Sea Level Rise Planning for Florida's Nuclear Energy Infrastructure: A Wait and "Sea" Approach?

James F. Choate III[1]

Even Castles made of sand, fall into the sea, eventually.
-Jimi Hendrix

Abstract: This Article seeks to highlight the apparent head-on collision of the latest sea level rise projections with the current and future siting of Florida-based nuclear power plants. In general, the author assesses current planning measures and explores the degree to which decision-makers are integrating sea level rise science into reactor permitting decisions. Following a brief overview of the current state of climate change science, background is provided on the siting and operation of Florida's existing and future nuclear power plants. The agency permitting regimes for new nuclear reactors at the local, state, and federal level are then examined to determine the extent to which sea level rise implications have been accounted for in siting Florida's newly proposed reactors. The article concludes with a review of existing planning measures and adaptation strategies that respond to climate-change and sea level rise science, and assesses whether such measures might have potential application and value in safeguarding Florida's nuclear energy infrastructure.

 J.D. (Stetson University College of Law), 2009; LL.M. (University of Florida), 2010; Attorney, U.S. Army Corps of Engineers, Charleston, S.C. All views expressed in this article are those of the author in his individual capacity and do not necessarily reflect those of the Department of Defense, the U.S. Army, or the U.S. Army Corps of Engineers, which have indicated neither approval nor disapproval of the positions the author takes in this article. The author would like to thank Professor Ankersen, Professor Flournoy, and the faculty of the Environmental & Land Use Law Program at the University of Florida, Levin College of Law for providing guidance and expertise over the course of the writing process. Research for this article was conducted as a result of the author's participation in the University of Florida, Levin College of Law's Conservation Clinic. The Conservation Clinic is supported in part by Florida Sea Grant to provide law and policy expertise to the State of Florida and its coastal communities.

I. Introduction

In light of the shocking events surrounding the coastal flood vulnerabilities exposed at Japan's Fukushima Daiichi nuclear complex in the wake of the March 11, 2011 earthquake and tsunami,[2] flood safety concerns at nuclear power plants around the world have become a reality.[3] And although Japan's catastrophic nuclear disaster resulted from seismic activity rather than climate change *per se*, the resulting horror of what happened in Japan forces the issue of how climate-induced sea level rise and its potential for enhanced weather events (e.g., floods, hurricanes, etc.) may affect similarly situated nuclear reactors around the world.[4]

Twenty-two years after James Hansen testified to Congress about global warming (now commonly referred to as "climate change"), a very political debate rages on as scientists, politicians, and the like continue to argue over the accuracy of climate change studies such as the UN's Intergovernmental Panel on Climate Change AR4 report (IPCC AR4).[5] But if climate-induced sea level rise projections and associated flood-safety concerns (e.g., enhanced storm events, hurricanes,

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[2] Int'l Atomic Energy Agency (IAEA), *Fukushima Nuclear Accident Update Log: Updates of 12-18 May 2011*, *available at* http://www.iaea.org/newscenter/news/tsunamiupdate01.html.

[3] *Nuclear Regulatory Commission Chief Says Agency will Examine Flood Risk at US Nuclear Plants*, ASSOCIATED PRESS (Washington), May 2, 2011, *available at* http://www.syracuse.com/have-you-heard/index.ssf/2011/05/nuclear_regulatory_commission.html. *See also, Last Decade of German Nuclear Power*, WORLD NUCLEAR NEWS, May 31, 2011, http://www.world-nuclear-news.org/NP_Last_decade_of_German_nuclear_power_3105111.html (reporting Germany's announcement to "avoid restarting the seven reactors shut[down] during the moratorium and close the rest by 2022.").

[4] *See* Alyson Kenward, *Sea Level Rise Brings Added Risks to Coastal Nuclear Plants*, CLIMATE CENTRAL, Mar. 23, 2011, http://www.climatecentral.org/news/sea-level-rise-brings-added-risks-to-coastal-nuclear-plants. *See also* U.S. EPA, *Coastal Zones and Sea Level Rise*, http://epa.gov/climatechange/effects/coastal/index.html (discussing enhanced storm and flooding events). *But see* U.S. Nuclear Regulatory Comm'n (NRC), *Frequently Asked Questions About the Japan Nuclear Crisis: "Can It Happen Here?,"* http://www.nrc.gov/japan/faq-can-it-happen-here.pdf ("Along the Gulf Coast and the Atlantic Coast, storm surge from hurricanes poses a greater threat than tsunamis to nuclear power plants. The plants in these regions are well protected against hurricane storm surge."); Progress Energy, *Progress Energy's Response to Japan's Fukushima Nuclear Events*, March 17, 2011, https://www.progress-energy.com/assets/www/docs/company/events-in-japan.pdf, ("Our plants' emergency electrical supplies are designed and built to withstand the impacts of all historical natural disasters for our area, such as hurricanes, tornados, earthquakes and flooding (including storm surges) at our coastal plants.").

[5] The IPCC, with a primary purpose of reporting the most up-to-date state of knowledge on climate change at regular intervals, recently issued IPCC Fourth Assessment Report: Climate Change 2007 (AR4), and is currently working on its fifth assessment report (AR5). *See* Intergovernmental Panel on Climate Change (IPCC), *Reports*, http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm. *See, e.g.*, IPCC, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS (Susan Solomon et al. eds., Cambridge Univ. Press, Cambridge, UK, and New York 2007) [hereinafter IPCC, AR4].

floods, etc.) are to be believed to any extent,[6] coastal states such as Florida must face whether newly proposed U.S. coastal nuclear reactors should be built in such vulnerable locations. Interestingly, as short- and long-term planning and development of the Florida coastlines continues, coastal infrastructure – including the potential for additional coastal nuclear reactors – is expanding rather than waning, even in light of the increasingly dire predictions of climate-induced sea level rise.[7]

Fortunately, policy-makers at all levels of government are beginning to realize the high stakes gambling game at play, and, in some cases, taking action to assess the coming impacts of sea level rise.[8] And although Japan's ongoing nuclear disaster has yet to halt proposals for newly constructed U.S. coastal nuclear reactors,[9] it is also important to recognize that those tasked with anticipating and planning to protect Florida's geographically vulnerable coastal infrastructure face particularly difficult decisions. Ultimately, effective countermeasures to sea level rise and enhanced storm events will not come easy, as formidable questions of policy await the delicate balancing act of allowing coastal growth to continue without shunning climate change and sea level rise altogether.[10] At the heart of this balance is the overly simple but extremely difficult questions of *where* to allow ongoing development, and *to what degree* existing and future development should be armored, protected, moved, etc.

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[6] *See, e.g.*, Thomas R. Knutson, Geophysical Fluid Dynamics Laboratory/NOAA, Global Warming and Hurricanes (finding that "[a]nthropogenic warming over the next century will likely cause hurricanes globally to be more intense (by a few percent on average) and have substantially higher rainfall rates than present-day hurricanes."), *available at* http://www.gfdl.noaa.gov/global-warming-and-hurricanes.

[7] *See* Mark Schrope, *Unarrested Development*, 4 NATURE REPORTS CLIMATE CHANGE 36 (Apr. 2010) (reporting that "[d]espite the threat of rising sea levels, the drive to develop Florida's coastline continues"), *available at* http://www.nature.com/climate/2010/1004/pdf/climate.2010.27.pdf. *See also* FED. EMERGENCY MGMT. AGENCY, PROJECTED IMPACT OF RELATIVE SEA LEVEL RISE ON THE NATIONAL FLOOD INSURANCE PROGRAM ii (October 1991) ("Assuming current trends of development practice continue, the increase in the expected annual flood damage by the year 2100 for a representative NFIP insured property subject to sea level rise is estimated to increase by 36-58 percent for a 1-foot rise, and by 102-200 percent for a 3-foot rise in sea level."), *available at* http://epa.gov/climatechange/effects/downloads/flood_insurance.pdf.

[8] *See* CTR. FOR CLIMATE STRATEGIES, FLORIDA'S ENERGY AND CLIMATE CHANGE ACTION PLAN Ch.8 (2009), *available at* http://www.flclimatechange.us/; MIAMI-DADE COUNTY CLIMATE CHANGE TASK FORCE – SCI. & TECH. COMM., STATEMENT ON SEA LEVEL IN THE COMING CENTURY (Jan. 17, 2008) [hereinafter MIAMI-DADE CCATF, SLR STATEMENT]; SOUTH FLORIDA WATER MGMT. DIST., PRELIMINARY ESTIMATE OF IMPACTS OF SEA LEVEL RISE ON THE REGIONAL WATER RESOURCES OF SOUTHEASTERN FLORIDA, ADAMS Accession No. ML102740603; SOUTH FLORIDA WATER MGMT. DIST., ESTIMATED IMPACTS OF SEA LEVEL RISE ON FLORIDA'S LOWER EAST COAST, ADAMS Accession No. ML102740602; U.S. Army Corps of Eng'rs, *Water Resource Policies and Authorities Incorporating Sea-level Change Considerations in Civil Works Programs*, Circular No. 1165-2-211, July 1, 2009, *available at* http://www.corpsclimate.us/guidance.cfm.

[9] Andrew Freedman, *Japan's Nuclear Crisis Sparks Conversation on Energy Safety*, CLIMATE CENTRAL, Mar. 15, 2011, http://www.climatecentral.org/blogs/nuclear-power-crisis-sparks-conversation-on-energy-safety/.

[10] *See* Schrope, *supra* note 7.

Within this context, the stakes have perhaps never been higher for utility companies and their regulatory counterparts who must decide whether to move forward with financing[11] and building what would be Florida's first nuclear reactors in over 30 years.[12] Upon considering that Florida already has five coastal nuclear reactors, with four more multi-billion dollar reactors in the works,[13] real questions as to the future viability of Florida's current and proposed coastal reactor sites come into focus. Because nuclear reactors are permitted for forty-year periods, with an option for renewal,[14] several of Florida's existing coastal reactors will likely face sea level rise impacts during the next half-century regardless of whether plans for new reactors move forward.[15]

This Article seeks to highlight the apparent head-on collision of the latest sea level rise projections with the current and future siting of Florida-based nuclear power plants. In general, it will assess current planning measures, and explore the degree to which decision-makers are integrating sea level rise science into reactor permitting decisions. Part II provides a brief overview of the current state of climate change science. Part III explores Florida's current nuclear profile, and provides background on the siting and operation of Florida's existing and future nuclear power plants. Part IV examines the agency permitting regimes for new nuclear reactors at the local, state, and federal level, and assesses the extent to which sea level rise implications have been accounted for in siting Florida's newly proposed reactors.

Part V reviews existing planning measures and adaptation strategies that respond to climate-change and sea level rise science, and assesses whether such measures might have potential application and value in safeguarding Florida's nuclear energy infrastructure. Specifically, Part V examines how projected negative impacts to Florida's nuclear energy infrastructure might be offset

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[11] It is important to note that even upon setting aside environmental concerns, the economics of new U.S. reactors are less than certain. *See* JOHN M. DEUTCH ET AL., UPDATE OF THE MIT 2003 FUTURE OF NUCLEAR POWER 6 (MIT 2009) ("While the U.S. nuclear industry has continued to demonstrate improved operating performance, there remains significant uncertainty about the capital costs, and the cost of its financing, which are the main components of the cost of electricity from new nuclear plants."); GEORGE S. TOLLEY & DONALD W. JONES, THE ECONOMIC FUTURE OF NUCLEAR POWER: A STUDY CONDUCTED AT THE UNIVERSITY OF CHICAGO xi (2004) (finding that new U.S. nuclear electricity may cost more per megawatt-hour than coal- and gas-fired electricity even with federal financial policy assistance supporting new reactors), *available at* http://www.ne.doe.gov/np2010/reports/NuclIndustryStudy-Summary.pdf. *But see* WORLD NUCLEAR ASS'N, THE ECONOMICS OF NUCLEAR POWER (2010) (finding that "[n]uclear power is cost competitive with other forms of electricity generation, except where there is direct access to low-cost fossil fuels."), *available at* http://world-nuclear.org/info/inf02.html; WORLD NUCLEAR ASS'N, THE NEW ECONOMICS OF NUCLEAR POWER (2005) (summarizing recent nuclear economic studies and citing Finland's fifth reactor as an example of how new nuclear plants can be economically competitive against alternative energies), *available at* http://www.world-nuclear.org/reference/pdf/economics.pdf.

[12] Press Release, Fla. Dep't of Envtl. Prot. (DEP), Florida Cabinet Approves Site Certification for Progress Energy Florida's Levy Nuclear Plant (Aug. 11, 2009), *available at* http://www.dep.state.fl.us/secretary/news/2009/08/0811_02.htm [hereinafter DEP Press Release].

[13] U.S. ENERGY INFORMATION ADMIN., STATUS OF POTENTIAL NEW COMMERCIAL NUCLEAR REACTORS IN THE UNITED STATES (Release date July 1, 2010), *available at* http://www.eia.doe.gov/cneaf/nuclear/page/nuc_reactors/com_reactors.pdf.

[14] U.S. NRC, *Combined License Applications for New Reactors*, http://www.nrc.gov/reactors/new-reactors/col.html.

[15] U.S. Energy Information Admin., *Florida Nuclear Profile*, http://www.eia.doe.gov/cneaf/nuclear/state_profiles/florida/fl.html.

through actions taken sooner rather than later, and asserts that the time to make significant gains in minimizing the negative effects of climate-induced sea level rise is now – before new multi-billion dollar coastal reactors are built. Further, Part V recommends that energy companies either (1) begin to take voluntary measures to minimize accelerated sea level rise impacts including decisions for siting future plants, or (2) openly disregard accelerated sea level rise projections by taking a public stance that accelerated projections are simply wrong. Ultimately, Part V advocates that the existing industry and regulatory refusal to account for accelerated sea level rise projections, when combined with the continued practice of siting nuclear reactors on the Florida coastline, creates an unwarranted risk of disaster.

II. Sea Level Rise Science

As affirmed by the 2007 IPCC AR4 report, climate-induced sea level rise occurs for three primary reasons: (1) an expansion of ocean waters as a result of warmer ocean temperatures, (2) the melting of mountain glaciers and ice caps, and (3) to a lesser extent, the melting of the Greenland and Antarctic ice sheets.[16] But even before the existence of supposed man-made climate change, it is important to note that the landward extent of Florida has seen dramatic shifts through time.[17] For example, during the last interglacial period 120,000 years ago, South Florida was a shallow marine environment.[18] And during a glacial period 18,000 years ago, sea level was at *minus* 420 feet, which nearly doubled the landward extent of Florida and extended its western boundary 100 miles into the Gulf of Mexico.[19] Thus, although the fate of Florida remains largely unknown in the face of sea level rise in the coming century, it is clear that Florida's coastline is subject to extreme changes over time (e.g., centuries and millennia) regardless of human impacts. Compounding this reality with an assumption that human-impacts are now somehow influencing this natural process (as climate change science suggests), it is alarming that U.S. coastlines, including Florida, are predicted to see dramatic and unprecedented change in sea level in *decades*, rather than centuries and millennia.[20] Unfortunately, some climate scientists are now suggesting that the speed at which

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[16] IPCC, AR4, *supra* note 5. *See also* U.S. EPA, *Sea Level Changes*, http://epa.gov/climatechange/science/recentslc.html. Other proposed contributing factors include the human consumption of groundwater, impoundment in reservoirs, wetland drainage, and deforestation. *Id.*

[17] Presentation, SCIENCE COMM. OF THE MIAMI-DADE COUNTY CLIMATE CHANGE ADVISORY TASK FORCE, STATEMENT ON SEA LEVEL IN THE COMING CENTURY (April 22, 2008) [hereinafter MIAMI-DADE CCATF, SLR PRESENTATION], *available at* http://www.miamidade.gov/derm/library/08_04_22Statement_on_Sea_Level.pdf.

[18] *Id.*

[19] *Id.*

[20] *See, e.g.*, SCIENCE COMM. OF THE MIAMI-DADE COUNTY CLIMATE CHANGE ADVISORY TASK FORCE, STATEMENT ON CRITICALLY IMPORTANT RECENT FINDINGS ON CLIMATE CHANGE AND ANTICIPATED SEA LEVEL RISE (April 2010), *available at* http://www.miamidade.gov/derm/climatechange/library/meeting_documents_2010/sea_level_rise.pdf. *See also* U.S. EPA, *Coastal Zones and Sea Level Rise*, http://epa.gov/climatechange/effects/coastal/index.html.

climate-induced sea level rise occurs could be increasing at unprecedented rates, the accuracy and extent of which is simply unknown.[21]

Although climate change and its projected impacts (e.g., sea level rise) have gained international prominence in recent years, sea level rise has been a looming environmental issue for Florida for at least a decade.[22] Fourteen years ago (in 1997), the U.S. Environmental Protection Agency (EPA) estimated that as a result of climate change, Florida will likely experience a sea level rise of 18 to 20 inches (1.75 to 1.83 feet) by 2100,[23] and, further, that the cumulative cost of replenishing Florida's coast with enough sand to withstand a 20-inch (1.83 foot) rise in sea level by 2100 would be $1.7 to $8.8 billion.[24]

In 2007, IPCC AR4 projected a global sea level rise of 18 to 59 centimeters (0.59 to 1.93 feet) from 1990 to the 2090's.[25] And now fast forward four years to 2011. Although the scientific community seems to agree that the extent to which sea level rise will occur over the course of this century is simply unknown, the latest science also seems to suggest that, if anything, past sea level predictions have underestimated the potential for accelerated increases.[26] And in acknowledging the limits of linear sea level rise modeling (i.e., relying upon historically linear data *only*), the latest science relates that accurate sea level rise predictions prove extremely difficult due to potential exponential increases resulting from melting icecaps, the accelerated rate of which is simply unaccounted for in many current models.[27] As a result, anticipated sea level rise projections that would have been dismissed as wildly extreme outliers in past years, are, in the eyes of some scientists, not necessarily so wild or improbable anymore.[28] For example, as acknowledged in a 2009 U.S. Global Change Research Program (USGCRP) report, "recent estimates of global sea-level rise substantially exceed the IPCC estimates, suggesting sea-level rise between 3 and 4 feet in this century."[29] At this rate, much of South Florida, if not a significant portion of the entire state would be under water in less than 100 years from now.[30] Although anything more than three to five feet (+1 meter) by year 2100 would still appear extreme, even a one-foot rise in sea level would inundate many coastal areas of Florida.[31]

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[21] Stefan Rahmstorf, *A New View on Sea Level Rise: Has the IPCC Underestimated the Risk of Sea Level Rise?*, 4 NATURE REPORTS CLIMATE CHANGE 44 (April 2010), *available at* http://www.nature.com/climate/2010/1004/pdf/climate.2010.29.pdf. *See also* U.S. EPA, *Sea Level Changes*, http://epa.gov/climatechange/science/recentslc.html; U.S. EPA, *Future Sea Level Changes*, http://www.epa.gov/climatechange/science/futureslc.html.

[22] U.S. EPA OFFICE OF POLICY, PLANNING AND EVALUATION (2011), CLIMATE CHANGE AND FLORIDA, EPA 230-F-97-008i (Sept. 1997).

[23] *Id.*

[24] *Id.*

[25] IPCC, AR4, *supra* note 5.

[26] *See* Rahmstorf, *supra* note 21, at 44-5.

[27] *See id.*

[28] *See id.*

[29] U.S. GLOBAL CHANGE RESEARCH PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 150 (Thomas R. Karl, Jerry M. Melillo & Thomas C. Peterson eds., Cambridge Univ. Press 2009) [hereinafter USGCRP REPORT], *available at* http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.

[30] MIAMI-DADE CCATF, SLR PRESENTATION, *supra* note 17.

[31] *Id.*

Regardless, the purpose of this Article is not to engage in an overly technical examination of sea level rise science, or to make any assessment as to whose science is most credible. To the contrary, this Article merely aims to acknowledge what appear to be two emerging trends within the scientific community: (1) that sea level rise predictions have potentially been underestimated in recent years, and (2) that although *accelerated* sea level rise may occur in the next half century and beyond, accurate predictions are simply beyond current scientific modeling.[32] In this regard, current science seems to raise more questions than answers, which leads to an uncomfortable state of uncertainty for policy-makers attempting to make sense of predictions as to what coastal communities and their supporting infrastructure will ultimately face in coming decades. Sound policy, other than a strict application of the precautionary principle, simply cannot flow from such uncertainties, and yet the permitting process for new coastal reactors moves forward.[33]

Perhaps reinforcing the chaotic nature (or at least the pervasiveness) of current climate change science and the ensuing duty to respond, there is no shortage of both independent and collaborative climate change studies among the various federal agencies. In fact, the EPA has been studying sea level rise for the last twenty-five years.[34] And since 1989, the USGCRP,[35] comprised of thirteen federal agencies, has been actively "build[ing] a knowledge base that informs human responses to climate and global change through coordinated and integrated federal programs of research, education, communication, and decision support."[36] As part of the USGCRP, the U.S. Geological Survey (USGS),[37] U.S. Army Corps of Engineers (Corps),[38] National Oceanic and Atmospheric Administration (NOAA),[39] U.S. Department of Energy (DOE),[40] and EPA,[41] are among the thirteen federal agencies actively addressing climate change science and its associated

[32] It is important to acknowledge the limits of using historical sea level data from the past 100 years to project sea level rise over the next 100 years if *accelerated* sea level rise is occurring. Rahmstorf, *supra* note 21, at 44-5.

[33] INT'L ATOMIC ENERGY AGENCY, FLOOD HAZARD FOR NUCLEAR POWER PLANTS ON COASTAL AND RIVER SITES, No. NS-G-3.5, § 14.9, 72 (2003) (recommending that "[w]ithin the framework of the Intergovernmental Panel on Climate Change investigations in relation to climate change, ... the upper boundary of the 95% confidence interval should be taken" when considering nuclear power plant safety), *available at* http://www-pub.iaea.org/MTCD/publications/PDF/Pub1170_web.pdf.

[34] A portion of EPA's website, entitled "Sea Level Rise Reports," states that "[f]or the last 25 years, EPA has been assessing the implications of rising sea level and opportunities to prepare for the possible consequences." U.S. EPA, *Sea Level Rise Reports*, http://www.epa.gov/climatechange/effects/coastal/slrreports.html.

[35] The USGCRP began as "a presidential initiative in 1989 and was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606)." USGCRP, *Program Overview*, http://www.globalchange.gov/about.

[36] *Id.*

[37] U.S. Geological Survey, *Sea Level and Climate*, http://pubs.usgs.gov/fs/fs2-00/.

[38] U.S. Army Corps of Eng'rs, *Responses to Climate Change*, http://www.corpsclimate.us.

[39] Nat'l Oceanic & Atmos. Admin., *NOAA Climate Service*, http://www.noaa.gov/climate.html.

[40] U.S. Dep't. of Energy, *Climate Change*, http://www.energy.gov/environment/climatechange.htm.

[41] U.S. EPA, *Climate Change*, http://epa.gov/climatechange/index.html.

impacts.[42] Curiously, the U.S. Nuclear Regulatory Commission (NRC), as the agency overseeing the permitting and regulation of U.S. nuclear reactors, is absent from the USGCRP program, and, in fact, the NRC has yet to provide any public comment on climate change science (to date).[43] But upon considering the danger that seemingly results from building a reactor in a vulnerable coastal location, it seems obvious that sea level rise science should be on the forefront of coastal siting decisions for new reactors.

In this vein, federal agencies are not the only governmental entities formulating climate change policy and taking a genuine interest in the vulnerabilities of coastal infrastructure. In Florida, the South Florida Water Management District (SFWMD) and the Miami-Dade County Climate Change Advisory Task Force (CCATF) are among the state and local entities taking sea level rise concerns very seriously. In 2008, and as recognized by the SFWMD,[44] the Miami-Dade CCATF made the following finding:

> Unfortunately, it looks as though sea level in the coming century will rise significantly more than two feet. With what is happening in the Arctic and Greenland, many respected scientists [footnote omitted] now see a likely sea level rise of **at least** 1.5 feet in the coming 50 years and a total of **at least** 3-5 feet by the end of the century, possibly significantly more (calculations used are provided at end of statement). Spring high tides would be at +6 to +8 feet. This does not take into account the possibility of a catastrophically rapid melt of land-bound ice from Greenland, and it makes no assumptions about Antarctica.[45]

When considering that "south Florida has experienced an average rate of relative sea level rise of about 1.5 inches per century" over the last 2,500 years, these predictions are of significant concern.[46]

III. Florida's Nuclear Energy Infrastructure

To oversimplify a highly sophisticated method of generating electricity, nuclear power plants operate by using the process of "fission" to cause uranium fuel to react and release heat, which is

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[42] For example, in 2008, the U.S Climate Change Science Program commissioned a USGS assessment of published scientific literature examining the projected impacts of climate change. *See* USGS-CCSP COMM., SYNTHESIS & ASSESSMENT PRODUCT 3.4: ABRUPT CLIMATE CHANGE SUMMARY AND FINDINGS (acknowledging that "an abrupt change in sea level is possible, but predictions are highly uncertain due to shortcomings in existing climate models"), *available at* http://downloads.climatescience.gov/sap/sap3-4/sap3-4-brochure.pdf.

[43] A May 2011 search of the NRC's website did not produce a single NRC webpage targeted at providing climate change or sea level rise information to the public. *See* http://www.nrc.gov.

[44] Letter from South Florida Water Mgmt. Dist. to Fla. Dep't of Envtl. Prot., Re: FPL Turkey Point Units 6 & 7, PA-3-45A3, Site Certification Application First Completeness Review (July 30, 2009) (acknowledging the Miami-Dade CCATF's prediction of a 1.5 to 5 foot sea level rise by 2050).

[45] MIAMI-DADE CCATF, SLR STATEMENT, *supra* note 8, at 3 (emphasis in original).

[46] *Id.* at 1.

used to convert water into steam to power a steam turbine and ultimately create electricity.[47] At this point, the non-radioactive steam is then converted back into water through the use of circulated cooling waters.[48] In light of this process, access to a consistent source of cooling waters proves crucial to the siting of new reactors, which makes Florida's coastlines very attractive to utility companies looking to take advantage of easily accessible ocean waters.[49] Even so, Florida's current nuclear capacity makes up only 7% of the state's total electric generating capacity, with nuclear generation representing approximately 15% of the state's total electric power generation.[50]

Traditionally, Florida has relied in large part on natural gas and coal fuels for the majority of electricity production needed to support one of the highest per capita demands in the country for residential electricity.[51] However, relatively low industrial electricity use offsets high residential and commercial demand (mostly resulting from high air-conditioning use during summer months) to result in relatively *low* total per capita electricity consumption.[52] Regardless, because "Florida [currently] has more petroleum-fired electricity generation than any other state,"[53] the resurgence in nuclear power has gained traction in Florida, as the state looks for ways to reduce its reliance on fossil fuel power (e.g., coal, natural gas, petroleum).[54] As explored below, Florida seems set on the idea of expanding its nuclear energy profile.[55]

A. *Existing Reactors*

Within the United States, seven nuclear reactors sites are located within two miles of either the Pacific or Atlantic Oceans.[56] Florida, as a peninsula state with over 1,260 miles of coastline,[57]

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[47] Florida Power & Light, *Nuclear Power Serves You*, http://www.fpl.com/environment/nuclear/nuclear_power_serves_you.shtml. *See also* U.S. NRC, *Power Reactors*, http://www.nrc.gov/reactors/power.html; PROGRESS ENERGY, CRYSTAL RIVER NUCLEAR PLANT: SAFETY INFORMATION 2010-2012, at 15 (explaining the mechanical operation of a nuclear power plant), *available at* https://www.progress-energy.com/assets/www/docs/home/crnp-safety.pdf.

[48] FPL, *supra* note 47.

[49] *See* NRC REGULATORY GUIDE 4.7 (REVISION 2), GENERAL SITE SUITABILITY CRITERIA FOR NUCLEAR POWER STATIONS, 4.7–6 – 4.7–7 (April 1998) (reviewing a nuclear reactor's cooling water requirements).

[50] U.S. EIA, *supra* note 15.

[51] U.S. EIA, *State Energy Profiles – Florida*, http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=FL.

[52] *Id.*

[53] *Id.*

[54] DEP, *supra* note 12 (reporting that Florida's approval of PEF's Levy Nuclear Plant "includes a requirement for [Crystal River's] coal-fired units to be discontinued by December 31, 2020, assuming timely licensing and construction" of the Levy Nuclear Plant).

[55] Press Release, Fla. Pub. Serv. Comm'n, *Florida Public Service Commission Adopts Rules to Encourage Nuclear Power Development* (Feb. 13, 2007), *available at* http://www.psc.state.fl.us/home/news/index.aspx?id=228.

[56] Letter from U.S. Nuclear Regulatory Comm'n to Rep. Edward J. Markey, Re: Impact of Rising Sea Levels on the Domestic U.S. Nuclear Power Industry 3 (May 28, 2008), ADAMS Accession No. ML081370004 [hereinafter U.S. NRC Letter]. *See also* Presentation, NATALIE KOPYTKO, SEA LEVEL RISE AT NUCLEAR POWER PLANTS IN THE UNITED STATES, WASHINGTON GIS CONFERENCE, at 8 (May 6, 2009), *available at* http://www.waurisa.org/conferences/2009/presentations/Weds/DickThomasStudentPaperCompetition_Weds_Kopytkoh_EvergreenState.pdf; Amanda Taub, *Third Annual Dick Thomas Student Paper Competition*, 16 THE SUMMIT: NEWS FROM AND FOR THE WASHINGTON GIS COMMUNITY 13 (Summer 2009), *available at* http://www.waurisa.org/thesummit/TheSummit_Summer_2009.pdf.

contains three of these seven coastal U.S. reactor sites, with a total of five coastal reactors operating within the State.[58] The combination of Florida's relatively flat geography and frequency of hurricane events leads to increased vulnerabilities (e.g., flooding, storm surges, wind damage, etc.) for the State's five coastal reactors.[59] Thus, as explored in a September 2010 *Energy Policy* article assessing flood-safety vulnerabilities of existing U.S. coastal nuclear power plants, the Progress Energy Florida (PEF) reactor at Crystal River, and the Florida Power & Light (FPL) reactors at St. Lucie and Turkey Point respectively, are among the most vulnerable U.S. reactors to the effects of sea level rise.[60]

1. Turkey Point (Units 3 & 4) – Florida Power & Light

FPL's Turkey Point facility is a 3,300-acre coastal site located at the southern tip of Florida as part of Miami-Dade County.[61] Of the four electric generation units at the Turkey Point site, only two are nuclear powered units (Units 3 & 4).[62] Unit 3, as the oldest active reactor in the state, dates back to December 14, 1972, and is currently licensed until 2032 (as a result of a twenty-year license extension granted in 2002 and taking effect in 2012).[63] Unit 4 commenced operation on September 7, 1973, and holds an operating license until mid-2033 (also as a result of a twenty-year license extension).[64] Biscayne Bay, a protected portion of the Atlantic Ocean, provides the cooling waters for Units 3 and 4.[65] As currently built, Units 3 and 4 sit on a pad, which elevates these structures to 18 feet above sea level.[66]

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[57] PHIL FLOOD, FLORIDA BEACHES AND SHORES 3, *available at* http://www.dep.state.fl.us/beaches/publications/pdf/actbook.pdf.

[58] U.S. EIA, *supra* note 15.

[59] *See* FLA. DEP'T OF ENVTL. PROT. (DEP), FLORIDA'S ENERGY PLAN 8 (Jan. 2006) ("The unprecedented level of storm activity during the 2004 and 2005 hurricane seasons spotlighted Florida's vulnerability to energy supply disruptions both in terms of power generation and transportation fuel supply."); U.S. NRC Information Notice 93-53, *Effect of Hurricane Andrew on Turkey Point Nuclear Generating Station and Lessons Learned*, July 20, 1993, *available at* http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1993/in93053.html.

[60] Natalie Kopytko & John Perkins, *Climate Change, Nuclear Power, and the Adaptation-Mitigation Dilemma*, ENERGY POLICY (2010) (assessing the vulnerability of Florida's nuclear reactors sites a result of climate change); KOPYTKO, *supra* note 56, at 8. *See also* U.S. NRC Information Notice 93-53, *supra* note 59.

[61] U.S. EIA, *supra* note 15; FPL, *About Turkey Point*, http://www.fpl.com/environment/nuclear/about_turkey_point.shtml; FPL, *Turkey Point Nuclear Power Plant Fact Sheet*, http://www.fpl.com/environment/nuclear/pdf/turkeypointfact.pdf.

[62] U.S. EIA, *supra* note 15; FPL, *About Turkey Point*, *supra* note 61; FPL, *Turkey Point Nuclear Power Plant Fact Sheet*, *supra* note 61.

[63] U.S. EIA, *supra* note 15; U.S. NRC, *Turkey Point Nuclear Generating Unit 3*, http://www.nrc.gov/info-finder/reactor/tp3.html; U.S. NRC, *Turkey Point Nuclear Plant, Units 3 & 4 – License Renewal Application,* http://www.nrc.gov/reactors/operating/licensing/renewal/applications/turkey-point.html; FPL, *About Turkey Point*, *supra* note 61; FPL, *Turkey Point Nuclear Power Plant Fact Sheet*, *supra* note 61.

[64] U.S. EIA, *supra* note 15; U.S. NRC, *Turkey Point Nuclear Generating Unit 4*, http://www.nrc.gov/info-finder/reactor/tp4.html; U.S. NRC, *Turkey Point Nuclear Plant, Units 3 & 4 – License Renewal Application*, *supra* note 63.

[65] FPL, *About Turkey Point*, *supra* note 61; FPL, *Turkey Point Nuclear Power Plant Fact Sheet*, *supra* note 61.

[66] U.S. NRC Letter, *supra* note 56, at 3.

2. St. Lucie (Units 1 & 2) – Florida Power & Light

FPL also operates a St. Lucie plant (St. Lucie), a 1,130-acre facility that contains two reactors.[67] Located approximately eight miles southeast of Ft. Pierce on Florida's east coast, St. Lucie relies on the Atlantic Ocean as a continuous source of cooling waters.[68] Unit 1, as St. Lucie's first reactor, commenced operation on December 21, 1976, and is licensed until early-2036 (as a result of a license extension in 2003).[69] Unit 2 followed in 1983, and is Florida's most recently constructed reactor to date, with a license expiration date of 2043 (as a result of a 2003 license extension).[70] Similar to Turkey Point, St. Lucie Units 1 and 2 sit on an elevated pad, which is 19 feet above sea level.[71]

3. Crystal River (Unit 3) – Progress Energy Florida (PEF)

In 1977, Progress Energy Florida (PEF) commenced operation of Unit 3, a nuclear reactor sited at the 4,700-acre Crystal River Energy Complex in Citrus County, Florida on the west coast of Florida.[72] Unlike FPL's coastal reactors at Turkey Point and St. Lucie, PEF's Unit 3 relies upon intake waters from the Gulf of Mexico, rather than the Atlantic Ocean.[73] The grade level of Unit 3 is 30.5 feet above sea level.[74] Although Progress Energy has a pending license extension application for Unit 3, NRC is not expected to make a decision until July 2011 at the earliest.[75] Thus, at present, Unit 3's operating license is set to expire in 2016.[76] As of May 2011, Unit 3 has been shut down for a period of 20 months (i.e., May 2009) as a result of cracks and delamination in the concrete containment structure.[77]

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[67] U.S. EIA, *supra* note 15; FPL, *About St. Lucie*, http://www.fpl.com/environment/nuclear/about_st_lucie.shtml; FPL, *St. Lucie Nuclear Power Plant Fact Sheet*, http://www.fpl.com/environment/nuclear/pdf/stluciefact.pdf.

[68] U.S. EIA, *supra* note 15; FPL, *About St. Lucie*, *supra* note 67; FPL, *St. Lucie Nuclear Power Plant Fact Sheet*, *supra* note 67.

[69] U.S. EIA, *supra* note 15; U.S. NRC, *St. Lucie Plant, Unit 1*, http://www.nrc.gov/info-finder/reactor/stl1.html; U.S. NRC, *St. Lucie, Units 1 & 2 – License Renewal Application*, http://www.nrc.gov/reactors/operating/licensing/renewal/applications/st-lucie.html.

[70] U.S. NRC, *St. Lucie Plant, Unit 2*, http://www.nrc.gov/info-finder/reactor/stl2.html; U.S. NRC, *St. Lucie, Units 1 & 2 – License Renewal Application*, *supra* note 69; U.S. EIA, *supra* note 15.

[71] U.S. NRC Letter, *supra* note 56, at 3.

[72] U.S. EIA, *supra* note 15; U.S. NRC, *Crystal River Nuclear Generating Plant, Unit 3*, http://www.nrc.gov/info-finder/reactor/cr3.html; Progress Energy, *Crystal River*, http://www.progress-energy.com/aboutenergy/powerplants/nuclearplants/crystalriver.asp.

[73] U.S.EIA, *supra* note 15.

[74] U.S. NRC Letter, *supra* note 56, at 3.

[75] U.S. EIA, *supra* note 15; U.S. NRC, *Crystal River – License Renewal Application*, http://www.nrc.gov/reactors/operating/licensing/renewal/applications/crystal-river.html.

[76] U.S. EIA, *supra* note 15; NRC, *Crystal River – License Renewal Application*, *supra* note 75.

[77] *Update on Repairs to Progress Energy's Crystal River Nuclear Plant, Shut Down for 20 Months, Due in "Several Weeks*," ST. PETERSBURG TIMES, May 10, 2011, *available at* http://www.tampabay.com/news/business/energy/update-on-repairs-to-progress-energys-crystal-river-nuclear-plant-shut/1168828.

B. Future Reactors

As mentioned above, Florida is on the forefront of the recent resurgence in U.S. nuclear energy expansion.[78] Of the fourteen U.S. sites entertaining the construction of new commercial nuclear reactors (as of July 2010), two proposed sites are in Florida, with both Florida sites looking to build two new reactors each.[79] Specifically, PEF is looking to build two new reactors *inland* in Levy County, Florida,[80] while FPL is exploring plans to expand its *coastal* Turkey Point facility with the addition of Units 6 and 7.[81] If the NRC and the State of Florida both approve these plans, Florida's nuclear reactor count will grow to nine, with only two of Florida's nine reactors more than two miles from the coast.[82]

IV. The Permitting Process For New Nuclear Reactors

A. Federal Permitting and Approval

1. The Current Process

The NRC is the federal agency tasked with protecting "the health and safety of the public and the environment by regulating the design, siting, construction, and operation of new commercial nuclear power facilities."[83] In carrying out this mission, the NRC requires a two-step process for obtaining an operating license for a new nuclear reactor: (1) a construction permit (to build the plant), and (2) an operating license.[84] Prior to applying for an initial construction permit, the applicant has the option to apply for an "early site review permit" (ESP).[85] If the applicant does not pursue an ESP, the first step, as mentioned above, is the construction permit application,[86] which

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[78] U.S. EIA, *Status of Potential New Commercial Nuclear Reactors in the United States* (Release date July 1, 2010), http://www.eia.doe.gov/cneaf/nuclear/page/nuc_reactors/reactorcom.html.
[79] *Id.*
[80] Progress Energy, *Nuclear Construction*, https://www.progress-energy.com/company/electricity-system/power-plants/nuclear-construction.page?.
[81] U.S. EIA, *supra* note 78; FPL, *Turkey Point Frequently Asked Questions*, http://www.fpl.com/environment/plant/turkey_point_faq.shtml.
[82] In contrast to the coastal reactor sites at Crystal River (current), St. Lucie (existing), and Turkey Point (existing and proposed), Progress Energy's Levy County site (proposed) is approximately seven miles inland. Progress Energy, *supra* note 80.
[83] U.S. NRC, *New Reactors*, http://www.nrc.gov/reactors/new-reactors.html. At the federal level, permits and approvals needed prior to construction of a new reactor include: (1) National Pollutant Discharge Elimination System permit, (2) Prevention of Significant Deterioration (PSD) permit, (3) U.S. Nuclear Regulatory Commission approval, and the (4) U.S. Army Corps of Engineers approval. Fla. DEP Press Release, *supra* note 12.
[84] *See generally* 10 C.F.R. § 50.30. *See also* U.S. NRC, *Nuclear Power Plant Licensing Process*, NUREG/BR-0298, Rev. 2, at 2 (Jul. 2004), *available at* http://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0298/br0298r2.pdf.
[85] U.S. NRC, *supra* note 84, at 2.
[86] *Id.*

requires a Preliminary Safety Analysis Report (PSAR),[87] Environmental Report (ER),[88] and financial and antitrust statements.[89] If the NRC grants a construction permit, the applicant then submits an application for the operating license at some point during the construction of the plant.[90] The operating license application consists of a final safety analysis report (FSAR)[91] and an updated ER.[92]

Per NRC rule amendments in 1989, an applicant also has the option of submitting an application for a construction permit *and* an operating license in what is known as a "combined license" (COL application).[93] According to the NRC, the COL application contains "essentially the same information required in an application for an operating license issued under 10 C.F.R. Part 50."[94] Ultimately, and regardless of what part of the process an applicant chooses to submit the required documentation, the applicant's ER satisfies NEPA[95] obligations and assists the NRC

[87] 10 C.F.R. § 50.34 (requiring that "[e]ach application for a construction permit shall include a preliminary safety analysis report" and setting forth the minimum requirements).

[88] 10 C.F.R. § 50.30(f) states: "An application for a construction permit, operating license, early site permit, combined license, or manufacturing license for a nuclear power reactor, testing facility, fuel reprocessing plant, or other production or utilization facility whose construction or operation may be determined by the Commission to have a significant impact in the environment, shall be accompanied by an Environmental Report required under subpart A of part 51 of this chapter." *See also* 10 C.F.R. § 51.45(c) (providing the requirements of the Environmental Report); 10 C.F.R. § 51.50(a); 10 C.F.R. § 51.14(a) ("Each applicant for a permit to construct a production or utilization facility covered by § 51.20 shall submit with its application a separate document, entitled 'Applicant's Environmental Report–Construction Permit Stage.'"); 10 C.F.R. § 50.36b; U.S. NRC, *supra* note 84, at 2.

[89] U.S. NRC, *supra* note 84, at 2. An explanation for the need of the power plant is also required as part of the construction permit application. *Id.*

[90] 10 C.F.R. § 50.30(d). *See also* U.S. NRC, *supra* note 84, at 2.

[91] 10 C.F.R. § 50.34(b) (stating that "[e]ach application for an operating license shall include a final safety analysis report" and setting forth the minimum requirements).

[92] 10 C.F.R. § 50.30(f); U.S. NRC, *supra* note 84, at 2.

[93] *See* 10 C.F.R. Part 52. "Combined license means a combined construction permit and operating license with conditions for a nuclear power facility issued under subpart C of this part." 10 C.F.R. § 52.1(a). *See also* 10 C.F.R. § 50.23; 10 C.F.R. § 52.79(a) ("The application must contain a final safety analysis report that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components of the facility as a whole."); 10 C.F.R. § 51.50(c) (requiring an ER as part of the combined license stage).

[94] U.S. NRC, *supra* note 84, at 1. *See also* 10 C.F.R. § 50.30(f) (requiring Environmental Report); 10 C.F.R. § 50.30.

[95] The National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321-4327, is administered by the Council on Environmental Quality. Council on Environmental Quality (CEQ), *The Council on Environmental Quality – About*, http://www.whitehouse.gov/administration/eop/ceq/about.

in issuing an environmental impact statement (EIS),[96] while the FSAR satisfies Atomic Energy Act (AEA)[97] safety obligations, and aids the NRC in issuing a Final Safety Evaluation Report (FSER).[98] Stated differently, the applicant's ER informs the NRC's EIS in compliance with NEPA, while the applicant's FSAR informs the NRC's FSER to comply with the AEA.[99]

To date, NRC Rules and Regulatory Guides have yet to *expressly* require a climate change and/or sea level rise analysis from new reactor applicants, which means that, arguably, neither analyses are mandatory within an applicant's FSAR and ER. And equally unclear is the extent to which the NRC staff can (or should) consider climate change and sea level rise as part of its own internal review of an application – the environmental review, i.e., NEPA-driven EIS, and/or the safety review, i.e., AEA-driven FSER. But even though the NRC has yet to issue a definitive climate change policy, NRC rules *do* require site characteristics to be examined as part of the AEA's safety analysis (i.e., applicant's FSAR and the NRC's FSER).[100] Per NRC rules, specific site evaluation factors include: (1) population density and use characteristics of the surrounding environment, (2) the nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military and chemical facilities), and (3) physical characteristics of the site, including seismology, meteorology, geology, and hydrology.[101] Specifically, 10 C.F.R. § 100.20(c) requires the NRC to take the following factors into consideration in determining the acceptability of a site for a stationary power reactor:

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[96] 10 C.F.R. § 51.14(a) states: "Environmental report means a document submitted to the Commission by an applicant for a permit, license, or other form of permission, or an amendment to or renewal of a permit, license or other form of permission, or by a petitioner for rulemaking, in order to aid the Commission in complying with section 102(2) of NEPA." *See also* 10 C.F.R. § 51.45 ("The environmental report should contain sufficient data to aid the Commission in its development of an independent analysis."); 10 C.F.R. § 51.45(c) (requiring the environmental report to contain a description of the proposed action, a statement of its purposes, a description of the environment affected, and a discussion of NEPA-related impacts, effects, and alternatives). However, only if the applicant opts for an early site permit must the NRC directly integrate the ER. 10 C.F.R § 51.14(a).

[97] The Atomic Energy Act of 1954, 42 U.S.C. § 2011 et seq., is administered by the U.S. Nuclear Regulatory Commission. "Under the Atomic Energy Act of 1954, a single agency, the Atomic Energy Commission [the NRC's predecessor], had responsibility for the development and production of nuclear weapons and for both the development and the safety regulation of the civilian uses of nuclear materials. [However, the Energy Reorganization Act of 1974, 42 U.S.C. 5801 et seq.,] split these functions, assigning to one agency, now the Department of Energy, the responsibility for the development and production of nuclear weapons, promotion of nuclear power, and other energy-related work, and assigning to the NRC the regulatory work, which does not include regulation of defense nuclear facilities." U.S. NRC, *Our Governing Legislation*, http://www.nrc.gov/about-nrc/governing-laws.html.

[98] U.S. NRC, *Fact Sheet – Nuclear Power Plant Licensing Process* 2 (Sept. 2010) (describing AEA and NEPA obligations for an applicant and the NRC for new reactor permitting), *available at* http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/licensing-process-fs.pdf.

[99] *Id.*

[100] 10 C.F.R. § 52.1(a) ("Site characteristics are the actual physical, environmental and demographic features of a site. Site characteristics are specified in an early site permit or in a final safety analysis report for a combined license.").

[101] *Id.* § 100.20.

> (c) Physical characteristics of the site, including seismology, meteorology, geology, and hydrology.
>
> (1) Section 100.23, "Geologic and seismic siting factors," describes the criteria and nature of investigations required to obtain the geologic and seismic data necessary to determine the suitability of the proposed site and the plant design bases.
>
> (2) Meteorological characteristics of the site that are necessary for **safety analysis** or that may have an impact upon plant design (such as maximum probable wind speed and precipitation) must be identified and characterized.
>
> (3) Factors important to hydrological radionuclide transport (such as soil, sediment, and rock characteristics, adsorption and retention coefficients, ground water velocity, and distances to the nearest surface body of water) must be obtained from on-site measurements. **The maximum probable flood along with the potential for seismically induced floods discussed in § 100.23(d)(3) must be estimated using historical data.**[102]

Further, 10 C.F.R. Part 50 Appendix A (General Design for Nuclear Power Plants) states:

> Criterion 2 – Design bases for protection against natural phenomena. Structures, systems, and components important to **safety shall 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 design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been **historically reported** for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed.[103]

In linking "safety concerns" to "protection against natural phenomena," Criterion 2 (GDC 2) reinforces the NRC's apparent stance that natural disasters, including floods, are more a part of the AEA's safety obligations rather than a part of the NEPA process.[104] *Historical* flooding, i.e., last century, is a highly scrutinized aspect of the safety review as the NRC's rules go to great lengths to assess the potential for flooding with special attention given to seismically induced floods (e.g.

[102] *Id.* § 100.20(c) (emphasis added). *See also* 10 C.F.R. § 100.23.
[103] 10 C.F.R. Part 50 Appendix A, Criterion 2 (emphasis added).
[104] Interestingly, although Criterion 2 is focused specifically at "[protecting] against natural phenomena," it relies wholly upon "historical data," which would not lead to any significant conclusions related to climate-induced sea level rise. This stance is further reinforced by the lack of consideration of natural disasters within the contents of the ER requirements. *See* 10 C.F.R. Part 50.

earthquake induced tidal waves).[105] However, the apparent mandated reliance on *historical* data in the NRC's flood analysis reveals a significant weakness in the NRC's flood-safety regulations as any attempt to use such data in a *future* sea level rise analysis would seemingly result in a gross underestimate due to the potential for accelerated sea level rise.

2. Climate Change Meets Federal Nuclear Permitting

As of 2011, the intersection of climate-change science and U.S. nuclear energy policy is emerging – policymakers (and nuclear power advocates) are rushing to build new reactors as a climate mitigation mechanism to phase out fossil fuel plants[106] without considering climate adaptation as it relates to nuclear power, i.e., the ability of nuclear energy infrastructure to withstand and/or adapt to the impacts of climate change and sea level rise.[107] And even though nuclear power is typically viewed as a more climate-friendly form of energy when compared to its fossil fuel counterparts,[108] many skeptics of nuclear power still point out the drawbacks in a renewed interest and reliance upon nuclear power (including the lack of a long-term solution for the waste).[109] Ultimately, the development of a climate-friendly energy policy, including whether to build new reactors at coastal locations, will require a broad perspective that considers both (1) climate mitigation (i.e., how to limit the impacts of current and future power plants on the environment as climate change creators) *and* (2) climate adaptation – the ability of plant

[105] *See* U.S. NRC Regulatory Guide 4.7 (*General Site Suitability Criteria for Nuclear Power Stations*) (Apr. 1998); Regulatory Guide 1.70 (*Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants – Section* 2.40) (Nov. 1978); U.S. NRC Regulatory Guide 1.59 (*Design Basis Floods for Nuclear Power Plants*) (Aug. 1977), http://www.nrc.gov/reading-rm/doc-collections/reg-guides/environmental-siting/rg/. *See also* 10 C.F.R. § 100.20(c) ("The maximum probable flood along with the potential for seismically induced floods discussed in § 100.23 (d)(3) must be estimated using historical data.").

[106] *See* IAEA, CLIMATE CHANGE AND NUCLEAR POWER I (2009) ("Climate change mitigation is one of the salient reasons for increasingly considering nuclear power in national energy portfolios."), *available at* http://www.iaea.org/OurWork/ST/NE/Pess/assets/09-43781_CCNP-Brochure_E.pdf; Deutch, *supra* note 11, at 4 (acknowledging that as of 2009, "[c]oncern with avoiding the adverse consequences of climate change has increased significantly in the past five years.").

[107] *See, e.g.,* Kopytko & Perkins, *supra* note 60.

[108] According to Progress Energy, "[n]uclear power is a clean source of electric power generation. Electric power generation from nuclear fuel produces no sulfur dioxide (SO_2), nitrogen oxide (NO_2), green house gases (GHG), or other emissions. Therefore, it will have a positive effect on the surrounding air quality." PROGRESS ENERGY FLORIDA, TEN-YEAR SITE PLAN AS OF DECEMBER 31, 2009, 4-3 (April 1, 2010). *See also* Fla. PSC, *supra* note 55 (enacting rules to encourage nuclear energy expansion in Florida); IAEA, *supra* note 107; IAEA, CLIMATE CHANGE AND NUCLEAR POWER 1 (IAEA 2000) (finding that because nuclear power produces virtually no GHG emissions, it could be an important part of future strategies to reduce GHG emissions), *available at* http://www.iaea.org/Publications/Booklets/ClimateChange/climate_change.pdf.

[109] *See Nuclear Waste/"Fast Breeder" Reactor - Study: Problem-Plagued Reactor No Solution to Long-Term Nuclear Waste Problem*, SALEM-NEWS.COM, Feb. 17, 2010, *available at* http://www.salem-news.com/articles/february172010/fast_reactors.php; Benjamin Spillman, *Is Nuclear Waste Reprocessing in Nevada's Future*, THE ELY TIMES, Feb. 11, 2010, *available at* http://www.elynews.com/articles/2010/02/11/news/news12.txt. *But see* IAEA, *supra* note 106, at 65 (concluding that although the future of Yucca Mountain as the ultimate disposal site for spent fuel is uncertain. Experts agree that spent fuel can be safely stored in dry storage casks for many decades.).

infrastructure to withstand the environmental impacts of climate-change (e.g., earthquakes, floods, changing salinity, sea level rise, etc.). To minimize risks involved with building new reactors, regulators and industry must definitively decide the extent to which uncertain climate change and sea level rise science can, and should, be integrated into new reactor location and permitting decisions.

Within this context, NEPA is on the front line of a developing U.S. energy policy that is attempting to incorporate climate change science. In early 2010, the Council of Environmental Quality (CEQ), as the agency charged with overseeing NEPA, issued a memorandum to Heads of Federal Departments and Agencies entitled, "Draft NEPA Guidance On Consideration Of The Effects Of Climate Change And Greenhouse Gas Emissions."[110] Although the NRC has yet to undergo rulemaking to integrate climate change science and policies, the CEQ's latest draft NEPA guidance appears to provide the NRC with at least an initial path for (1) integrating climate change science into the permitting process for new reactors and (2) updating outdated regulatory guidance documents.

In the interim, a trend is emerging. Environmental interests have recently attempted to intervene in COL proceedings to force applicants to address climate change impacts within the contents of the applicant's ER.[111] Upon receiving referrals from the NRC's Atomic Safety & Licensing Boards (ASLB) in both *In re Duke Energy Carolinas, LLC* (i.e., COL Application for Duke Energy's William States Lee III Nuclear Station, Units 1 and 2, in South Carolina), and *In Re Tennessee Valley Authority* (i.e., COL Application for TVA's Bellefonte Nuclear Power Plant, Units 3 and 4, in Alabama), the NRC Commissioners issued CLI-09-21, Memorandum and Order, which considered the admissibility of two contentions "concerning the consideration in COL applications of certain environmental impacts relevant to greenhouse gas emissions" for Duke Energy and TVA's respective applications.[112] Although declining to review the ASLB rulings, the NRC Commissioners noted the inclusion of a "Global Warming, Climate Change, and Greenhouse Gas Impacts" section as part of the NRC's Draft Supplemental Environmental Impact

[110] Council on Environmental Quality, Memorandum For Heads Of Federal Departments And Agencies, Draft NEPA Guidance On Consideration Of The Effects Of Climate Change And Greenhouse Gas Emissions (Feb. 18, 2010), *available at* http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf. *See also* National Environmental Policy Act Draft Guidance, Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, 75 Fed. Reg. 8046 (Feb. 23, 2010).

[111] Memorandum and Order, In re Duke Energy Carolinas, LLC, CLI-09-21, at 2 (N.R.C. Nov. 3, 2009) (acknowledging environmental intervenors' argument that TVA failed to include in its environmental report (1) "an analysis of the emission of [g]reenhouse gases in the process of the production of raw materials and components, and the transportation of these materials and components and the construction processes required to build Bellefonte 3 [and] 4;" and (2) an analysis of greenhouse gas emissions associated with each step in the uranium fuel cycle, including reprocessing."), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2009/2009-21cli.pdf.

[112] *Id.* at 5 n. 16.

Statement (DSEIS)[113] for the North Anna Power Station Unit 3, and, in turn, provided the following guidance:

> We expect the [NRC] Staff to include consideration of carbon dioxide and other greenhouse gas emissions in its environmental reviews for major licensing actions under the National Environmental Policy Act. The Staff's analysis for reactor applications should encompass emissions from the uranium fuel cycle as well as from construction and operation of the facility to be licensed. The Staff should ensure that these issues are addressed consistently in agency NEPA evaluations and, as appropriate, update Staff guidance documents to address greenhouse gas emissions.[114]

On April 8, 2010, the NRC staff responded by issuing an internal memorandum entitled Supplemental Guidance to NUREG 1555: Environmental Standard Review Plan for Consideration of the Effects of Greenhouse Gases and of Climate Change (Supplemental Guidance) with a stated purpose to "clarify the consideration of greenhouse gas (GHG) emissions and the treatment of climate change in developing draft environmental impacts statements (EISs) for new reactor reviews."[115] However, in apparently preempting the applicability of NEPA as means to assess climate change adaptation for a new reactor, an NRC cover letter to the Supplemental Guidance expressly sets forth that "**the change in climate may affect safe design or operation of a facility**; this aspect should be treated as part of the **safety review, not the environmental review [NEPA]**."[116] In further clarifying this new NRC policy, the Supplemental Guidance states:

> For some Federal agencies, it may be entirely appropriate for their EISs to consider "public health and safety." As a regulatory agency with its organic statute principally focused on public health and safety, the NRC's responsibilities under the Atomic Energy Act already include consideration of natural phenomena on the safe design and operation of reactors. Public health is considered as part of the NRC's NEPA review as well, but public safety is

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[113] Section 5.11, Global Warming, Climate Change, and Greenhouse Gas Impacts, of the Duke Energy DSEIS states: "While there is general agreement in the scientific community that some change in climate is occurring, considerable uncertainty remains in the magnitude and direction of some of the changes. In light of these uncertainties, balancing society's need for electricity and water under an altered climate is not now feasible and would amount to speculation … The impacts of global warming and climate change from the operation of the proposed Unit 3 at the NAPS site are negligible at the global level … Consequently, the environmental impacts associated with the effects of greenhouse gas emissions from the operation of a base-load power plant are unique between a fossil fuel and nuclear plant." Draft Supplemental Environmental Impact Statement for the Combined License (COL) for North Anna Power Station Unit 3, NUREG-1917 (Dec. 2008), § 5.11, Global Warming, Climate Change, and Greenhouse Gas Impacts, 5-49–5-50, ADAMS Accession No. ML093070690, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1917/. [hereinafter North Anna Draft SEIS]. *See also* In re Duke Energy Carolinas, LLC, CLI-09-21, 5 n. 16. (acknowledging that the NRC's draft SEIS for the North Anna Power Station Unit 3 COL application addressed global warming concerns to some extent).

[114] In re Duke Energy Carolinas, LLC, CLI-09-21, at 5-6.

[115] In re Turkey Point, Case No.52-040-COL, 52-041-COL, Exhibit 5.18 - Supplemental Guidance to NUREG-1555, at 1, Adams Accession No. ML102740609 [hereinafter Turkey Point Exhibit 5.18].

[116] *Id.* (emphasis added).

> considered in the NRC's safety evaluation reports (SERs) developed concomitant with its EIS for the regulatory action.[117]

As for the environmental impacts of the reactor on the environment, i.e., climate mitigation, the Supplemental Guidance states:

> For new reactor licensing actions where an EIS is being prepared to fulfill its responsibilities under NEPA, the NRC Staff should consider certain aspects of climate change. **These aspects include (1) the potential impacts of the proposed action on the environment and (2) the changes in significant resource areas that may occur during the lifetime of the proposed action as a result of a changing climate**. In addition to the direct effects of the action, the Staff considers the indirect and cumulative effects of the proposed action and alternatives (sites and energy sources) to the proposed action. **The Staff should now consider changes in climate that may occur during the period of the proposed action on susceptible environmental resources; the Staff should consider air and water resources, ecological resources, and human health issues as the areas to consider the effects of climate change for new reactor applications**.[118]

Thus, it appears that the NRC is willing to use NEPA to assess climate mitigation (as part of the applicant's ER and the NRC's EIS analysis under NEPA), and to recognize that climate change can affect the environment.[119] Further, the NRC's express adoption of the scientific findings of the USGCRP reflects a new trend in U.S. climate change policy.[120] The NRC Supplemental Guidance states:

> These statements [EPA Administrator's Endangerment Finding] support the NRC Staff's view that assessments such as the June 2009 USGCRP report on impacts of climate change in the United States represent appropriate source material to be used for framing resource issues associated with climate change. The NRC Staff is responsible for the reliability of all information used in developing its EISs (10 FR 51.70); at this time, **the Staff finds that the information in the USGCRP report [i.e., 3 foot-plus rise in sea level by 2100] is of high quality and that the report is a reliable source for information regarding climate change in the U.S. As discussed below, the Staff notes that the Council on Environmental Quality (CEQ) also relies on the USGCRP report in its proposed guidance.** The Staff will

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[117] *Id.* at 9. Whether such a policy is ripe for a legal challenge is another subject altogether. *See, e.g.,* Limerick Ecology Action, Inc. v. U.S. NRC, 869 F.2d 719, 723 (3d. Cir. 1989) ("We are confronted at the outset by the NRC's contention that by making decisions under the Atomic Energy Act, 42 U.S.C. §§ 2011 to 2282 (1982) ("AEA"), it has precluded the need for consideration of environmental implications under NEPA. Because we conclude that consideration under NEPA should not be precluded by the AEA, we must address [plaintiff's] specific contentions.").

[118] Turkey Point Exhibit 5.18, *supra* note 115, at 10 (emphasis added).

[119] North Anna Draft SEIS, *supra* note 113, at § 5.11, Global Warming, Climate Change, and Greenhouse Gas Impacts, 5-49–5-50.

[120] USGCRP Report, *supra* note 29.

> continue to monitor the development of EPA and CEQ positions and their reliance on the USGCRP report.[121]

As highlighted in the introduction of this Article, formulating sound policy from uncertain science is extremely difficult, and the Supplemental Guidance gives much needed insight into the NRC's attempt at doing so. And although the Supplemental Guidance clearly acknowledges that the NRC is following the CEQ and EPA's lead in apparently looking to integrate climate change science into the NEPA review process, i.e., applicant's ER and the NRC's EIS, it is also important to recognize that the NRC chose to expressly limit the scope of the Supplemental Guidance to NEPA compliance. This reinforces the NRC's apparent stance that *safety* concerns related to climate change, including flooding and sea level rise, are *not* a part of the environmental review (i.e., NEPA analysis).[122]

As for the extent to which the NRC will similarly adopt the USGCRP's findings (i.e., 3 foot-plus sea level rise by 2100) as part of the AEA's safety review, a 2008 letter from Representative Edward J. Markey, Chairman of the now defunct Select Committee on Energy Independence and Global Warming, spurred a highly interesting NRC response.[123] Specifically, in answering Rep. Markey's request, i.e., how the impacts of climate change might affect "the continued safe operation of U.S. nuclear power plants and spent fuel storage installations," the NRC provided the following:

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[121] Turkey Point Exhibit 5.18, *supra* note 115, at 4 (emphasis added). The reference to the EPA Administrator's Endangerment Finding, as adopted within the contents of the Supplemental Guidance, states in part: "The release of the U.S. Global Climate Research Program (USGCRP) [formerly the Climate Change Science Program (CCSP)] report on impacts of climate change in the United States in June 2009 ... synthesized information contained in prior CCSP reports and other synthesis reports, many of which had already been published ... [and undergo a rigorous and exacting standard of peer review by the expert community, as well as rigorous levels of U.S. government review and acceptance ... The review processes ... provide EPA with strong assurance that this material has been well vetted by both the climate change research community and by the U.S. government.]. These assessments therefore essentially represent the U.S. government's view of the state of knowledge on greenhouse gases and climate change. For example, with regard to government acceptance and approval of IPCC assessment reports, the USGCRP Web site states that: 'When governments accept the IPCC reports and approve their Summary for Policymakers, they acknowledge the legitimacy of their scientific content.' It is the Administrator's view that such review and acceptance by the U.S. Government lends further support for placing primary weight on these major assessments." Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, 74 Fed. Reg. 66,496, 66,504 (Dec. 15, 2009) (to be codified at 40 C.F.R. Chapter I); Turkey Point Exhibit 5.18, *supra* note 115, at 3 (quoting the EPA Administrator's Endangerment Finding). *See also* North Anna Draft SEIS, *supra* note 113, at § 5.11, Global Warming, Climate Change, and Greenhouse Gas Impacts, 5-49 (demonstrating the NRC's staff use of a 2000 report of the USGCRP and the IPCC Climate Change AR4 Synthesis Report of 2007 in considering the potential impact of climate change on water supply).

[122] As for the NRC's future climate change policies related to NEPA, the Supplemental Guidance expresses that the NRC will likely issue an update to its Environmental Standard Review Plan. Turkey Point Exhibit 5.18, *supra* note 115, at 3. *See also* U.S. NRC, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan* (NUREG-1555), *available at* http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/.

[123] U.S. NRC Letter, *supra* note 56, at cover page.

> Currently, NRC staff is working directly with IPCC scientists, as well as scientists from the World Meteorological Organization (WMO) and from the International Atomic Energy Agency (IAEA), to update regulatory guidance for the IAEA, expected to be published in 2010. This guidance will directly address climate change issues and will describe tools and methods for incorporating sea level rise and meteorological phenomena into safety assessments for nuclear facilities**. This guidance will also be incorporated into a revision to NRC Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants," expected to be published in 2011.** As a result, the latest information from the IPCC and WMO are being directly incorporated into NRC guidance on flooding.[124]
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> Based on NRC's activities related to climate change, and the relatively slow rate of this change, NRC is confident that any regulatory action that may be necessary will be taken in a timely manner to ensure the safety of all nuclear facilities regulated by the NRC.[125]

Interestingly, five years earlier (in 2003), the IAEA released "Flood Hazard for Nuclear Power Plants on Coastal and River Sites: Safety Guide" (IAEA Flood Safety Guide), which recommended a mean sea level rise safety margin of 35 to 85 centimeters (1.15 to 2.79 feet) over the lifetime of a plant.[126] As of 2011, eight years after the IAEA's sea level rise recommendations regarding flood safety concerns [127] and five years after the NRC reassured Rep. Markey, the NRC flood regulations and guidance have yet to be updated. To date, neither the IAEA update nor NRC Regulatory Guide 1.59 (RG 1.59) update have been officially released, which means that severely antiquated NRC rules continue to govern flood safety concerns for new reactor applications.[128] Thus, until the NRC officially amends RG-1.59 in late 2011 and/or undergoes notice-and-comment rulemaking, an applicant's FSAR and the NRC's FSER for all pre-2011 coastal reactor applications will likely severely underestimate the potential for accelerated sea level rise.

B. State and Local Permitting and Approval

At the state level, the Florida Electrical Power Plant Siting Act (PPSA), §§ 403.501-.518, Florida Statutes, governs Florida's centralized process for licensing large power plants (including

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[124] *Id.* at 1.

[125] *Id.* at 2.

[126] IAEA, *supra* note 33, §§ 14.9–14.10, at 72. Section 14.10 states: "Some safety margin should be taken into consideration in the design of a nuclear power plant. If periodic safety reviews are conducted, such a margin may refer to the interval between two consecutive reviews. **If the entire plant lifetime is considered, the following generally agreed estimated variations in parameters may be considered: … Rise in mean sea level: 35–85 cm [1.15 to 2.79 feet].**" (emphasis added).

[127] According to Mohamed ElBaradei, Director General of the IAEA: "The IAEA's safety standards are not legally binding on Member States but may be adopted by them, at their own discretion, for use in national regulations in respect of their own activities. The standards are binding on the IAEA in relation to its own operations and on States in relation to operations assisted by the IAEA." IAEA, *supra* note 33.

[128] The most recent published update to RG 1.59, Design Basis Floods for Nuclear Power Plants, occurred in August 1977. NRC, *NRC Regulatory Guides – Power Reactors (Division I)*, http://www.nrc.gov/reading-rm/doc-collections/reg-guides/power-reactors/rg/.

nuclear reactors),[129] a process that operates independently of the federal licensing process.[130] Although local governments and multiple state agencies participate in this process,[131] one license – a certification – supersedes other local and state permits.[132] Accordingly, the Florida Department of Environmental Protection (DEP) touts the state certification process as an "an all encompassing license for affected state, regional and local agencies, and includes any regulatory activity which would be applicable under these agencies' regulations for the facility."[133] Thus, the PPSA certification goes well beyond merely providing approval for the location of the power plant. It also provides certification requirements for the plant's associated facilities (e.g., natural gas pipeline, rail lines, roadways, and electrical transmission lines),[134] and addresses "permitting, land use and zoning, and property interests."[135] Over the course of the certification process, DEP's Siting Coordination Office and Office of General Counsel provide crucial administrative and legal support,[136] and although DEP is responsible for coordinating interagency review, the Governor and Cabinet ultimately issue site certifications once DEP has concluded the review process.[137]

C. *Florida's Proposed Reactors*

1. Levy County Construction (Units 1 & 2) – Progress Energy Florida

PEF's plans to build new reactors in Florida date back to 2005.[138] Two years later (in 2007), PEF notified the NRC and the public that its planned expansion would consist of two new units (Units 1 and 2) in Levy County, Florida.[139] Fortunately, the 3,100-acre Levy County site[140] is located about seven miles *inland* from the Gulf of Mexico, and approximately eight miles north of

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[129] FLA. STAT. § 403.503(14) states in part: "'Electrical power plant' means, for the purpose of certification, any steam or solar electrical generating facility using any process or fuel, including **nuclear materials**, except that this term does not include any steam or solar electrical generating facility of less than 75 megawatts in capacity unless the applicant for such a facility elects to apply for certification under this act." (emphasis added).

[130] DEP, *Siting Coordination*, http://www.dep.state.fl.us/siting/.

[131] DEP, *Power Plant Siting Act*, http://www.dep.state.fl.us/siting/power_plants.htm.

[132] *Id.*

[133] Fla. DEP, *supra* note 130.

[134] Fla. DEP, *supra* note 131. Section 403.503(14), Florida Statutes, states in part: "This term [Electrical power plant] also includes the site; all associated facilities that will be owned by the applicant that are physically connected to the site; all associated facilities that are indirectly connected to the site by other proposed associated facilities that will be owned by the applicant; and associated transmission lines that will be owned by the applicant which connect the electrical power plant to an existing transmission network or rights-of-way to which the applicant intends to connect."

[135] Fla. DEP, *supra* note 131.

[136] Fla. DEP, *supra* note 130.

[137] Fla. DEP, *supra* note 130; Fla. DEP, *supra* note 12.

[138] U.S. EIA, *supra* note 78.

[139] *Id.*; PROGRESS ENERGY FLORIDA, *supra* note 108, at 4-1.

[140] Units 1 and 2 (and supporting infrastructure) will only use approximately 10% of the 3,000-acre site. PROGRESS ENERGY FLORIDA, *supra* note 108, at 4-1.

the Progress Energy's Crystal River Energy Complex in Citrus County.[141] According to current plans, Units 1 and 2 will rely on cooling waters from the Florida Barge Canal.[142]

In March 2008, the Florida Public Service Commission gave PEF the first approval needed to move forward with plans to construct Units 1 and 2 at the Levy County site.[143] Three months later (in June 2008), PEF submitted a Site Certification Application (SCA) to DEP (state level),[144] followed by a combined license (COL) application submittal to the NRC (federal level).[145] Following the conclusion of DEP's review of the SCA in March 2009,[146] the Florida Siting Board at that time, i.e., Governor Charlie Crist, Attorney General Bill McCollum, and Chief Financial Officer Alex Sink, unanimously approved the Site Certification for Levy County's Units 1 and 2 on August 11, 2009.[147] The DEP's Conditions of Certification for Units 1 and 2 were most recently updated on January 25, 2011.[148] In April 2010, PEF submitted to the PSC a Ten-year Site Plan, which provided the following insight into the selection of the Levy County site:

> This site was chosen based on several considerations including availability of land and water resources, access to the electric transmission system, and environmental considerations. First, the Levy County site had access to an adequate water supply. **Second, the site is at a relatively high elevation, which provides additional protection from wind damage and flooding**. Third, unlike a number of other sites considered, the Levy site has more favorable geotechnical qualities, which are critical to siting a nuclear power plant. **Fourth, the Levy site provides geographical separation from other electrical generating**

[141] Progress Energy, *supra* note 80.

[142] According to Progress Energy: "The site is about 2.5 miles from the Cross Florida Barge Canal, from which the Levy units may draw their makeup water to supply the on-site cooling water system. The Levy County Plant, together with the necessary associated site facilities, will occupy approximately ten percent of the 3,100-acre site and the remaining acreage will be preserved as an exclusionary boundary around the developed plant site and a buffer preserve. PEF purchased an additional 2,100-acre tract contiguous with the southern boundary of the Levy site that secures access to a water supply for the site from the Cross Florida Barge Canal as well as transmission corridors from the plant site. The property for many years had been used for silviculture and was designated as Forestry/Rural Residential. The surrounding area land use is predominantly vacant, commercial forestry lands. Progress Energy Florida, *supra* note 108, at 4-1.

[143] *New Levy Plant gets Approval*, WORLD NUCLEAR NEWS, July 16, 2008, http://www.world-nuclear-news.org/newsarticle.aspx?id=18882&terms=levy%20county%20progress%20energy. *See also* Fred Hiers, *Progress Nuclear Plant Fee Approved*, OCALA.COM, Oct. 26, 2010, http://www.ocala.com/article/20101026/ARTICLES/101029758.

[144] In Re: Progress Energy Florida Levy Nuclear Project Units 1 and 2, DOAH Case No. 08-002727-EPP (Case Closed May 15, 2009). *See also* PROGRESS ENERGY FLORIDA, *supra* note 108, at 4-2.

[145] U.S. EIA, *supra* note 14; U.S. EIA, *supra* note 12; U.S. NRC, *Combined License Application Documents for Levy County, Units 1 and 2 Application*, http://www.nrc.gov/reactors/new-reactors/col/levy/documents.html.

[146] In Re: Progress Energy Florida Levy Nuclear Project Units 1 and 2, DOAH Case No. 08-002727-EPP (Case Closed May 15, 2009). *See also* PROGRESS ENERGY FLORIDA, *supra* note 108, at 4-2.

[147] PROGRESS ENERGY FLORIDA, *supra* note 108, at 4-2.

[148] The DEP Conditions of Certification for Units 1 and 2 make no mention of climate change or sea level rise. *See* DEP, CONDITIONS OF CERTIFICATION: PROGRESS ENERGY FLORIDA LEVY NUCLEAR POWER PLANT, PA08-51C (Modified Jan. 25, 2011), *available at* http://www.dep.state.fl.us/siting/files/certification/pa08_51_2010_C.pdf.

> **facilities**. Even though the Crystal River Energy Complex site has many favorable qualities, **adding new nuclear generating capacity to the Crystal River Energy Complex at this time would result in a significant concentration of PEF's generating assets in one geographical location**. This increases the likelihood of a significant generation loss from a single event and a potential large-scale impact on the PEF system. The Levy County location also would assist in avoiding a potential loss from a single significant transmission system event that might result in a large-scale impact on the PEF system.
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> The proximity of the Levy County site to the PEF's existing Crystal River Unit 3 nuclear plant provides opportunities for efficiencies in shared support functions.[149]

Arguably, PEF's concerns for flooding and geographic elevations reveal caution, and allude to an unspoken awareness of the risks of accelerated sea level rise during the next 100 years.[150] It is also important to highlight PEF's view that a newly sited *inland* reactor site is *not* overly burdensome for a utility company if it is sited relatively close to a current coastal reactor site, e.g., the Crystal River Energy Complex.[151]

With the majority of the state hurdles out of the way, PEF is working through the NRC's ongoing review process. Although PEF's COL application briefly mentions climate change mitigation in Chapters 8 and 10 of the ER,[152] its FSAR Section 2.3.1.3, "Effects of Global Climate Change on Regional Climatology" dismisses climate change adaptation altogether due to scientific

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[149] PROGRESS ENERGY FLORIDA, *supra* note 108, at 4-2 (emphasis added); Progress Energy, *supra* note 80 (listing "land, access to sufficient quantities of water (from the Gulf) and access to the electric transmission system, as well as an overall evaluation of environmental considerations" as the major siting criteria for the Levy County Site). At an October 23, 2010 public meeting, an NRC senior project manager supported the Levy County siting decision by reportedly suggesting that the decision to build at the Levy County site rather than Crystal River ultimately came down to a business decision by Progress Energy. The NRC project manager also reportedly echoed Progress Energy's belief that "separating the two nuclear plants would make business sense so that a major weather event could not take out both plants." Chris Van Ormer, *Man Doesn't Want Levy Nuke Plant as Neighbor Nuclear Regulatory Commission Takes Public Comments*, CEDAR KEY BEACON, Oct. 1, 2010. *See also* Progress Energy, *supra* note 80.

[150] Progress Energy, *supra* note 80.

[151] PROGRESS ENERGY FLORIDA, *supra* note 108, at 4-2.

[152] PEF, Environmental Report Part 3, Rev. 1, Ch.10, § 10.4.1.1 Need for Power, 10-63, and § 10.4.1.4.5 Air Pollution and Emissions Avoidance, 10-67–10-68 (Oct. 2, 2009) ("Given concerns in Florida and the rest of the south about climate change and carbon emissions, the LNP will serve another important need by reducing carbon emissions in the state. The LNP will displace significant amounts of carbon as soon as the plant becomes operational, as compared to a coal-fired generating plant."). S*ee also* PEF, Environmental Report Part 3, Rev. 1, Ch. 8, at 8-80 (Oct. 2, 2009).

uncertainty.[153] Stated differently, a climate change-related sea level analysis related to climate adaptation is simply nowhere to be found in either the Levy County ER or FSAR.[154] In response, the NRC looked to *General Design Criterion 2*,[155] 10 C.F.R. § 52.17, and 10 C.F.R. Part 100, and requested that PEF "explicitly state the value of the design basis flood in the FSAR including a description of any adjustment made for long-term sea level rise."[156] PEF's answer estimated a maximum sea level rise scenario of 1.99 mm/yr (0.39 feet over 60 years; 0.5876 feet by 2100; or 0.65 feet per century),[157] which would appear to severely underestimate sea level rise when compared to the USGCRP findings (i.e., 3 foot plus by 2100) and IAEA flood-safety recommendations (i.e., 1.15 to 2.79 feet over the lifetime of a plant).

On August 6, 2010, the NRC issued a Draft Environmental Impact Statement (DEIS) for the Levy County Site that echoes PEF's maximum sea level rise calculation (1.99 mm/yr) with the following:

> Adjustment to Long-term Sea Level Rise: The nearest tidal datum is located at Cedar Key, Florida, which is considered a valid estimate for the determination of long-term sea level rise affecting the coastline in the vicinity of the LNP site. The long-term sea level rise at Cedar Key, Florida, as provided by NOAA is 1.8 millimeters per year (mm/yr) with a 95 percent confidence interval of +/- 0.19 mm/yr. [link to website omitted]. Therefore, the

[153] Section 2.3.1.3, "Effects of Global Climate Change on Regional Climatology" states: "Global trends in various meteorological and geophysical parameters are currently the subject of much discussion in both the scientific community and in the media. While it may be evident (and expected) that changes in the averages of certain meteorological parameters are occurring over time (i.e., such as temperature and precipitation), it is also evident and generally acknowledged that the prediction of any such changes are difficult if not impossible to reliably predict. **Even the most reliable climate change models are not capable of accurately predicting design basis extremes in weather patterns. A discussion of public concerns or speculations about climate change would not add to the resolution of these issues, nor would a discussion of changes in average global trends, because these data cannot be reviewed on a site-specific basis with any degree of accuracy or reliability.** It is relatively easy to demonstrate that an increase in the average value of temperature (or precipitation) at a given location is much more likely to be a result of numerous increases in temperatures (or precipitation) in the 'normal range' rather than increases in extreme values, because a change in a select number of extreme values will essentially have no measurable effect on longer term average values. Therefore, the information presented in this subsection of the FSAR is focused on the extreme meteorological conditions that will facilitate a plant design that will operate within these safety margins throughout the projected plant life of 40 to 60 years. This is accomplished by identifying historical extremes and projecting, in a scientifically defensible manner, the potential effects weather will have on the safety and operation of the LNP." PEF, Levy Nuclear Plant Units 1 and 2 COL Application Part 2, Final Safety Analysis Report, Rev. 0, § 2.3.1.3, 2.3-15 (Oct. 2, 2009) (emphasis added).

[154] Section 2.4.1 of PEF's FSAR specifies the pre-construction elevation of the footprints of LNP 1 and LNP 2 and associated facilities as varying between 12.5 m (41 ft.) and 14.9 m (49 ft.) NAVD88, and concludes that "[b]ased on historical water level observations, flooding of the LNP site is considered unlikely." Levy Nuclear Plant Units 1 and 2 COL Application Part 2, Final Safety Analysis Report Rev. 0, at 2.4-13.

[155] 10 C.F.R. Part 50 Appendix A, Criterion 2. *See infra* note 103 and accompanying text.

[156] Letter from Brian C. Anderson (U.S. NRC) to Garry Miller (Progress Energy Florida), Request for Additional Information Letter No. 045 Related to SRP Section 2.4.3 for the Levy County Nuclear Plant Units 1 and 2 Combined License Application, at 6 (May 19, 2009).

[157] *Id.* at 10.

> upper 95 percent confidence bound of sea level rise is 1.8 + 0.19 = 1.99 mm/yr. Considering a design period of 60 years for LNP 1 and LNP 2, the upper 95 percent estimate of sea level rise will be approximately 119.4 mm (0.39 ft.).[158]

But in demonstrating the NRC's Supplemental Guidance at work, the DEIS also states:

> On a longer-term scale, climate change is a subject of national and international interest. The recent compilation of the state of knowledge by the [USGCRP] has been considered in preparation of this EIS. **According to the [US]GCRP, it is reasonably foreseeable that sea-level rise may exceed 3 ft by the end of the century (GCRP 2009).** At a location, relative sea-level rise can have two components: (1) eustatic rise caused by absolute change in water volume of the oceans and (2) apparent rise in sea level caused by land subsidence. The increase in sea level would result in the saltwater front in the CFBC moving further inland.[159]

Thus, when compared collectively, the FSAR and DEIS both estimate sea level rise at 0.5876 feet by 2100 (based upon historical data collected by NOAA), while the DEIS simultaneously acknowledges a potential 3 foot-plus sea level rise by 2100 as "reasonably foreseeable" (according to the USGCRP). Detailing the unaccounted for negative impacts to Units 1 and 2 that potentially result from a long-term 2-3 foot rise in sea level is far beyond the scope of this Article, and in fact, the NRC's responsibility. But the fact that a "reasonably foreseeable" rise in sea level that is *five times* greater than the estimated rate (using historical data) is *not* integrated into PEF's FSAR, let alone the NRC's own DEIS, is concerning. The NRC's apparent reliance upon General Design Criteria 2 (GDC 2)[160] in using "historically reported" natural phenomena simply cannot be reconciled with accelerated sea level rise projections alluded to within the USGCRP report.

Considering that the IAEA addressed this very issue eight years ago in its Flood Safety Guide – projecting sea level rise of 1.15 to 2.79 feet over the lifetime of a plant – legitimate concerns arise over the NRC's pace at integrating new scientific information to adequately assess climate change impacts within the safety review. Only time will tell if the NRC's Final Safety Evaluation Report (FSER) – the final approval of the Levy County safety review – will similarly overlook the USGCRP's findings when it comes to the numbers used in the flood safety assessment. And if the current review process stays on schedule, the NRC anticipates issuing the FSER in April 2012.[161] If the NRC grants a construction permit, work will begin in 2016 at the earliest,[162] which means that

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[158] Draft Environmental Impact Statement for the Combined License (COL) for Levy Nuclear Plant Units 1 and 2, Draft Report for Comment, NUREG-1941 (Aug. 2010), § 2.3.1 Hydrology, 2-16.
[159] *Id.* (emphasis added).
[160] 10 C.F.R. Part 50 Appendix A, Criterion 2.
[161] U.S. NRC, *Levy County Nuclear Power Plant Units 1 and 2 Combined License Application – Revised Review Schedule*, Table 1 (Nov. 30, 2010), *available at* http://www.nrc.gov/reactors/new-reactors/col/levy/documents/nrc-2010.html.
[162] U.S. EIA, *supra* note 15.

Units 1 and 2 would go online around 2021 and 2023 respectively, [163] with a potential operating life extending to 2080 or beyond.[164]

2. Turkey Point Expansion (Units 6 & 7) – FPL

In 2006, FPL followed PEF's lead, and informed the NRC of its intent to apply for a combined license for two new units (Units 6 and 7) at Turkey Point.[165] In March 2008, the Florida PSC approved FPL's plans to construct Units 6 and 7,[166] and in June 2009, FPL submitted a Site Certification Application (SCA) to DEP, and a COL application to the NRC to build Turkey Point Units 6 and 7.[167] According to the federal EIA, FPL's COL application, dated June 30, 2009, was the only 2009 submittal to the NRC, and, therefore, a potential sign that the recent wave of new reactor applications has concluded.[168] Both DEP and the NRC are in the process of reviewing FPL's application.

a) Federal Review

FPL's COL application does account for sea level rise. Specifically, FPL's FSAR states:

> The long-term sea level rise trend at Miami Beach, Florida, as estimated based on data from 1931 to 1981, is **0.78 foot per century** (Reference 206). **Accordingly, a nominal long-term sea level adjustment of 1 foot is applied to the 10 percent high tide level resulting in an antecedent water level of 3.6 feet NAVD 88 (2.6 feet NAVD 88 + 1 foot)**, which represents the initial water level condition in the SLOSH model simulations.[169]

And FPL's ER addresses sea level rise as follows:

> Bathymetry variation within Biscayne Bay is shown on Figure 2.3-13. Long- and short-term shoreline change rates for the bay are not available. The average long-term rate of shoreline change for east Florida along the Atlantic coast shoreline is 0.2 ± 0.6 meter per year (0.66 ± 2.0 feet per year) (Morton and Miller 2005). This long-term shoreline rate of change is relatively small compared to shoreline changes for the other parts of the southeast Atlantic coast (Morton and Miller 2005). Shoreline changes within Biscayne Bay would be smaller than the rates for the Atlantic coast shoreline because the bay is protected from tide and

[163] U.S. EIA, *supra* note 13.
[164] Peter Behr, *Experts Weigh Extending the Lives of Nuclear Power Plants to 80 Years*, NY TIMES, Sept. 20, 2010, *available at* http://www.nytimes.com/cwire/2010/09/20/20climatewire-experts-weigh-extending-the-lives-of-nuclear-71936.html.
[165] *Florida approves FPL plan for two more reactors*, WORLD NUCLEAR NEWS, March 19, 2008, http://www.world-nuclear-news.org/NN-Florida_approves_FPL_plan_for_two_more_reactors_190308.html.
[166] *Id.*
[167] U.S.EIA, *supra* note 13.
[168] *Id.*
[169] Turkey Point Units 6 & 7 COL Application Part 2 – FSAR, Revision 0, Section 2.4.5.2.2.1, Antecedent Water Level, at 2.4.5-6 (June 30, 2009), ADAMS Accession No. ML091870858 (emphasis added).

> wave actions by the barrier islands. **The long-term trends in sea level rise at Miami Beach, Vaca Key, and Key West, Florida are approximately 2.39 ± 0.43 millimeters/year (0.09 ± 0.017 inch per year) [*0.78 ± 0.14 foot per century*], 2.78 ± 0.6 millimeters/year (0.11 ± 0.024 inch per year), and 2.24 ± 0.16 millimeters per year (0.09 ± 0.006 inch per year), respectively (NOAA 2008f).** Because Units 6 & 7 would not use surface water from or discharge process water into Biscayne Bay, detailed sediment transport properties for the bay are not provided.[170]

Thus, according to FPL's ER and FSAR, historic sea level trends for Miami Beach convert to approximately 0.78 foot per century. Even so, an NRC site audit report requested the following information of FPL in relation to FSAR Section 2.4.5:

> ID #19 Information Needs: Provide an SME to discuss the basis for estimating (1) initial rise (also called forerunner or sea level anomaly) and (2) expected sea level rise over the life of the plant. Based on historical records, sea level is stated to have risen at a rate of 0.78 ft per century in the local area (Turkey Point Units 6&7 FSAR page 2.4.5-6). Provide an SME to discuss the various processes and phenomena that have combined to produce this net change in sea level, how this value was used in estimating initial rise and expected future sea-level rise, and **why it is considered to be appropriate for safety analyses to use 1.0 ft as a nominal long-term sea level adjustment for the future. Discuss how potential sea-level rise due to potential future climate change is accounted for in this analysis.**[171]

The NRC's site audit report documented FPL's response to ID#19 as follows:

> Applicant Response: Applicant explained the basis for initial rise and expected sea-level rise, including the conservatism in the estimates. **Applicant will provide discussion (for the updated FSAR) of future sea level rise relative to plant life expectancy, but will not discuss climate change *per se*.**[172]

The NRC's site audit report also addressed sea level rise concerns in the context of coastal erosion:

> ID #39 Information Needs: Provide an SME to discuss the uncertainty related to future shoreline changes, including (1) the potential for sea level rise due to future climate change to increase the rate of shoreline change and (2) the potential for erosion or inundation of the barrier islands that currently help to protect the site of Units 6 & 7 from wave action.[173]

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[170] Turkey Point Units 6 & 7 COL Application Part 3 – Environmental Report, Revision 0, Section 2.3.1.1.3, Biscayne Bay, at 2.3-9 (June 30, 2009), ADAMS Accession No. ML091870907 (emphasis added). *See also* Turkey Point Units 6 & 7 COL Application Part 3 – Environmental Report, Revision 1, Section 2.3.1.1.3, Biscayne Bay, at 2.3-9 (Sept. 3, 2010), ADAMS Accession No. ML102580468.

[171] U.S. NRC, Hydrology Safety Site Audit for Turkey Point COLA – Site Safety Audit Information Needs for Turkey Point COLA at 4 (Apr. 9, 2010) (emphasis added).

[172] *Id.* (emphasis added).

[173] *Id.* at 11-12.

And the NRC documented FPL's response to ID #39 with the following:

> Applicant Response: No discussion will be included about climate change based on applicants and NRC Counsel discussion as reported by the applicant. The discussion will be on sea level rise.[174]

While the context of this correspondence is limited, the message is clear – FPL has no intentions of accounting for climate-induced sea level rise beyond the one-foot per century assessment within its original COL application. FPL is unwavering in its position that climate-induced sea level rise is not a part of the NRC's flood safety analysis. Such a stance simply cannot be reconciled with the IAEA's 2003 Flood Safety Guide (i.e., 1.15 to 2.79 feet over the lifetime of a plant) and the USGCRP findings (i.e., 3 foot plus by 2100).

In September 2010, FPL submitted an updated FSAR that stood by its one-foot per century sea level rise estimate.[175] And not surprisingly, FPL has justified much of the FSAR's probable maximum surge and seiche flooding analysis upon RG 1.59, the antiquated NRC guide yet to be updated as of mid-2011.[176] Where the NRC ultimately stands on this issue will not likely be seen until it delivers an FSER for Units 1 and 2, which is presently scheduled for December 2012.[177]

As for the progress of the environmental review, in June 2010 the NRC published a notice of intent to begin to conduct information scoping for preparation of a DEIS.[178] Upon receiving an NRC invitation to participate in the EIS scoping process, the SFWMD recommended that the EIS consider:

> Hurricanes/Climate Change/Sea Level Rise: The potential for adverse impacts related to the siting and design of the proposed plant and associated facilities directly on the coast in an area subject to the direct effects of hurricane tidal surge, climate change, and sea level rise.[179]

And in response to a similar NRC invitation, the U.S. National Park Service (NPS) also expressed significant concerns related to flooding and sea level rise:

> Extreme flooding could cause significant flushing of contaminants into Biscayne Bay from the Cooling Canal system due to its lower elevation (i.e., 1 to 3 feet above sea level). NPS

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[174] *Id.*

[175] Turkey Point Units 6 & 7 COL Application Part 2 – FSAR, Revision 1, Section 2.4.5.2.2.1, Antecedent Water Level, at 2.4.5-6 (Sept. 9, 2010), ADAMS Accession No. ML102580413.

[176] *See id.*

[177] *See* U.S. NRC, *Application Review Schedule for the Combined License Application for Turkey Point, Units 6 and 7*, http://www.nrc.gov/reactors/new-reactors/col/turkey-point/review-schedule.html.

[178] U.S. NRC, Notice of Intent to Prepare and Environmental Impact Statement and Conduct Scoping Related to a Combined License Application for Turkey Point, Units 6 and 7 (June 9, 2010), ADAMS Accession No. ML101530683.

[179] Letter from South Fla. Water Mgmt. Dist. to U.S. Nuclear Regulatory Comm'n, Re: FPL Turkey Point Units 6 & 7 License Application Review Scoping Comments 7 (Aug. 16, 2010).

> does not believe the COL sufficiently analyzes or evaluates these hydrological and estuarine issues.[180]
>
> 7. Climate Change/Sea Level Rise: The impacts of sea level rise due to climate change should be addressed as they pertain to the operation and maintenance of the RCWs and the hydrologic modeling, which is being used to forecast the percentage of water derived from Biscayne Bay versus freshwater from the Biscayne Aquifer. The effects of climate change should also address major storm events and cooling canal functionality over the projected lifespan of Units 6 & 7. Peer reviewed and governmental references should be part of this analysis, including the IPCC Fourth Assessment Report: Climate Change 2007; the Miami-Dade Climate Change 2007; and the **Army Corps of Engineers, engineering circular - sea level rise 1165-2-211**.[181]

The NPS reference to a U.S. Army Corps of Engineers (Corps or USACE) sea level rise policy becomes highly relevant when recognizing the NRC and Corps' relationship regarding new reactor permitting. Per a 2008 Memorandum of Understanding between the NRC and the Corps, the Corps is a "cooperating" agency on the environmental review of proposed reactors.[182] Although applicable *only* to civil works projects (rather than regulatory decisions related to nuclear licensing), on July 1, 2009 the Corps issued "Water Resource Policies and Authorities Incorporating Sea-level Change Considerations in Civil Works Programs, Circular No. 1165-2-211" (USACE Sea Level Rise policy). Specifically, the Corps' Sea Level Rise policy includes the following mandate for civil works projects:

> The planning and design of USACE water resource projects in and adjacent to the coastal zone must consider the potential for **future accelerated rise** in GMSL [Global Mean Sea Level] to affect the MSL [Mean Sea Level] trend. At the same time, USACE project planners and engineers must be aware of the historic trend in local MSL, because it provides a useful minimum baseline for projecting future change in local MSL. Awareness of the **historic** trend of local MSL also enables an assessment of the impacts that sea-level change may have had on regional coastal resources and problems in the past.[183]

Thus, although acknowledging the usefulness of *historical* data in estimating MSL, this new policy demonstrates that the Corps has stepped beyond such data to embrace the importance of

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[180] Letter from U.S. Nat'l Park Serv. to U.S. Nuclear Regulatory Comm'n, Re: Florida Power and Light Company Turkey Point Units 6 and 7 Combined License Application Review Scoping Comments 5 (Aug. 16, 2010).

[181] *Id.* (emphasis added).

[182] Memorandum of Understanding Between U.S. Army Corps of Engineers and U.S. Nuclear Regulatory Commission on Environmental Reviews Related to the Issuance of Authorization to Construct and Operate Nuclear Power Plants (Sept. 12, 2008), ADAMS Accession No. ML082540354. *See* Draft Environmental Impact Statement for the Combined License (COL) for Levy Nuclear Plant Units 1 and 2, Draft Report for Comment, NUREG-1941 (Aug. 2010), § 2.3.1 Hydrology, 4-1 to 4-2 (explaining the MOU relationship); *see also* NRC Regulatory Guide 4.2, Revision 2, Preparation of Environmental Reports for Nuclear Power Stations, NUREG-0099, vii (July 1976) (explaining the reasoning behind the MOU).

[183] USACE, *supra* note 8, at B-2 (emphasis added).

examining "the potential for future, accelerated [sea level] rise."[184] In contrast, the NRC's continued practice of looking to GDC 2 and RG 1.59, wholly relying upon strictly historical data, amounts to what the Corps would consider a "minimum baseline" of projecting mean sea level rise.

A DEIS scheduled for October 2011 may provide insight into (1) whether these agencies will provide independent and differing sea level projections, and/or (2) whether the NRC and the Corps will adopt FPL's suggested sea level rise estimate of one-foot per century.

b) State Review

At the state level, FPL's SCA similarly estimates sea level rise at one-foot rise per century. However, DEP, the South Florida Planning Council (SFPC), and the SFWMD have all expressed concerns that FPL's one foot per century assumption is inadequate, which has led to ongoing incompleteness determinations of the Power Plant Portion of the SCA.[185] On September 7, 2010, DEP issued a Fourth Incompleteness Review for FPL's SCA, and as part of DEP's request for additional information with this fourth request, the SFPC again expressed its opinion that FPL's SCA was incomplete without assessing a plus-one foot rise in sea level for the Turkey Point site.[186] FPL's response to this ongoing debate included the following:

> … FPL has considered other information, including the U.S. Army Corps of Engineers Circular regarding sea level rise. If it is demonstrated that significant sea level rise will affect South Florida and accessibility to Turkey Point 6 & 7, associated facilities, or operations in any way, FPL will have the opportunity to address these in an effective manner to allow the continued operations of plant facilities as planned by the Company. FPL will comply with all applicable regulatory requirements to maintain safe and continuous operation of the facility and associated features.[187]

According to FPL's plans, Units 6 and 7 are scheduled to become operational around 2020.[188]

V. Recommendations

Similar to Florida, and other vulnerable coastal states of the U.S., the United Kingdom (UK) must decide how to implement sea level rise policies that effectively protect existing nuclear reactors,[189] while simultaneously weighing whether to move forward with newly proposed coastal

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[184] *Id.*

[185] *See* DEP, *Florida Power & Light Turkey Point Nuclear Units 6 & 7*, http://www.dep.state.fl.us/siting/apps.htm#ppn1.

[186] *Id.*

[187] Response to SFWMD – FPL TURKEY POINT UNITS 6 & 7 SITE CERTIFICATION APPLICATION PLANT AND NON-TRANSMISSION FACILITIES 4TH ROUND COMPLETENESS, 0938-7652 (Feb. 2011).

[188] *Id.*

[189] International Nuclear Safety Center, *Maps of Nuclear Reactors: United Kingdom*, http://www.insc.anl.gov/pwrmaps/map/united_kingdom.php.

reactors.[190] In 2006, the MET Office, as the United Kingdom's National Weather Service, partnered with three leading U.K. energy companies to study and assess the potential impacts of climate change on the U.K. energy industry.[191] This study resulted in a follow-up project known as EP2 – an *industry-funded* partnership between eleven energy companies and the MET Office to further explore how the energy industry should adapt to climate change.[192] And specific to sea level rise, EP2 "[b]uilt a tool to enable UK coastal and marine sites of interest to be screened to assess if sea level rise should be considered in more detail."[193] This cooperative mentality will likely serve the U.K. well, and even more importantly, also seemingly embodies the IAEA's current approach to flood safety as it relates to sea level rise (i.e., to integrate and follow IPCC predictions in an abundance of caution). No such measures have been taken in the U.S., as the NRC has yet to address climate change, and continues to apply seemingly out-dated regulations based upon historical trends in sea level rise that simply fail to account for an accelerated rise. To their credit, state-level entities such as DEP, SFWMD, and SFRPC, and federal agencies such as the National Park Service have all raised legitimate sea level concerns regarding new reactor applications. Hopefully, the NRC will eventually update RG 1.59 in mid-to-late 2011, but even then, such measures will likely have no retroactive effect on PEF and FPL's previously submitted COL applications.

Unfortunately, future accelerated sea level rise planning is currently absent from the NRC's review process. And arguably, the only real sea level rise planning for Florida's two pending COL applications occurred prior to the NRC's involvement when PEF took a self-implemented "hard look" at sea level rise science and decided to build seven miles inland at a higher elevation than its coastal Crystal River site. As a result, even though sea level rise was potentially grossly underestimated in both the NRC and FPL's safety analysis, the majority of flood safety concerns were preempted by PEF's decision to move inland. Stated differently, because PEF exercised responsibility in choosing an *inland* reactor site at a higher elevation, and relinquished the opportunity to expand the existing coastal site at the Crystal River Energy Complex, sea level concerns have been significantly reduced regardless of whether the NRC is enforcing effective flood-safety policies.

In contrast, South Florida's flat geography and limited space left FPL with few, if any, choices to expand its nuclear operation to undeveloped, higher geographic elevations. But limited siting opportunities do not justify a decision to build at an overly risky location simply because more protected sites were not available. The realities of the latest sea level rise predictions as reported by the USGCRP and the IAEA only further reinforce that the South Florida coastline is not a good place to build new reactors.

As for the existing reactors at Crystal River, St. Lucie, and Turkey Point, the NRC has assured Rep. Markey that if sea level rise infringes a technical specification of a reactor's operating license,

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[190] *See* GREENPEACE, THE IMPACTS OF CLIMATE CHANGE ON NUCLEAR POWER STATIONS SITES: A REVIEW OF FOUR PROPOSED NEW-BUILD SITES ON THE UK COASTLINE (March 2007) (recommending against building new coastal reactors in the UK), *available at* http://www.greenpeace.org.uk/files/pdfs/nuclear/8176.pdf.

[191] Met Office, *Impacts on energy*, http://www.metoffice.gov.uk/climatechange/businesses/casestudies/energy.html.

[192] *Id.*

[193] *Id.*

the NRC will force the energy company to take action, which includes "reducing power or shutting down the plant entirely."[194] So although it seems reassuring that the NRC will take such precautions if necessary, what happens when such measures are necessary only 20 to 30 years into the life of a new coastal reactor? If the USGCRP believes a 3-4 foot rise in sea level is "reasonably foreseeable" in this century, it would also seem "reasonably foreseeable" that FPL's new reactors may never operate long enough to recoup the billions of dollars spent on building these units in the first place.

As of 2011, an emerging U.S. energy policy seems set on becoming more environmentally friendly in the face of climate change, yet is just now beginning to examine how climate change may impact the power plants themselves. If only because of the unfortunate events in Japan, the time has come for decision-makers to either (1) begin to take voluntary measures to minimize the potential for accelerated sea level rise impacts including decisions for siting future plants, or (2) openly disregard accelerated sea level rise projections by taking a public stance that accelerated projections are simply wrong. And if Russia's newly constructed *floating* reactors are a cause for concern, at least they are designed to rise with the sea.[195]

VI. Conclusion

NRC's out-dated flood safety policies largely ignore the high-stakes consequences of nuclear power vulnerability in the form of inundation and/or island-like conditions from accelerated sea level rise. And as nuclear power reemerges with renewed life as a potential means of combating climate change, the very same proposed coastal reactors in which to accomplish that goal appear to largely ignore or underestimate climate-induced sea level rise concerns. Because Florida is one of the most geographically vulnerable sites to the potential impacts of sea level rise, and simultaneously both the home of current and future coastal reactors, the future looks *expensive* if current climate change science proves accurate.

In the meantime, the planned construction of multi-billion dollar coastal nuclear reactors continues, and as these plans move forward, it is inevitable that the decisions of today will have long-term consequences. When considering the uncertain extent to which the utility companies and regulators are actually considering the threat of accelerated sea level rise to Florida's existing and future coastal reactors, the fate of such infrastructure in coming decades, in many respects, is purely a game of wait and "sea."

And after all, even multi-billion dollar U. S. Nuclear Reactors become islands in the sea, eventually.

-James F. Choate III

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[194] U.S. NRC Letter, *supra* note 56, at 2.

[195] *Russia Offers to Build Floating Nuclear Plant for Indonesia, for Power and Water*, LAROUCHE POLITICAL ACTION COMMITTEE, Oct. 20, 2010 ("The first floating nuclear plant, the 'Akademik Lomonosov,' which is nearing completion, is scheduled to be deployed in the Kamchatka region of Russia's far east in 2012. The barge that will be the platform for the pair of 25MW reactors was completed and launched earlier this year."), http://www.larouchepac.com/node/16149. *See also* Rod Adams, *Offshore Power Systems: Big Plants for a Big Customer*, ATOMIC, Vol. 2, Issue 5 (Aug. 1996) (profiling the U.S. attempt to build offshore floating reactors), *available at* http://www.atomicinsights.com/aug96/Offshore.html.