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Report to the Chairman, Subcommittee on Nuclear Regulation, Committee on Environment and Public Works, U.S. Senate

September 1992

NUCLEAR SAFETY

Concerns About the Nuclear Power Reactors in Cuba

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GAO

United States
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Resources, Community, and
Economic Development Division

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September 24, 1992

The Honorable Bob Graham
Chairman, Subcommittee on Nuclear Regulation
Committee on Environment and Public Works
United States Senate

Dear Mr. Chairman:

This report responds to your June 1992 request that we provide information on the status of the construction of the two Soviet-designed nuclear power reactors in Cuba and summarize allegations by former Cuban nuclear power officials that poor construction practices and other problems could affect the safety of the nuclear reactors' operation. The report also presents information obtained from representatives of the Cuban and Russian governments about the nuclear reactors.

In addition, this report discusses concerns of officials from the State Department, the Nuclear Regulatory Commission (NRC), and the Department of Energy (DOE) about the safety of the Cuban nuclear power reactors. It further presents information from the U.S. Geological Survey (USGS) on the potential for earthquakes at the reactor site and from the National Oceanic and Atmospheric Administration (NOAA) on the probability that radioactive pollutants accidentally released into the atmosphere from the Cuban nuclear reactors could reach the United States.

Results in Brief

It is uncertain when Cuba's nuclear power reactors will become operational. On September 5, 1992, Fidel Castro announced the suspension of construction at both of Cuba's reactors because Cuba could not meet the financial terms set by the Russian government to complete the reactors. Cuban officials had initially planned to start up the first of the two nuclear reactors by the end of 1993. However, before the September 5 announcement, it was estimated that this reactor would not be operational until late 1995 or early 1996. The civil construction (such as floors and walls) of the first reactor is currently estimated to be about 90 percent to 97 percent complete, but only about 37 percent of the reactor equipment (such as pipes, pumps, and motors) has been installed. The civil construction of the second reactor is about 20 percent to 30 percent complete. No information was available about the status of equipment for the second reactor.

According to former Cuban nuclear power and electrical engineers and a technician, all of whom worked at the reactor site and have recently emigrated from Cuba, Cuba's nuclear power program suffers from poor construction practices and inadequate training for future reactor operators. One former official has alleged, for example, that the first reactor's containment structure, which is designed to prevent the accidental release of radioactive material into the atmosphere, contains defective welds. Another said that reactor operator trainees have received training on inadequate reactor simulators. In contrast, a representative of the Cuban government told us that Cuba wants to build its reactor in accordance with safety standards. Also, according to information provided to us by a representative of the Russian government, Cuba's reactor has been constructed according to safety rules that take into account, among other things, the possible impacts of an earthquake.

State Department, NRC, and DOE officials have expressed a number of concerns about the construction and operation of Cuba's nuclear power reactors. According to State Department officials, the United States maintains a comprehensive embargo on any U.S. transactions with Cuba and discourages other countries from providing assistance, except for safety purposes, to Cuba's nuclear power program. The United States would prefer that the construction of the reactors never be completed and wants Cuba to sign the Non-Proliferation Treaty or the Treaty of Tlatelolco, both of which bind signatories to blanket nonproliferation commitments for their entire nuclear program, before the United States considers reversing its policy of discouraging other countries from assisting Cuba with the construction of the reactors. The United States has asked Russia to cease providing any nuclear assistance until Cuba has signed either treaty.

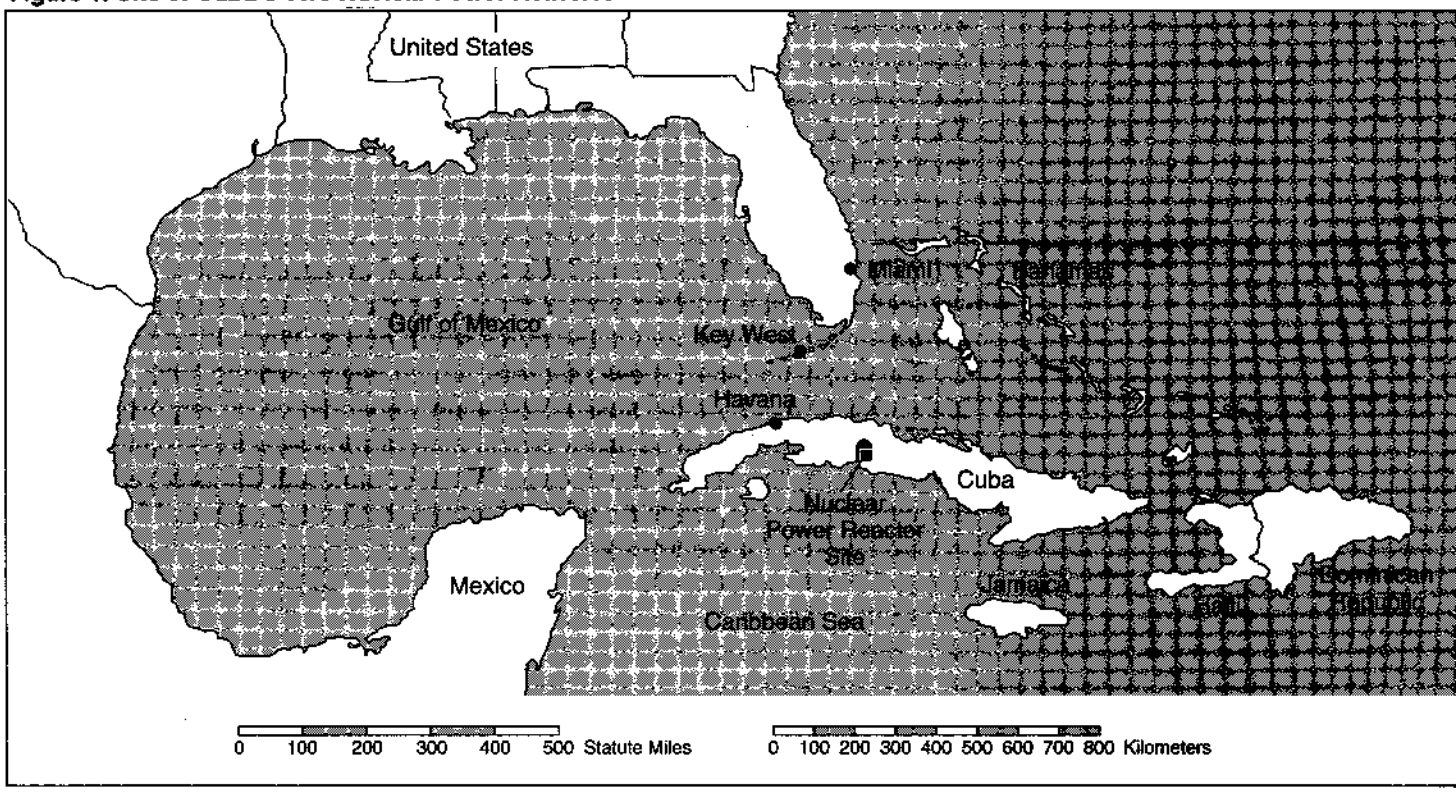
NRC officials are aware of, but could not verify, the Cuban émigrés' allegations of safety deficiencies because available information was limited. They said, however, that if the allegations were true, the cited deficiencies could affect the safety of the reactors' operation. In addition, they expressed concern about the ability of Cuba's industrial infrastructure to support the nuclear power reactors, the lack of a regulatory structure, the adequacy of training for reactor operators, the quality of the civil construction, and the design of the reactors' containment structure. A DOE official expressed similar concerns about the quality of the reactors' construction and design.

USGS has not assessed the risk of an earthquake at the reactor site in Cuba, in part because USGS does not have access to the information required for this type of analysis. An analysis prepared by NOAA scientists shows that there is a possibility that radioactive materials could reach the United States by air currents in the event of an accident at Cuba's nuclear power reactor site.

Background

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. (See fig. 1.) The construction of these reactors, which began around 1983, was a high priority for Cuba because of its heavy dependence on imported oil. Cuba is estimated to need an electrical generation capacity of 3,000 megawatts by the end of the decade. When completed, the first reactor unit would provide a significant percentage (estimated at over 15 percent) of Cuba's need for electricity.

Figure 1: Site of Cuba's Two Nuclear Power Reactors



Most of the reactor parts, except for civil construction materials, have been supplied by the former Soviet Union under bilateral economic cooperation agreements. Cuba planned to start up the first reactor at the end of 1993, but construction lags, technical complications, and problems with deliveries of equipment have caused delays. Following the breakup o the Soviet Union, economic links to Cuba have been disrupted as the newly formed Russian republic has shifted to a market economy and begun to provide technical assistance to Cuba on a commercial basis. These changes have contributed to the delays in the operational starting date for the reactors.

Design of Cuban Reactors

Cuba's nuclear power reactors are the newest model (known as the VVER440 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 VVER440 V318, is the model that the 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.

Study of Cuban Reactors

Because of Cuba's proximity to the United States and the risk to which U.S. citizens may be exposed 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 was completed in 1989 and discusses similarities and differences in safety characteristics between the Cuban reactors and comparable U.S. reactors.

The study noted that although the design of the Cuban reactors has many features in common with that of the U.S. PWR, several differences could lead to significantly different reactions in the event of a serious accident. For example, the Cuban reactor, like the U.S. PWR, uses water to cool the reactor core, but the Cuban reactor uses a different system for handling the steam pressure that would be generated by a severe accident. In the Cuban reactor, the steam is condensed to water in a bubbler-condenser system so that pressure is reduced in the containment structure.[1] If, in a worst-case scenario, the steam bypassed the bubbler-condenser system and reached 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, the U.S. PWR is designed to accommodate pressures of about 50 pounds per square inch throughout the entire containment structure. The study indicated that the Cuban reactor 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

[1]A bubbler-condenser pressure system is located in the containment building and is composed of towers containing trays of water that serve as suppression pools and expansion volumes connected to each tray. Steam is convected from the region around the reactor's primary system to below the surface of the water in the trays, and as the steam bubbles upward through the water, it is condensed, and gases are released into the expansion volumes. Noncondensed steam and other gases are then vented from the expansion volumes to the dome of the containment building.

because the information required for such an assessment was not available.

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 (such as floors and walls) completed for the first nuclear power reactor range from 90 percent to 97 percent, but only about 37 percent of the reactor equipment (such as pipes, pumps, and motors) has been installed.[2] About 20 percent to 30 percent of the civil construction is estimated to be complete for the second reactor. No information was made available to us about the status of the equipment for the second reactor.

Concrete has been poured on the upper portion of the containment dome for the first unit. However, the reactor's instrumentation and control system has not been purchased because Cuba does not have the hard currency to pay for it. The reactor fuel has not been delivered, and some key or primary system components (1 reactor vessel, 6 steam generators, 5 primary coolant pumps, 12 isolation valves, 1 pressurizer and catch tank, and 4 accumulators) have been delivered but not installed. These components have been stored outside on-site since December 1990.

According to information provided to us by an official of the Embassy of the Russian Federation in Washington, D.C., the first nuclear reactor was tentatively scheduled to be operational in late 1995 or early 1996. Because Cubans constructing the reactor lack experience, all critical work was being done by Russians or under the control of Russians. As of April 1, 1992, the cost of the plant's construction totaled 1.6 billion rubles, or about $960 million.

Safety Concerns Raised by Former Cuban Nuclear Power Officials

We talked with five former Cuban nuclear power officials who were identified as having concerns about the Cuban reactors. These officials included nuclear and electrical engineers and a technician who had worked at the reactor site and emigrated from Cuba. They believed that problems exist that could affect the safe operation of the reactors, such as the lack of a system to check reactor components, defective welds in the civil construction, and questionable training of future operators. The

[2]Information regarding the status of the construction of the Cuban reactors was developed from our interviews with NRC and State Department officials, Mexican nuclear power officials who had visited the nuclear power site, and the Cuban émigrés.

following discussion summarizes these officials' allegations as well as information that we obtained from Cuban and Russian officials knowledgeable about the nuclear reactors. Our work served neither to confirm nor to refute the allegations.

Allegations of Problems and Defects in Construction

According to the former Cuban nuclear power officials, the nuclear facility does not have a good system to check reactor components. For example, two of the officials alleged that advisers from the former 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 these officials that the valves had been tested, the advisers did not provide any documentation showing 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 percent to 15 percent of these welds were defective. Although he did not know exactly where the pipes with the defective welds were located, it was 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 former official said that even though defective welds were found in the containment dome, concrete was still poured.

The former technician said that he had reported the defective welds to his superiors, who made an effort to locate the defects. He left Cuba shortly after reporting the problem and does not know whether any corrective action was taken. He said that Cuba's state security had classified the information about the defective welds as it routinely did any reports of problems at the plant.

In June 1991, this former Cuban official testified on problems in the reactors' civil construction before the Subcommittee on Western Hemisphere Affairs of the House Committee on Foreign Affairs. State Department, DOE, and NRC officials debriefed this individual and concluded that the Cuban reactors appeared to have quality control problems but that the welding problems probably would not lead to a major accident. Two of

the former Cuban officials who were still working at the nuclear power plant at the time of the hearings told us that the Cubans had paid increased attention to safety concerns after this individual testified.

Former Cuban officials 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 official, individuals trained to be reactor operators have received 5 months of instruction from the Russians on a VVER440-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 VVER1,000-megawatt reactor simulator because it was similar to the reactor in Cuba, but he did not know why they had not been 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.

Assertions of Adherence to Safety Rules

The Acting Principal Officer of the Cuban Interests Section (at the time of our review, one of the highest-ranking Cuban officials in the United States), told us that he was aware of the allegations made by the Cuban émigrés. He said, however, that Cuba was interested in building the nuclear reactor in accordance with recognized safety standards to avoid the effects that a "Chernobyl-type" accident could have on the Cuban people and surrounding countries. He said that Cuba had provided medical treatment to children from the former Soviet Union affected by the Chernobyl accident and, as a consequence, knew firsthand the problems that could result from a nuclear accident. He said that he did not know whether the plant would ever be finished because so much money was needed to buy equipment for the reactors (between $100 million and $200 million).

We submitted a list of written questions to this official about the status and quality of the reactors' construction, design and operational safety features, and nuclear fuel. He said that he would submit the questions to the appropriate nuclear power officials in his government and try to arrange for GAO staff to meet with Cuban nuclear power officials and visit the nuclear plant site. As of September 1, 1992, we had not received a response to our questions.

According to information provided to us by the Embassy of the Russian Federation, the design of Cuba's nuclear reactors takes into account special considerations, such as the tropical environment and the impact of an earthquake (seismicity) or of an airplane's crashing into the plant.

U.S. Policy and Concerns of U.S. Officials About the Safe Construction and Operation of Cuba's Nuclear Reactors

According to State Department officials, the United States would prefer that the nuclear reactors not be completed. NRC and DOE officials with whom we spoke also have a number of concerns about the construction and future safe operation of the reactors.

United States Prefers That Reactors Not Be Completed

Currently, the United States maintains a comprehensive embargo on any U.S. transactions with Cuba and discourages other countries from providing assistance, except for safety purposes, to Cuba's nuclear program. The United States would prefer that the construction of the reactors never be completed and insists that Cuba sign either the Non-Proliferation Treaty or the Treaty of Tlatelolco—both of which bind signatories to blanket nonproliferation commitments for their entire nuclear program—before the United States considers reversing its policy of discouraging other countries from assisting Cuba with the construction of the reactors.

According to the State Department, U.S. nuclear energy officials believed, on the basis of information available about the design of the power plant, that the possibility of an off-site radiation leak was considerably lower for the Cuban reactors than for "Chernobyl-type" reactors because the design of the Cuban reactors differed from that of the Chernobyl-type reactors and the Cuban reactors had containment structures and other safety

features that the other reactors did not possess. However, U.S. officials are concerned that Cuba is not equipped to deal with an accident.

In October 1989, the State Department arranged a limited visit with Cuba through which an NRC official and two U.S. nuclear power industry representatives visited the plant and met with Cuban nuclear power officials. Previously, Cuban nuclear power officials had visited a U.S. nuclear power plant. After that visit, the United States proposed further visits to look at construction, quality assurance, and operational safety. In September 1991, the then head of Cuba's Atomic Energy Commission (Fidel Castro's son) requested that a formal agreement on nuclear safety and cooperation be signed before any further exchanges took place between the United States and Cuba.

The State Department proposed instead that safety visits occur on a case-by-case basis. U.S. officials thought that a formal agreement would signal U.S. acceptance of Cuba's building a nuclear power plant without having signed the Non-Proliferation Treaty or the Treaty of Tlatelolco. Also, U.S. officials thought that the Cuban government could use a formal agreement for propaganda purposes to indicate falsely that the United States did not have concerns about the nuclear reactors. In addition, according to State Department officials, a formal agreement between the United States and Cuba would not be consistent with U.S. efforts to discourage cooperation between Russia and others in building the Cuban nuclear reactors. The State Department may seek a follow-up visit to the Cuban reactors by NRC officials if construction proceeds.

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 United States has asked Russia to cease providing any nuclear assistance until Cuba has signed the Non-Proliferation Treaty or the Treaty of Tlatelolco, which would allow inspections of Cuba's nuclear facilities by the International Atomic Energy Agency (IAEA).[3] If Cuba signs either treaty, State Department officials believe that aid from Russia should be limited to safety matters.

We spoke with IAEA's Director, Division of Nuclear Safety, to determine whether any contacts had taken place with the Cuban government

[3]IAEA is an independent intergovernmental organization within the United Nations that helps to promote, among other things, improvements in operation and maintenance practices for nuclear power plants.

regarding possible inspections of the reactors. He said that he had discussed the possibility of IAEA's conducting a preoperational safety review team program (pre-OSART) visit with a high-ranking Cuban nuclear power official but that no date had been set for such a visit. A preoperational safety review team visits a nuclear power plant under construction to review project management; quality assurance; civil construction; mechanical, electrical, and instrumentation and control equipment; preparations for start-up and operation; training and qualification; and radiation protection and emergency response planning. Pre-OSART visits are voluntary and must be requested by the host country.

NRC Officials Concerned About Allegations of Safety Deficiencies

NRC officials familiar with the allegations raised by the former Cuban nuclear power officials concluded that these officials 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 detailed information available on the reactors is limited, NRC officials have no way of verifying the validity of these concerns. An NRC official told us that their concerns about the Cuban reactor include (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.

According to NRC's Director of International Programs, before NRC could form an opinion on Cuba's nuclear reactors, a team of NRC inspectors and/or U.S. nuclear industry officials would have to conduct an extensive investigation of the plant and be given access to information about construction procedures, techniques, and test results. Such a team would also need visually to inspect construction and equipment installation as they occur. He suggested that if the plant is to be completed, he would like to see a "robust" exchange of safety experts between the United States and Cuba. The Director noted that Cuban personnel lack experience operating nuclear reactors and that Cuba lacks the industrial infrastructure to support a nuclear power plant. He also said that the Cuban government had indicated that it was planning to establish a regulatory structure similar to the NRC with inspectors who had been trained in the former Soviet Union, but he did not think that this would happen.

The Director expressed concern about the design of the plant's containment system, which he had initially thought to be similar to the design used in U.S. or Western-style reactors. Specifically, he said that the design of the pressure suppression system was based on analytical models

and had not been tested. He added that NRC would not allow such a system in a U.S. nuclear power reactor unless it had undergone extensive testing. Furthermore, he was concerned that the upper portion of the containment dome was designed to withstand pressures of only 7 pounds per square inch. He also expressed concern that the reactor's pressure vessel and other primary reactor components have been stored outdoors since December 1990 and exposed to corrosive salt water vapor. He said that such equipment should have been stored in an enclosed building.

The Director said that other than meeting occasionally with Cuban nuclear officials at various international nuclear conferences, NRC had no plans for any substantive contacts with the Cuban government regarding nuclear safety matters.

DOE Official Concerned About Quality of Reactors' Construction and Components

DOE's Acting Director, Division of International Programs, told us that he was concerned about the quality of the reactors' construction and components because Soviet-designed components were never recognized for their quality and reliability. According to the Acting Director, there is no reason to believe that the quality of the Soviet components being used in the Cuban reactors is any better. In addition, he said that because the Soviet Union placed a higher priority on production than safety, a number one priority should be the development of a "safety culture"[4] for all Soviet-designed plants, including the plant in Cuba. Like the NRC official, he was concerned that the upper half of the containment dome might be capable of withstanding pressures of only 7 pounds of pressure per square inch. He said that since DOE's 1989 report on Soviet-designed reactors, Department of Energy's Team Analysis of Soviet Designed VVER's, which discussed the reactors being built in Cuba, DOE had not performed any additional analysis of Cuba's nuclear reactors, nor was any planned.

Assessments of Risks From Earthquakes and Radioactive Pollutants

USGS officials could not determine the potential for earthquakes at the reactor site, in part because available information was limited. NOAA scientists, at our request, prepared an analysis that shows the probability of radioactive material's reaching the United States by air currents in the event of an accident at the nuclear power reactor site.

According to the Deputy Chief, Latin American Geology, Office of International Geology, USGS, USGS has not assessed the risk of an

[4]A "safety culture" is the assembly of characteristics and attitudes in organizations and individuals that establishes safety issues at a nuclear power plant as an overriding priority and ensures that they receive the attention warranted by their significance.

earthquake in Cuba, in part because USGS does not have access to the information required for this type of analysis. He added that USGS had attempted to obtain this information but the Cuban government had not provided it. Therefore, the USGS official could not answer specific questions about the seismic conditions at the site of the reactors in Cuba.

According to the 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 USGS official said that 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.

An international insurance group in Munich, Germany, which conducted an earthquake risk assessment of Cuba as part of a 1988 assessment of natural hazards, estimated that the Cienfuegos area, where the nuclear reactor is located, could produce an earthquake with a probable maximum magnitude of 5.0 on the Richter scale.

At our request, NOAA scientists analyzed, by season, 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.[5] Based on climatological data for summer 1991 and winter 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 towards the east, possibly as far north as Virginia and Washington, D.C., in about 4 days.

Conclusions

Although work on the Cuban nuclear power reactors has apparently been suspended, the civil construction is estimated to be 90 percent to 97 percent complete for the first unit and about 20 percent to 30 percent complete for the second unit. The primary components have not been installed, and the nuclear fuel has not been delivered. A number of concerns exist about Cuba's reactors, including the questionable quality of the civil construction, the lack of a regulatory structure, the inadequacy of training for operators, and the absence of an industrial infrastructure in

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

Cuba to support the reactors' operation and maintenance. If the allegations of safety problems are true, the safe operation of the reactors could be affected. In addition, there are concerns that the upper portion of the containment dome was designed to withstand pressures of only 7 pounds per square inch.

Because Russia requires hard currency as payment for—and Cuba currently lacks the financial resources to buy—equipment needed for the reactors, it is uncertain when the nuclear reactors will become operational. Continued monitoring of Cuba's progress towards completing the reactors is warranted. If Cuba obtains the assistance needed to complete its nuclear power reactors, U.S. officials will need assurances that the safety concerns expressed by the former Cuban nuclear officials and others are resolved and that the nuclear reactors are built and will be operated in a manner that does not pose a risk to the United States in the event of an accidental release of radioactive material.

Agency Comments

We discussed the facts presented in this report with the State Department's Director and Deputy Director, Office of Cuban Affairs, and Deputy Director, Office of Nuclear Technology and Safeguards; NRC's Director of International Programs; and DOE's Acting Director, Division of International Programs. In general, these officials agreed with the facts presented and gave us additional clarifying information. We revised the text as necessary. However, as requested, we did not obtain written agency comments on a draft of this report.

Scope and Methodology

To determine the status of the Cuban nuclear power reactors' construction, design, and potential safety problems, we interviewed officials and reviewed documentation from the State Department, NRC, DOE, USGS, NOAA, and the Central Intelligence Agency. We also interviewed officials from the Department of the Navy, IAEA, the World Association of Nuclear Operators, and the Institute of Nuclear Power Operations, as well as a professor of nuclear engineering at the University of Florida.

Because Mexico has a radiation safety and nuclear safety agreement with Cuba, we conducted telephone interviews on the status of the Cuban reactors' construction with several Mexican officials, including the Director General of the National Institute of Nuclear Investment and the Director General of the National Commission of Nuclear Security and Safeguards. In addition, we interviewed, by telephone, two Mexican

officials who had visited Cuba's nuclear power plant within the past year—the construction manager and the licensing manager of Mexico's Laguna Verde nuclear power plant.

We interviewed five former Cuban nuclear power officials, including nuclear and electrical engineers and a technician, all of whom had worked at the Cuban nuclear power plant and alleged that there were serious safety defects in the reactors' construction. We discussed these allegations with NRC and DOE officials. We also met with the Acting Principal Officer of the Cuban Interests Section of the Swiss Embassy and submitted a list of questions about the nuclear reactors to him to be answered by nuclear power officials in Cuba. In addition, we submitted questions about the reactors to Russian nuclear power officials through our embassy in Moscow, Russia. As of September 1, 1992, we had not received a response to our questions. We will report separately on this information after we have obtained and reviewed it.

We performed our review between June and September 1992 in accordance with generally accepted government auditing standards.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies of the report to appropriate congressional committees; the Secretaries of State and Energy; and the Chairman, Nuclear Regulatory Commission. We will make copies available to others on request.

Please contact me at (202) 275-1441 if you or your staff have any questions. Major contributors to this report are listed in appendix I.

Sincerely yours,

Victor S. Rezendes
Director, Energy and Science Issues

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.

Jim Wells, Associate Director, Energy and Science Issues
Gene Aloise, Assistant Director
Thomas J. Flaherty, Evaluator-in-Charge
Duane Fitzgerald, Ph.D., Nuclear Engineer
Mario Zavala, Evaluator
Mary Alice Hayward, Evaluator

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