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NUCLEAR SAFETY

Concerns With the Nuclear Power Reactors in Cuba

Statement of Keith O. Fultz,
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Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today to testify on our report that discussed concerns about the construction of the two Soviet-designed nuclear power reactors in Cuba.[1] While the construction of these reactors was suspended in September 1992, recent information suggests that Cuba may resume the construction if it obtains financial support. Our testimony is based on our report and on recent discussions with State Department, Nuclear Regulatory Commission (NRC), Department of Energy (DOE), Central Intelligence Agency, and International Atomic Energy Agency (IAEA) officials. We also had discussions with U.S. and foreign nuclear industry officials.

In summary, it is uncertain if and when Cuba's nuclear power reactors will be operational. It appears that no progress has been made on the construction of the reactors since the issuance of our 1992 report. The civil construction (such as floors and walls) of the first reactor is estimated to be about 90 to 97 percent complete, while the second reactor is only between 20 to 30 percent complete. However, if Cuba obtains the assistance necessary to complete the reactors' construction, a number of safety concerns must be resolved.

Specifically, it is possible that in the event of a severe accident, the containment structure--the ultimate barrier to the release of radioactive material in the event of an accident--could be breached, and a radioactive release could occur. It is possible that air currents could carry radioactive materials to the United States--possibly as far west as Texas and as far north as Washington, D.C. Furthermore, former Cuban nuclear and electrical engineers and a technician who worked at the reactor site and had emigrated from Cuba told us of safety concerns such as poor construction practices, that, if true, could affect the safety of the reactors' operation. In addition, there are unanswered questions about the potential for earthquakes at the reactor site because the Cuban government has not given the U.S. Geological Survey (USGS) the information that it needs to make the appropriate analysis.

Mr. Chairman, in cooperation with the State Department, we tried to gain permission from the Cuban government to visit the reactor site during the course of our 1992 review. In addition, we submitted a list of questions regarding the design, construction, and operation of the reactors to the Acting Principle Officer of the Cuban Interest Section, who said that he would submit them to Cuban nuclear power officials. However, we have never received a

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[1]Nuclear Safety: Concerns About the Nuclear Power Reactors in Cuba (GAO/RCED-92-262, Sept. 24, 1992).

response from the Cuban government to our request for a visit or the answers to our questions. As you know, a few weeks ago, an NBC news crew visited the reactor site and shot extensive film footage, which included interior and exterior scenes of the containment building and the reactor vessel. Our review of this film assisted us in assessing the current conditions at the reactor site. I believe this film footage obtained by NBC represents the most current information on the Cuban reactors. On the basis of our review of this film footage, we have heightened concerns about the quality of the construction of the reactors. The film graphically portrays a nuclear plant in a state of deterioration that appears to be abandoned, rather than properly maintained.

According to the State Department, the position of the United States regarding the Cuban reactors has not changed since the issuance of our 1992 report. The United States prefers that the Cuban reactors not be completed and discourages other countries from providing assistance, except for safety purposes, to Cuba's nuclear program. In addition, Cuba must ratify the Treaty of Tlatelolco, which it signed in March 1995. The treaty binds signatories to blanket nonproliferation commitments for their entire nuclear program and would allow IAEA inspections of Cuba's nuclear facilities.

THE DESIGN AND STATUS OF CONSTRUCTION OF THE CUBAN REACTORS

In 1976, the Soviet Union and Cuba concluded an agreement to construct two 440-megawatt nuclear power reactors near Cienfuegos on the south central coast of Cuba, about 180 miles south of Key West, Florida. The construction of these reactors, which began around 1983, was a high priority for Cuba because of its heavy dependence on imported oil. When completed, the first reactor would provide a significant percentage (estimated at over 15 percent) of Cuba's need for electricity.

Most of the reactor parts, except for civil construction materials, were supplied by the Soviet Union under bilateral economic cooperation agreements. Following the breakup of the Soviet Union, economic links to Cuba were disrupted as the Russian Republic shifted to a market-based economy and began providing technical assistance to Cuba on a commercial basis. These changes in the economic conditions contributed to the suspension of the reactors' construction.

Design of Cuban Reactors

Cuba's nuclear power reactors are the newest model of the Soviet-designed 440-megawatt pressurized water reactors (PWR) and are the first Soviet-designed reactors to be built in the Western Hemisphere and in a tropical environment. The Cuban model, called the VVER 440 V318, is the model that the former Soviet Union

planned to export to other countries. The most notable difference between the Cuban model and other Soviet-designed reactors is that the Cuban reactors will have a full containment. The containment--a steel-lined concrete domelike structure--serves as the ultimate barrier to a release of radioactive material in the event of a severe accident. As discussed below, there are differences between the design of the Cuban reactors' containment and the containment of reactors designed in the United States.

NRC's 1989 Study of Cuban Reactors

Because of Cuba's proximity to the United States and the risk to which U.S. citizens may be exposed to a radioactive release in case of an accident, NRC performed a limited study to examine the containment design and safety features of the Cuban nuclear power reactors. The study, completed in 1989, discusses similarities and differences in safety characteristics between the Cuban reactors and comparable U.S. reactors.

NRC's study noted that although the design of the Cuban reactors has many features in common with those of the U.S. PWRs, several differences could lead to significantly different reactions in the event of a serious accident. For example, while the Cuban reactors, like the U.S. PWRs, use water to cool the reactor core, the Cuban reactors use a different system for handling the steam pressure that would be generated by a severe accident. In the Cuban reactors, the steam is condensed so that pressure is reduced in the containment structure. If, in the case of a severe accident, the system for condensing the steam in the Cuban reactors is bypassed and the steam reaches the upper portion of the containment in pressures greater than the upper portion's designed pressure retention capability of 7 pounds per square inch (other portions of the containment are designed to withstand pressures of about 32 pounds per square inch), the containment could be breached, and a radioactive release could occur. In contrast, U.S. PWRs are designed to accommodate pressures of about 50 pounds per square inch throughout the entire containment structure. The study indicated that the Cuban reactors and the comparable U.S. PWR are designed to accommodate similar types of accidents but concluded that it was difficult to compare the risk posed by the two types of reactors because the information required for such an assessment was not available for the Cuban reactors.

Status of Construction

On September 5, 1992, Fidel Castro announced that the construction of both of Cuba's reactors was suspended because Cuba could not meet the financial terms set by the Russian government to complete the reactors. Estimates of the amount of the civil construction completed for the first nuclear power reactor ranged from 90 to 97 percent, but only about 37 percent of the reactor's equipment (such as pipes, pumps, and motors) had been installed.

For the second reactor, about 20 to 30 percent of the civil construction was estimated to be complete. No information was made available to us about the status of the equipment for the second reactor. According to responses to our recent inquiries, the status of construction has apparently not changed since the issuance of our 1992 report.

Mr. Chairman, in cooperation with the State Department, we tried to gain permission from the Cuban government to visit the reactor site during the course of our 1992 review. In addition, we submitted a list of questions regarding the design, construction, and operation of the reactors to the Acting Principle Officer of the Cuban Interest Section, who said that he would submit it to Cuban nuclear power officials. However, we have never received a response from the Cuban government to our request for a visit or the answers to our questions. As you know, a few weeks ago, an NBC news crew visited the reactor site and shot extensive film footage, which included interior and exterior scenes of the containment building and the reactor vessel. Our review of this film assisted us in assessing the current conditions at the reactor site. I believe this film footage obtained by NBC represents the most current information on the Cuban reactors. On the basis of our review of this film footage, we have heightened concerns about the quality of the construction of the reactors. The film graphically portrays a nuclear plant in a state of deterioration that appears to be abandoned, rather than properly maintained.

Concrete had been poured on the upper portion of the containment dome for the first unit. At the time of our review, the reactor's instrumentation and control system had not been purchased because Cuba did not have the hard currency to pay for them. Furthermore, the reactor fuel had not been delivered, and some key primary system components (1 reactor vessel, 6 steam generators, 5 primary coolant pumps, 12 isolation valves, 1 pressurizer and catch tank, and 4 accumulators) had been delivered but not installed. At the time of our 1992 review, these components had been stored outside on-site, and there was concern that the equipment was exposed to corrosive salt water vapor. The cost of the plant's construction was estimated, in 1992, at $960 million. It is estimated that it will cost about $300 million to complete the construction of the first reactor. We could not verify the validity of these estimates.

Recent news reports suggest that Cuba may resume the construction of the reactors with the financial assistance of Russia and an international consortium of major corporations. According to the State Department, several foreign companies have reportedly expressed interest in participating in the project and are currently carrying out a technical and feasibility study of the project reportedly to be released soon. To verify this information, we contacted representatives of the firms (Siemens AG [Germany], Ansaldo [Italy], EdF International [France], and NNC

[England]) identified as potential participants in the international consortium. These representatives told us that their firms were not part of an international consortium to finance the completion of Cuba's reactors. However, representatives of two of the companies told us that they are performing, on behalf of the Russian company ATOMENERGOEXPORT, a financial and technical feasibility study designed to evaluate the costs to complete the Cuban reactors. According to one of these representatives, the study, described as preliminary in nature, is similar to studies currently being performed by western companies for eastern European nuclear reactors.

SAFETY CONCERNS RAISED BY FORMER CUBAN NUCLEAR POWER PLANT WORKERS

During our 1992 review, we talked with five Cuban individuals including nuclear and electrical engineers and a technician who had worked at the reactor site, all of whom had emigrated from Cuba and expressed concerns about the reactors. They believed that problems exist that could affect the safe operation of the reactors, such as the lack of a system to check the reactor's components, defective welds in the civil construction, and questionable training of future operators.

Allegations of Problems and Defects in Construction

According to the former Cuban nuclear plant workers, the nuclear facility did not have a good system to check the reactor's components. For example, two individuals alleged that advisers from the Soviet Union working at the reactor site could not guarantee that the valves installed in the first reactor's emergency core-cooling system would function under certain conditions. Although the Soviet advisers told the Cuban officials that the valves had been tested, the advisers did not provide any documentation showing the test results. Emergency core-cooling systems are an important part of the reactor because they help ensure that in the event of an accident in which coolant is lost, radioactive material does not escape into the environment.

The former Cuban technician, who was responsible for checking welds in the civil construction, told us that he and a Soviet technician had examined X-rays from about 5,000 weld sites that had passed inspection. They found that about 10 to 15 percent of these welds were defective. Although the Cuban technician did not know exactly where the pipes with the defective welds were located, he thought that they were part of the auxiliary plumbing system. According to this former technician, a group of Soviet officials also reviewed the X-rays and confirmed that the welds were defective. Another individual said that even though defective welds were found in the containment dome, concrete was still poured.

Former Cuban nuclear plant workers alleged that defective welds were also found in hermetic seals, in support structures for the primary components, and in the spent fuel cooling system. The seals and support structures are important to safety because they are part of the containment that prevents radioactive material from leaking into the environment if an accident occurs. The spent fuel cooling system is important because it prevents radioactive material from leaking if overheating occurs.

Allegations of Inadequate Simulator Training

According to one former Cuban nuclear plant worker, individuals trained to be reactor operators received 5 months of instruction from the Russians on a VVER 440-megawatt model V230 reactor simulator at the Novovoronezh nuclear power plant in Russia. However, he said that the value of this training is questionable because this simulator does not resemble the reactor under construction in Cuba. In addition, he said that some Cuban reactor operator trainees had asked for training on a VVER 1,000-megawatt reactor simulator because it was similar to the reactor in Cuba, but were not trained on it. Furthermore, according to an NRC official, Soviet-designed simulators are slow-response simulators and are considered deficient by U.S. standards because they do not simulate an accident as it would actually happen.

NRC OFFICIALS' CONCERNS ABOUT ALLEGATIONS OF SAFETY DEFICIENCIES

NRC officials familiar with the allegations raised by the former Cuban nuclear power plant workers concluded that these individuals were knowledgeable in their respective areas and that the deficiencies they alleged could affect the construction and future safe operation of Cuba's nuclear reactors. However, because the information available on the reactors was limited, NRC officials had no way of verifying the validity of these concerns. An NRC official told us that NRC was concerned about (1) the adequacy of Cuba's nuclear regulatory infrastructure, (2) the adequacy and number of trained regulatory and operational personnel, and (3) reports of defective welds.

NRC's Director of Bilateral Cooperation and Assistance recently told us that NRC has not had any recent contact with the Cubans and wondered whether that plant has been adequately maintained. He said that NRC has the same concerns about the Cuban reactors that it had at the time our report was issued. He also said that he doubted whether there is a viable nuclear regulatory body in Cuba that could license the plant in accordance with internationally recognized nuclear safety standards.

ASSESSMENTS OF RISKS FROM EARTHQUAKES AND DISPERSION OF RADIOACTIVE POLLUTANTS

According to USGS' Chief, Latin American Programs, USGS has not assessed the risk of an earthquake in Cuba, in part, because the agency does not have access to the information required for this type of analysis. USGS attempted to obtain this information, but the Cuban government has not provided it. Therefore, USGS cannot answer specific questions about the seismic conditions at the site of the reactors in Cuba.

However, according to a USGS official, the Caribbean plate, a geologic formation near the south coast of Cuba, is active and may pose seismic risks to Cuba and the reactor site. The plate could produce large to moderate earthquakes. In fact, on May 25, 1992, this plate produced an earthquake measuring about 7.0 on the Richter scale. A 1988 assessment by an international insurance group estimated that the Cienfuegos area could produce an earthquake with a probable maximum magnitude of 5.0 on the Richter scale.

At our request, scientists from the National Oceanic and Atmospheric Administration analyzed the probability of impact, the average arrival time, and the relative concentrations of radioactive pollutants that would be released into the atmosphere by an accidental release of radioactivity from the nuclear power reactors in Cienfuegos, Cuba.[2] On the basis of climatological data for the summer of 1991 and the winter of 1991-92, the analysis showed that the summer east-to-west trade winds could carry radioactive pollutants over all of Florida and portions of the Gulf states as far west as Texas in about 4 days. In the winter, when the trade winds are weaker and less persistent, radioactive pollutants would encounter strong westerly winds that could move the pollutants toward the east, possibly as far north as Virginia and Washington, D.C., in about 4 days.

CURRENT U.S. POLICY

According to a State Department official, the position of the United States regarding the Cuban reactors has not changed since the issuance of our 1992 report. The United States prefers that the Cuban nuclear reactors not be completed and discourages other countries from providing assistance, except for safety purposes, to Cuba's nuclear program. The U.S. position is that sales and or assistance to the Cuban nuclear power program should not be provided until Cuba has undertaken a legally binding nonproliferation commitment, including a commitment to accept full-scope IAEA safeguards on all present and future nuclear facilities. In addition, Cuba must ratify the Treaty of Tlatelolco, which binds

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[2]Jerome L. Heffter and Barbara J. B. Stunder, Transport and Dispersion for a Potential Accidental Release of Radioactive Pollutants From the Nuclear Reactor at Cienfuegos, Cuba, NOAA, Air Resources Laboratory (Aug. 1992).

signatories to blanket nonproliferation commitments for their entire nuclear program and would allow IAEA inspections of Cuba's nuclear facilities. Cuba signed that treaty in March 1995.

CONCLUSIONS

In summary, a number of concerns exist about the Cuban reactors, including concerns about the quality of the civil construction completed to date, the lack of a regulatory organization, and the adequacy of operator training. If the allegations of safety problems are true, the safe operation of the reactors could be affected. In addition, it is unclear how well the equipment on-site has been maintained and preserved. Although the reactor will have a containment building and an emergency core-cooling system, which lessens the likelihood of an escape of radiation in the event of an accident, the containment dome was not designed to withstand pressures as great as U.S. containment structures can withstand.

We believe that continued monitoring of Cuba's progress toward completing the reactors is warranted. If Cuba obtains the assistance needed to complete its nuclear power reactors, U.S. officials will need assurances that all safety concerns are resolved and that the reactors are built and operated in a manner that does not pose a risk to the United States.

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This concludes our prepared statement, Mr. Chairman. We would be pleased to respond to any questions that you or other Members of the Subcommittee may have.

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