


<b>United States Nuclear Regulatory Commission Official Hearing Exhibit</b>	
<b>In the Matter of:</b>	Progress Energy Florida, Inc. (Levy County Nuclear Power Plant, Units 1 and 2)
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**WHAT ARE CUMULATIVE IMPACTS?  
SYNOPSIS OF THE U. S. COUNCIL ON ENVIRONMENTAL QUALITY  
1997 CUMULATIVE EFFECTS REPORT**

1. **Cumulative impacts** (effects) are not some nebulous, new concept that defies comprehensive, evaluation, or quantification. In fact, the large-scale, wide-spread damage to the environment from cumulative impacts was recognized at least by 1969, when the term was defined by **40 CFR § 1508.7** as follows:

**"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."**

2. An excellent example of cumulative effects, as incremental impacts from past, present and reasonably foreseeable future actions, can be found in the current state of the Floridan aquifer system. Adverse impacts from an individual residential well may be insignificant. The adverse cumulative impacts from many individual residential wells; groundwater mining at municipal well fields; industrial groundwater mining; and agricultural groundwater mining; added to mining of the structural component of the aquifer system (sand, rock); and covering large expanses of natural recharge areas with impervious surfaces; however, has resulted in a water crisis throughout much of the regional Floridan aquifer system. This concept of cumulative impacts also can be seen by looking at a single permit issued by a local, state, or federal agency, then considering all of the impacts from all of the projects permitted by all of those agencies. For example, see the summary of permits evaluated (and permitted) by the U. S. Army Corps of Engineers for Nationwide General projects that was summarized in the January 27, 2001 Daytona Beach News-Journal article by Catron (see <http://www.n-jcenter.com/2002/Jan/27/ENV1.htm>). The cumulative impacts of all of those NWP projects have not been considered, but when combined with each other, and other projects permitted by that agency and other agencies, they are significant and adverse.

3. The U. S. Council on Environmental Quality, Executive Office of the President published a report in January 1997 entitled, **"Considering Cumulative Effects Under The National Environmental Policy Act"** (Cumulative Effects Report). Some of the information in the Cumulative Effects Report particularly is useful in illustrating the types of things that must be considered for a scientifically-valid evaluation of the actual impacts of projects routinely authorized and/or permitted under the CWA by the COE in Florida. Table E-1 of the Cumulative Effects Report summarizes the basic principles of a cumulative effects analysis. The Executive Summary of that Cumulative Effects Report expands on these basic principles, stating, in relevant part:

".....The handbook presents practical methods for addressing coincident effects (adverse or beneficial) on specific resources, ecosystems, and human communities of all related activities, not just the proposed project or alternatives that initiate the assessment process." [page v]

"The process of analyzing cumulative effects can be thought of as enhancing the traditional components of an environmental impact assessment: (1) scoping, (2) describing the affected environment, and (3) determining the environmental consequences. Generally it is also critical to incorporate cumulative effects analysis into the development of alternatives for an EA or EIS. **Only by reevaluating and modifying alternatives in light of the projected cumulative effects can adverse consequences be effectively avoided or minimized.** Considering cumulative effects is also essential to developing appropriate mitigation and monitoring its effectiveness." [page v, emphasis added]

".....By evaluating resource impact zones and the life cycle of effects rather than projects, the analyst can properly bound the cumulative effects analysis." [page v]

" Determining the cumulative environmental consequences of an action requires delineating the cause-and-effect relationships between the multiple actions and the resources, ecosystems, and human communities of concern....Then **they must describe the response of the resource to this environmental change.....**" [page vi]

".....**Address the sustainability of resources, ecosystems, and human communities.**" [Table E-1, page vii, emphasis added]

3. The introductory chapter of the Cumulative Effects Report elucidates the purpose of analyzing cumulative impacts. Table 1-1 in that chapter provides a list of federal agencies, with examples of the types of situations in which cumulative impacts are (or should be) involved. The COE is the first agency listed in Table 1-1. The example provided in Table 1-1, for the COE's consideration of cumulative impacts is provided below, following the Congressional testimony excerpt explaining the purpose of evaluating cumulative impacts, and other relevant excerpts from the introductory chapter:

"...as a result of the failure to formulate a comprehensive national environmental policy...**environmental problems are only dealt with when they reach crisis proportions.....** Important decisions concerning the use and shape of man's environment continue to be made in small but steady increments which perpetuate requirements." [page 2, emphasis added]

"...Cumulative effects analysis should be the tool for federal agencies to **evaluate the implications of even project-level environmental assessments (EAs) on regional resources.**" [page 3, emphasis added]

**"incremental loss of wetlands under the national permit to dredge and fill and from land subsidence"** [Table 1-1, page 2, emphasis added]

4. The fact the Floridan aquifer system has suffered irreparable damage in the form of subsidence, contamination, and depletion, to the point where Congress has authorized approximately \$8 billion dollars in tax relief for experimental remedies in south Florida alone, should be sufficient evidence to conclude **the environmental problems in Florida have reached crisis proportions.** The reason for this crisis can be found in the fact that cumulative impacts have not been considered. Figure 1-2 of the Cumulative Effects Report is a flow chart depicting the results of a review of 89 EAs announced in the Federal Register during the first six months of 1992, to determine how many EAs correctly treated cumulative impacts. Only three were found to have correctly considered cumulative impacts.

5. The principles of cumulative impacts are further summarized in Table 1-2. With respect to the information provided in Table 1-2 and this case, the "given resource" is the Floridan aquifer system. Some of the more relevant parts of Table 1-2, with respect to the issues addressed in this affidavit, are as follows:

"2. Cumulative effects are the total effect, including both direct and indirect effects, on a **given resource,** ecosystem, and human community of all actions taken, no matter who (federal, nonfederal, or private) has taken the actions." [emphasis added]

"5. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries."

"7. Cumulative effects may last for many years beyond the life of the action that caused the effects.....(e.g., acid mine drainage, radioactive waste contamination, **species extinctions.**) **Cumulative effects analysis needs to apply the best science** and forecasting techniques **to assess potential catastrophic consequences in the future.**" [emphasis added]

"8. **Each affected resource, ecosystem, and human community must be analyzed in terms of its**

capacity to accommodate additional effects, based on its own time and space parameters...The most effective cumulative effects analysis focuses on what is needed to ensure long-term productivity or sustainability of the resource." [emphasis added]

6. Eight scenarios of accumulating effects are described in Table 13 of the Cumulative Effects Report. Examples of the eight scenarios ("Types") of cumulative impacts that are specific to Florida (based on the "Main Characteristics" in Table 1-3) are relatively easy to identify. Some of the examples already are occurring in Florida, at crisis proportions, while others are building to such levels. All of the examples could have been triggered solely by the General permits authorized by the COE in Florida. **Type 1** (frequent and repetitive effects on an environmental system) is exemplified by the extensive destruction of forested wetlands - particularly pond-cypress wetlands - with no "regrowth" or replacement. **Type 2** (delayed effects) is exemplified by collapse of the aquifer structure - sinkholes - from groundwater mining, and exposure of coastal organisms and human communities to slow-acting contaminants (e.g., endocrine disruptors) from aquifer-injected effluent and other wastes. **Type 3** (high spatial density of effects on an environmental system) is exemplified by pollution discharges into the aquifer from nonpoint sources. **Type 4** (effects occur away from the source) is exemplified by breached groundwater "divides" causing diversions from one watershed as a result of groundwater pumping in another watershed. **Type 5** (change in landscape pattern) is exemplified by fragmentation of critical wildlife migration corridors (e.g., Florida black bear migration corridor). **Type 6** (effects arising from multiple sources or pathways) could be exemplified by synergism among contaminants injected into the aquifer. **Type 7** (secondary effects) is exemplified by any and all type of development following highway construction. **Type 8** (fundamental changes in system behavior or structure) is exemplified by large-scale flow reversals in the Floridan aquifer system, such that the aquifer system that formerly discharged ground water to springs, streams, wetlands, and coastal areas, now is sucking water from those same systems.

7. The Cumulative Effects Report further explains that, "in simplest terms, cumulative effects may arise from single or multiple actions and may result in additive or interactive effects." Table 1-4 of the Cumulative Effects Report is a matrix showing the four combinations of single and multiple actions combined with either additive or interactive processes. Again, examples of the four types of action/process outcomes (based on the matrix) that are specific to the situation in Florida are provided. The **single action/additive process** combination is exemplified by linear transportation projects (General Category 14) and particularly wetland road which result in continual deaths of wildlife and generally disrupt natural flow patterns. Another example is stormwater management facilities (General Category 43) excavated near depression wetlands that result in continual draining of those wetlands. Mining activities (General Category 44) are yet another example of this type of cumulative impact, similar to excavated stormwater facilities in the continual draining of wetlands, but on a much larger scale. This combination also is exemplified by dewatering activities, such as those authorized under General Category, that result pathogenic fungal infections of tree roots that later result in the death of those trees. The **single action/interactive process** combination is exemplified by stormwater management facilities (General Category 43) that act as "attractive nuisances" to wildlife, exposing them to biomagnifying contaminants such as heavy metals they would not be exposed to in natural wetlands. The **multiple actions/additive process** combination is exemplified by single-family housing (General Category 29), residential, commercial, and institutional development projects (General Category 39) and agricultural activities (General Category 40) that all contribute to drawing down the Floridan aquifer system. The **multiple actions/interactive process** is exemplified by any combination of the General Categories referenced in this paragraph that lead to both the reduction in pristine aquifer discharges to Florida's coastal waters (disrupting salinity regimes), in conjunction with induced aquifer discharge of injected sewage effluent (stress from nutrient-loading and other contaminant).

8. The second chapter of the Cumulative Effects Report describes the importance of proper scoping.

It is important to note that the General Categories of projects routinely authorized by the COE in Florida result in virtually all of the cumulative effects issues listed under Item 7 of Table 2-1 of the Cumulative Effects Report. The discussion regarding identifying geographic boundaries uses Figure 21 of the Cumulative Effects Report to illustrate the "utility of using the ecologically relevant watershed boundary of the Anacostia River basin rather than the political boundaries of local governments to develop restoration plans." Although watersheds are logical geographic units in many areas of the U. S., this is not the case in Florida. Extensive groundwater mining of the karst Floridan aquifer system does not recognize watershed boundaries any more than it recognizes political boundaries, and has resulted in breached groundwater "divides". Consequently, geographic boundaries of resources in Florida now must be expanded to coincide with the natural boundaries of the regional aquifer system. Table 2-2 of the Cumulative Effects Report illustrates how an aquifer is an appropriate geographic area for a cumulative impacts analysis involving water quality. In Florida, the regional aquifer also is an appropriate geographic area for evaluating virtually every other resource listed in Table 2-2 of the Cumulative Effects Report. The following quote from Chapter 2 of the Cumulative Effects Report reiterates the importance of expanded geographic boundaries for a scientifically-based cumulative impacts analysis:

"...Analyzing cumulative effects differs from the traditional approach to environmental impact assessment because it requires the analyst to expand the geographic boundaries and extend the time frame to encompass additional effects on the resources, ecosystems, and human communities of concern." [page 12]

9. Chapter 3 of the Cumulative Effects Report illustrates how to describe the affected environment during a cumulative impacts analysis. For example, "the analyses and supporting data should be **extended in terms of geography, time, and the potential for resource or system interactions.**" [page 23, emphasis added] Numerous components of the affected environment are listed, with examples of various issues to be considered under each component. All of the components and issues listed in Chapter 3 of the Cumulative Effects Report are capable of resulting solely from the cumulative impacts triggered by the General permits authorized by the COE in Florida. Examples of components and issues particularly relevant to this case include the following [NOTE - the following "Surface Water" issues are equivalent to "Ground Water issues for Florida]:

"Surface Water

Water shortages from unmanaged or unmonitored allocations of the water supply that exceed the capacity of the resource.

**Deterioration of recreational uses from nonpoint-source pollution, competing uses for the water body, and over-crowding.** [page 25, emphasis added]

"Ground Water

Water quality degradation from nonpoint- and multiple-point sources of pollution that infiltrate aquifers.

**Aquifer depletion or salt water intrusion following the overdraft or groundwater for numerous uncoordinated uses.** [page 25, emphasis added]

"Wetlands

**Habitat loss and diminished flood control capacity resulting from dredging and filling individual tracts of wetlands.**

Toxic sediment contamination and reduced wetlands functioning resulting from irrigation and urban runoff." [page 25]

"Ecological Systems

Habitat fragmentation from the cumulative effects of multiple land clearing activities,

including logging, agriculture, and urban development.

Loss of fish and wildlife populations from the creation of multiple barriers to migration (e.g., dams and highways)." [page 25, emphasis added]

"Socioeconomics

Over-burdened social services due to sudden, unplanned population changes as a secondary effect of multiple projects and activities." [page 25, emphasis added]

10. Chapter 4 of the Cumulative Effects Report explains **how to determine the environmental consequences of cumulative effects**. Table 4-3 provides an example of a narrative description of effects on various resources, illustrating how the significant cumulative loss of wetlands occurs. With respect to the issues addressed in this affidavit, some of the other more relevant points in that chapter (beginning with "Step 10") are as follows:

"Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects." [page 37]

"In preparing any assessment, the analyst should gather information about the cause-and-effect relationships between stresses and resources..." [page 38]

"If cause-and-effect relationships cannot be quantified, or if quantification is not needed to adequately characterize the consequences of each alternative, qualitative evaluation procedures can be used. The analyst may categorize the magnitude of effects into a set of number classes (e.g., high, medium, or low) or provide a descriptive narrative of the types of effects that may occur...." [page 41]

"...As discussed above, the magnitude of an effect reflects relative size or amount of an effect. Geographic extent considers how widespread the effect might be. Duration and frequency refers to whether the effect is a one-time event, intermittent, or chronic..." [page 44]

"...In most cases, however, avoidance or minimization are more effective than remediating unwanted effects. For example, attempting to remove contaminants from air or water is much less effective than preventing pollution discharges into an airshed or watershed. Although such preventative approaches can be the most (or only) effective means of controlling cumulative effects, they may require extensive coordination at the regional or national scale (e.g., federal pollution control statutes)." [page 45]

11. The final chapter of the Cumulative Effects Report addresses **"Methods, Techniques, and Tools for Analyzing Cumulative Effects."** As a guide, Table A-1 (page A-8) provides a hypothetical checklist for identifying potential cumulative effects of a highway project (e.g., General Category 14 "linear transportation projects"). "Methods 9: Ecosystem Analysis" (page A-37) also is an important entry, based on the concerns expressed in this affidavit. Other aspects of this chapter that are most relevant to the problems addressed in this affidavit are as follows:

"...Fortunately, the methods, techniques, and tools available for environmental impact assessment can be used in cumulative effects analysis...." [page 49]

"Although the NEPA practitioner must draw from the available methods, techniques, and tools it is important to understand that a study-specific methodology entails using a variety of methods to develop a conceptual framework for the analysis...." [page 50]

"Ecosystem analysis involves considering the full range of ecological resources and their interactions with the environment. This approach can improve cumulative effects analysis by *providing the broad regional perspective and holistic thinking needed to address the following cumulative effects principles:* [page A-37]

"Focus on the resource or ecosystem...." [page A-37]

"Use natural boundaries.... [page A-37]

"Address resource or ecosystem sustainability....." [page A-37]

"Traditionally, environmental impact assessment has considered air quality, water resources, wildlife, and human communities as separate entities for analysis. This separation of resources has obscured many cumulative effects. Recognition of the interconnectedness of land, water, and human resources has driven many federal and state agencies to undertake ecosystem or watershed approaches to environmental protection....." [page A-37]