons program, review each other, rigorously challenge weapons and systems safety, and communicate these points up and down the line.

Strong regulation and peer review are needed, particularly in nations new to nuclear power and weapons.

The Institute of Nuclear Power Operations provides peer review and oversight of the U.S. civil nuclear sector. Its global counterpart, the World Association of Nuclear Operators, should further strengthen its safety operations, in particular its peer-review process. Enhanced capacity to arrange fines could also help states develop the culture of quality needed to achieve a superior safety record.

Fourth, nuclear threat reduction should be organized around a clear goal: a global effort to reduce reliance on nuclear weapons, to prevent their spread into potentially dangerous hands, and ultimately to put an end to them as a threat to the world (5–7). Demonstrated progress toward a world free of nuclear weapons will build international trust and cooperation required to address dangers and prevent catastrophes.

Military and civilian nuclear communities should learn from each other. A periodic dialogue on assessing and reducing risks would be valuable [e.g., (8, 9)]. Analysis of the probabilities of undesired events and ways to minimize them, including lessons learned from accidents and close-call incidents, should be a priority. Increasing knowledge of appropriate measures to be taken in the event of a nuclear incident is needed. Finally, effective response to a nuclear crisis requires an informed public. Greater understanding of risks and consequences can increase public confidence in a more secure nuclear enterprise.

References and Notes

- For commitments and achievements, see: www.thenuclearsecuritysummit.org/userfiles/Highlights%20of%20the%20Seoul%20Nuclear%20Security%20Summit%28120403%29.pdf.
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