Testimony before the
Subcommittee on Prevention of Nuclear and Biological Attack
and
Subcommittee on Emergency Preparedness, Science, and Technology
House Committee on Homeland Security
By
Benn Tannenbaum, Ph.D.
Senior Program Associate
American Association for the Advancement of Science
June 21, 2005

Mr. Chairman, Congressman Langevin, Congressman Pascrell, members of the Subcommittees, thank you for this opportunity to testify before you today on the detection of nuclear weapons and radiological material. I am Benn Tannenbaum, Senior Program Associate at the Center for Science, Technology and Security Policy within the American Association for the Advancement of Science. Founded in 1848, AAAS is the world's largest general scientific society with over 120,000 members and 262 affiliated societies. The specific Center for which I work seeks to connect policy makers, such as the members of this Committee, with scientific and technical experts in a broad range of science and security-related topics. In general, we work to identify the experts best suited to meet your needs by providing clear, objective, unbiased research; we do not perform original research ourselves but instead act as a conduit between the academic research community and the policy arena.

In this case, we were approached by Congressmen Markey and Thompson, who sought to better understand the capabilities and limitations of the radiation portal monitors being deployed to detect smuggled radioactive and fissile materials arriving in U.S. ports. We consulted two physicists with long experience in this particular field, Professor Frank von Hippel of Princeton University and Professor Steve Fetter of the University of Maryland. Based on their expert input, we drafted a report for Congressmen Markey and Thompson that is included with my written testimony. The testimony I present today is based in large part on their work. In addition, I am a physicist with some experience in the design and construction of detector technology.

Having made those caveats, I would like to address five main points in my remarks.

First, the isotopes best suited for use in dirty bombs, such as cesium-137, cobalt-60, or americium-241, can be detected with passive radiation detectors, similar to those deployed since 9/11 at ports both in the United States and abroad. A passive radiation detector is one that simply monitors the rate at which radioactive decays occur near the detector. The very feature that makes for a good dirty bomb—namely, a strong source of radiation—also makes detection easier and shielding more difficult. In addition, the properties of plutonium, one of two elements most useful in constructing nuclear weapons, are such that it, too, can be detected with passive radiation detectors. An active radiation detector, in contrast, uses some sort of a probe such as x-rays or neutrons to determine the contents of a container.

Second, the physical properties of uranium, including the highly enriched uranium (HEU) that would be used to construct a nuclear weapon, are such that shielded uranium is very likely to escape detection by passive radiation monitors. While some ports of entry have both active and passive detectors, some observers argue that they are not being used in the most effective manner. The passive detection of specific energies of radiation coupled with an active method that identifies the location of very dense objects is a good technique to detect smuggled uranium.

Third, there are several ways to improve the capabilities of the passive detectors currently in use and to improve future generations of detectors. The current detectors can be improved by increasing the sampling time, decreasing the distance between the container and the detector, decreasing the background radiation through additional shielding around the detector, and adding collimators to the detectors. In addition, future detectors must have better energy resolution. This allows one to distinguish harmless radioactive materials, such as kitty litter, from dirty bombs and nuclear weapons. There are limits, however, to the space available for these detectors and to the time available for scanning.

Fourth, there are several interesting R&D programs exploring new techniques to locate radiological and fissile materials. At Los Alamos National Lab, researchers are using cosmic rays to find very dense materials, such as plutonium and uranium, in very small quantities within cargo containers. At Lawrence Livermore National Lab, researchers use neutrons to “ping” a container. These neutrons induce a very characteristic gamma ray response in fissile materials. An Ohio-based company has proposed inexpensive detectors that would be placed in cargo containers during transoceanic shipment. These detectors take advantage of the 10-day or longer transit time to locate HEU. This has the additional feature of allowing the interception of dangerous materials before they enter a U.S. port. The Department of Homeland Security and the Department of Energy’s National Nuclear Security Administration have recently begun construction of a facility to test portal monitors and expects to select the next generation of technology next year using a temporary test bed.

Fifth, the best way to protect the United States from smuggled nuclear weapons is to use a layered defense. The currently deployed portal monitors in many domestic and foreign ports are an important first step. Adding in-transit detectors and active scanners would increase our ability to locate radiological and fissile material. The intrinsic difficulties in detecting uranium make it particularly important to secure, control, and protect existing supplies of HEU and plutonium around the world. It will always be far easier to monitor a lump of uranium at a known location than it will be to detect uranium smuggling. The Comprehensive Threat Reduction program has enabled the safeguarding much of Russia’s HEU and plutonium, and some of the HEU and plutonium is being converted to fuel for use in nuclear power reactors. This program should be expanded to cover more countries and the rate of fuel conversion should be increased. In addition, research reactors in many countries use HEU as fuel; these reactors should all be converted to use low enriched uranium fuel as soon as possible.

I thank you for the opportunity to testify, and look forward to your questions.

APPENDIX

American Association for the Advancement of Science (AAAS)

Founded 150 years ago, AAAS is the world's largest federation of scientific and engineering societies, with nearly 275 affiliates. AAAS counts more than 130,000 individual scientists, engineers, science educators, policymakers, and interested citizens among its members, making it the largest general scientific organization in the world. Our mission is to advance science and innovation throughout the world for the benefit of all people. Our objectives in this mission are to foster communication among scientists, engineers and the public; enhance international cooperation in science and its applications; promote the responsible conduct and use of science and technology; foster education in science and technology for everyone; enhance the science and technology workforce and infrastructure; increase public understanding and appreciation of science and technology; and strengthen support for the science and technology enterprise.

Benn Tannenbaum

Benn Tannenbaum is a Senior Program Associate at the Center for Science, Technology and Security Policy. Dr. Tannenbaum works on a variety of projects for CSTSP, including drafting policy briefs, tracking legislation, serving as liaison with MacArthur-funded centers and the security policy community, organizing workshops and other meetings, attending Congressional hearings and conducting topical research.

Prior to joining AAAS, Dr. Tannenbaum worked as a Senior Research Analyst for the Federation of American Scientists. Dr. Tannenbaum worked extensively on the FAS paper Flying Blind; this paper explores ways to increase the quality and consistency of science advising to the federal government. He also researched nuclear weapons testing and prepared a paper on the subject. He coordinated FAS's Congressional outreach efforts.

Before joining FAS, Dr. Tannenbaum served as the 2002-2003 American Physical Society Congressional Science Fellow. During his Fellowship, Dr. Tannenbaum worked for Representative Edward J. Markey (D-MA) on nonproliferation issues. This work included several nuclear policy amendments, numerous oversight letters and staffing the House Bipartisan Task Force on Nonproliferation.

Before his Fellowship, Dr. Tannenbaum worked as a Postdoctoral Fellow at the University of California, Los Angeles. At UCLA, he was involved in the Compact Muon Solenoid (CMS) experiment at CERN, in Geneva, Switzerland, and the Collider Detector Facility (CDF) at the Fermi National Accelerator Laboratory outside Chicago, Illinois. Dr. Tannenbaum worked on the design, construction, installation and calibration of two scintillating tile calorimeters for CDF, studied the effects of radiation on various detector components, and wrote software to simulate the behavior of detector components for CMS. He received his Ph.D. in particle physics from the University of New Mexico in 1997. His dissertation involved a search for evidence of supersymmetry.

Frank von Hippel

A former assistant director for national security in the White House Office of Science and Technology, von Hippel's areas of policy research include nuclear arms control and nonproliferation, energy, and checks and balances in policymaking for technology. Prior to coming to Princeton, he worked for ten years in the field of elementary-particle theoretical physics. He has written extensively on the technical basis for nuclear nonproliferation and disarmament initiatives, the future of nuclear energy, and improved automobile fuel economy. He won a 1993 MacArthur fellowship in recognition of his outstanding contributions to his fields of research. Ph.D. Oxford University.

Frank von Hippel is co-director of the Program on Science and Global Security at Princeton University.

Steve Fetter
Steve has been a professor in the School of Public Policy at the University of Maryland since 1988 and will become Dean on July 1. Trained as a physicist, his current research interests include nuclear weapons and nonproliferation policy, nuclear energy, and climate change. In 1993-94 he was a special assistant to the Assistant Secretary of Defense for International Security Policy, and in 1992 was a Council on Foreign Relations fellow at the State Department. He is author or coauthor of three books and over 60 journal articles, book chapters, and reports.