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ONE HUNDRED ELEVENTH CONGRESS

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March 1, 2010

Gene Dodaro
Acting Comptroller General of the United States
Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Dodaro:

I am writing to request that the Government Accountability Office (GAO) commence a review of the policies and procedures of the Nuclear Regulatory Commission (NRC) regarding issues critical to the public health and safety: the NRC licensing process for both new reactors and operating license extension for existing reactors, actions by the NRC to evaluate and improve the resilience of the nation's nuclear power plants to climate change and natural disasters, the NRC's response to ingoing fire safety issues, and the status of state-held licensee-held decommissioning funds.

Nuclear power generation has been offered by some as one answer to the escalating crisis of global warming, as the operation of nuclear power plants results in a lower carbon dioxide output than burning carbon-based fossil fuels. However, a catastrophic accident at a nuclear plant would pose a threat to the public health and safety many orders of magnitude more severe than at any other type of power plant. If a radiation release were to occur from a nuclear power plant, or even if one were threatened, it is likely that public reaction would result in a severe curtailment of investor interest in financing nuclear power in this country, rendering moot the technology's potential positive impact on global warming.

The economics of nuclear power must also make fiscal sense. The cost of a new nuclear reactor often exceeds the total market capitalization of the companies seeking to build them. In addition, industry cost and construction estimates have historically been vastly underestimated, the nuclear component supply chain and skilled human resource base has contracted substantially over the last two decades, and worldwide reactor construction is constrained due to manufacturing bottlenecks of key components like the heavy forgings

needed for containment vessels.[1] As a result, there is a danger that high costs, long construction times, and procurement complications may cause licensees to prioritize speed of completion over safety of construction.

If nuclear power is to achieve the potential to combat global warming that its proponents believe it has, the public will need assurances that the NRC is responsibly undertaking its regulatory mission to protect public health and safety. Consequently, the Subcommittee requests that you commence an examination of the following issues related to this mission:

1) NRC Licensing Process

Please review whether the NRC new reactor licensing and license extension processes are effective and sufficient to ensure public health, safety and confidence, whether the processes fully comply with NRC policies and practices, and whether the process is fully transparent with adequate opportunity for public comment and access to relevant information.

A) License Renewal: Verification of Application Information. On September 6, 2007, the NRC Office of the Inspector General (OIG) released a report (OIG-07-A-15), entitled "Audit of NRC's License Renewal Program." This report stated that, "Most audit team members do not conduct independent verification of operating experience, instead relying on licensee-supplied information." Furthermore, the OIG report stressed that "In the absence of conducting independent verification of plant-specific operating experience, license renewal auditors may not have adequate assurances that all relevant operating experience was captured in the licensee's renewal application." The possibility that the NRC license renewal process does not include a comprehensive verification of important reactor operation information provided by the applicant is quite alarming.

B) New Reactor Licensing: Quality Assurance. Given that any new nuclear reactors constructed in this country will be of new design, a GAO examination of whether there are sufficient quality assurance measures associated with new reactors would be of great value. On November 16, 2009, the NRC OIG released a report (OIG-10-A-02) on the quality assurance (QA) program in the Office of New Reactors (NRO). As part of the combined license application (COLA) review, a report is submitted that includes a

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[1] *Nuclear New Build Cost Visibility and Predictability*, PowerAdvocate, (http://pepei.pennnet.com/display_article/342995/6/ARTCL/none/none/1/Nuclear-New-Build-Cost-Visibility-and-Predictability/); *Nuclear Revival Bumps Against Atrophy*, TheStar.com (May 3, 2008) (http://www.thestar.com/Business/article/420941); *U.S. Cedes Capability for Largest Nuclear Forgings*, Industry Week, (June 24, 2009) (http://www.industryweek.com/articles/u-s-_cedes_capability_for_largest_nuclear_forgings_19453.aspx?ShowAll=1).

description of the applicant's QA program to be applied to the design, fabrication, construction, and testing of the structures, systems, and components of the facility. With the increasing use of foreign parts in domestic plants, this QA program is important in maintaining oversight of international vendor programs, and dealing with particular challenges such as overcoming cultural and language barriers. The OIG presented two findings which require management's attention:

- Since the coordination of QA reviews among NRO branches is informal, "there is no way to verify that the QA review coordination has occurred, nor that all the QA portions of the standard review plan technical chapters have been fully satisfied."

- "NRC's QA oversight does not include a review for accurate translations." Inaccurate translations would likely affect the overall QA program, but the NRC has not fully assessed the potential impacts. There also appears to be internal disagreements among individual NRC staff members as to whether the QA rules apply to document translation.

As part of your review of NRC licensing and relicensing procedures, please address the following questions:

1) What are the procedures for the a) comprehensive nuclear reactor license renewal process, and b) the COLA process for new reactors as established by the NRC?
2) Is the NRC following its own procedures, particularly in ensuring the necessary public access to the decision-making process? In the view of stakeholders, are procedures sufficient to provide certainty about the process and schedule while ensuring public health, safety and confidence?
3) Has the NRC adequately addressed concerns raised by the 2007 Audit of the License Renewal Program, including the independent verification of licensee-supplied information? To what extent is applicant-supplied information independently verified or validated by NRC staff?
4) Is the NRC continuing to use contractors to evaluate licensing applications?[2] If so, what are the functions of these contractors? Are NRC contractors engaged in any "inherently governmental" activities as defined by the Federal Activities Reform Act (PL 105-270) or OMB Circular No. A-76 (Revised)? Are there any apparent or actual conflicts of interest between any NRC contractor and any NRC licensee?
5) Is the NRC moving forward with adequate responses to the issues identified in the NRC IG November 2009 report on the QA program at the NRO?

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[2] Congressman Ed Markey, *Nuclear Reactor Decisions to be Made by Private Contractors?* (Sept. 24, 2007) (http://markey.house.gov/index.php?option=com_content&task=view&id=3093&Itemid=141)
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2) NRC Actions to Evaluate and Improve Resilience of Nuclear Reactors to Natural Disasters and Climate Change

A) Seismic Dangers. The 2007 Chūetsu (6.8 magnitude) earthquake occurred just 12 miles from the Kashiwazaki-Kariwa nuclear power plant in Japan. Seismic safety standards had been strengthened in 2006 to withstand a 6.5 magnitude earthquake, and the plant did not sustain significant damage to the nuclear components. However, there was still extensive damage to non-safety-related systems, as well as overturned barrels of low-level radioactive waste, a release of radioactive iodine gas, a spill of cooling pool water, and a large transformer fire. The International Atomic Energy Agency, after inspection of the site, recommended additional geophysical surveys of the area to detect undiscovered fault lines and improved understanding of the intersection of seismic events and reactor aging[3]. The two nuclear power reactors in California, Diablo Canyon and San Onofre, both reside in highly active seismic zones as well.

1) How do current NRC regulations on seismic safety compare to those from other countries with robust seismic activity?
2) Do NRC regulations provide adequate protection against earthquakes?
3) Are those regulations enforced at plants nationwide?
4) Has the NRC taken steps to utilize the improvements in seismic research, modeling, and monitoring over the past decades to inform its regulations?

B) Severe Weather. Severe weather conditions, such as tornadoes and hurricanes, as well as flooding caused by heavy rains, can all impact the status of a nuclear reactor. The Davis-Besse plant was hit by an F2 (113-156 mph winds) tornado in 1998, knocking out power to the site. Diesel generators were used to maintain power, although they were not used for "non-emergency priority" systems such as cooling the onsite spent fuel rod pond (whose temperature rose from 110° to 137° during the outage). Just as one of the two generators was declared inoperable due to overheating (just 23 hours later due to faulty ventilation), off-site power was restored. In 2002, an F4 tornado (207-260 mph) came within 1 mile of the two reactors at Calvert Cliffs,

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[3] *Earthquake Spills Water at Japanese Nuclear Plant*, Washington Post, (July 17, 2007) (http://www.washingtonpost.com/wp-dyn/content/article/2007/07/16/AR2007071601712.html); *IAEA: No Significant Damage at Nuke Plant*, The Japan Times, (Aug. 19, 2007) (http://search.japantimes.co.jp/cgi-bin/nn20070819a2.html).

MD.[4] According to the NRC, a tornado of this force can badly damage steel-reinforced concrete.[5]

Similar problems with off-site power outages during hurricanes have occurred as well. In 1992, Hurricane Andrew passed over the Turkey Point site (which contains both nuclear reactors and fossil-fueled plants). Not only did the plant lose power for 5 days, but damage rendered their fire suppression system inoperable, wind stripped the fire protection off the conduits for the cables used to shut down the reactor, all while the site was covered in 100,000 gallons of combustible fuel that spilled from the neighboring fossil-fuel plant.[6]

5) What has the NRC done to mitigate the potential impacts of storms and other severe weather events on nuclear reactors?

C) Climate and Water. In addition to discrete events such as a storm or earthquake, climate change has the potential to affect more routine reactor operations. Although NRC Commissioner Klein stated in a May 2008 letter that no nuclear power plants—neither operational nor decommissioned—are threatened by rising seas, the estimates of potential rise in sea level by 2100 have increased significantly since then – with estimates now (up to 1.4 m) more than double the 2007 IPCC prediction (up to 0.6 m).[7]

Nuclear power plants also require a very large volume of water for cooling purposes. Consequently, the increasing frequency and severity of heat waves and drought due to climate change will likely lead to more regional water shortages that have the potential to significantly impact their operations. For example, summertime operation of the two reactors at the Susquehanna nuclear plant in Pennsylvania requires nearly 41 million gallons of water a day (or nearly 28,600 gallons per minute) from the Susquehanna River.[8] But during heat waves and drought, the volume of water available to a nuclear power plant can be severely curtailed. In 2007 the Browns Ferry

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[4] *Natural Disasters and Safety Risks at Nuclear Power Stations*, Nuclear Information Resource Service, November 2004 (http://www.nirs.org/factsheets/naturaldisaster&nuclearpower.pdf).

[5] U.S. Nuclear Regulatory Commission, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioned Nuclear Power Plants, October 2000.

[6] *Natural Disasters and Safety Risks at Nuclear Power Stations*, Nuclear Information Resource Service, November 2004 (http://www.nirs.org/factsheets/naturaldisaster&nuclearpower.pdf).

[7] Scientific Committee on Antarctic Research, *Antarctic Climate Change and the Environment* (2009). (http://www.scar.org/publications/occasionals/ACCE_25_Nov_2009.pdf).

[8] Union of Concerned Scientists, *Got Water?*, (December 4, 2007) (http://www.ucsusa.org/assets/documents/nuclear_power/20071204-ucs-brief-got-water.pdf).

reactors in Alabama were forced to shut down when intake water became too warm to keep the discharged cooling effluent temperature from exceeding the maximum allowable limit as determined by the Clean Water Act. Other heat and drought-related shutdowns at nuclear plants have appeared in Illinois, Missouri, and Georgia recently.[9] Alternatively, thermal pollution limits can be relaxed to allow plant operation, as they were throughout France during the 2003 heat wave that devastated Europe, [10] but at a potentially devastating cost to local and downstream river ecosystems.

6) What considerations are given to future water quantity and quality conditions in approving new reactors?
7) What are the approaches to reduce water use and water quality impacts by nuclear power plants and their drawbacks?
8) What steps has the NRC taken to continually review the implications of climate change on U.S. nuclear power plants?

In light of these new seismic concerns, predictions of increased hurricanes, water resource challenges and other effects of climate change, I would like to know what steps – if any – that licensees have taken to incorporate new information and science relating to natural or anthropogenically-influenced disasters which could affect reactor operations. Recent incidents have shown that even if the event itself does not directly damage the nuclear components, secondary consequences could create unsafe operating conditions or cause a radiological release. Such a review should include both operating reactors and new license applicants:

3) NRC's Ongoing Response to Fire-Safety Issues

Long-standing problems with fire protection at our nation's nuclear plants have led to considerable Congressional oversight efforts,[11] as well as GAO investigations.[12]

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[9] Nuclear Energy Information Service, *It's the Water, Stupid!*, July 3, 2009 (http://www.neis.org/Campaigns/YCNGW/2009-08_07_Its_the_water_stupid.pdf); Drought Could Force Nuclear Plants to Shut Down, WRAL.com, Jan. 23, 2008, (http://www.wral.com/news/state/story/2343605/).

[10] *Europe's Summer of Infernos*, The Christian Science Monitor, Aug. 13, 2003 (http://www.csmonitor.com/2003/0813/p06s01-woeu.html).

[11] e.g., Congressman Ed Markey, *Markey: Pilgrim Plant Fire Raises Issue of Lax Fire Safety Regulation by NRC*, (Oct. 31, 2008) (http://markey.house.gov/index.php?option=com_content&task=view&id=3483&Itemid=141)

In the past, the NRC had prescriptive fire code to assure the protection of electrical power, control and instrumentation circuits for safe shutdown of equipment at US reactors. Even these were plagued by problems. For example, in 1975 at the Browns Ferry reactor, a fire burned uncontrolled for nearly eight hours. It started in a cable penetration seal consisting of flammable polyurethane foam and 'Flamemastic' coating.[13] After that incident, the NRC required more stringent controls in order to reasonably ensure that no single fire could disable a control of reactor operations. However, many of these materials were later shown to be combustible and inoperable themselves. As early as 1991, it came to the attention of NRC that certain materials used as fire barriers were non-compliant with the fire safety requirements of 10 CFR 50 Appendix R 111.G.2. By 1992, the agency issued Bulletin 92- 01 declaring Thermo-Lag 300-1 fire barriers "inoperable."[14] In one response to these findings, the NRC took the remarkable step of ruling that these fire barrier penetration seal materials no longer needed to be non-combustible.[15] Clearly, the NRC's history with fire protection regulations has been problematic.

The Commission is now moving to regulation and enforcement of fire safety based on a performance-based risk-informed approach using mathematical modeling, developed through NFPA-805.[16,17] For that to work, the models need to be accurate. Indeed, the risk-informed side of NFPA-805 specifically requires that licensees use validated and verified (V&V) fire models in the development of their fire safety analyses to reasonably assure that no single fire can knock out redundant systems.

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[12] General Accounting Office, *Barriers to Effective Implementation of NRC's Safety Oversight Process*, April 2000, (http://www.gao.gov/archive/2000/rc00039.pdf ; http://www.gao.gov/new.items/d08747.pdf)

[13] U.S. Nuclear Regulatory Commission, *Cable Fire at Browns Ferry Nuclear Plant*, Apr. 3, 1975, (http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/1975/bl75004a.html)

[14] U.S. Nuclear Regulatory Commission, *Related Documents about Fire Barriers*, (http://www.nrc.gov/reactors/operating/ops-experience/fire-protection/fire-barriers/fire-barriers-related-docs.html#thermo).

[15] NRC Technical Assessment of Fire Barrier Penetration Seals in Nuclear Power Plants, SECY-96-146, July 1, 1996.

[16] National Fire Protection Association, *NFPA 805: Performance-Based Standards for Fire Protection for Light Water Reactor Electric Generating Plants*, 2010 Edition, (http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=805)

[17] We note, and question, the use of the 2001 NFPA-805 in 10 CFR 50.48(c), as opposed to the updated 2006 edition.

However, it has come to light that NRC plans to allow licensees to use non-V&V fire protection models to comply with NFPA 805.[18] The NRC says that a licensee would have to defend their non-V&Ved model to the staff, who will then determine whether that model is appropriate. Secondly, the NRC's modeling of the damage assessment to electrical cables and cable trays in a fire zone from radiant heat may require additional empirical data collection to ensure model accuracy, according to the National Institute for Standards and Technology (NIST), the same government agency that conducted this fire research for the NRC.[19]

In your report, I ask that you review the Commission's response to GAO's recommendations from its 2000 and 2008 reports, as well as the NRC's current efforts in this area,[20] specifically:

1) Does the NRC have the resources and expertise to evaluate non-V&Ved fire models to determine if they are sufficiently accurate? What are the advantages and disadvantages to allowing licensees to use non-V&Ved models?
2) How does the NRC's assessment of fire damage (e.g., to electrical cables in a fire zone from radiant heat fire models) compare to similar assessment methods favored by NIST and the International Collaborative Fire Modeling Project (ICFMP)?

4) The State of Licensee-Held Decommissioning Funds

By law, nuclear power plant owners are required to set aside sufficient funding to pay for the costs of decommissioning their plants after the end of their useful life.

A 2001 GAO report I requested[21] on decommissioning efforts found that, 1) the transfers of plant licenses between owners have affected assurances that adequate funds remain available for decommissioning, 2) the different site cleanup and decommissioning standards among plants affect the projected decommissioning costs, and 3) changes in financial reporting standards affect the disclosure of liabilities and funding of decommissioning. GAO recommended revision of the NRC's review plan and management controls for license transfers to include a check on decommissioning fund status. In addition,

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[18] U.S Nuclear Regulatory Commission, *Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications*, NRC NUREG-1824; http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1824/

[19] http://fire.nist.gov/bfrlpubs/fire08/PDF/f08039.pdf (see page 88 of the document under "Conclusions")

[20] NUREG/CR-6905/NIST SP 1013-1

[21] General Accounting Office, *NRC's Assurances of Decommissioning Funding During Utility Restructuring Could be Improved*, (December 2001) (GAO-02-48) (http://www.gao.gov/new.items/d0248.pdf).

concern that alternative decommissioning approaches may be affected by ongoing changes to the manner in which nuclear waste is kept onsite at plants. If decommissioning funds will be required to fund removal of additional stored wastes then new monies should be set aside for these activities.

Additionally, in a 2003 GAO report I also requested,[22] 42 of 122 nuclear plants were predicted to be without sufficient funds set aside to clean up their plants once they are permanently shut down, potentially leaving the taxpayers to foot the bill. This issue has been in the news this month regarding the $80 million shortfall in Vermont Yankee's decommissioning fund.[23] This 2003 report concluded that the NRC failed to identify fund shortages because of two failings in its trust fund monitoring methods: 1) the NRC relied too heavily on owners' statements of future funding plans, and 2) the NRC failed to evaluate separately the multiple trust funds for joint-ownership plants, effectively assuming that owners with excess funds would balance those with insufficient funds, even though funds are generally not transferable between owners. The GAO recommended that the NRC develop an effective method to determine if owners are adequately contributing to the decommissioning fund, with a separate evaluation for individual owner contributions. The GAO further recommended that the NRC establish criteria for taking action when an owner fails to contribute to the fund at a sufficient rate.[24]

I request that you follow-up the work of the 2001 and 2003 GAO reports on decommissioning to determine if the NRC has incorporated the necessary changes in order to ensure adequate funding of this program. In addition, I request that the GAO investigate whether new concerns have arisen in this area, such as the effect of leaked tritium from buried pipes on the cost of cleanup during decommissioning.

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[22] General Accounting Office, *NRC Needs More Effective Analysis to Ensure Accumulation of Funds to Decommission Nuclear Power Plants* (Oct. 2003) (GAO-04-32) (http://www.gao.gov/new.items/d0432.pdf).

[23] *NRC Accepts Entergy Stance on Yankee Decommissioning Fund*, Times Argus (December 11, 2009) (http://www.timesargus.com/article/20091211/NEWS02/912110348/1003/NEWS02).

[24] General Accounting Office, NRC Needs More Effective Analysis to Ensure Accumulation of Funds to Decommission Nuclear Power Plants, (October 2003) (GAO-04-32) (http://www.gao.gov/new.items/d0432.pdf).

Thank you very much for your consideration of this important matter. If you have any questions or concerns, please contact me, or have your staff contact Dr. Michal Freedhoff and Dr. Katie Matthews of my staff at (202) 225-2836.

Sincerely,

Edward J. Markey
Chairman
Subcommittee on Energy
and Environment