BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 110009-EI
FLORIDA POWER & LIGHT COMPANY

MAY 2, 2011

IN RE: NUCLEAR POWER PLANT COST RECOVERY
FOR THE YEARS ENDING
DECEMBER 2011 AND 2012

TESTIMONY & EXHIBITS OF:

NILS J. DIAZ

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DIRECT TESTIMONY OF NILS J. DIAZ

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Q. Please state your name and business address.

A. My name is Nils J. Diaz. My business address is 2508 Sunset Way, St. Petersburg Beach, Florida, 33706.

Q. By whom are you employed and what is your position?

A. I am the Managing Director of The ND2 Group (ND2). ND2 is a consulting group with a strong focus on nuclear energy matters. ND2 presently provides advice for clients in the areas of nuclear power deployment and licensing, high level radioactive waste issues, and advanced security systems development.

Q. Please describe your other industry experience and affiliations.

A. I presently hold policy advising and lead consulting positions in government and industry, as well as board memberships in National Labs and private institutions. I previously served as the Chairman of the United States Nuclear Regulatory Commission (NRC) from 2003 to 2006, after serving as a Commissioner of the NRC from 1996 to 2003. Prior to my appointment to the NRC, I was the Director of the Innovative Nuclear Space Power and Propulsion Institute for the Ballistic Missile Defense Organization of the U.S. Department of Defense, and Professor of Nuclear Engineering Sciences at the University of Florida. I have also consulted on nuclear energy and energy policy development for private industries in the United States and abroad, as well as the U.S. Government and other governments. I have testified as an expert witness to the U.S. Senate and House of Representatives on multiple occasions for the last 25 years. I recently served as Commissioner, Florida's Energy and Climate Commission.

Q. Have you previously provided testimony in this docket?

A. Yes.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the recent events at the Fukushima Daiichi Nuclear Plant Japan and the potential impacts of those events on Florida Power & Light Company's (FPL) new nuclear and extended power uprate projects.

Q. Please describe the events in Japan affecting the Fukushima Daiichi Nuclear Plant.

A. The following reflects my understanding of the situation in Japan from reports by the Japanese Government, Tokyo Electric Power Company (the plant owner and operator), the International Atomic Energy Agency, the NRC, and from my discussions with sources in Japan.

The initiating events that led to the accidents at the Fukushima Daiichi nuclear plant were extraordinary natural forces far beyond the plant's design parameters and historical records. After suffering a 9.0 earthquake, the strongest in Japanese modern recorded history, and a subsequent massive tsunami with a surge as high as 43 feet above normal sea level at the plant site, the Fukushima Daiichi nuclear plant first lost the connections to the electrical grid which provide off-site power to the units. Units 1 through 3 shut down automatically after the earthquake, and emergency core cooling systems were activated.

Electrical power was temporarily provided for about an hour by the plants on-site emergency diesel generators, and after these failed, emergency battery power provided the controls needed to maintain reactor core cooling. Due to the severe infrastructure damage in the entire area, no additional emergency power was made available and eventually the battery power was exhausted, and resulted in the loss of backup decay heat removal systems. The resulting situation is called a "station blackout." The station blackout affected the capability of the plant to provide cooling to the reactor core, and eventually to the spent fuel pools on site, resulting in Units 1 through 3 with core degradation and Units 1 through 4 four with inadequate spent fuel cooling. The fuel degradation resulted in hydrogen generation from the metal-to-water reaction of the fuel cladding and subsequent explosions. Therefore, four reactor units have different degrees of damage with radiological consequences.

Station blackout is considered a primary accident precursor for nuclear power plant accidents. The plant should have been well supported by on-site and off-site resources to restore cooling prior to impacts on the reactor core and spent fuel pools. However, it seems that too much time elapsed from the first indication of loss of emergency power to the time that significant resources were brought to bear in the management of the situation.

The situation in Japan was completely unexpected because it was caused by an inordinately strong earthquake and tsunami combination that paralyzed Japan's national response capabilities. The Fukushima Daiichi units are the first reactors in the world to experience core degradation and release significant radioactivity off-site due to a catastrophic external event and complete loss of cooling capability. Additionally, the situation was initiated by external events far beyond the plant's design basis and historical norms. Two reactors were severely damaged by an earthquake in Armenia on December 7, 1988; however, both reactors were successfully shutdown and cooled, preventing a major accident and radioactive release. Moreover, it appears that nuclear reactor accident management was wanting in Fukushima when compared to the manner, timing, and intensity of plans in place for the U.S. nuclear fleet for responses to any internal or external events impacting plant safety.

Nuclear plant accident management is predicated on a series of simple-to-understand yet complex-to-execute instructions: maintain core cooling; maintain cooling of spent fuel pools; maintain containment integrity; and minimize radiological releases to the public and the environment. All of these goals are collapsed into a dominant reactor safety requirement: provide adequate heat removal for heat generating sources. Reactor accidents or incidents can be effectively managed if adequate cooling is provided when needed and maintained.

While the full extent of damage to these reactors still is not well known, it appears there was a lack of timely and adequate cooling of the over-pressurized boiling-reactor cores at the Fukushima plants, and later of the open spent fuel pools, due to a generalized loss of electrical power. The recurrent loss of cooling to the reactors and spent fuel pools at Fukushima Daiichi Units 1-4 resulted in hydrogen generation and explosions in the reactor systems and in loss of water inventory and cooling of spent fuel pools, with the ultimate result of degradation to nuclear fuel and radioactive contamination on-site and off-site.

Q. Does the U.S. nuclear regulatory scheme address the scenario that occurred at the Fukushima Daiichi Nuclear Plant?

A. Yes. First, NRC regulations at 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 2, "Design Bases for Protection against Natural Phenomena," requires that structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The established Defense-in-Depth approach for US nuclear power plants also require the capability to cope with beyond design basis events.

All U.S. nuclear plant designs include appropriate consideration of seismic events and tsunamis, which includes the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin to ensure performance of safety functions. These catastrophic natural events are very region- and location-specific, based on tectonic and geological fault line locations; therefore, it is important not to extrapolate earthquake and tsunami data from one location of the world to another when evaluating these natural hazards. The geologic makeup of the U.S. and its surrounding areas is very different from the geologic makeup of Japan and its surrounding areas.

Second, U.S. nuclear power plants are designed to cope with a station blackout event that involves a loss of offsite power and onsite emergency power. The NRC's detailed station blackout regulations at 10 CFR 50.63 address this scenario. U.S. nuclear plants are required to conduct a "coping" assessment and develop a strategy to demonstrate to the NRC that they could maintain the plant in a safe condition during a station blackout scenario. These assessments, proposed modifications, and operating procedures to deal with a station blackout event were reviewed and approved by the NRC for the entire U.S. fleet. Several plants added additional alternating current power sources to comply with this regulation.

Third, in the aftermath of the 9/11 terrorist attacks, the NRC moved quickly to enhance already existing layers of defense at nuclear power plants. These programs culminated in a series of orders and rulings that require nuclear power plant licensees to maintain safety margins under extreme conditions, regardless of origin. These requirements are known collectively as "B.5.b" (from the section of the Security Order mandating these requirements) which requires licensees to adopt mitigation strategies using readily available resources to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities to cope with the loss of large areas of the facility due to large fires and explosions from any cause, including beyond-design basis aircraft impacts. The NRC Staff and the nuclear industry also developed guidance for implementing B.5.b requirements, including best practices and strategies for mitigating losses of large areas of the plant and measures to mitigate fuel damage and minimize radiological releases, including adding make-up water to spent fuel pools, spraying water on spent fuel, enhanced initial command and control activities for challenges to core cooling and containment, and enhanced response strategies for challenges to core cooling and containment. These safety enhancements, if effectively and timely implemented in Japan, would have mitigated the events facing the operator of the Fukushima Daiichi reactors.

Finally, the continued implementation and enhancement of these measures are inspected and monitored by the NRC to ensure that plant safety is maintained under most severe challenges, with the support of specified on-site resources and procedures and established off-site support, as needed. The most critical element in the management of potential nuclear accidents remains the establishment and continuity of command and control activities and emergency preparedness activities, which are routinely exercised by the nuclear industry, by the NRC, by the Federal Emergency Management Agency, and by state and local governments.

Q. Have there been any external weather-driven events in the U.S. that have challenged the design and safety of U.S. nuclear plants?

A. Yes. In 1992, Hurricane Andrew, a category 5 storm, passed directly over FPL's Turkey Point Nuclear Plant. Despite damage to offsite power sources, road access, communications, fire protection, and security systems, there were no radiological impacts, and Turkey Point Unit 4 was restarted without incident approximately 30 days after the storm. Following a previously scheduled refueling and maintenance outage, Turkey Point Unit 3 was restarted approximately 90 days after the storm. In fact, in contrast to the events in Japan, the emergency diesel generators (EDGs) at Turkey Point, which are housed in seismic Category 1 steel-reinforced concrete structures, were not affected by the storm. The EDGs and their safety-related buses remained operable to supply power for cooling functions when the off-site power supply was unavailable. This challenge clearly demonstrated the robust nature of the Turkey Point design to be able to withstand one of the most severe hurricanes on record.

Q. Do the nuclear plant designs currently under review in connection with combined operating license applications (COLAs) provide enhanced margin to address events such as the ones affecting the Fukushima Daiichi Nuclear Plant?

A. Yes. The current generation of nuclear power plant designs that are the subject of COLAs, such as the Westinghouse AP1000 design that is referenced in the Turkey Point Units 6&7 COLA, are more robust than the existing plants in the areas shown to be compromised by the earthquake/tsunami combination in Japan. Specifically, the Westinghouse AP1000 new nuclear power plants planned for Florida have passive reactor cooling safety systems that do not require electrical power for operation, provide spent fuel pools with enhanced security and cooling, and also include the B.5.b measures and additional requirements. The B.5.b requirements were codified into the Code of Federal Regulations for all existing and new reactors in March 2009, and additional requirements for consideration of aircraft impacts for new reactors, amending 10 CFR Part 50 and Part 52, were added in September 2009, further enhancing protection and response requirements for all new reactors, including the AP1000.

Q. What are the potential impacts of the Japan incident for the fleet of U.S. commercial nuclear reactors?

A. The global consequences of the nuclear accidents in Japan will be the subject of much discussion and debate. It appears that the severity of the accidents is more significant than the Three Mile Island (TMI) accident and less than the Chernobyl accident, from the overriding radiological protection viewpoint. TMI experienced core degradation with severe contamination limited to the reactor core and primary coolant system and very limited release of radioactivity off-site. The fact that measurable radioactive contamination is being detected off-site around the Fukushima plant area, even though at levels not considered to present a serious health hazard, will present multiple challenges to the nuclear community and Governments at large. The fact that there is substantial radioactive contamination outside of the pressure vessel and reactor coolant systems present an additional level of severity and complication in effectively managing the accidents.

It is important, therefore, to place the U.S. existing and proposed new-built nuclear reactors safety and accident management programs in perspective. Existing nuclear power reactors in the U.S. are considered safe to operate due to the stringent requirements that have been systematically improved since the TMI accident. The consideration of station blackout events was the earliest regulatory requirement imposed from the probabilistic safety analysis of reactors following the TMI accident, and continues to be reviewed and upgraded. U.S. nuclear power plants have received significant additional regulatory and licensee enhancements to satisfy safety, reliability, and security requirements.

The NRC is currently conducting an in-depth review of the safety of existing and new nuclear power plants in the U.S. NRC announced a 90-day preliminary review followed by a more systematic analysis to ensure that any lessons learned from the accidents at Fukushima are incorporated into U.S. nuclear power accident management plans. The standard to be followed has been established by law and affirmed by the Courts: the operation of U.S. nuclear reactors shall provide reasonable assurance of adequate protection of public health and safety and the environment. In consideration of the existing safety requirements and in light of these activities, it is likely that the NRC will deny a request filed in all COL and license renewal proceedings in April 2011 to suspend these proceedings pending a review of the events in Japan.

Although I fully expect that NRC will mandate some additional improvements arising out of these analyses, my view is that current U.S. plant designs and safety margins provide adequate protection to public health and safety, and that additional requirements arising out of the Japan situation will enhance safety but will not radically change U.S. nuclear power safety regulation. My observation that there will be no radical changes in NRC regulation of nuclear power plants is supported by NRC decisions in the wake of the events in Japan to renew the operating license of the Vermont Yankee and Palo Verde nuclear plants, to defend the issuance of the renewed operating license for the Oyster Creek nuclear plant in a federal court proceeding, and to approve extended power uprates for the Point Beach Nuclear Plants.

In this regard, I believe that FPL's strategy to pursue licensing for Turkey Point Units 6 and 7 and for the extended power uprate projects for Turkey Point Units 3 and 4 and St. Lucie Units 1 and 2 continues to be prudent and that, assuming that all NRC requirements are met, the NRC should approve the license applications for these projects.

Q. Does this conclude your direct testimony?

A. Yes.