American Nuclear Society

Position Statement #55

Nonproliferation

Nuclear science and technology provide significant benefits to humanity, such as clean energy and medical applications. Nonproliferation policy and technology help ensure nuclear material and facilities are used for peaceful purposes and thereby prevent the spread of nuclear weapons. An effective nonproliferation policy should prevent

- diversion of nuclear material[a] from the nuclear fuel cycle;
- theft of nuclear material by subnational or terrorist groups, or other state actors;
- unauthorized transfer of dual-use technology; and
- planning, construction, or operation of an undeclared nuclear facility.

The American Nuclear Society (ANS) supports the following principles and actions related to nonproliferation:

- Nuclear science and technology must be promoted for peaceful purposes in a manner that fully supports and is compatible with achieving nonproliferation goals, as embodied in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).[2] Sovereign states should adhere to the NPT and its safeguards system including the Additional Protocol[3] and adopt effective export controls.[4]
- The United States should continue to be a global leader in peaceful applications of nuclear technology. A strong domestic nuclear industry and supporting infrastructure are essential to the ability of the United States to work effectively with other countries to meet global nonproliferation goals.[5]
- U.S. governmental policy should consider the potential for a variety of nuclear and fuel cycle approaches to be used by other countries and base negotiations on numerous factors, such as energy and geopolitical security, in addition to nonproliferation goals. Within the current global civilian fuel cycle, effective safeguards have been applied to the European and Japanese nuclear power programs; however, expansion of global fuel cycle activities may require improved frameworks and/or additional resources for proper administration.
- The United States should continue to refine technologies to monitor, secure, and safeguard nuclear materials that pose proliferation challenges. The International Atomic Energy Agency (IAEA) and the U.S., and other nations, should continue to assess nuclear materials diversion criteria, detection metrics, applications of safeguards and security by design, physical protection, and the expanded use of advanced reactor technologies. ANS endorses the principles and objectives of United Nations Security Council Resolution (UNSCR) 1540,[6] which requires states to implement "effective measures to establish domestic controls to prevent the proliferation of nuclear [and other] weapons . . . including by establishing appropriate controls over related materials," and to criminalize export control violations.

a. The term *nuclear material* refers to *source material* or *special fissionable material.* Paraphrasing and simplifying from terminology in the Atomic Energy Act of 1954, as amended,[1] source material is defined as (1) uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores that contain by weight one-twentieth of one percent (0.05%) or more of (i) uranium, (ii) thorium, or (iii) any combination thereof. Special fissionable material refers to plutonium-239, uranium-233, uranium enriched in the isotopes U-235 or U-233, or any material containing one or more of the foregoing.

- Significant quantities[b] of weapons-usable plutonium and high-enriched uranium (HEU) pose a continuing proliferation threat to the world community. Important efforts to secure these materials and to transform them into less directly usable forms require and warrant substantial attention and resources. Significant progress has been made toward the elimination of HEU, while realizing the energy benefit in the material when downblended to a non-weapons-usable form, such as low-enriched uranium (LEU) or high-assay low-enriched uranium (HALEU).[8] Essential nuclear nonproliferation programs, such as weapons-grade plutonium disposition, should be pursued with an emphasis on elimination of the weapons-usable material, while maximizing beneficial uses, such as energy production and research and development.[9]

Background

Since the dawn of the nuclear age in the 1930s when nuclear fission was discovered, the tension between the positive use of this energy and its weaponization has been a challenge for humanity. As nuclear power, nuclear medicine, and other beneficial uses advanced, so did the proliferation of nuclear weapons. World leaders recognized the threat of the expansion of nuclear weapons and created the IAEA[10] in July 1957 following serious consideration of how to prevent proliferation.[11] The U.S. Congress passed the Atomic Energy Act of 1954,[1] since amended, to govern the development and regulation of nuclear materials and facilities in the U.S. and to direct how private industry and foreign entities can gain access to nuclear materials and technologies.

As additional countries developed nuclear weapons programs, concerns over the spread of nuclear weapons led to adoption of the NPT,[2] which was signed in July 1968 and entered into force by March 1970. The NPT has three "pillars": nonproliferation, disarmament, and peaceful uses of nuclear technology. The NPT permits non-weapons countries party to the NPT to enter into comprehensive safeguards agreements with the IAEA that allow the IAEA to apply safeguards on all source or special fissionable material in a country. Weapons states party to the NPT may enter into voluntary safeguards agreements. Non-NPT countries may enter into item-specific safeguards agreements. The Additional Protocol[3] was developed to strengthen existing verification agreements established under the IAEA safeguards regime.

The international nonproliferation regime has been successful. When the NPT went into effect, there were five acknowledged "weapons states": the United States, the Soviet Union, the United Kingdom, France, and China. While many countries have the capability to develop nuclear weapons, only four additional countries are known to have nuclear weapons programs: Israel, India, Pakistan, and North Korea. Only one—North Korea—developed its weapons in violation of the NPT.

Although consensus was not achieved at the 10th Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the final draft produced by member states and their delegations reaffirms the pillars of the NPT and reflects a large majority of global commitment to nonproliferation.[12] These principles include, but are not limited to, adherence to and implementation of UNSCR 1540,[6] the Convention on Physical Protection of Nuclear Material (CPPNM),[13] and the International Convention on the Suppression of Acts of Nuclear Terrorism[14]; requiring member states to share best practices on nuclear safety and security standards; and enhancing capabilities in the detection, determent, and disruption of illicit trafficking in radioactive materials.

In the current landscape of developing new nuclear power technologies, the breadth of advanced reactor designs incorporates many different fuel types, and some new reactor developers propose to recycle used fuel to recover additional energy and minimize the volume of long-lived radioactive waste. While success in safeguarding the current global civilian fuel cycle provides a starting point, new technologies will dictate whether improved frameworks may be applied and/or whether additional resources will be necessary to effectively administer global security and safeguards. The ability of the U.S. and the IAEA to detect nuclear weapons programs prohibited by the NPT is crucial to global nonproliferation efforts. Existing and future detection criteria metrics should consider new and emerging technologies while maintaining or improving the ability to identify the diversion of nuclear materials. This is particularly important as nations and companies seek advanced reactor technologies and look to benefit from alternative fuel cycles to meet growing energy demands. Policy should support the implementation of guidelines for nuclear and nuclear-related exports developed by the Nuclear Suppliers Group.[15]

The downblending of HEU stockpiles, particularly from Russia (e.g., the Megatons to Megawatts program),[16] has been a significant accomplishment. Disposal of surplus weapons-grade plutonium, however, has lagged. The U.S. surplus weapons plutonium disposition program transitioned in 2013 from beneficial reuse of the material to geological disposal, which does not destroy the material or degrade its characteristics. Given the renewed interest in advanced reactors, particularly fast reactors that are well-suited to consume plutonium, the U.S. should look for opportunities to expend at least some of its surplus weapons-grade plutonium for energy production and research applications.

b. The IAEA defines a *significant quantity* as the approximate amount of fissile material for which the possibility of manufacturing a nuclear explosive device cannot be excluded.[7]

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