CUBA'S NUCLEAR POWER PROGRAM AND POST-COLD WAR PRESSURES

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At the closing session of the Cuban National Assembly on July 6, 1993, Fidel Castro stated, "we are really facing a very, very great challenge. We have to be ready for greater difficulties than we can imagine."[2] This stark assessment of Cuba's economy is based on the fact that oil imports and international trade have declined to half their previous levels, resulting in a severe energy crisis as well as shortages of food, medicine, and most other goods. Of all the issues confronting Cuba in the now two-year-old "special period,"[3] energy has emerged as the most daunting. How can Cuban government justify its enormous capital outlays in the pursuit of nuclear energy while most Cubans have been reduced to rations of one piece of bread daily?[4] The answer is that only a reliable source of energy can get Cuba back on its feet again and allow it to feed its people. That source, in the absence of a steady flow of imported oil, may well be nuclear energy.[5] Miguel Alfonso, a professor of International Relations at the University of Havana and Cuba's representative to the United Nations Commission on Human Rights, clearly captured the importance of the issue when he stated, "Nuclear energy is a must. It is not impossible. We will complete it with the Russians or other sources (...)." He concluded, "for the time being it is only delayed."[6]

In September 1993, Moscow advanced $30 million to Cuba to mothball the Juragua project in the Cienfuegos province, where two 440-VVER reactors sit nearly completed.[7] This ends, at least for the time being, speculation over the nuclear safety and proliferation concerns surrounding the Cuban nuclear program. Given the stop-and-go nature of the project in the past three years and Cuban overtures to the nonproliferation community, this temporary lull in the project presents an opportunity to assiduously address these issues.

While this announcement could be viewed as a death knell of sorts for Cuban nuclear power aspirations, Cuba has had to clear a number of hurdles over the past several years to reach this point. When Russian officials agreed in April 1992 to continue funding for the construction of two VVER-model reactors in Cienfuegos province, the regime of Fidel Castro appeared to have cleared the last hurdle in its 10-year quest for nuclear ascendancy. The nuclear power reactors were to be the crowning achievement of the Cuban revolution. Indeed, the Cubans claimed that the first reactor in Juragua was more than three-fourths complete.[8] Cuba needed only to negotiate payment of $21 million to the German firm Siemens AG for the installation of instrumentation and control facilities at Juragua-1 to reach its goal. The agreement was all but forgotten in the September 1992 "State of the Revolution" address, when Fidel Castro proclaimed that Cuba was temporarily suspending construction of the nuclear power reactor at Juragua. In announcing his bitter and painful decision at that time, Castro blamed the Russians for demanding $200 million for continued work on the project. Yet, on November 4, 1992, Russian and Cuban officials announced that they had agreed to resume the long-stalled construction of Cuba's nuclear power plant with French assistance. Although this agreement called for resuming construction at the Juragua site, no concrete plans have ever been detailed.

Moreover, now that Russia has advanced $30 million to mothball the reactor site at Juragua, the United States and the nonproliferation community have new opportunities for cooperation with Cuba. Such cooperation would be timely because of the recent move of Cuba towards a broader endorsement of nonproliferation goals. A letter from Secretary of State Warren Christopher to U.S. Senator Connie Mack stated: "The Russian government, which is fully aware of our non-proliferation and safety concerns about the Juragua plant, has concluded that completion of the project is not feasible under present circumstances."[9] This cooperation could serve to eliminate safety concerns about the construction at Juragua, and also eliminate proliferation fears concerning a possible weapons program surrounding Cuba's power program.

It is important to note that shortly before Castro's announcement on the suspension, Cuba declared at the August 1992 Organizacion por la Prohibicion de Armas Nucleares en America Latina (OPANAL)[10] meeting in Mexico City that it would join Argentina, Brazil, and Chile in signing the newly-amended Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco). The new amendments would, in effect, place the nuclear facilities of all signatories under full-scope international safeguards.[11] These changes to the regional agreement suggest two catalysts for Cuba's action: the nonproliferation regime's strengthening resolve to condition nuclear exports to non-signatories of the Non-Proliferation Treaty (NPT) on acceptance of full-scope safeguards and Russia's inability to act as a reliable, sole-source provider of capital and technology.

Because of Cuba's positive movement on the issue, the world community and particularly the United States should increase cooperation on the most pressing issue related to Cuba's nuclear program, that of nuclear safety. The potential safety hazards at Juragua surely concern Cuba's leadership, which has not rejected safety assistance from the United States and the international community in the past. In fact, if economic considerations are the main factors preventing safe completion or completion at all of the reactor, Cuba may welcome this type of aid. By providing assistance in this area, the United States and the international community can establish contacts with Cuba that may further influence its attitude toward nonproliferation. In summary, the United States should use this window of opportunity to see that Cuba's nuclear program, long feared as both a proliferation and safety concern, becomes neither.

To provide a basis for considering these opportunities, this focused case study examines the history of Cuba's nuclear program. This analysis includes current and future proliferation developments, the political and economic motivations for pursuing nuclear power, the difficulties faced in continuing construction, and the nuclear safety questions surrounding the project.

NONPROLIFERATION CONCERNS

Cuba has never had a positive nonproliferation record. Since the first days of the nonproliferation regime, it has strongly opposed the efforts of the international community to curb the spread of weapons of mass destruction. The Havana government was one of only four countries in the United Nations General Assembly to vote against the resolution endorsing the NPT in June 1968. Furthermore, Cuba is now the only major Latin American state that has neither signed nor ratified the Treaty of Tlatelolco (despite its 1992 announcement). It has repeatedly put forward conditions for its accession to the treaty, including the cessation of persistent hostility from the United States, a U.S. pledge to renounce the use of military force against Cuba, and the end of port visits of U.S. ships equipped with nuclear weapons to the U.S. Naval Base at Guantanamo Bay.

Before the Soviet break-up, Cuba's generally negative attitude towards nonproliferation had the effect of undermining the credibility of the Soviet position on these issues. In fact, after 1968, Cuba's unyielding stance on nonproliferation was the only apple of discord in the generally amicable Cuban-Soviet relationship. Cuba's intransigence aroused suspicion. This behavior, along with the questionable economic value of the nuclear energy program, was interpreted by those in the anti-Castro community as an indication of the possibility of another, more nefarious, rationale behind the Cuban program. At the end of the 1980s, rumors about a secret weapons program were magnified in a series of denouncements of the nuclear program made by knowledgeable and seemingly trustworthy Cuban defectors.[12] There has been little evidence to support these claims, but the Congressional hearings in July 1991 before the Committee on Energy and the Environment as well as an October 1992 General Accounting Office (GAO) study of the issue highlight the significance of these concerns. The current state of Cuban nuclear activities has provided little evidence of a weapons programs. This conclusion is buttressed by experts in the field who consistently refer to "Cuba's inability to develop nuclear weapons."[13]

At the insistence of the Soviets, Cuba signed three safeguards agreements with the International Atomic Energy Agency (IAEA), which currently apply to all nuclear facilities, including

nuclear power plants, a nuclear research reactor, and a zero-power nuclear reactor.[14] In January 1993, Cuba announced the opening of a nuclear waste facility. Under an INFCIRC/66 model agreement, this facility would be safeguarded, but it is uncertain whether or not Cuba and the IAEA have negotiated such an agreement.[15] Cuba may now be driven toward participation in the nonproliferation regime by Russia's refusal to bankroll Cuban nuclear activities.

HISTORICAL BACKGROUND

Before weighing the motivations surrounding Cuba's nuclear program, it is important to examine the program's historical context. Cuba began to show an interest in nuclear energy before the 1959 Revolution. Its first nuclear accord was struck during the Bautista regime in June 1956. The agreement envisaged close cooperation with the United States in civilian uses of nuclear energy. The initiative for the agreement came from the United States, which was making an aggressive attempt to capture the world nuclear market under the "Atoms for Peace" policy.[16] Under the terms of this agreement, a small nuclear power plant of 40 megawatts was to be built jointly by American Machine Foundry and Mitchell Engineering (Great Britain) in Pinar del Rio province. However, the plan was canceled in the middle of 1960 after the break in diplomatic relations between Cuba and the United States.

The new revolutionary leadership inherited this interest in nuclear energy. The government, however, was seeking support from Cuba's new ally, the Soviet Union. The first sign of links between the Cuban and Soviet governments in the nuclear field appeared in January 1967, when a Soviet-sponsored photo exposition, "Atomic Energy for Peaceful Purposes," was held at the Academy of Sciences in Havana. Nine months later Granma and Pravda announced almost simultaneously that the countries had reached an agreement on cooperation in the peaceful uses of atomic energy.[17]

Under the accord, the Soviet government was to provide Cuba with a research reactor for experimental and teaching purposes, as well as hardware to set up physics and radiochemical laboratories. The Soviet Union also agreed to assist in assembling and operating equipment exported to Cuba. Soviet specialists were to be sent to Cuba to "help in organizing studies on a corresponding faculty of Havana University to train specialists in physics, nuclear physics, and radiochemistry."[18]

After a lull in nuclear-related activities, the next major agreement came in April 1976. It obliged the Soviet Union to assist its client in the construction of two 440-megawatt nuclear power reactors at Juragua, on the south central coast in the Cienfuegos province. In March 1981, the Leningrad branch of Atomenergoproyekt began research on the design of a Cuban nuclear power station. The actual construction started two years later. Cuba was to receive 12 atomic power reactors in all, at least twice as many as all other Latin American countries combined. If all the reactors were built by the year 2005, as planned, Cuba would have had the nuclear generating capacity of 4,800 megawatts (or roughly double its current needs).[19]

Nuclear power engineering was not the only field in which Cuba sought to expand its expertise. Nuclear medicine, biotechnology, and other nuclear-related applications were also considered. However, quite logically, given the nation's dependence on external sources of energy, nuclear power engineering was the top priority.

POLITICAL IMPERATIVES

In retrospect, an analysis of Cuban nuclear activities suggests that officials involved in initiating the nuclear program gave primary consideration to political reasons, viewing potential economic dividends as important but less significant. At the start of the program, however, the government attempted to emphasize the economic benefits. Fidel Castro Diaz-Balart, the former Executive Secretary of the Cuban Atomic Energy Commission, claimed that the first Juragua reactor, when running at full capacity, would allow the country to save 600,000 tons of oil annually. If all four units were operating, he said, the savings would be 2.4 million tons of oil annually.[20]

Yet Cuba's actions left little doubt as to the prime motivation for the venture. Two possible forms of nuclear cooperation were available to Cuba, the construction of a "turnkey" project, or the provision of technical assistance, which would be less efficient. Cuba opted for the latter, which was perceived to be "the most flattering for the political ambitions of the Cuban leadership."[21] Moreover, it was not clear that a nuclear energy program was needed in Cuba. A 1970 monograph by Soviet geologist Boris Semevski did not even discuss nuclear power engineering as a possible alternative for overcoming Cuba's acute shortage of organic fuel. Semevski concluded that the planned construction of two thermoelectric power stations with a total capacity of 1,200 megawatts would "finally solve the shortage of energy and would make Cuba the Latin American leader in energy production per capita."[22]

But only a short while later, Cuba launched its ambitious scheme to construct a network of nuclear power facilities on the island. Cuba's nationalism was an important motivation for the

project. The country needed a symbol to prove its increased international stature and a means of exhibiting the capabilities of its model of revolution. Indeed, "a nuclear power station built with Cubans' own hands would become a brilliant propagandistic confirmation of the success of the Cuban revolution."[23]

As a by-product of nuclear ascendancy, Cuba could lessen its dependance on oil imports, thereby developing a stronger bargaining position with the Soviets and diminishing the impact of the U.S. embargo. Cuba's domestic oil production is roughly 1.5 million tons annually. The amount required to meet its basic energy requirements is 8 million tons annually.[24] Under its trade agreement with the Soviet Union, Cuba received 13 million tons a year. This arrangement allowed Cuba to resell the 5-million-ton excess and to export 6.5 million tons of oil annually. During the "special period," Cuba has been able to generate only 30 percent of the energy required. The severely diminished output has resulted in nightly blackouts, limited telephone service, and extensive shutdowns of factories throughout the island. The peak energy use on the island is 1,300 to 1,500 megawatts per hour, the addition of the 440-megawatt reactor to the grid would partially reduce the impact of the loss of Russian oil imports.[25]

PRESENT ECONOMIC ENVIRONMENT

Cuba's ambitious nuclear plans did not foresee the dramatic changes in its economic relations with the former Soviet Union after 1991. As a superpower, the Soviet Union had been willing and able to provide the Caribbean nation with all the technology and materials necessary for its program. But with the dissolution of the Soviet Union and the implementation of new political and economic policies in Russia, Cuba found itself in dire straits. Nearly bankrupt after the abrupt ending of Russian aid, it was incapable of continuing construction with indigenous funds. More than 80 percent of Cuba's trade had been with the former Soviet bloc. Its collapse sent the Cuban economy into a swift, downward spiral. Recent press reports estimate that the Cuban economy has declined by 85 percent since 1991.[26]

Although the end of the Cold War has not severed all economic relations between Cuba and Russia, Cuba must now deal with a country with severely limited resources. Russia still seeks to maintain trade relations with the Caribbean state, but relations between the countries reflects Russia's new "real-economik." Russia is also facing economic pressure from the United States and the International Monetary Fund (IMF) to cut off trade with the country. The recently-signed Torricelli bill in the United States prohibits port entry to any ships that have recently conducted trade with Cuba and, moreover, threatens to cut off aid to Cuba's trade partners. However, the new legislation also provides incentives for Cuba should it decide to hold democratic elections, including aid and trade assistance to develop industry on the island. An added enticement is the expansion of mail and telephone services to Cuba, expanding links between it and the mainland. The efficacy of this bill remains in doubt, however, because the European Community and the United States' new North American Free Trade Agreement (NAFTA) partners, Canada and Mexico, have both stated that they will not honor this new law.[27] Mexico has stated emphatically that no one will dictate its foreign policy.[28] In late November 1992, the General Assembly of the United Nations delivered an unexpected rebuke to the United States by overwhelmingly passing a resolution calling for an end to Washington's 30-year-old embargo against Cuba.[29] Most of America's allies either voted for the Cuban-sponsored resolution or abstained. The vote serves as a gentle reminder to the United States of its own limited authority in the post Cold War era.

In April of 1992, Russia agreed to complete construction at Juragua if the Cubans would begin repayment of Soviet loans for the construction of the plant and assume responsibility for all additional hard currency spending for the Juragua project. Although the decisions by the Cuban government to suspend and then resume construction were unexpected, a closer inspection reveals that these were necessary and rational decisions for at least two reasons.

Given the nature of Cuba's economic free-fall, even the will of *El Máximo Líder* was unable to overcome the difficulty in funding the venture. Castro now freely admits the catastrophic blow to the economy and has urged the Cubans to be ready for even greater difficulties ahead.[30] In the nuclear field, moreover, the recent GAO evaluation of the program confirmed lingering fears that safety and design deficiencies could require extensive retrofitting of the reactor sites to bring them up to international standards. Changes of this nature could increase the cost of the project by millions of dollars.

Despite its current offer to mothball the plant, it is obvious that Russia has a vested long-term economic interest in the successful and safe completion of the Cuban project, because it is likely to increase the marketability of the Russian reactors. Recently, this was implied by Alexander Nechayev, of the Russian engineering firm Zarubezhatomenergostroy, who stated that "under the present conditions, where the first reactor is almost 90 per-

cent complete, it would be *extremely unreasonable* to end the construction."[31] Perhaps the most obvious demonstration of this sales effort took place when Russian officials invited prospective clients from India and Iran to Cuba in an effort to promote Russian reactor sales. But there is at least one flaw that can seriously undermine the credibility of Russian reactors: the lack of confidence in the safety of their design.

In summary, the overwhelming weight of Cuba's economic slide has forced the pre-existing political rationale for the nuclear energy program to take a back seat for the time being, if not permanently. Russia no longer has the means to support the venture. In reality, reaching out for international cooperation is the only way that either Cuba or Russia can hope to have safely operating nuclear power reactors in the near-term.

SAFETY ISSUES AND THE CUBAN NUCLEAR PROGRAM

Critics assert that the prevailing economic difficulties have forced the Castro regime to cut corners, approve shoddy workmanship, and compromise safety considerations. The debate over safety at Juragua raises the possibility of a "Cuban Chernobyl" lying a mere 90 miles off the coast of Florida. Critics contend that if a "serious" or "major accident"[32] were to take place, large amounts of nuclear fuel could spew into the atmosphere and surrounding waters. The radioactive fallout would create a "dead-zone" with an 18-mile radius where nothing could survive; a 200-mile radius where there would be serious health risks and food production would be impossible; pockets of high contamination that could drift as far as 300-miles away, and a radioactive cloud creating serious ecological damage as far north as Tampa, Florida, with secondary fallout extending to a 900-mile radius (depending on prevailing weather conditions).

Although an accident might happen because of design deficiencies, it is more likely that one would occur due to improper or faulty operation of the facility. Part of this problem stems from the fact that 300 of the 450 Soviet advisors who helped to construct the reactors have been recalled to Russia since the dissolution of the Soviet Union. The remaining specialists had nothing to do before the November announcement and it is uncertain what role they will play in the future of the project. They are being replaced with Cubans with less experience, which may further erode the on-site expertise.[33] Yet Cubans point to the fact that many of the Cuban engineers were educated in the former Soviet Union and have hands-on experience working in Russian and Mexican reactors. Under the original agreement between Cuba and the Soviet Union, Soviet technicians were to operate the facility for two years after startup. Now, because of the financing difficulties and the ensuing changes of project status, the issue of who will operate this facility has been placed into question.

The Cuban reactor was the first Soviet nuclear venture in the Western Hemisphere. The challenges of building a reactor so far from home led to extensive delays in the construction schedule. Also, the original reactor design was inappropriate for the Cuban project and had to be revised in the fourth year of construction, adding another two years to the planned seven-year project.[34]

Recently, a published editorial by an engineer on the project (who defected to the United States) all but declared the Cuban reactor a technical disaster.[35] In the editorial, defector Vladimir Cervera, a senior engineer responsible for overseeing quality control at the reactor, stated that x-ray analysis showed that the welding pipes for the cooling system were weakened by air pockets, bad soldering, and heat damage. Of the pipes that were originally approved, 15 percent were later found to be flawed. Another defector, Jose Oro, a senior nuclear engineer at the site, stated that the support structure of the plant contains numerous faulty seals and structural defects, and that the steam supply system has been left outdoors and uncovered since December 1990. This would have exposed the equipment to highly corrosive tropical salt air, risking critical damage. The stability of this equipment is essential to reactor safety, because leakage or other structural failure could result in a meltdown.[36] Dr. Nils Diaz, the director of Nuclear Engineering Sciences at the University of Florida and a staunch opponent of the Cuban program, succinctly summarizes the critique of safety at Juragua by stating:

There is no design control, no procurement document control, no control of purchases and materials, no controls of equipment (...) who is going to operate this plant? The indispensable international requirement for operation of a nuclear reactor is that the operator be trustworthy, that people believe this person will respect international law, will be capable of operating and maintaining this plant in strict compliance with safety standards(...). It is obvious that Fidel Castro does not meet any of these requirements.[37]

Russian officials responsible for construction and quality control defensively and flatly deny that Juragua's safety is a legitimate concern. They point to Finland's Loviisa Soviet-designed VVER nuclear plant as evidence of a safely-operating Soviet designed nuclear power facility.[38] Cuban specialists who have worked at the Juragua site are quoted as saying that the Juragua facility is virtually earthquake and tornado

proof. They also say that the humid climate and the possibility of a direct aircrash have been taken into consideration in the construction of the containment structure.

The recently-published GAO report is a comprehensive study of the safety concerns regarding Cuba's nuclear program. Currently, the United States discourages other countries from providing assistance, except for safety purposes. The United States would like to prevent construction from ever being completed and insists that Cuba sign either the NPT or the Treaty of Tlatelolco--both of which require signatories to place their entire nuclear programs under international safeguards--before it will consider reversing its policy. The GAO report did not take into account reports of Cuba's request to the IAEA to conduct operational safety and review (OSART) inspections in 1993.[39]

The United States continues to discuss concerns about the safety of the Cuban reactors with the Russian government. According to State Department officials, the Russian government has given assurances that the nuclear power reactors in Cuba will meet international safety norms. The U.S. government also asked Russia to cease providing any nuclear assistance until Cuba signs the NPT or the Treaty of Tlatelolco. If Cuba were to sign either treaty, State Department officials would prefer to have Russian aid limited to safety matters.[40]

In response to the allegations that the reactors are a technical disaster, Andres Garcia de la Cruz, director of the *Centro Nacional de Seguridad Nuclear* (National Nuclear Safety Center), asserted the efficacy of safety measures at the construction site and added that U.S. doubts "are a political argument which can be countered with techniques and scientific exactness."[41] He said that international experts who have visited the Juragua facility and know about its safety measures include William Lee, director of the World Association of Nuclear Operators (WANO) and Hans Blix, director of the IAEA. The U.S. Nuclear Regulatory Commission's (NRC) Director of Operations James Taylor, in testimony before the Senate Energy and Environment Subcommittee on Nuclear Regulation, told the panel that senior NRC staffer Harold Denton had visited the site in 1989. He said that construction work observed then included the containment liner, turbine generator building, and other components. No primary system components had been installed at the time of the visit. Taylor further stated that NRC experts had concluded that the Cubans were knowledgeable in their respective areas of expertise and that the technical issues raised by critics could potentially be safety concerns. But he added that since analysts have no way to evaluate the validity of the claims made by defectors and lack specific inspection knowledge, it is somewhat difficult to assert that they are safety concerns.[42]

Due to the fact that no comprehensive appraisal of safety measures has been undertaken, there remains a degree of uncertainty as to whether Juragua could meet international standards. This doubt is fostered by new reports of safety failures and ecological disaster in the former Soviet nuclear industry, including at the Semipalatinsk nuclear test range and in the seas off the Kola Peninsula. Cuba, apparently recognizing the danger, has invited the IAEA to conduct a safety review. However, if the inspections find that retrofitting is necessary, the cost of making Juragua safe may be prohibitive.

In addition to safety concerns, equally important issues include the supply of fissile material and the disposal of spent fuel. The Soviet Union, at a time when it was promoting its nuclear power business, sweetened contracts with commitments to take away all spent fuel from reactors it sold.[43] Will Russia fulfill the promise of the former Soviet Union to transport fissile material to and from Cuba despite logistical difficulties and the expense of building a flotilla expressly for this purpose? Given the dire economic situation in Russia, this possibility seems remote at best. Even if Russia managed to commission such a flotilla, the outcry from activist groups over Japan's plutonium transports from France indicates that this kind of transport effort would not be undertaken without some controversy.

Some sources claim that Boris Yeltsin's administration has said that Russia will not accept Cuban nuclear waste. Consequently, it would have to be shipped to Argentina for reprocessing. Cuba would then receive the extracted plutonium and weapons grade uranium.[44] This seems highly unlikely now, however, because of Argentina's nuclear cooperation agreements with Brazil and its impending accession to the Treaty of Tlatelolco, which will place all its facilities under full-scope safeguards.

ADDITIONAL FACTORS

A number of other significant factors are pushing Cuba toward a broader endorsement of nonproliferation regulations. First, some major changes have taken place in the policy positions of key nuclear exporters. For example, in 1990 Germany decided to permit substantive exports of nuclear technology to states not party to the NPT, if the recipient submits all its nuclear activities to IAEA safeguards.[45] This shift, along with the accession of China and France to the NPT, introduces a new set of criteria to the states that are in-

terested in developing nuclear programs with foreign assistance. Second, Cuba has failed to establish close contacts with other potential suppliers. Castro's attempts to elicit nuclear cooperation from Argentina and Iran pointed to the program's glaring weakness and the lack of any indigenous nuclear know-how. As one U.S. Senate aide describes it: "All the knowledge and expertise has been exported from elsewhere."[46] This combination of factors proves what has been evident since the first days of the Cuban nuclear program: the country is incapable of carrying out such a large-scale program without massive external support, assistance, and aid.

The first indications of Cuba's willingness to join the Treaty of Tlatelolco appeared as early as the end of 1990 in a statement made by Argentina's Foreign Minister Domingo Cavallo.[47] Then, in May 1991, the country became an observer to OPANAL. This positive drift towards nonproliferation was expressed by Castro at the July 1991 Ibero-American summit when he stated that, "although no condition named by Cuba as an impediment to its adhesion (sic) to the Tlatelolco Treaty has yet disappeared, we hereby reiterate our will to sign it when all Latin American countries commit themselves to the Treaty."[48]

This was not the usual rhetoric and posturing. Cuba announced its intention to accede to the Treaty of Tlatelolco when three other major holdouts--Argentina, Brazil, and Chile--agreed to amendments in the treaty, clearing the way for their signing. Obviously, this step was primarily motivated by general foreign policy considerations. Since the dissolution of the Soviet Union, Cuba has been steadily enhancing its ties with Latin American states.[49]

At the same time, the probable accession of Cuba, along with Argentina, Brazil, and Chile, to the Treaty of Tlatelolco bodes well for the nonproliferation community. The strengthening of this regional nuclear nonproliferation agreement has the effect of complementing the prevailing international system rather than distracting or diminishing the effectiveness of the regime.

But accession to the regional nonproliferation pact provides no guarantee that Cuba will soon endorse the more universal NPT. Its preconditions for signing the Treaty of Tlatelolco are still in place, and Cuba may renew its reasoning for not signing the NPT. Furthermore, Argentina, Brazil, and Chile continue to consider the NPT as discriminatory and reject any possibility of joining it.

In practical terms, Cuba's accession to the Treaty of Tlatelolco will lead to negotiation of a full-scope safeguards agreement under INFCIRC/153 with the IAEA. Even after the most recent developments, the Cubans remain intransigent in the face of the United States' continued hostile posturing and appear unwilling to discuss anything with the United States until the Torricelli bill is rescinded or radically altered.

CONCLUSION

The future of the Juragua nuclear power plant is predicated on Cuba's cooperation with the nonproliferation regime. If funding is not available and Cuba's overall economic situation worsens, a proliferation risk arises, as Castro may "dispatch cadres of specialists to other Latin American countries to procure hard currency for Cuba."[50] Similar to the situation in the former Soviet Union, this could include engineers and scientists from the nuclear program selling their expertise to the highest bidder. Regardless of financial difficulties, other fields of nuclear science are unlikely to be abandoned. Nuclear medicine and radiology attract patients from abroad and thereby help the Cuban economy to remain afloat. This research does not require huge investments and is sponsored in many cases by international agencies.[51]

How the anti-Castro opposition will react to U.S. attempts to cooperate on safety and support nonproliferation is less predictable. Human rights analysts consistently point out the highly volatile nature of extremist anti-Cuba groups in parts of the United States as an impediment to better relations with Cuba. Calls by print and broadcast journalists for warmer relations with the island nation have been met with death threats, assassination and bombings.

Since energy is the most important economic issue facing Cuba during this "special period," Cuba will continue with its nuclear program. But the only viable means for acting upon this desire may be its participation in the international nonproliferation regime. As a source of proliferation concern, Cuba is unique by virtue of its relationship with and dependence on the former Soviet Union. As Russia's support waivers or becomes a less-dominate factor, Cuba may become the most notable example of a country forced to observe international safeguards in order to develop its nuclear industry. Given the isolated nature of the Cuban program, it is quite obvious that the international community has the capacity to help with the construction of a nuclear power plant now and to prevent Cuba from adventurous undertakings in the future.

Castro has not abandoned ship on the nuclear issue. He is simply waiting for a time when Russia or some other willing partner will be able to provide Cuba with assistance. Castro also may be ready to seek out Western assistance to supplement Russian aid and to continue to yield ever so grudgingly on Cuba's long-held principle of noncommitment to the nonproliferation regime.

The biggest threat stemming from the presence of a nuclear reactor at Juragua is that an accident might occur, not that Cuba could possibly produce fuel for atomic bombs indigenously. The fact that Cuba has now taken steps to enter the nonproliferation regime provides Washington and the international community with the clearest window of opportunity for a *rapprochement*, mainly in the field of technical cooperation with the Castro regime. Experience with research assistance and technical cooperation has been encouraging, and these efforts should be continued and extended. This process will have the effect of not only ensuring that the Juragua facility is completed safely and with no threat of nuclear catastrophe, but it will also enable the nonproliferation regime to monitor and accurately assess the nature of Cuba's nuclear program.

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[1] The authors would like to thank Clay Moltz, Glenn Chafetz, Chris Fitz, Betsy Perabo, and Joseph DiChiaro for their invaluable editing assistance. The passages from Spanish and Russian sources were translated by the authors.

[2] Quoted in Jose De Cordoba, "Survival tactics: Its economy dying, Cuba seeks salvation in dollars," The Wall Street Journal, July 19, 1993, p. A1.

[3] In 1991, Fidel Castro announced that because of the loss of its Soviet benefactor, Cuba would be entering a "special period" in which it would utilize every means available to address the devastating economic impact of losing aid from the former Soviet Union. The "special period" is still intact with no end in sight.

[4] Interviews conducted by author Benjamin-Alvarado with Cuban citizens, Miramar section of Havana, Cuba, June 8, 1993.

[5] Ibid. Cuban citizens lined up outside a state provisions store shared their impressions about the economy. Notably, those who were willing to speak supported Cuba's efforts to employ nuclear power as a means towards achieving national economic and energy self-sufficiency.

[6] Interview by author Benjamin-Alvarado, June 8, 1993, Havana, Cuba.

[7] Wilson Dizard III, "Christopher Says Moscow Will Pay Juragua's $30-million Mothball Tab," Nucleonics Week, September 30, 1993, p. 7. The term "mothball" here refers to an indefinite suspension, where materials and equipment are stored in place so that construction or operation can be resumed at some later date.

[8] A U.S. General Accounting Office report (GAO/RCED-92-262)(Washington, D.C.: GPO, September 1992) says that no fuel has been delivered and key primary components at the site are not in place. Furthermore, the report states that just 37 percent of the Unit-1's internal construction is complete.

[9] Cited by Dizard, op. cit.

[10] In English, the Agency for the Prohibition of Nuclear Weapons in Latin America.

[11] The amendments provide that special inspections of all safeguarded facilities will now be delegated to the IAEA. Presently, Argentina, Brazil, and Chile are attempting to ratify the agreements in their respective domestic legislatures.

[12] Examples of such evidence were found first in John Barron, "Castro, Cocaine and the A-Bomb Connection," Reader's Digest (March 1990) and in the account by the Cuban defector Jose R. Oro Alfonso, "Some Aspects About Environmental Pollution and Protection of the Ecological System in Cuba and its Surroundings," unpublished paper (November 1991).

[13] Taken from a statement by Brazilian Foreign Minister Rezek in "Argentina, Brazil Propose Changes to Tlatelolco," Proliferation Issues, 3/20/92, pp. 8-9.

[14] These three INFCIRC.66 model agreements are: INFCIRC.281 (signed May 5, 1980); INFCIRC.298 (signed September 25, 1980); and INFCIRC.311 (signed October 7, 1983).

[15] The IAEA's INFCIRC/66 model agreements relate to "item-only" safeguards--particular technologies or materials. INFCIRC/153 model agreements cover "full-scope" safeguards--all nuclear material in the peaceful activities of a nation.

[16] From 1956 to 1959 the United States concluded such agreements with some 40 "friendly states." See Betrand Goldschmidt, The Atomic Complex: A Worldwide Political History of Nuclear Energy (Le Grange Park, Illinois: American Nuclear Society, 1982) p. 303-306.

[17] Alexander Belkin, "Cuba's Nuclear Program," unpublished paper (April 1992), p. 12.

[18] "Soglasheniye mezhdu Souzom Sovetskikh Sotsialisticheskikh Respublik i Respublikoy Kuba o sotrudnichestve v oblasti ispol'zovanya atomnoy energii v mirnyikh tselyakh ot 15 sentyabra 1967 goda" (Agreement between the USSR and the Republic of Cuba in the Use of Atomic Energy for Peaceful Purposes of September 15, 1967), in Sbornik deystvuyuschikh dogovorov, soglashenii i konventsii, zakluchennykh SSSR s inostannymi gosudarstvami (Moscow: IMO, 1972), Vol.XXV, p. 225.

[19] In 1980, the total amount of economic assistance to Cuba from the Soviet Union was $3.2 billion. Most of this assistance (72 percent) consisted of trade subsidies for sugar and petroleum. In 1983, the total amount of Soviet economic assistance had increased by 65 percent to $4.9 billion. In 1983, 70 percent of all economic aid extended to communist countries was going to Havana. For more detailed information see, Central Intelligence Agency, Directorate of Intelligence, Handbook of Economic Statistics, 1990, CPAS 90-10001 (Washington, D.C.: G.P.O., 1990), pp. 178-79.

[20] Fidel Castro Díaz-Balart, La Energía Nuclear En La Economía Nacional De La República De Cuba (Moscow: COMECON, 1986), p. 9.

[21] Igor Ivanov, "The Atlantis of the Castro Brothers? Will Fidel's Bulb Light up in Cuba?," Literaturnaya Gazeta in JPRS Proliferation Issues, June 25, 1992, p. 20.

[22] B.N. Semevski, Economicheskaya geographiya Kuby (Leningrad: Nauka, 1970), p. 67. This monograph is still considered by some to be the most comprehensive study on Cuban geography.

[23] Ivanov, loc. cit.

[24] Interview by author Benjamin-Alvarado with Arnaldo Coro, chief science and technology corespondent, Radio Havana, in Havana, Cuba, June 6, 1993.

[25] Ibid.

[26] Jose De Cordoba, "Some see Castro regime coming to end in violence as Cuban economy worsens," The Wall Street Journal, September 10, 1993, p. A14.

[27] Guy Gugliotta, "The Castro Bill: No Cigar," The Washington Post, February 29, 1992, p. C5.

[28] "Making Poor Cubans Suffer More," The New York Times, June 15, 1992, p. A18.

[29] Stanley Meiser, "U.N. Rebuffs U.S. on Cuba Embargo," The Los Angeles Times, November 25, 1992, p. A1. See also Frank J. Prial, "U.N. Votes to Urge U.S. to Dismantle Embargo to Cuba," The New York Times, November 25, 1992, p. A1.

[30] Granma, July 8, 1993, p. 1.

[31] Quoted in Izvestiya, September 9, 1992, p. 4.

[32] The International Nuclear Event Scale (INES) adopted by the IAEA defines a "major accident" as an external release of a large fraction of the radioactive material in a large facility (e.g. the core of a reactor). Such a release would result in the possibility of acute health effects, delayed health effects over a wide area (possibly

involving more than one country), and long-term environmental consequences.

[33] John Shanahan, "Cuba's Potential Chernobyls," The Wall Street Journal, August 5, 1992, p. A14.

[34] For more details, see Men'kin Y.A., A.G. Liparteliani, and D.V. Kiranov, " Planirovaniye i upravlenye stroitel'stvom AES Juragua na osnove setevykh graphikov," Energeticheskoye stroitel'stvo za rubezhom, No. 6, 1987, p. 20.

[35] Shanahan, loc. cit.

[36] Shanahan, loc. cit. See also Susan Benesch "Cuban warns of risky reactors," The Washington Times, May 6, 1992, p. A1. It should be noted that although the criticisms of the design and safety risks are harsh and worrisome, the editorial gave no technical analysis supporting its assertions.

[37] Dr. Nils Diaz, testimony before the Subcommittee on Nuclear Regulation of the Committee on the Environment and Public Works, U.S. Senate, 102nd Congress, hearing on International Commercial Reactor Safety (Washington, D.C.: Government Printing Office, July 25, 1991), pp. 42-43. (Hereafter: Committee on the Environment and Public Works, op. cit.)

[38] Press Conference Transcript, NBC Nightly News, July 5, 1991.

[39] U.S. General Accounting Office, op. cit., p. 11.

[40] Michael Kozak, Principal Assistant Secretary, Inter-American Affairs, U.S. Department of State, in Committee on the Environment and Public Works, op. cit., p. 20.

[41] "Director Insists Facility Safe," Nuclear Developments, June 24, 1991, p. 17.

[42] Committee on the Environment and Public Works, op. cit., p. 24.

[43] B.A. Kuvshinnikov, A.M. Petrosyants, and B.A. Semenov, "Opit SSSR v Mezhdunarodnom sotrudnichestve po mirnomu ispol'zovaniu atomnoi energii," Atomnaya Energiya 63 (November 1987), p. 295.

[44] Eric Ehrmann, "Cuba's Nuclear Safety Struggle," The Journal of Commerce, July 5, 1991.

[45] Roland Timerbaev, "A Major Milestone in Controlling Nuclear Exports," Eye on Supply, No.6, Spring 1992, p. 60.

[46] Wilson Dizard III, "Castro Halts Juragua Construction Over Russian Hard Currency Demand", Nucleonics Week, September 10, 1992, p.3

[47] "Cavallo Says Cuba To Sign Tlatelolco Treaty", Nuclear Developments, January 4, 1991, p. 10.

[48] Granma, July 23, 1991.

[49] Pedro Nuñez Mosquera, Director of Multilateral Affairs at the Cuban Foreign Ministry, told the Cuban news agency Prensa Latina: "We are ready to sign (The Treaty of Tlatelolco) for the sake of Latin American unity." See Pascal Fletcher, "Cuba Ready To Sign Regional Treaty Against Nuclear Arms," Reuter News Service, August 20, 1992.

[50] Ivanov, loc. cit., p. 20.

[51] For example, the IAEA helped fund the Center for Applied Nuclear Energy in Cuba, which was inaugurated by Hans Blix. Through U.N. assistance, Cuba received a special laboratory for the Institute of Oncology and Radiobiology. This is now a center for applied nuclear studies in medicine. The treatment of Chernobyl and Brazilian radiation victims attests to the efficacy of Cuban advancements on this front.