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Small Modular Reactors and Nuclear Nonproliferation
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President John F. Kennedy truly believed that there was a serious risk that nuclear weapons were destined to sweep all over the world. In March of 1963 in response to a reporter's question at a news conference, he said, "Personally, I am haunted by the feeling that by 1970 . . . there may be 10 nuclear powers instead of 4 and by 1975, 15 or 20. . . . I would regard that as the greatest possible danger and hazard." He spent much of his presidency pursuing the cause of nonproliferation. President Kennedy had been told by the outgoing Secretary of State, Christian Herter, in December of 1960 that nuclear weapons would spread to additional countries and that the most likely next nuclear weapon states were India and Israel. He took this very seriously.

If such anticipated proliferation had in fact happened, there could be significantly more than two dozen nuclear weapon states in the world today, with nuclear weapons integrated into their national arsenals. Dr. Mohamed El Baradei, the most distinguished former Director General of the International Atomic Energy Agency who is present here today, was quoted in 2004 in a speech in Washington DC, as follows, "The danger is so imminent…not only with regard to countries acquiring nuclear weapons but also terrorists getting their hands on some of these nuclear materials- uranium or plutonium." Director General El Baradei was also quoted in another speech more or less around the same time to the effect that more than 40 countries perhaps can have the capability to build nuclear weapons. Thus, if such proliferation had taken place under the circumstances with that many nuclear weapon states in existence, potentially every significant conflict could have brought with it the risk of going nuclear, and it might have become extremely difficult to keep nuclear weapons out of the hands of terrorist organizations, they would have become so widespread. Illustrating this danger of nuclear weapon proliferation and the threat of terrorist acquisition, former U.S. Defense Secretary William Perry, a scientist not given to exaggeration, has often said that in his judgment nuclear

terrorism which could involve a nuclear detonation in a major city is today's gravest security threat.

When President Kennedy became so concerned about nuclear weapon proliferation, the United States had approximately 22,000 nuclear weapons in its arsenal, the Soviet Union nearly 2,500 and the United Kingdom 50. This total is a smaller number of nuclear weapons than exist in the world today. But, from the earliest of days in the nuclear era it had been clear that it was necessary to prevent the spread of nuclear weapons, although early attempts to prevent proliferation of nuclear weapons did not succeed.

However, in 1965 the UN General Assembly took up the subject. A resolution was passed which over the next few years proved to be the blueprint of the Nuclear Nonproliferation Treaty, The NPT. Among other things this resolution called for "balanced obligations" between nuclear weapon and non nuclear weapon states in the treaty to be negotiated. The NPT was signed in 1968 and entered into force in 1970, and came to be recognized as the principal reason- along with the parallel extended deterrence policies of the United States and the Soviet Union- that President Kennedy's darkest fears have thus far not been realized.

But the success of the NPT was no accident. It was based on a carefully crafted central bargain which incorporated the "balanced obligations" concept. In exchange for a commitment from the non nuclear weapon states (today more than 180 nations, most of the world) not to acquire nuclear weapons and to submit to international safeguards to verify compliance with this commitment, the NPT nuclear weapon states pledged unfettered access to peaceful nuclear technologies and undertook to engage in nuclear disarmament negotiations aimed at the ultimate elimination of their nuclear arsenals. It is this central bargain that for the last four decades has formed the central underpinnings of the international non proliferation regime.

However, one of the principal problems with all this has been that the NPT nuclear weapon states have never fully delivered on the disarmament part of this bargain and in recent

years it appeared to have been largely abandoned. The essence of the disarmament commitment in 1968 and thereafter was that pending the eventual elimination of nuclear weapon arsenals the nuclear weapon states would: agree to a treaty prohibiting all nuclear weapon tests, that is a comprehensive nuclear test ban; negotiate an agreement prohibiting the further production of nuclear bomb explosive material; undertake obligations to drastically reduce their nuclear arsenals; and give legally binding commitments that they would never use nuclear weapons against NPT non-nuclear weapon states. However, virtually none of these disarmament elements of the NPT basic bargain have been actually accomplished forty years later. This must change and perhaps real change can begin at this year's NPT Review Conference.

But the NPT is essentially a strategic international political bargain which should be observed, it is not a gift from the non-nuclear weapon states. Therefore, few deny that today the NPT is in crisis. The question is how long can it remain viable as an unbalanced treaty with an important part of its basic bargain unrealized and a significant part unraveling as North Korea and Iran pursue the bomb. It is true that the norm of nonproliferation runs deep after forty years. It may be that the NPT can limp along for some years with only limited further proliferation or maybe not.

Recognizing this vulnerability of the NPT, and with the end of the Cold War accompanied by the potential spread of nuclear weapon technology to failed and failing states and international terrorist organizations, serious efforts have recently begun to attempt to move toward the elimination of nuclear weapons, as called for in the NPT.

On January 4th, 2007, in an op-ed article published in the *Wall Street Journal* by George Schultz, William Perry, Henry Kissinger and Sam Nunn (and signed on to by a number of other former senior officials in the Reagan, first Bush and Clinton administrations) the authors contended that reliance on nuclear weapons for deterrence "is becoming increasingly hazardous and decreasingly effective." Noting that President Ronald Reagan had called for the

abolishment of "all nuclear weapons" which he considered to be "totally irrational, totally inhumane, good for nothing but killing, possibly destructive of life on earth and civilization," and that General Secretary Mikhail Gorbachev shared this vision, the four authors called for "reassertion of the vision of a world free of nuclear weapons and practical measures toward achieving that goal…." This op-ed article is most significant in that it represents the U.S. national security establishment coming to the realization that the world has in fact become so dangerous that nuclear weapons are now a threat even to their possessors. A second similar article followed a year later.

But no statesman has spoken out more eloquently and in such a comprehensive way as did President Obama in Prague last April. He declared his strong support for a replacement START Treaty to be followed by deeper cuts in nuclear weapons leading to a multilateral nuclear weapon reduction negotiation involving all of the nuclear weapon states. He reiterated his support for U.S. ratification and entry into force of the Comprehensive Nuclear Test Ban Treaty, as Vice President Biden reaffirmed in his speech on February 18 in Washington, and confirmed his support for a process leading to a nuclear weapon free world. He underscored his commitment to the strengthening of the NPT, along with measures to do more to safeguard fissile material around the world. And he urged the prompt negotiation of a treaty prohibiting the further production of fissile material. The Prague speech unquestionably placed the current U.S. Administration generally and President Obama personally squarely behind an activist program in nuclear arms control and nonproliferation. And last September, with President Obama in the chair, the United Nations Security Council endorsed the goal of the elimination of nuclear weapons.

But as President Obama in his speech and the NPT itself makes clear an essential part of the NPT basic bargain which underlies the effort to eliminate nuclear weapons is international support for the peaceful use of nuclear energy. This is increasingly important as the world is threatened by climate change. But realizing the potential of nuclear power to meet the world's

growing energy needs and the same time help to combat global warming is only possible if nuclear power can be completely separated from weapons.

World electricity use is expected to more than double by the year 2030, as energy grids are currently configured around the world; much of that increase will be provided by the burning of much greater amounts of coal. Yet every year a single 500 megawatt coal-fired plant also sends up into the sky the same amount of carbon dioxide as do 750,000 cars. Coal combustion is responsible for a major share of the world's man-made carbon dioxide, a significant cause of global warming. Anyone who has been to China in recent years was exposed to the immense amount of air pollution that pervades most of Western China. Indeed it is often injurious to health. And this coal burning caused smog is so intense that it crosses the Pacific and creates some of the air pollution in California. Approximately 40 percent of the world's electricity is generated by coal, 20 percent by natural gas and around 7 percent from oil combustion. These fossil fuels pour huge quantities of soot, smoke, toxins, radio nuclides, carbon dioxide, methane and other noxious gases into the atmosphere every day. These greenhouse gases it is believed create climate change in the form of global warming which can cause lethal heat waves, violent storms and rising sea levels which some scientists believe can eventually threaten human civilization itself. It is widely believed that alternative energy sources must be developed and deployed which will lead to a predominantly carbon free energy production sector in order to counter this alarming trend.

Any pragmatic plan must include more nuclear power. The American Wind Energy Association hopes that by 2020 wind farms will be supplying as much as 6 percent of our electricity. The American Energy Information Administration estimates that the figure will be

closer to 0.5 percent. Even with increased conservation of energy, the need for base load electricity will still have to be met by either fossil-fuel or nuclear power. The U.S. Nuclear Regulatory Commission (NRC) has made licensing of nuclear plants simpler through new regulations and through advance approval of the location and design. This should prevent long delays and cost overruns. Some estimates indicate that a plant of standardized, steamlined design, with many more built-in passive safety features, and therefore fewer pumps, valves, and other components, could be built in five years. Reactors could make hydrogen for fuel cells as well as electricity while burning up waste residues. Although meeting base load demand means that new nuclear plants are likely to be large, designs now come in different sizes; smaller reactors can supply electricity to local consumers or feed supplementary power to the grid during peak demand. Toshiba is now offering to provide and maintain a nuclear power plant of very small size; it features an underground, replaceable sealed reactor core that can electrify a remote village- say, a small settlement way off the grid in Alaska, where diesel-fired generators are the norm- and supply all of a town's heat for thirty years. The new small modular reactor has an important place in all this. If additional SMRs are added to the site of a first deployment there is not additional burden on nonproliferation monitoring, but if a group of SMRs have separated locations they will each have to be safeguarded separately as though each are 1000 MW reactors. This would be the potential additional burden that SMRs might put on the Nonproliferation Treaty (NPT) safeguard system.

By mid-century, the world's need for energy is expected to vastly increase. A simultaneous expansion of global nuclear capacity to around 1,350 reactors would cut the predicted increase in carbon emissions by a quarter. Additional, smaller reductions could be

obtained by renewables, conservsation, and cleaner fossil fuel technology. Studies have called for a tripling in the number of American nuclear plants, supported by an increase in government support for their construction as a means of not only delivering emission-free electricity and but also of achieving a reduction in the number of coal-fired plants. There should be a tax on carbon emissions to support nuclear expansion. Control of carbon output through emissions trading or taxation would raise the cost of electricity from fossil-fuel plants considerably. Nuclear power, once established, is not intrinsically more expensive than other means of electricity generation. France sells cheap electricity to other countries from its nuclear plants. Over the long run, uranium is and will continue to be inexpensive. We have enough of it to last indefinitely, as well as the technology to keep recycling uranium fuel if necessary and to burn useless residues in reactors.

But in order to in fact provide the power to "save the world" nuclear power must in no way contribute to weapon programs. But at the same time its advancement is an important part of the nuclear Non-Proliferation Treaty the central security instrument of our age. The NPT encourages the expansion of the peaceful atom and the elimination of the warlike atom. NPT Article IV, paragraph 1 reads as follows:

"Nothing in this Treaty shall be interpreted as affecting the alienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty."

Article IV is an essential part of the NPT basic bargain of nonproliferation in exchange for nuclear disarmament and access to peaceful nuclear technology. Many of the states negotiating the terms of the NPT were deeply concerned that the NPT would block or

significantly inhibit their access to peaceful nuclear technology which they regarded as a sovereign right and essential to their economic development.

So, Article IV became a compensatory article for the benefit of the non-nuclear weapon states. It became one of the obligations intended to apply largely to the nuclear weapon states to balance the non-proliferation obligations of the non-nuclear weapon states. How much was gained by the non-nuclear weapon states was not entirely clear in 1968 due to the vagueness of the language of Article IV itself. However, one can say, from the negotiating history of this provision, that the negotiators intended to guarantee the right of all NPT Parties to the use of nuclear energy for peaceful purposes as long as a program is an honest one—that is, consistent with the non-proliferation undertakings of Articles I and II. This right, with respect to a national indigenous program of a State is absolute. Second, in Article IV, the intent of the negotiators was to provide a more qualified right to participate in nuclear trade involving materials, equipment and information, and to place an obligation on all nuclear capable states—not just nuclear weapon states—able to do so to facilitate this trade. It was recognized that this trade, the exchange of material, equipment and information, and the commitment of nuclear capable states to cooperate, should be limited by prudence in order to support the non-proliferation goals of the Treaty. In summary, the right to develop peaceful nuclear technology, if a program is in compliance with the Treaty, is unqualified, the right to participate in nuclear trade can be subject to restriction even if a program is in compliance with the Treaty.

The nuclear renaissance is a reality. With the threat of global warming on the horizon, the potential for serious world-wide air pollution, the political problems surrounding fossil fuels and the enormous increase in energy demand throughout the world, nuclear power must be a

growing part of the energy production mix. The introduction of non-proliferative fuels and other non-proliferative nuclear technology will help ensure that nuclear power, as its use expands, can be completely separated from any potential nuclear weapon proliferation. It is possible also to substantially reduce the problem of nuclear waste. So with effort and consistent world-wide cooperation further nuclear weapon proliferation can be prevented, progress can be made toward the elimination of nuclear weapons and the benefits of the peaceful atom be made available virtually everywhere.

This is a time of promise because of the commitment of President Obama and his Administration and widespread support in the international community for nuclear non-proliferation and its counterpart, safe, reliable and non-proliferative nuclear power. It is also a time of great difficulty because of the many overwhelmingly serious crises that were left at the end of 2008 and against which to date only limited progress has been made. But while the hour is growing late, it is not too late. Success remains possible; all of us must stay committed to progress on both nuclear weapon limitation and elimination and cooperation in the peaceful and non-proliferative use of nuclear technologies, and we can still build that safer, economically abundant and more secure world that all of us want.