

Report on
Proliferation Implications of the Global
Expansion of Civil Nuclear Power



International Security Advisory Board

April 7, 2008

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United States Department of State
Washington, D.C. 20520

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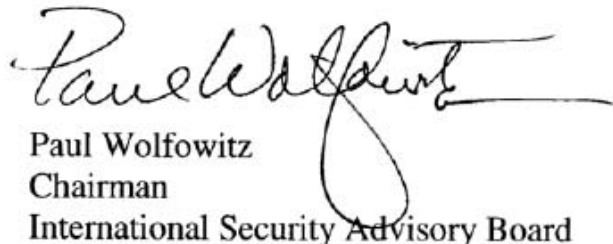
MEMORANDUM FOR UNDER SECRETARY JOHN C. ROOD, ACTING

SUBJECT: Final Report of the International Security Advisory Board (ISAB) on
the Proliferation Implications of the Global Expansion of Civil Nuclear
Power

I am forwarding herewith the ISAB's report dealing with the Proliferation Implications of the Global Expansion of Civil Nuclear Power. The report was drafted by a Task Force chaired by Ambassador C. Paul Robinson. The draft report provided by the Task Force was reviewed by the Board Members and the final version of the report was approved by Board Members without objections.

The report provides four recommendations that will assist the Department in mitigating nuclear weapons proliferation in the future as the international demand, development, and expected use of civil nuclear fuel expand. The report concludes that the best method of preventing expansion of civil nuclear power capabilities leading to increased proliferation will be through cooperation on nonproliferation activities by the suppliers of nuclear energy technologies.

I encourage you to consider all four of the report's recommendations carefully. The Board Members stands ready to brief you and other members of the Administration on the report.


Paul Wolfowitz
Chairman
International Security Advisory Board

INTERNATIONAL SECURITY ADVISORY BOARD

Proliferation Implications of the Global Expansion of Civil Nuclear Power

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Report on Proliferation Implications of the Global Expansion of Civil Nuclear Power

The main body of this report presents the Board's detailed policy arguments and recommendations. Readers who want more background on the scope of the Task Force discussions, or more detail regarding the current state and predicted emergence of nuclear power, should read Appendix B first.

Introduction

The assigned Terms of Reference (TOR) requested the ISAB undertake a study of the proliferation risks associated with an anticipated global expansion of civil nuclear power. Specifically, it asked us:

- (1) to consider whether the anticipated rise in the use of nuclear power around the world must inevitably lead to a rise in nuclear weapons proliferation;
- (2) to identify and evaluate potential initiatives which could address any nuclear proliferation concerns while still supporting the anticipated expansion of nuclear power worldwide;
- (3) to prepare an overview of the anticipated evolution of the nuclear power industry worldwide, as well as an evaluation of the initiatives currently being developed to expand nuclear energy and strengthen nonproliferation. (This overview is presented in Appendix C and is summarized in Table 1 on page 3 of this report); and
- (4) to examine the implications for the existing nuclear nonproliferation regime that might result from a global expansion of civil nuclear power. It specifically challenged us to generate ideas for new international initiatives (or changes within existing programs) that could more effectively address the new nuclear proliferation concerns.

In addressing these tasks, we noted that the rise in nuclear power worldwide, and particularly within Third World nations, inevitably increases the risks of proliferation. What the United States must do is to find ways to *mitigate* those risks. In our work to address these TOR requests, we looked broadly and tried to imagine the full set of possible U.S. actions: new international treaties, the imposition of new requirements on current signatories of the Treaty on the Nonproliferation of Nuclear Weapons (referred to as the NPT), and a plethora of much lesser measures. However, as the discussion within the body of this report will show, we concluded that — to realistically make progress in strengthening proliferation protections — it will be necessary to set our sights considerably lower than seeking a new nonproliferation treaty.

We concluded that the current international climate is quite unpropitious for gaining support from non-nuclear weapon states to accept stricter measures against proliferation. While the root causes for this current condition can be debated, we believe that incremental measures, rather than either revolutionary or comprehensive changes, will be far more likely to succeed in the near term.

Even though, on the whole, the NPT has been highly useful in preventing proliferation, there has not been universal nor uniform success. Some nations did not participate at all (*e.g.*, India, Israel, Pakistan), while others have pursued nuclear weapons in clear violation of the Treaty. Some have successfully achieved nuclear weapons, despite the concerted efforts of the international community, but doubtless the rate has been considerably slowed because of these efforts. President Kennedy's prediction of March 21, 1963, that "personally I am haunted by the feeling that by 1970 there may be ...10 nuclear (weapons) powers instead of four, and by 1975, 15 or 20," did not come true. However, this success cannot be attributed to the power of the NPT alone, nor to the work of the International Atomic Energy Agency (IAEA), the UN organization that now implements the NPT. For all of the years since its creation, the NPT has been an important psychological and political barrier to proliferation, while the IAEA itself has continued to grow in capabilities and performance.

Unfortunately, in recent years, the NPT regime has begun to face even more difficult challenges. The cases of North Korea and Iran have demonstrated that nations can pursue nuclear weapons while claiming that they are only interested in peaceful nuclear energy applications. There have now been more than 10 independent states — above the original five depositary states — with either actual nuclear weapons, or at least in possession of feasible designs. Although these totals still number below what President Kennedy feared we would have to face, these nevertheless stand as a very sobering statistic for us. These historical data best demonstrate the continuing, and in fact, urgent need by all nations of the world to direct both greater vigilance and actions to prevent further proliferation (and to roll-back actual proliferation). We believe that, unless there are additional efforts to shore up the implementation of the NPT, we run the risk that the primary objective of the NPT will not be achieved.

The United States, in concert with six other nations, has proposed an "Attractive Offer" to states seeking to acquire nuclear power fuel and capabilities, and has also supported the creation of "fuel banks" to assure access to nuclear fuel at reasonable prices and with agreement to stronger proliferation protection conditions. The proposed "Attractive Offer" would be administered by the IAEA, and would facilitate countries in acquiring reactors, nuclear fuel supplies, and services from suppliers. The IAEA would assess safeguards, agreement to the Additional Protocol, and agreement to not use "sensitive" fuel cycles and then seek to match up requestors with supplier nations. Suppliers would require various written commitments from the receivers (*e.g.*, not to undertake either enrichment or reprocessing, or to export any of the transferred items to others). We believe there are additional nonproliferation measures than can be achieved as conditions for supplying nuclear power technology and fuel supplies. These measures are discussed below, and focus on the necessity for all of the nuclear suppliers to stand together in requiring strengthened proliferation protections in all future contracts.

We considered two cases:

First, we examined the potential for the nation states, which are already utilizing nuclear energy for electrical generation, to take advantage of already identified loopholes within the NPT structure to help them acquire nuclear weapons. (“Loopholes” describes the scenario wherein a nation can declare its commitment to nonproliferation, sign the NPT, build up its nuclear infrastructure to include either enrichment or fuel reprocessing (or both), but then withdraw from the Treaty to use those capabilities to rapidly produce nuclear weapons.)

Secondly, we focused the majority of our efforts on examining the risks of proliferation for those nations who would be acquiring nuclear generating capabilities for the first time. We have examined what additional controls and protections might be implemented (in both of these cases) to prevent proliferation associated with nuclear energy use.

TABLE 1

Countries giving serious consideration to nuclear power (within 10 years)

Azerbaijan	Belarus	Egypt	Indonesia	Kazakhstan
Norway	Poland	Lithuania	Estonia	Latvia
Turkey	Vietnam			

Countries with longer term plans underway

Algeria	Australia	Chile	Georgia	Ghana
Jordan	Libya	Malaysia	Morocco	Namibia
Nigeria	Bahrain	Kuwait	Oman	Saudi Arabia
Qatar	United Arab Emirates	Syria	Venezuela	Yemen

Other countries who also participated in 2006 IAEA Workshop on Nuclear Power

Cameroon	Croatia	Kenya	Sudan	Tanzania
Uruguay				

A discussion of each table entry is included in Appendix C: Countries Considering Nuclear Energy

Proliferation Outside of Nuclear Power Production

There are other means for nations to acquire nuclear weapons without embracing nuclear energy as a power source. For example, it is possible to establish small enrichment plants whose sole purpose would be to produce weapons-quality uranium. The most dangerous and continuing fallout of the A.Q. Khan network (which was active during the 1990s and early 2000s) was the clandestine manufacture, sale, and distribution of centrifuge enrichment devices, which are capable of producing reactor-grade or weapons-grade uranium.

The clandestine uranium enrichment efforts of both Iran and North Korea (at least initially) were not necessary for these nations’ production of nuclear power. *Enrichment and reprocessing capabilities thus represent quite dangerous paths to proliferation that are not effectively addressed by current international law or treaties.* We must find ways to block both open as

well as clandestine procurements of such capabilities, and to prevent their indigenous creation (which as technology expands will be an even more daunting task), if we are to prevent further international proliferation of nuclear weapons. However, since our assigned Terms of Reference asked us to focus on proliferation that might result from the perversion of infrastructures and capabilities *originally intended for civil nuclear power*, we did not explicitly address these possibilities in our deliberations. The importance of convincing nations to forego both indigenous enrichment and reprocessing capabilities was a constant focus of our work. A corollary realization was that we must similarly work to bring all existing enrichment and reprocessing activities under appropriate international safeguards and protections against misuse.

We also articulated the importance of *extended deterrence* as a vital factor to encourage other nations to agree to forego indigenous enrichment and reprocessing capabilities, in concert with eschewing the development of their own arsenals of nuclear weapons. Some 30 nations now depend on the United States for protection against nuclear weapons. The majority of these are technologically-advanced and economically-secure nations (*e.g.*, Japan and Germany), who could easily and quickly “proliferate” by developing their own nuclear weapons if they believed an independent nuclear force were required for their protection. Thus, the United States must continue to provide its nuclear umbrella to these nations to guarantee nuclear deterrence against both today's and tomorrow's threats, otherwise we seriously risk a rash of proliferation independent of whether these nations utilize nuclear power or not.

Recognizing that sound nonproliferation policy should address both the root causes of why nations may want to proliferate as well as the technical means through which nations might go about the creation of independent nuclear arsenals, the United States should consider the merits of expanding its nuclear umbrella to protect other newly-endangered states, and thus prevent their choosing to proliferate. A near term focus for such efforts should be on northeast Asia, the Middle East, and south Asia. The dual path of convincing independent states to embrace international safeguards against enrichment and reprocessing (with their concomitant inspections) while entrusting their own vital security interests to the United States or other reliable allies will be a difficult and challenging diplomatic package for the United States and other nations to obtain, but we believe there are few or no viable alternatives.

Defining the Scope of Changes in Nonproliferation Protections

A fundamental challenge which we examined was the question of how expansive should the scope of our thinking be when considering the implementation of potential proliferation protections. The Additional Protocol (to the NPT), which the United States proposed to the IAEA in 1997 as a “voluntary” legal document for supply of nuclear technology, would grant the IAEA expanded rights of access to information and sites regarding both declared and possible undeclared activities to those provided in underlying safeguards agreements. Under the Protocol, the IAEA and its inspectors would have access to all parts of a State’s nuclear materials and nuclear fuel cycle, including short notice inspections and the taking of samples. We questioned whether the Additional Protocol should become a *mandatory requirement* for nations to purchase nuclear fuel and technology and, if *yes*, how this can best be accomplished.

It is also apparent that the Additional Protocol itself is not comprehensive enough to block all of the paths to proliferation that are possible under the current nonproliferation treaty. Neither are the corresponding IAEA safeguards protections comprehensive enough. We investigated whether very substantive changes are needed to strengthen the NPT regime, or whether a new, more comprehensive treaty has to be considered to effectively close off further proliferation.

The NPT Should Not be Reopened at this Time

Even though the signatories of the NPT are obliged to inform the IAEA of any military activities and to subject themselves to safeguards including inspections, the “loophole” of first acquiring the capabilities, then withdrawing from the NPT, then converting the capabilities to military use, skirts these requirements. We believe that the NPT cannot be revised to close this loophole because reopening the Treaty for negotiation could more likely backfire and result in its further weakening. Furthermore, the U.S. ability to muster support for its position that nonproliferation measures should be strengthened has also been eroded by intelligence shortfalls and errors. In short, our own view that nuclear proliferation remains a high threat is not supported by most other nations.

Focusing on Nuclear Energy Suppliers

As a result, we turned our attention to the task of crafting additional “voluntary measures” which might prove so attractive to nations that are just beginning to acquire nuclear capabilities that the *odds* for their acceptance would be *high*. That is, we believe the best route for progress in strengthening the proliferation protections — for preventing nuclear power capabilities from being misused — will be through *supply-side agreements*, which should contain strict prohibitions against diversion of materials or facilities for weapons production. For example, we believe there must be explicit provisions that commit the receiving nations from having indigenous enrichment or reprocessing capabilities. Suppliers must bind the receivers to these conditions. This will require some new approaches to be successful, because the majority of suppliers are not as well connected to their governments as is the case in the United States.

Thus, we believe that it may be possible to require such policies as placing a clause within any contracts written to bring nuclear energy use into countries that seek new or additional nuclear generating capabilities. An obvious corollary action, if such an approach is to be pursued, is that it will be *critical* for *all* nuclear supplier states to demand that such provisions must be agreed to before nuclear-generating capabilities would be supplied.

Recommendation 1: The Department of State should pursue strategies that would provide reliable, economical supplies of fuel to nations undertaking new or additional nuclear energy plants.

Recommendation 2: The Department of State should work with other supplier states to jointly establish guidelines by which to judge compliance with recipients’ commitments to forego

enrichment and reprocessing capabilities. The suppliers should also develop criteria and procedures for shutting off fuel and hardware supply in the event that a recipient is found to be non-compliant. The contract of supply should make clear the full range of diplomatic and economic responses that would ensue in event of non-compliance.

Recommendation 3: The United States should focus its nonproliferation efforts for the near term on uniting the nuclear suppliers, rather than taking on the full panoply of international states. In taking this approach, it will be even more important that there be strong and steadfast support among the supplier states that new nonproliferation measures must be included in all commercial nuclear supply contracts, with commitment at a governmental level to enforce same.

Uniting the Nuclear Supplier States

We recommend that U.S. efforts focus on discussions with the other nuclear suppliers for the near term, rather than taking on the full panoply of international states. However, in taking this approach, it will be even more important that there be strong and steadfast support among these states that such new nonproliferation measures *must* be included in all supplier commercial contracts.

A declared intent of the suppliers will be to guarantee nations' access to nuclear fuels at reasonable prices. While this aim is obviously the opposite of exploitive behavior, it will nevertheless be important that any relationships we establish among these nuclear suppliers must never seek to exploit or negatively impact on the recipients' nuclear programs, energy production, or their economies. Any actions which might appear to be driven by a desire to dominate worldwide supply of nuclear materials for economic reasons (*i.e.*, in cartel-like behaviors) would undoubtedly undercut the likelihood that new nations would continue to accept fuel supplies or to honor nonproliferation provisions. Indeed, a likely reaction of the receiving nations might be to develop their own means to supply the needed nuclear materials, directly defeating our intended nonproliferation benefits. *Thus, success in this approach will require that we walk a fine line — making available nuclear power technology at reasonable costs, but also requiring that those nations who receive the nuclear technology commit to strict measures that ensure peaceful uses only.*

We are not naïve in our realization of the challenge of winning acceptance of such measures — even though we believe that the value of such measures as a universal good will be widely acclaimed. But, at the same time, we realize the extreme difficulties to be overcome in achieving effective nonproliferation through means of contract provisions (in what will likely be seen as just “commercial sales agreements” rather than international treaties). In any case, the road ahead for achieving better means of preventing proliferation will not be an easy one.

Other Issues that must be addressed to Assure Nuclear Power Growth

Corollary issues arise from concerns over how to solve “the tail end of the fuel cycle.” Obviously, leaving spent fuel at reactor sites around the world raises the risk that it will be used

for weapons purposes. Returning it to the country-of-origin also raises difficulties, primarily political, but also technical.

What to do with the highly radioactive wastes produced by nuclear power generation remains an unsolved problem worldwide. We in the United States continue to be stalemated over how to dispose of our own radioactive wastes from nuclear power generation. However, expanding our sights — to review the status of nuclear waste disposal in the rest of the world — reveals that, to-date, no nation has achieved a satisfactory solution to this problem.

In the earlier history of nuclear power within the United States, a number of optional waste treatment processes were explored. Each one was designed to offer improvements by either reducing the volume of waste or by reducing the specific radioactivity of the spent fuel and thereby reducing the heat load for design of a permanent repository. These treatment processes also had two other dual goals:

- (1) To separate out the uranium and plutonium so that these could be recycled into the fuel elements for other nuclear reactors (the primary objective at the time, as a shortage of uranium was expected, and recycling the fuels into successive reactors greatly expands the amount of energy that can subsequently be generated from the original uranium supply); and
- (2) To sufficiently partition the long-lived radioisotopes from the shorter-lived fission products in order to reduce the time scale for which any waste storage repository would have to ensure that these wastes would remain isolated from the biosphere.

This would lower the required design lifetime (for a repository) from more than a million years to approximately one thousand years. (Note that, recently, a U.S. federal judge was persuaded to increase the lifetime goal for designing the proposed Yucca Mountain waste repository upwards to *a million years*, but it is important to note that this decision was made for wastes that would not have been treated according to the processes (1) and (2) above. Far shorter design lifetimes would suffice for the more highly-partitioned wastes that were originally conceived of for the U.S. repository.)

U.S. plans for how to solve the nuclear waste problem took a major detour in the late 1970s and early 1980s when laws were enacted that restricted any reprocessing of nuclear wastes in favor of a once-through fuel cycle. Without reprocessing, the unfissioned nuclear fuel and the nuclear waste products would remain encased within the original fuel rods. The change in the waste form from reprocessed fuel and waste products to “untouched fuel rods” was primarily driven by proliferation fears. Specifically, it was believed that if the uranium and plutonium were separated from the highly radioactive waste, it might become more difficult to prevent the theft of the plutonium or uranium, and thus it would be easier for someone to steal or otherwise acquire the materials and use them for nuclear weapons. In 1977, the U.S. administration at that time justified the action to require all U.S. spent fuels to be stored only in their original state within reactor rods (*i.e.*, with no chemical separations of the constituent materials) on the basis of proliferation fears.

The administration argued then that even though the possibility for stealing the separated plutonium and uranium was not very likely within the United States, the risk for theft of such materials would be substantially greater within foreign nations. The United States ultimately fell back to a posture of attempting to set *an example* for the rest of the world by abolishing all reprocessing of our nuclear spent-fuel wastes. At the time, the United States believed that by making such a pronouncement against separation and reuse of fuels on proliferation grounds, both the European nations and Japan would abandon their reprocessing plans — a notion that history has proven to be naïve.

Now, after nearly 30 years since those U.S. decisions, the fact is that *no* other nation has chosen to follow the U.S. lead in this regard. Instead, the other industrial powers around the world have elected to reprocess their fuel. Faced with this result and little likelihood that others will abandon their current course, different alternatives for disposal of wastes are being examined within the Department of Energy and by the nuclear industry. A key premise is that the United States should once again pursue reprocessing — yet maintain current emphases on controls to prevent theft of uranium and plutonium. Only those technologies that do not result in separated plutonium are being considered.

A key obstacle to creating a permanent U.S. repository for spent fuel has been the political fight over where to locate it. This problem would be easier to solve if the volume of wastes were reduced and if they could be made less usable as a source for weapons materials. Similarly, if reprocessing were to remove the longer-lived radioactive components and to partition the major heat-generating components of the waste, determining the appropriate site for a repository would be easier.

Another complication is that Congress has not approved the appropriation of the Nuclear Waste Fund for such uses. (This Fund has been collected from nuclear electricity suppliers since 1983 and currently totals more than \$27 billion. The “tax” is collected at a rate of 0.1 cents per kilowatt-hour.) The funds have been mixed into the general Federal budget, rather than being sequestered into a separate fund for its originally intended purposes. (After the original bill had established the Waste Fund, the Congress had later made the availability of these funds dependent on other “appropriation ceilings being met,” in effect mixing these collected funds within the general government treasury.)

Both political parties are hesitant to allow any uses of this fund in the near term for fear that it would “break the bank” of federal expenditures. Yet there are lawsuits in progress against the government by the utilities to have the government take possession of the fuel and wastes. These lawsuits were entered when the government missed its original deadline of 1998 to take possession of the spent fuel and wastes. A “train wreck” is surely coming on this issue, and one argument for allowing reprocessing and partitioning of the wastes is that such a strategy would appear to make the licensing of a U.S. repository far more feasible, while still not requiring major implementation funding for several more years.

We support the promising initiative proposed and led by the U.S. Department of Energy, the Global Nuclear Energy Partnership (GNEP). GNEP is intended simultaneously to address

proliferation concerns while helping to develop export technologies that would bring the benefits of nuclear power more widely around the world.

GNEP would:

- develop and deploy advanced means for recycling spent fuel (without separating out the plutonium);
- develop and deploy advanced reactors that consume transuranics from recycled spent fuel;
- establish supply arrangements among nations to provide reliable fuel services worldwide, and taking back spent fuel for recycling, without further spreading of enrichment and reprocessing technologies; and
- cooperate with the IAEA to develop enhanced nuclear safeguards to monitor nuclear materials and facilities to ensure they are only used for peaceful purposes.

GNEP would favor only those reprocessing methods that keep the plutonium and uranium fuels mixed together rather than being separated prior to their re-introduction into reactors. The rationale for this approach is to erect an additional barrier that potential proliferators would have to overcome should they attempt to construct a nuclear weapon. They would first have to develop a means to separate the uranium and plutonium metals. Whether or not this “new thinking” by the United States can convince other nations to change their own reprocessing approaches is not known, but the costs for the changes are low in comparison to the benefits for nonproliferation.

However, the GNEP initiative has moved slowly because its budget plan has been caught up in the Continuing Budget Resolution for federal expenditures, which does not allow for new starts. The GNEP current budget of \$167.5M arises through allowed redirections of related programs, whereas the request for 2008 was for \$395M.

Opening up the U.S. plans to consider reprocessing of spent fuel can put us in an improved position to partner with the other leading nuclear power nations to collaborate in developing more acceptable solutions worldwide. Already Russia, the United Kingdom, France, China, and Japan have indicated interest in such joint efforts. U.S. participation in global cooperation with the nuclear power supplier states — to jointly solve and implement solutions to the current problems of the tail-end of the nuclear fuel cycle — can be a motivator to simultaneously strengthen nonproliferation protections as well. Past U.S. opposition to reprocessing has left us isolated from being a stronger player in the development of common solutions to these problems and lessened our influence in emphasizing proliferation concerns as this work proceeds.

We believe that the GNEP can be a valuable initiative for the United States, but the timing for these efforts will be important. If nuclear power does rapidly expand around the globe, but without solutions for either waste treatment or storage and without greatly improved protections against proliferation, it will be enormously more difficult to add-on technology solutions after the fact. It is both easier and wiser to build them in as part of the plan for any expansion of nuclear power use rather than attempt to add these protections later.

Recommendation 4: The Department of State should consider endorsing U.S. fuel reprocessing options as a key step toward undermining other nations' rationale for obtaining reprocessing and/or enrichment technologies.

U.S. reprocessing will help resolve the continuing fuel disposition problems. Only when these issues are resolved will it be possible to return U.S.-supplied fuel to the United States (or perhaps to a shared, international repository), significantly increasing protections against its being stolen, diverted, or attacked.

Appendix A – Summary of Recommendations

Recommendation 1: The Department of State should pursue strategies that would provide reliable, economical supplies of fuel to nations undertaking new or additional nuclear energy plants.

Recommendation 2: The Department of State should work with other supplier states to *jointly* establish guidelines by which to judge compliance with recipients' commitments to forego enrichment and reprocessing capabilities. The suppliers should also develop criteria and procedures for shutting off fuel and hardware supply in the event that a recipient is found to be non-compliant. The contract of supply should make clear the full range of diplomatic and economic responses that would ensue in event of noncompliance.

Recommendation 3: The United States should focus its nonproliferation efforts for the near term on uniting the nuclear suppliers, rather than taking on the full panoply of international states. In taking this approach, it will be even more important that there be strong and steadfast support among the supplier states that new nonproliferation measures must be included in all commercial nuclear supply contracts, with commitment at a governmental level to enforce same.

Recommendation 4: The Department of State should consider endorsing U.S. fuel reprocessing options as a key step toward undermining other nations' rationale for obtaining reprocessing and/or enrichment technologies.

Appendix B

Background on Nuclear Power and the Scope of Task Force Discussions

Anticipated Evolution of the Worldwide Nuclear Power Industry

Findings: There are several prominent descriptors of the current state of nuclear power and the strong expectation that there is likely to be significant growth in nuclear electricity production:

- (1) There are 435 reactors operating around the world.
- (2) There are 28 new reactors being constructed.
- (3) There are currently 222 new reactors “planned.”
- (4) Currently, 1.8 billion inhabitants of our globe (30% of the earth’s peoples) have no access to electric power.

Predictions of the need for new generating capacity are that the United States itself will require 50% more electricity by 2030. The rest of the world is predicted to need 100% more electricity by 2030. Nuclear energy is likely to be in great demand because of the large price increases for both oil or natural gas and the fact that nuclear power produces no carbon (or other) emissions.

A Parallel Assessment: We examined advance copies of a document from the American Council on Global Nuclear Competitiveness, entitled “The U.S. Domestic Civil Nuclear Infrastructure and U.S. Nonproliferation Policy” (April 2007).

This paper traces the history of the United States in leading the production and commercialization of nuclear power plants while also enjoying a dominant position in the nuclear supply market for several decades. The United States exercised a leadership role in shaping a global nonproliferation regime, in parallel with its civilian (non-defense) nuclear power efforts. Today the United States no longer enjoys such a dominant position, having not ordered a new U.S. nuclear power plant for more than 30 years. In the emerging expansion of civil nuclear power around the world, the United States is far from being a dominant supplier of plants, equipment, or fuel, and has no real international role in the reprocessing or spent fuel storage industries.

The Council report assessed the ability of the United States to advance its nonproliferation objectives if it continues to have erosion in its own nuclear power industries and infrastructures. The U.S. influence on these issues will also suffer if we continue to decline participation in international supply chains for nuclear power plants and components. It notes that the U.S. Enrichment Corporation (USEC) today has only a 30% market share worldwide. The report concludes that if the United States is to exercise strong and specific influence on the worldwide expansion of nuclear power, while also placing strong emphasis on protections against misuse of civil nuclear power infrastructures for nuclear weapons proliferation by foreign nations, we must

remain an active player in advanced nuclear power systems, uranium enrichment services, and nuclear fuel technologies.

It suggests that the United States must achieve growth in its domestic nuclear power industry as well. The report also appropriately cautions that civil nuclear cooperation should not be overstated in its importance. The roles and leadership of governments (as opposed to industry) in nuclear proliferation initiatives and agreements will always be essential.

The Global Nuclear Energy Partnerships (GNEP)

We received briefings on a U.S. program, led by the Department of Energy, called the Global Nuclear Energy Partnership (GNEP). GNEP was described as “a comprehensive strategy to increase U.S. and global energy security, reduce the risk of nuclear proliferation, encourage clean development around the world, and improve the environment.” The goal of the recently established program is to seek both energy and security in advanced energy initiatives. This is to be achieved by working with partner nations to deploy advanced reactors and advanced recycling of spent nuclear fuel, supporting developing countries to deploy secure and cost-effective reactors, and ensuring a reliable supply of nuclear fuel for developing nations (if they will agree to use nuclear power only for civilian purposes and will forego uranium enrichment and reprocessing of spent fuel that could lead to nuclear weapons development). The program also aims to develop technologies that can dramatically reduce nuclear waste volumes while avoiding separating out plutonium during the reprocessing of fuel and to effectively eliminate the nuclear byproducts that might be used by either unstable (national) regimes or terrorists to make nuclear weapons.

To date, both Japan and France have endorsed the GNEP *Statement of Principles*. Russia, China, and the United Kingdom are currently reviewing them.

We reviewed the GNEP Technology Roadmap and the “Path Forward.” A number of nations have expressed interest in teaming with the United States under the GNEP principles to acquire civil nuclear energy capabilities, including Indonesia, Poland, Libya, Bahrain, and Egypt.

Implications of the Expansion of Civil Nuclear Power for Nonproliferation

We reviewed the history of the Nonproliferation Treaty (NPT), the International Atomic Energy Agency (IAEA), and theorized various options for strengthening the nonproliferation regime.

Findings: The first call within the United Nations to “entirely eliminate the use of atomic energy for destructive purposes” appeared as early as Nov. 15, 1945. It has been a long and tortuous path to attempt to achieve same ever since. The IAEA dates to 1957 (the year 2007 marked the 50th anniversary of its creation), while the NPT was opened for signature on July 1, 1968, with the United States, United Kingdom, and Soviet Union (and 59 other nations) signing on that date. The NPT entered into force on March 5, 1970. In 1995, during the NPT Review Conference, the NPT was ratified for an Indefinite Extension of the Treaty. Only three major nations have never

joined the NPT: India, Pakistan, and Israel; while North Korea joined the NPT, then later abrogated it.

To date, 31 nations do not have comprehensive safeguards agreements in place (to tailor the basic safeguards) between the IAEA and themselves. Today, the IAEA has 144 member states, of which 35 sit on the Board of Governors (with 13 permanent seats). The agency Board has three committees (Technical Cooperation, Programs and Budget, and Safeguards) and day-to-day operations are carried out under a Secretariat and Director General. Currently, the IAEA has 2200 employees, drawn from 90 countries.

Because an NPT State could invoke its interest in nuclear power production, use it as a cover to acquire a complete infrastructure for the manufacture of nuclear weapons, and then withdraw from the NPT while never having “legally” violated it, the Bush administration proposed in 2004 that two new initiatives were needed to close this possible “loophole.” The first initiative would call on the Nuclear Suppliers Group to prohibit sales to nations that do not already possess full-scale functioning enrichment and reprocessing plants. Secondly, and in parallel with this step, the world’s exporters of nuclear fuel must ensure that there is reliable access at reasonable costs which could provide fuel for reactors around the world in order not to “force anyone” to have to develop their own enrichment or reprocessing to meet their nuclear generating needs. These concepts were codified in an “Additional Protocol” to the NPT, and, so far, 112 States have signed the Additional Protocol and seven more “have approved but not yet signed.”

Current U.S. Efforts to Strengthen Nonproliferation

We received briefings and reviewed a number of current initiatives within the U.S. Government: State Department; Department of Energy; and the Nuclear Regulatory Commission.

Findings: We reviewed the Six Country Concept for Reliable Access to Nuclear Fuel, communicated to the IAEA Board of Governors on May 31, 2006, by France, Germany, Netherlands, Russian, the United Kingdom, and the United States. It would use the competitive commercial market as the source of supply. The IAEA would assess whether a nation seeking fuel through this arrangement met the Additional Protocol, whether they had obtained fuel on the international market, and ensure that they had not pursued proliferation-sensitive fuel cycles. Supplier states would be qualified under a set of laws and regulations, and must not oppose exports by other states so qualified. (*i.e.*, they must avoid cartel-like behavior).

This proposal is described as the “Attractive Offer” and such fuel provisions would be enacted through commercial contracts with inter-governmental agreements. The latter would deal with the legal and policy issues governing the fuel, and would, for example, specify options for spent fuel and waste take-back or storage. It might also require that a receiving state refrain from enrichment or reprocessing for the life of the reactor to be supplied. This concept is still very much a “work in progress” and the proponents are awaiting a response from the IAEA Board of Governors.

We questioned the “Attractive Offer” approach as being essentially all “carrots” with no “sticks” to enforce the nonproliferation aims. The State Department representative agreed that such is the case at this point, and that further — all of their efforts have focused on working through the IAEA, rather than any other body (with the possible exception of the UN Security Council, where the current efforts to persuade Iran and North Korea to end their nuclear weapons programs are being carried out).

We reflected on the fact that a significant number of nations had nuclear weapon development programs in the past, which were given up *voluntarily*. The list includes South Africa, Switzerland, Sweden, Argentina, Brazil, Libya, and the former member States of the Soviet Union (during the CIS phase).

We evaluated the need for a set of legal prohibitions that would make it a crime to traffic in actual nuclear weapons, nuclear weapons design, special nuclear materials, and technology (including enrichment and reprocessing systems), perhaps with strong international enforcement, such as through the International Court of Justice. Although the Nuclear Suppliers Group still exists and it generates a trigger list that the countries involved are to self-police, history shows that its effectiveness is inadequate. An additional problem today is that not all suppliers are members of the Suppliers Group.

We received a report on the status of enforcements and prosecutions of those involved in the proliferation trafficking through the A.Q. Khan network.

We held a set of (highly classified) discussions with members of the Weapons Intelligence Proliferation and Arms Control Group (WINPAC) from the Intelligence Community (IC). The venue was a set of very interactive Q&A sessions with several of the regional experts to explore the current status of proliferation around the world.

Because of the sensitivity of those discussions, reporting on it will be left for others. However, the IC believes there is currently significant interest and activity in seeking to develop or acquire nuclear weapons (*i.e.*, to proliferate) by states and terrorist groups in many areas of the world. When we asked the group to generate for us a “Top Ten Worry List of States that May Proliferate,” they very quickly (and interactively) generated a much longer list, including within the Middle East.

New International Initiatives (or changes in existing programs) to Strengthen Nonproliferation

Findings: Here we came face-to-face with the heart of the problem: as nuclear energy grows worldwide, how can we ensure that others do not misuse this technology for weapon production? There is no one solution that fits all countries for all time.

The best approach we see so far is to achieve a regime where any enrichment and reprocessing of civilian spent fuel is only done by multilateral partnerships of states and only under strict

international safeguards. (Russia has a proposal that the contract under which a nation could lease fuel would become void if the receiving state builds its own enrichment capabilities.)

Establishing a Nuclear Fuel Bank

We were briefed on efforts wherein states that agree to forego national enrichment or reprocessing are guaranteed access to lease fuel at a market rate (from several suppliers). Russia has set aside quantities of enriched uranium for these purposes. The U.S. Secretary of Energy has also created a "fuel reserve" of 17.4 tons of highly enriched uranium that, after it is blended down to stocks of low enriched uranium (LEU), could be sold and used (with continued monitoring through the IAEA) as a means to assure access to nuclear fuel by developing nations.

The Nuclear Threat Initiative (NTI), a non-governmental organization (NGO) created by Ted Turner and Senator Sam Nunn, has promised a pledge of \$50M (if other states match it with \$100M) to create an LEU bank that would be administered by the IAEA.

Fuel Leasing

As the United States expands its nuclear commerce internationally, is there a means to achieve fuel return, for reprocessing or storage, after it is spent through electrical power production? We note that Russia has just established a law that allows Russian-produced fuel to be returned for reprocessing *only*.

Fuel Reprocessing and Storage

We identified a major set of hurdles to be dealt with in the United States, but seemingly of equal difficulty in other potential nuclear partner nations (*e.g.*, Russia, France). These myriad issues revolve around *how* to take back spent fuel (for either reprocessing or storage, or some of both). The "not-in-my-back-yard" problems in the United States discussed earlier in this report are legendary and they are springing up around the world as well. For example, the snail-like progress of the U.S. effort to create a repository at the Yucca Mountain in Nevada is but one major roadblock to being able to deliver on any ideas for how to store spent fuel or fissile products within the United States. We learned, however, that there are currently no laws that would prevent reprocessing of spent fuel from civilian reactors, but there is no budget nor a proven large-scale facility demonstration (since the proposed Barnwell plant was shutdown in the 1980s and the passage of the Waste Policy Act of 1987, which mandated a "once-thru" fuel cycle — *i.e.*, indefinitely deferring reprocessing).

However, no other nation has yet established a full process for what to do with spent fuel either. These problems seem almost certain to impact almost any plans and to stretch out anticipated timescales for improving nuclear fuel cycles while the use of civil nuclear power expands worldwide.

There are also fundamental barriers in place for any U.S. sharing of fuel reprocessing (fuel cycle) technologies with other nations. These would require a 1 2 3 Agreement to go beyond the current restrictions on sharing these technologies. Such an agreement requires extensive negotiation, with each agreement being a “custom” one, and ultimately would require ratification by the U.S. Senate.

Other Issues to Strengthen Nonproliferation Protections - Moving Forward

We identified a number of issues surrounding the NPT, including identified “loopholes” and shortfalls in verification through the IAEA. Some of the limitations of proposed initiatives stem from the fact that, over the years, the IAEA has evolved to a posture where a majority of the players represent small, non-nuclear, developing nations.

A senior State Department representative who met with us responded to the question: “Have you thought about what might be done either to modify or go beyond the NPT?” by saying that changes of the NPT always seems to be in the “too hard” category.

We also considered, “should we consider only improvements to the NPT itself or contemplate a more comprehensive treaty?” Our response of “no,” which we stated above, is primarily driven by the current disarray of nations over proliferation, and the fear that in the near term, opening up this issue could make things worse, not better.

For example, there were two fundamental principles of the U.S. Atoms for Peace program that were not, repeat not, incorporated into the NPT:

- (1) an absolute statement that there is a prohibition against using nuclear power for non-peaceful purposes; and
- (2) that verification of this prohibition by other nations is a requirement.

Similarly, the United States began the NPT process (in negotiations with the USSR) with an assumption that, beyond the five depositary States, all others must forswear not to manufacture or use nuclear weapons, and to accept IAEA safeguards (rather than the process adopted wherein each country negotiates a “customized” contract agreement with the IAEA). Unfortunately, however, this important concept never made it into the NPT.

We examined the option of negotiating a Verification Protocol to the Nonproliferation Treaty which would move the IAEA progressively from an *accountancy* function to a *detective* function to a *law enforcement* function. The inherent difficulty with such a measure is apparent from the example of UNSCOM. UNSCOM inspectors (with many individuals seconded from the IAEA) attempted to determine whether or not Iraq had developed and was hiding WMD, including nuclear weapons, after the first Gulf War. Iraq was able to repeatedly defeat the inspectors’ attempts to verify and inspect. In fact, most of the major discoveries were a result of serendipity rather than systematic inspections.

We also considered a more stringent set of export controls and a “consultative commission” whose role would be to assess these and suggest modifications if/as technology changes. Such an approach should be considered further as (and if) the discussions between the Nuclear Supplier states appear to hold the possibility of generating a set of such controls and an enforcement body that would be acceptable to all.

One of our State Department presenters suggested that *the United States needs to identify the big issues and articulate them, but must avoid going too far in “developing the solution,” but instead depend on the process of negotiation with others to develop the solutions.* The wisdom of such an approach — that people are more likely to support what they have a hand in creating — is an important observation, particularly against the historical backdrop of the Nonproliferation Treaty, where no one got a chance to negotiate the Treaty language except two of the depositary states.

Perhaps the greatest challenge we identified — in terms of the timescale to create a new regime for nonproliferation within the expanding civil nuclear power efforts — is: “What do we do about reprocessing, spent fuel storage, and disposition?” The intense differences between the industry, the Department of Energy, the Congress, the State of Nevada (and its representatives and a key Senator), and the courts over the issue of a U.S. repository have resulted in gridlock. Meanwhile, the crowded local storage of spent fuel at the operating reactor sites continues to grow. The Department of Energy, through its Global Nuclear Energy Partnership efforts is currently evaluating some major ideas for how to make progress on these problems, which would offer hope that the United States would be positioned to take on the larger problem of solutions for waste reprocessing, storage and disposition, and for transmutation of selected fuel products that might provide a model for global handling of nuclear power spent fuel and wastes.

Appendix C

Background Paper: Countries Considering Nuclear Energy (Prepared by U.S. State Department Staff, Spring 2007)

Countries with plans for or giving serious consideration to nuclear power in the near term (within 10 years)

Azerbaijan: The government is planning construction of a 1000-1500 MWe nuclear power reactor, possibly starting 2010 in the Avai region in the south of the country, supporting proposed industrialization there.

Belarus: In mid 2006 the government approved a plan for the construction of an initial 2000 MWe PWR nuclear power plant in the Mogilev region of eastern Belarus. In February 2007, it was announced that construction of this plant would start in 2008, with commissioning planned for 2014 or 2015. Both Russian and Areva technology have been under consideration. Two further units are envisaged for operation by 2025. Belarus is also considering participating with Russia in a new nuclear plant to be located in that country.

Egypt: Egyptian interest in acquiring a nuclear power plant dates at least from an unsuccessful attempt to acquire a desalination/power reactor in the mid-1960s, but enthusiasm waned after the Three Mile Island and Chernobyl accidents. Interest in nuclear energy revived in September 2006, when President Mubarak and Gamal Mubarak, his son and likely successor, publicly called for nuclear power to play a role in meeting future energy needs. Egypt is currently conducting a study of the associated political, economic and technical issues. Egypt attended the December 2006, IAEA workshop for states considering nuclear power.

Indonesia: Indonesia has been planning for nuclear power since at least 1978. The government's national energy plan currently calls for building four 1600 MWe nuclear power plants by 2016. The Korea Hydro and Nuclear Power Company has concluded an agreement with the Indonesian government on assistance in the introduction of nuclear power. Indonesia has been the most interested of the so-called "reactor states" to receive information about GNEP, with DOE, State and the Nuclear Energy Institute meeting with the Minister of Science and Technology in July 2006. Indonesia attended the December 2006, IAEA workshop for states considering nuclear power.

Kazakhstan: Kazakhstan has substantial experience in nuclear activities, but no currently operating power reactors. Kazakhstan's BN-350 reactor on the shore of the Caspian Sea began operating in 1972 and generated up to 135 MWe for desalination, district heating, and electricity needs, but was shut down in 1999. The government is considering proposals for a new nuclear power plant to be located near Lake Balkhash to replace the BN-350.

Norway: To lessen continued reliance on North Sea gas and oil, Norway is seriously considering nuclear power, probably based on a thorium fuel cycle. (Norway is estimated to hold the world's third largest reserves of thorium.) Three Norwegian energy companies (Bergen Energi, Statkraft, and Thor Energi) have expressed strong interest in developing nuclear power.

Poland + Baltic States: The Polish cabinet decided early in 2005 that for energy diversification and to reduce CO₂ and sulfur emissions the country should move immediately to introduce nuclear power, so that an initial plant might be operating soon after 2020. In February 2007, Lithuania, Estonia, Latvia and Poland agreed to jointly build a new nuclear plant at Ignalina, Lithuanian. (This would replace the Soviet-era nuclear plant at Ignalina, now shut down at the insistence of the European Union.) Lithuania as host will have 34% of the project and Poland, Latvia and Estonia 22% each. At least one unit of the project is expected to be operating by 2015. Poland and Lithuania both attended the December 2006, IAEA workshop for countries considering nuclear power.

Turkey: In August 2006 the government announced plans to have three nuclear power plants operating by 2012-15, a \$10.5 billion investment. Discussions have been under way with Atomic Energy of Canada Ltd for two 750 MWe CANDU units as an initial investment. The first units would probably be built at Akkuyu, since the site is already licensed.

Vietnam: Vietnam is considering introducing its first nuclear power plant in the 2015-2020 timeframe, with the goal developing an eventual capacity of 2,000 MWe- 4,000 MWe. A feasibility study for the first nuclear plant is to be completed in 2008, followed by a formal approval process and open bidding. Vietnam has already engaged in discussions with vendors from Canada, Japan, South Korea, Russia and the United States. In November 2006, officials visiting Washington, D.C., to discuss radioactive safety issues inquired about the possibility of a future bilateral agreement with the United States on peaceful nuclear cooperation.

Countries with longer term plans or studies underway

Algeria: Algeria attended the December 2006, IAEA workshop for countries considering nuclear power. In January 2007, in a speech at Algiers, IAEA Director General ElBaradai noted Algeria's interest in nuclear power for both desalinization and electricity production. Algeria has also stated its intention to join INPRO, the IAEA's International Project on Innovative Nuclear Reactors and Fuel Cycles.

Australia: On April 28, 2007, Prime Minister Howard announced a new government "strategy for the future development of uranium mining and nuclear power." (Australia is already a major exporter of uranium.) The strategy included development of a regulatory regime for possible nuclear energy plants and enhancement of nuclear education, research and development. He also announced Australia's intent to seek membership in the Generation IV International Forum, an international body coordinating research and development on advanced nuclear energy systems.

Chile: The debate on the potential development of nuclear power in Chile has recently been reopened, in part due to recent cuts in foreign supplies of natural gas but probably also in part

due to political pressure from Brazil's and Argentina's recent announcements of renewed interest in nuclear energy. In September 2006, President Bachelet announced that although no nuclear plants will be constructed during her administration, the Government will carry out studies for the next administration. In 2006, Bachelet also signed a bilateral agreement with Brazil for cooperation in peaceful nuclear energy. Chile also has a peaceful nuclear cooperation agreement with South Korea; the two countries monitor bilateral cooperation under the auspices of a Chile-Korea Joint Standing Committee on Nuclear Energy Cooperation. Chile attended the December 2006 IAEA workshop for states considering nuclear power.

Georgia: Georgia is considering future options for nuclear power, in part to help develop more energy independence from Russia. However, Georgia's interest in nuclear power will probably for the near term take a back seat to the development of its energy independence by other means (*i.e.*, oil and hydropower development) and addressing other domestic issues. Georgia attended the December 2006, IAEA workshop for states considering nuclear power.

Ghana: The Energy Commission of Ghana is currently undertaking a study of options for future electrical generating capacity. Nuclear energy is one of the options they are considering for the long term, with specific focus on the South African PBMR. In July 2006, a member of the Commission, Professor A.K. Addae, visited DOE and NRC to seek information on the PBMR. In March 2006, the director-general of the Ghana Atomic Energy Commission (not to be confused with the Energy Commission of Ghana), publicly stated that nuclear power should be included in the national energy mix to serve as a basis for sustainable development. In June 2005, Ghana raised its interest in nuclear energy with U.S. officials in the margins of the IAEA Board of Governors meeting. In December 2006, Ghana participated in the IAEA workshop for countries considering nuclear energy.

Jordan: In December 2006, Jordan sent three participants to the IAEA workshop for countries considering nuclear energy, including one it funded itself. In January 2007, King Abdullah publicly expressed strong interest in developing nuclear power for Jordan.

Libya: In a February 2006 letter to the Secretary and her G-8 counterparts, the Libyan Foreign Minister linked Libya's delayed ratification of the Additional Protocol to the perceived lack of benefits flowing from its decision to renounce its WMD programs. The letter specifically requested G-8 support in constructing three nuclear power plants (totaling 1500 MWe) and assistance with the various nuclear-related research projects. While Libya has since signed and ratified the Additional Protocol, Libyan officials continue to make the appeal for increased nuclear cooperation, including a desire to explore nuclear reactors for power or desalination. Libyan officials have also requested U.S. Embassy assistance in communicating their interest in nuclear energy to the Westinghouse and General Electric corporations.

Malaysia: The Malaysian Government has undertaken a comprehensive energy policy study, including consideration of the nuclear power, to be completed before 2010. The state-owned utility TNG is tentatively in favor of nuclear power, and in August 2006, the Malaysian Nuclear Licensing Board said that plans for nuclear power after 2020 should be brought forward and two reactors built much sooner. Malaysia participated in the December 2006 IAEA workshop for countries considering nuclear power.

Morocco: The Moroccan government intends to diversify its energy sources and, although no final political decision has been made, it is strongly considering nuclear power as part of that effort. It has also long expressed interest in nuclear energy for desalination and has participated in IAEA technical cooperation projects studying the possibility. The state electrical company has tentative plans to build a 1000 MWe nuclear power plant to come on-line between 2015 and 2016, pending final political approval. In December 2006, Morocco participated in the IAEA workshop for countries considering nuclear energy.

Namibia: Namibia is an exporter of uranium ore. In 2006, Namibian officials approached the U.S. Embassy to express interest in developing nuclear power. Namibia participated in the December 2006 IAEA workshop for countries considering nuclear power. During an official visit to Namibia in March 2007 the Russian prime minister announced that his country was prepared to provide nuclear power plants for Namibia.

Nigeria: According to Embassy reporting, Nigeria's interest in pursuing the development of peaceful nuclear energy dates from 2003. The policy was publicly announced in the A National Energy Policy published in 2005. On August 1, 2006, Nigerian President Obasanjo stated that Nigeria was ready for nuclear power. Nigeria participated in the December 2006, IAEA workshop for countries considering nuclear power.

Persian Gulf States: On December 11, 2006, the Gulf Cooperation Council (GCC) announced that it was commissioning a study on setting up a common peaceful nuclear energy program. The GCC consists of Bahrain, Kuwait, Oman, Saudi Arabia, Qatar and the United Arab Emirates (UAE). In the IAEA and other forums, several GCC members have long expressed interest in using nuclear power for water desalination, and South Korea is conducting an IAEA-sponsored feasibility study with the UAE. Officials from Bahrain, Kuwait and the UAE all attended the IAEA December 2006 workshop on Issues for the Introduction of Nuclear Power. On the margins of that meeting, a Kuwaiti mentioned to a U.S. official his country's desire to develop nuclear energy, but in a safe and secure manner.

Syria: Syria had plans in the 1980s to build a Soviet era light water reactor, but abandoned them after the Chernobyl accident. In December 2006, Syria participated in the IAEA workshop for countries considering nuclear energy. The participant noted that a detailed study (NFI) on electricity demand and oil production shows Syria needs to include nuclear power for electricity production not later than 2020, or even earlier.

Venezuela: Venezuelan President Hugo Chavez has publicly stated that Venezuela is studying the possibility of using nuclear power to generate electricity. Argentina's Foreign Minister Rafael Bielsa announced on October 10, 2006, that Venezuela was seeking to purchase a medium-sized nuclear reactor from Argentina for energy production (a reactor design which was not ready for export). It is unclear whether Chavez is truly serious about the intent to pursue nuclear power, as the country is clearly not short of energy supply. Venezuela participated in the December 2006 IAEA workshop for countries considering nuclear power.

Yemen: Yemen participated in the December 2006, IAEA workshop for countries considering nuclear power. In late March 2007, a delegation from the American Power Corporation, accompanied by representatives of potential investors, went to Yemen to discuss financing nuclear power projects for electricity generation and desalinization.

Other participants in the December 2006 IAEA workshop for countries considering nuclear power

In addition to the participants noted elsewhere in this paper, the following countries without nuclear power participated in the workshop: Cameroon, Croatia, Kenya, Sudan, Tanzania and Uruguay.

Appendix D – Terms of Reference

UNDER SECRETARY OF STATE FOR
ARMS CONTROL AND INTERNATIONAL SECURITY
WASHINGTON

February 8, 2007

MEMORANDUM FOR THE CHAIRMAN,
INTERNATIONAL SECURITY ADVISORY BOARD (ISAB)

SUBJECT: Proliferation Implications of the Global Expansion of Civil
Nuclear Power

The ISAB is requested to undertake a study of the proliferation risks associated with global expansion of civil nuclear power.

After a period of relatively slow growth in nuclear power in the latter part of the 20th century, there is now a growing interest worldwide in expanding nuclear power production, including in countries that do not currently generate nuclear power. Ever-increasing energy demands, security of energy supplies, and environmental considerations are driving the debate on the need for a greater investment in nuclear energy. A large increase in nuclear power production would mean uranium enrichment for reactor fuel and spent fuel reprocessing would expand, perhaps with a corresponding increased risk of the spread of critical fuel cycle technologies to new countries. The consequences for nuclear weapons proliferation could be profound.

The Nuclear Non-Proliferation Treaty (NPT) and its associated safeguard programs are intended to stop the diversion of materials and technology from legitimate peaceful uses to prohibited weapons programs. Because of the real risk that civilian nuclear programs could provide a path to a weapons capability, the U.S. has proposed to establish a mechanism at the IAEA to assure reliable access to nuclear fuel for states that forego enrichment and reprocessing, and launched the Global Nuclear Energy Partnership (GNEP) to promote nuclear energy technologies for recycling spent fuel without separating plutonium.

This ISAB study should include:

- An overview of the anticipated evolution of the nuclear power industry worldwide;

- An evaluation of the implications of the expansion of civil nuclear power for the nuclear nonproliferation regime;
- An evaluation of the initiative being developed to expand nuclear energy and strengthen nonproliferation, including ideas for making the initiative more effective; and
- Ideas for new international initiatives, or changes to existing programs, that could address the nuclear proliferation concerns associated with the anticipated expansion of nuclear power.

The ISAB may expand upon the tasks listed above, as it deems necessary. I request that you complete the study in 180 days. The Under Secretary of State for Arms Control and International Security will sponsor the study. The Director for Strategic Planning and Outreach will support the study. The Executive Director will identify an Executive Secretary for the study.

The study will be conducted in accordance with the provisions of P.L. 92-463, the "Federal Advisory Board Committee Act."

A handwritten signature in dark ink, appearing to read "Rb Joseph". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Robert G. Joseph

Appendix E - Members and Project Staff

Board Members

Amb. Paul Wolfowitz (Chairman)

Dr. Michael R. Anastasio

Ms. Alison B. Fortier

Dr. William Graham

Amb. Robert Joseph

Mr. Mitchel B. Kugler

Amb. Ronald F. Lehman

VADM Robert Monroe, USN (ret.)

Dr. Gordon Oehler

Dr. Keith B. Payne

Dr. Robert Pfaltzgraff

Senator Charles Robb

Amb. C. Paul Robinson

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Mr. Brandon Buttrick
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Ms. Thelma Jenkins-Anthony
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Appendix F - Individuals Consulted by the Task Force

Dr. J. Stephen Adams	Physical Scientist, Office of Multilateral and Nuclear Security Affairs, International Security and Nonproliferation Bureau, Department of State
Mr. Scott L. Campbell	President, American Council on Global Nuclear Competitiveness
Mr. Stan Fraley	Director, Office of Nuclear Affairs, Verification, Compliance, and Implementation, Department of State
Dr. Dan Fenstermacher	Office of Nuclear Energy, Safety, and Security, International Security and Nonproliferation Bureau, Department of State
Mr. Timothy Frazier	Senior Technical Advisory for Nuclear Energy, Department of Energy
Mr. Kurt Kessler	Office of Regional Affairs, International Security and Nonproliferation Bureau, Department of State
Dr. Peter B. Lyons	Commissioner, Nuclear Regulatory Commission
Dr. Frederick McGoldrick	American Council on Global Nuclear Competitiveness
Ms. Patricia Metz	Office of Nuclear Energy, Safety, and Security, International Security and Nonproliferation Bureau, Department of State
Dr. Victor Reis	Senior Advisor, Office of the Secretary, Department of Energy
Dr. Thomas L. Sanders	Vice President, American Council on Global Nuclear Competitiveness
Mr. Adam Scheinman	Assistant Deputy Administrator for Nonproliferation and International Security, National Nuclear Security Agency, Department of Energy
Mr. Dennis Spurgeon	Assistant Secretary of Energy (Nuclear Energy), Department of Energy
Mr. Mark Skootsky	Weapons Intelligence, Nonproliferation, and Arms Control Center
Dr. James Timbie	Senior Advisor to the Under Secretary for Arms Control and International Security, Department of State
Mr. William Tobey	Deputy Administrator for Defense Nuclear Nonproliferation, National Nuclear Security Agency, Department of Energy
Dr. Larry Turnbull	Chairman, Joint Atomic Energy Intelligence Committee