



U.S. DEPARTMENT OF
ENERGY

PNNL-20432

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Nuclear Nonproliferation and Arms Control Primer Prepared for the Blue Ribbon Commission on America's Nuclear Future

LS Williams

May 2011



Pacific Northwest
NATIONAL LABORATORY

*Proudly Operated by **Battelle** Since 1965*

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor Battelle Memorial Institute, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or Battelle Memorial Institute. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information,
P.O. Box 62, Oak Ridge, TN 37831-0062;
ph: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

Available to the public from the National Technical Information Service
5301 Shawnee Rd., Alexandria, VA 22312
ph: (800) 553-NTIS (6847)
email: orders@ntis.gov <<http://www.ntis.gov/about/form.aspx>>
Online ordering: <http://www.ntis.gov>



This document was printed on recycled paper.

(8/2010)

Nuclear Nonproliferation and Arms Control Primer Prepared for the Blue Ribbon Commission on America's Nuclear Future

LS Williams

May 2011

Prepared for
the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory
Richland, Washington 99352

Although the list of U.S. nuclear nonproliferation and arms control is too extensive to be described fully in these pages, the subset of arms control and nonproliferation initiatives that are most relevant to managing the back end of the nuclear fuel cycle includes the following:

Nuclear Suppliers Group (NSG):

The NSG is a group of 46 nuclear supplier states—including the United States—“that have voluntarily agreed to coordinate their export controls governing transfers of civilian nuclear material and nuclear-related equipment and technology to non-nuclear weapon states.”¹ These states agree to forego exports of nuclear material and technology to states that fail to join or comply with international nuclear nonproliferation regimes such as the NPT and nuclear weapon free zone agreements (e.g., North Korea, Pakistan). Fissile materials, nuclear reactors, reprocessing and enrichment technology are among the controlled items in the NSG Guidelines. In addition to other nonproliferation commitments, recipient states must commit not to transfer these imports to a third country without the supplier’s permission, and must ensure adequate physical security measures to prevent theft or unauthorized use. Established in 1975, the NSG is a “gentleman’s agreement” that has not been ratified by the Senate and lacks the legal stature of a treaty.

Zangger Committee:

Also known as the Nuclear Exporters Committee, the Zangger Committee is an informal group of 38 states (including the United States) established in the early 1970s in connection with NPT Article III to help ensure peaceful use of nuclear material and equipment by states importing nuclear material or technology. In accordance with the NPT, “parties to the Treaty should not export, directly or indirectly, nuclear material and equipment to non-nuclear weapon states unless the export is subject to IAEA safeguards....The Zangger Committee helps to prevent the diversion of exported nuclear items from peaceful purposes to nuclear weapons or other nuclear explosive devices”² through a series of understandings and domestic export controls governing conditions of supply for items, including those on the Committee’s Trigger List. Among other items, the Trigger List control the export of “plants for the reprocessing of irradiated fuel elements, and equipment especially designed or prepared therefore.”³

¹ *The Nuclear Suppliers’ Group at a Glance*, Arms Control Association Fact Sheet, Washington, D.C., May 2011. Available at <http://www.armscontrol.org/factsheets/NSG>

² “The Zangger Committee Mission,” Zangger Committee home page, Vienna, Austria, January 13, 2010. Available at <http://www.zanggercommittee.org/Mission/Seiten/default.aspx>

³ “Communications of 15 November 1999 received from Member States regarding the Export of Nuclear Material and of Certain Categories of Equipment and Other Material,” (INFCIRC/209/Rev. 2 as amended), International Atomic Energy Agency, Vienna, Austria, March 9, 2000.

Fissile Material Cutoff Treaty (FMCT):

A Fissile Material Cutoff Treaty would ban the production of fissile material available worldwide for nuclear weapons and nuclear explosive devices and lay a basis for future reductions, consistent with the NPT Article VI commitment of nuclear weapon states to pursue negotiations in good faith on effective nuclear disarmament. The United States and other P-5 countries have pursued the commencement of negotiations on an FMCT at the U.N. Conference on Disarmament (CD) in Geneva for many years. Because the CD operates on the basis of consensus, Pakistan has been able to block the start of negotiations in recent years, citing its desire to see an FMCT address existing stockpiles as well as future production.

The definition of fissile material in the U.S. draft FMCT “is close to the definition adopted by the IAEA for weapon-usable or ‘direct-use’ material: uranium enriched to more than 20% in U-235 or U-233 and plutonium containing less than 70% Pu-238.”⁴ Some experts have debated adding “alternative nuclear materials” like neptunium-237 and americium to the scope. The involved states agree on the importance of an effectively verifiable treaty, and the United States has argued that no additional verification responsibilities should be required for NPT non-nuclear weapon states with Comprehensive Safeguards Agreements and Additional Protocols in force. The United States has also stated that verification should focus on facilities that are “producing or are clearly capable of producing fissile material.”⁵ Currently, however, no FMCT text has been agreed, ratified, or entered into force.

Peaceful Uses of Atomic Energy (123) Agreements:

Also called a Peaceful Uses of Atomic Energy (PUAE) Agreement, the 123 Agreement is an agreement for cooperation between the United States and another state that is required by Section 123 of the U.S. Atomic Energy Act as a prerequisite for nuclear trade. These agreements must be reviewed by Congress in 90 days of continuous session before entry into force and can be opposed by a joint resolution from both houses; the terms of a 123 Agreement may vary significantly from state to state. Some agreements expressly permit the partner state—either automatically or with advance consent from Washington—to undertake back-end fuel cycle activities such as reprocessing of nuclear material obtained or produced as a result of the agreement. For example, the U.S.-Russian 123 Agreement (entry into force January 2011) permits cooperation in areas such as uranium enrichment and spent fuel management. Russian experts have also suggested cooperation under the 123 in areas including

⁴ “A Fissile Material Cutoff Treaty,” International Panel on Fissile Materials (IPFM) Global Fissile Material Report, Princeton, New Jersey, 2010.

⁵ “Ambassador Kennedy on the Fissile Material Cutoff Treaty,” United States Mission to the United Nations and Other International Organizations, remarks delivered by Amb. Laura Kennedy in Geneva, Switzerland, March 3, 2011.

innovative new technologies for spent nuclear fuel reprocessing and safe long-term storage of radioactive waste.⁶

Cooperative Threat Reduction (Nunn-Lugar Program):

The Cooperative Threat Reduction (CTR) or Nunn-Lugar Program was established in 1992 to secure and dismantle weapons of mass destruction in the former Soviet states. Although the largest programs have traditionally been funded through DOD/DTRA and DOE/NNSA, significant cooperative threat reduction programs are also funded through DHS and the State Department. Among other areas, U.S. CTR programs are securing tons of FSU-origin fissile material, blending down hundreds of tons of proliferation-attractive Russian HEU to proliferation-resistant LEU for use as fuel in U.S. commercial nuclear reactors under the HEU Purchase Agreement, converting civilian research reactors and isotope production facilities from HEU to LEU targets, eliminating both foreign and domestic radiological material (e.g., through waste solidification and conversion to mixed-oxide fuel for civilian power reactors) and shutting down Russian plutonium production reactors—the last of which was permanently shutdown in fall 2010.

Nuclear Security Summit:

Held in April 2010 and attended by 47 nations, the U.S.-hosted Nuclear Security Summit was launched with the goal of securing all vulnerable nuclear material worldwide within four years. Among other achievements since that time, the United States signed a plutonium disposition protocol with Russia, is converting its remaining HEU-fueled research reactors, and is pursuing ratification to an amendment of the Convention on Physical Protection of Nuclear Materials that would extend and strengthen the Convention's coverage of peaceful nuclear material in storage or use at domestic nuclear facilities, rather than merely in international transit. In preparation for the next summit, some U.S. experts are proposing the development of an international "nuclear material security framework agreement [that] would identify the threats to humankind from vulnerable fissile and radiological materials...and list actions and commitments required to mitigate them."⁷ The next nuclear security summit takes place in Seoul in spring 2012.

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention):

⁶ "US-Russian 123 Agreement Enters Into Force: What Next?" by Anton Khlopkov, Center for Energy and Security Studies, Moscow, Russia, Jan. 11, 2011.

⁷ "The Urgent Need for a Seoul Declaration: A Roadmap for the 2012 Nuclear Security Summit and Beyond," by Kenneth N. Luongo, *Arms Control Today*, Washington, D.C., April 2012.

The IAEA has supported international cooperation in radioactive waste management since the Agency's inception in 1957.⁸ The Joint Convention was the first legal instrument to address directly the issues of spent fuel and radioactive waste management on a global scale. The scope of the Convention's safety provisions includes spent fuel and radioactive waste generated by civilian NPPs and applications, spent fuel and waste from defense programs when the material is permanently transferred to exclusively civilian programs, as well as both planned and controlled liquid or gaseous releases from regulated nuclear facilities. Centered on the mechanisms of review meetings and annual reporting, the Convention entered into force in the United States in July 2003, was ratified by the U.S. Senate and has the status of a treaty under international law.

Convention on Nuclear Safety (CNS):

Prepared in the aftermath of the Three Mile Island and Chernobyl accidents, the CNS was established "to achieve and maintain a high level of nuclear safety worldwide, to establish and maintain effective defenses in nuclear installations against potential radiological hazards, and to prevent accidents having radiological consequences."⁹ The scope of the CNS includes land-based civilian nuclear power plants under the state's jurisdiction, including radioactive materials storage, handling and treatment facilities that are on the same site and directly related to the NPP's operation. Safety obligations for the Parties are largely based on the IAEA Safety Fundamentals.¹⁰ Among other obligations, Parties must take appropriate steps to ensure that "the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum extent practicable...both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal."¹¹ An incentive-based arrangement centered on peer review and reporting, the CNS entered into force in October 1996. It was ratified by the U.S. Senate and has the status of a treaty under international law.

IAEA Additional Protocol (AP) and Other Safeguards Agreements:

The NPT and other nuclear nonproliferation treaties entrust the International Atomic Energy Agency (IAEA) with the role of nuclear inspectorate. To fulfill this role, the IAEA implements safeguards to verify that a State is meeting its international commitments not to use its nuclear programs for nuclear weapons-related purposes. Prior to 1997, the IAEA utilized safeguards frameworks including

⁸ The IAEA's recently-approved Strategic Approach to Education and Training in Radiation, Transport and Waste Safety (2011-2020) further strengthens the Agency's involvement in education and training for radiation, transport and waste safety education.

⁹ *Convention on Nuclear Safety (CNS): Introduction to the CNS and Its Associated Rules of Procedure and Guidelines*, International Atomic Energy Agency CNS Brochure, Vienna, Austria, May 2010.

¹⁰ *The Safety of Nuclear Installations*, IAEA Safety Series No. 10, Vienna, Austria, 1993.

¹¹ CNS brochure, *ibid.*

Comprehensive Safeguards Agreements, which cover “all source or special fissionable material in all peaceful nuclear activities within the territory of a State, under its jurisdiction, or carried out under its control anywhere.”¹² Beginning in 1997, the IAEA adopted the Model Additional Protocol, which grants the Agency additional authorities that enable it to provide increased assurance about State compliance at both declared and possible undeclared nuclear facilities. Among other areas, the AP’s broader scope requires States to provide information and IAEA inspector access to all parts of a State’s nuclear fuel cycle, including nuclear waste sites and fuel cycle-related R&D activities. The AP was ratified by the U.S. Senate, entered into force in 2009, and has the status of a treaty under international law.

¹² “The Safeguards System of the International Atomic Energy Agency,” International Atomic Energy Agency website, Vienna, Austria. Available at <http://www.iaea.org/OurWork/SV/Safeguards/>



Pacific Northwest
NATIONAL LABORATORY

*Proudly Operated by **Battelle** Since 1965*

902 Battelle Boulevard
P.O. Box 999
Richland, WA 99352
1-888-375-PNNL (7665)
www.pnnl.gov



U.S. DEPARTMENT OF
ENERGY