Statement of Rose Gottemoeller
Senior Associate of the Carnegie Endowment for International Peace

Before the Senate Subcommittee on International Security,
Proliferation and Federal Services
Committee on Governmental Affairs

November 7, 2001

This is a critical time to review weapons of mass destruction (WMD) technologies and materials and examine the effectiveness of export controls to curb these threats. Suddenly, the press is full of terrible scenarios: Nuclear weapons in the hands of Osama bin Laden. A suitcase bomb detonating in the middle of the Golden Gate Bridge. A radiological bomb spewing plutonium over the White House, creating a keep-out zone in central Washington that could last for many years. After reading about threats such as these, many people are worried. I commend the Subcommittee on International Security, Proliferation and Federal Services for confronting these complex and difficult issues in the search for new answers.

I would like to begin my remarks by examining the nuclear and radiological threats, how they differ, and what the level of concern should be about them. In describing these threats, I will also summarize the kind of technological challenge that they present to any would-be proliferator, whether state-sponsored, or non-state actors with a terrorist agenda. I will then move on to discuss the nuclear and radiological threats that, in my view, deserve more attention than they currently receive. I will conclude by commenting on how export controls have related to the nuclear nonproliferation regime and peaceful uses of nuclear technologies in the past, and offer my view of how they should relate in the future.

Nuclear and Radiological Weapons: The Threats and The Technologies

A simple nuclear device of the Hiroshima design is actually not the easiest nuclear capability for a proliferator to acquire, be he a terrorist or a rogue state actor. Although the design is now almost fifty years old, the Hiroshima device, also called a “gun-type” weapon, requires a large amount of nuclear material to achieve a nuclear explosion. We assume that 15-30 kg of highly enriched uranium or 3-4 kg of plutonium are needed for a sophisticated nuclear weapon.[1] Cruder devices may require more. One estimate, for example, places the likely size of a Pakistani weapon at around 1,500 pounds.[2] Therefore, although achieving a workable trigger device and other components would not be a trivial matter, the principal barrier to acquiring a nuclear weapon is the large amount

of weapons-usable material that is needed.

For this reason, international nonproliferation policy has stressed keeping nuclear material production and enrichment technologies out of proliferators' hands. The crisis begun in 1994, when North Korea threatened to pull out of the Nonproliferation Treaty, was over its production of plutonium at the Yongbyon reactor. The more recent disagreement with Russia over its potential sale of laser isotope enrichment technology to Iran is another example. In all cases, the acquisition of sufficient nuclear material to achieve a nuclear detonation is the goal of would-be proliferators; it is the goal of U.S. nonproliferation policy to prevent that acquisition.

Following the breakup of the Soviet Union in 1991, the possibility that large amounts of weapons-usable material could be stolen from former Soviet nuclear facilities has become a major concern for the nonproliferation policy community worldwide. What would have had to be achieved through years of arduous and expensive production, enrichment and separation work—a sufficient amount nuclear material to build a bomb—could be acquired in an instant through thievery. Therefore, in the past decade, an enormous amount of attention and significant U.S. dollars ($173 million in FY 01 alone) have been spent on cooperating with Russia and the other states in the region to enhance the physical protection of weapons-usable materials in facilities that housed the Soviet weapons complex.

These sites stretch in an archipelago across the former Soviet territory—a vestige of Stalin's mania to spread industrialization to every corner of the Soviet land. In the case of nuclear production, facilities were especially located in remote areas, away from prying eyes and imprudent questions. In addition, operational weapons such as those deployed with the Russian Navy are often located at remote bases in areas such as the Arctic and Far East. The United States is currently working with the Ministry of Atomic Energy and Russian Navy to improve security of nuclear material and weapons at 95 sites in Russia and the former Soviet Union.[3] This program complements and strengthens efforts to control exports of nuclear technology. Barriers to the acquisition of weapons-usable nuclear material, in short, take several forms.

In contrast to bombs that would produce a nuclear detonation, radiological weapons are a simpler capability for a proliferator to acquire, if only because the threat in the case of a radiological device exists in a wide spectrum. The spectrum could range from low-level nuclear waste planted as a package in an urban location, through highly toxic nuclear material exploded as a "dirty bomb", using conventional explosives to spread it over a wide area. At the extreme end of the spectrum would be an aircraft attack on a nuclear facility that would turn the facility itself into a radiological weapon. As Mohamed El

Baradei, the Director-General of the International Atomic Energy Agency (IAEA), has said, "We are not just dealing with the possibility of governments diverting nuclear materials into clandestine weapons programs. Now we have been alerted to the potential of terrorists targeting nuclear facilities or using radioactive sources to incite panic, contaminate property and even cause injury or death among civilian populations."[4]

It is important to stress the differences among the types of radioactive materials that may come into play in a radiological attack. Since 1993, the IAEA has tracked 175 cases of trafficking in nuclear materials and 201 cases of trafficking in radioactive materials used for medical and industrial purposes. Of all of these cases, however, only 18 involved small amounts of plutonium or highly enriched uranium, the "weapons-usable" material that is required to make a nuclear bomb.[5]

Therefore, a radiological attack would most likely involve lower-level radioactive material or even nuclear waste. Depending on what the material was and the amount of conventional explosive that was used to spread it around, it would potentially sicken people and contaminate large swaths of territory. However, it would not kill thousands of people outright, as would a nuclear explosive blast. Relatively few people, for example, were killed in the immediate aftermath of the 1986 accidental explosion at the Chernobyl nuclear reactor. They were mostly the firefighters who were bravely fighting the blaze, and were dead within a few days from radiation exposure. A thirty-kilometer area around Chernobyl remains a contaminated keep-out zone today, however, and many people have suffered thyroid and other illnesses that are directly related to the Chernobyl disaster.

But even a small amount of low-level nuclear waste, if planted in an urban setting, would have the potential to sow considerable panic unless authorities were quickly able to neutralize the incident in the public's mind. Chechen operatives, for example, planted low-level nuclear material in a park in Moscow in the mid-1990s and brought television cameras to the site to advertise that they had a "nuclear capability". The Russian authorities were quickly able to convey to the public that the material did not amount to a serious threat, thereby neutralizing the incident and preventing widespread panic. Similar quick action to analyze and clarify for the public the nature of radiological threats should be an important goal of public policy in the current environment, both in the United States and in other countries where such incidents might occur.

Nuclear and Radiological Threats Deserving More Attention

In my view, we now must begin to strike a balance between the most dangerous nuclear threats, and the less lethal but profoundly disruptive radiological threats. For many years, we have rightly emphasized in our nonproliferation policy preventing weapons-usable

nuclear material and weapons-related technologies from falling into the hands of would-be proliferators—the most urgent and dangerous threat to counteract, given that a taboo against using nuclear material in a terrorist attack seemed to be operating. Nowadays, however, the taboo has disappeared. As David Albright, President of the Institute for Science and International Security, has said, "You'd always reach the point where you'd say, 'yes, a terrorist could theoretically do it…and you'd look at the terrorists and say… they're not capable or they don't want to.' That's what's changed. Al Qaeda could do it, and they want to."[6]

Given the disappearance of this taboo, the relative ease with which a proliferator might acquire nuclear or radioactive material for use as a radiological device is a cause for strong concern. I believe, therefore, that radiological threats deserve greater attention in our efforts to secure nuclear materials and technologies then they have had in the past. At the same time, we cannot short-change the priorities that we have placed on preventing the proliferation of weapons-usable material and weapons-related technologies. We have to do both.

But resources are limited, and new funding for nonproliferation and nuclear threat reduction activities will have to compete with other urgent priorities in the conduct of the U.S.-led campaign against terrorism. Clearly, ongoing programs in the nuclear threat reduction arena should continue. They are receiving resources, and should not be interrupted in any way.

I would, however, like to suggest that we focus immediately on three new priorities as threats that deserve more attention. Given the demand on resources, we should also consider new methods of funding such projects, which I will specifically suggest in one case. The three priorities that I would suggest are: (1) halting the production of weapons-grade plutonium in Russia, (2) securing nuclear facilities that remain vulnerable in the former Soviet Union, and (3) improving security at nuclear reactors and other sites where lower-level (non-weapons-usable) nuclear material is stored or used. The order in which these priorities are presented does not in any way reflect their relative importance. In my view, each of them is critical, and should be given serious and urgent consideration.

The first priority is halting the production of weapons-grade plutonium in Russia, which also deserves consideration as a project that could benefit from new methods of funding. The shutdown of plutonium production reactors in Russia has been a long-standing goal of the U.S. nuclear threat reduction programs. Originally built to pump out plutonium for the Soviet bomb program, the reactors now provide heat and electricity to the cities of Tomsk and Krasnoyarsk. In the process, they continue to produce a ton-and-a-half of weapons-grade plutonium every year, adding to Russian stocks that are well over 100

tons already. Since it takes about four kilograms to build a nuclear bomb, the Tomsk and Krasnoyarsk reactors are producing every year enough plutonium for over 300 new bombs.

The Bush Administration, however, has not been enthusiastic about the shut-down plan, which involves replacing the three plutonium reactors with fossil fuel alternatives. They have apparently argued that we should not be building fossil fuel plants in Russia when the Russians could be building them themselves. The Bush team does have a point. The Russian Federation is no longer in such desperate straits as it was a decade ago. Indeed, while the U.S. economy has ceased growing, the Russian economy is growing at an annual rate of over 5 percent. Russia should therefore be in a position to shoulder more of the responsibility for nonproliferation priorities.

I believe that we should not take this argument too far, since the size of the Russian economy is still miniscule compared to that of the United States. As one Russian counterpart commented when he heard about the $40 billion supplemental that has been put in place in the U.S. to fund post-September 11 requirements, "That is more than double the entire Russian defense budget for this year." To square this circle, perhaps Russia could focus on programs, such as shutdown of the plutonium reactors, that the United States finds difficult to fund. At the same time, we could take special action to help the Russians to finance such programs.

One good idea in the funding arena is the so-called "debt-for-security" swap that Senators Biden and Lugar have proposed in new legislation. Under this concept, we would forgive Soviet-era debt in exchange for Russia putting rubles into nonproliferation programs. These swaps would have to be carefully structured. Moscow and Washington would have to agree firmly in advance what the priorities will be, and what schedule will be followed to achieve them. The shutdown of the Tomsk and Krasnoyarsk reactors, for example, would have to be decided in advance as an absolute and urgent priority.

In addition to new rubles, some new dollars should go into priority programs as well. The second priority that I would suggest, securing nuclear facilities that remain vulnerable in the former Soviet Union, falls into this category because it is a straightforward expansion of the existing Material Protection, Control and Accounting (MPC&A) program. This expansion would enable us to counter the potential for nuclear theft. Every time we go into a Russian nuclear site, we immediately survey it to decide what "quick fixes" are needed to urgently upgrade security. Is there a splintered old door that needs to be replaced on a nuclear storage building? Do windows need to be bricked up or equipped with bars? Does underbrush need to be cleared away from the perimeter, so no one can sneak up to the building unseen? These "quick fixes" can generally be completed within

three months, if the weather cooperates.

If we began next April, the start of the summer construction period, within nine months we could complete quick fixes on all of the facilities in the Russian weapons complex that so far have not been touched under the MPC&A program. The Russian government would have to agree to give the U.S. access to the sites, and the U.S. government would have to move fast to get all the planning and paperwork in place before April. But it could be done, and would give a huge boost to the nuclear security of the United States, Russia, and the rest of the world community.

The third priority, improving security at nuclear reactors and other sites where lower-level (non-weapons-usable) nuclear material is stored or used, addresses the radiological threat that has taken on a new importance in the wake of September 11. Traditionally, U.S. cooperation with the countries of the former Soviet Union to reduce the risk of nuclear proliferation has emphasized so-called higher value material and facilities—sites associated with the weapons complex and especially with nuclear material that can be used in the manufacture of nuclear weapons. Uranium, for example, must be enriched to a level above 20 percent before it is considered a proliferation threat in current U.S. programs. Materials below 20 percent enrichment have been considered a lower priority.

Given that radiological threats have taken on a new importance, programs to address them should also take on a new importance. One simple step that the United States could accomplish, for example, would be to restore the funds for international nuclear safety in the federal budget. For nearly a decade, the United States has been working with the countries of the former Soviet Union to upgrade the safety of Soviet-built nuclear reactors. The focus of the program has been precisely on safety, the rationale to prevent another Chernobyl-style disaster.

It has largely been successful in achieving these goals, and in fact, the permanent shut-down of the last Chernobyl reactor was accomplished in December 2000. For that reason, the program is slowly ramping down, dropping from over $30 million in FY 99 to just $10 million in the FY 02 budget. This program could be quickly ramped up in order to improve security at nuclear reactors and other sites where lower-level (non-weapons-usable) nuclear materials are stored. It could be extended not only to Russia and the former Soviet Union, but also to other countries around the world where such facilities are vulnerable.

How Export Controls Relate to the Nuclear Nonproliferation Regime

With regard to export controls, there is one essential difference between nuclear weapons,

and chemical and biological weapons. Chemical and biological weapons are both banned by international protocols, and thus there is a global norm against them. Clearly both chemical and biological weapons are related to a host of dual-use technologies, which complicates efforts to control their proliferation. However, the ban represents a useful prohibition that somewhat simplifies the export control problem.

Nuclear weapons differ in that an essential deal was reached in the Nonproliferation Treaty (NPT), permitting five states to retain nuclear weapons, and other countries who agree to remain non-nuclear weapon states to acquire nuclear technology for peaceful purposes. Trade in support of these peaceful uses of nuclear technology has grown up over the years, principally relating to nuclear energy systems, but also related to medical, agricultural, and other technologies.

This situation is complicated by the fact that many of the peaceful uses of nuclear technology were born along with weapon uses, employing very similar technologies. The Tomsk and Krasnoyarsk reactors, producing weapons-grade plutonium at the same time they are producing heat and electricity for civilian populations, are extreme examples of this phenomenon, but they serve to illustrate the point. During the first fifty years of the nuclear era, it has often been complicated to distinguish between weapon and peaceful uses of the atom.

In this complicated environment, an export control regime has nevertheless grown up in the form of the Nuclear Suppliers Group (NSG), which makes use of mechanisms such as trigger lists of dual-use items to steer trade in nuclear technologies. The NSG has been an effective instrument, and no doubt will go through further development and improvement to address new challenges, such as the presence of nuclear weapons in South Asia. As this topic will receive full attention in the following panel on export control, I will not delve into further detail on it, but instead consider the future of nuclear export controls in a strategic sense.

Increasingly, those who are engaged in nuclear technology development, particularly for electricity generation purposes, are interested in new approaches that have limited cross-over to the weapon sector. They want to avoid the situation inherent in Tomsk and Krasnoyarsk, rather than continuing to proceed along that trajectory. For that reason, the nuclear industry today is beginning to concentrate on developing *proliferation-resistant* reactors that will minimize the production of weapons-usable material in their cycles. Ideally, proliferation-resistant reactors would burn up plutonium rather than breed it.

Although such reactors may be 20 years or more from commercial application, it is important that a new strategic approach is developing in the nuclear industry. The

industry is emphasizing proliferation resistance along with other attributes such as minimization of nuclear waste, and stringent design for safety and security. If this trend develops successfully, it will simplify the export control problem for nuclear technologies. It may also prove to be the best way to fulfill the promise of peaceful nuclear uses in the Nonproliferation Treaty.

[1] David Albright, Frans Berkhout and William Walker, "Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies," SIPRI (Oxford Press, 1997), p. 8.

[2] William J. Broad, Stephen Engelberg and James Glanz, "Assessing Risks, Chemical, Biological, Even Nuclear," *New York Times,* November 1, 2001.

[3] A useful summary of this program, with an excellent map of the sites, is contained in "MPC&A Program Strategic Plan," National Nuclear Security Administration, U.S. Department of Energy, July 2001.

[4] Quoted in Mark Henderson, "Terrorists 'Could Make Atom Bomb By Raiding Hospitals,'" *London Times*, November 1, 2001.

[5] John Tagliabue, "A Warning From An Official About An Increased Possibility of Nuclear Terror," *New York Times*, November 2, 2001.

[6] Quoted in Broad, et. al., *New York Times*, November 1, 2001.