November 30, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)		
	)	Docket Nos.	52-029-COL
Progress Energy Florida, Inc.	)		52-030-COL
	)		
(Combined License Application for Levy County Nuclear Plant, Units 1 and 2)	)	ASLBP No.	09-879-04-COL

MOTION TO COMPEL DISCLOSURE OF BASES FOR EXPERT OPINION WITH REGARD TO CONTENTION 4

Pursuant to 10 C.F.R. § 2.323, applicant Progress Energy Florida, Inc. ("Progress") hereby submits this motion requesting that the Atomic Safety and Licensing Board ("Board") compel Nuclear Information and Resource Service, the Ecology Party of Florida, and the Green Party of Florida (collectively, "Joint Intervenors") to supplement their initial disclosure with the analyses or other authority that provide bases for allegations in their Petition[1] with regard to Contention 4 as admitted. Progress believes that the Joint Intervenors' initial disclosure submitted pursuant to 10 C.F.R. § 2.336(a)(1) is deficient because no analysis or other authority is provided with regard to certain specific conclusory opinions[2] of their expert. It is inconsistent to file an expert opinion but claim to have no expert report. The lack of disclosure materially interferes with the ability of Progress to prepare for the hearing and engenders a significant risk of unfair surprise; therefore, the Board should compel prompt compliance with the mandatory disclosure requirements.

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[1] Petition to Intervene and Request for Hearing By the Green Party of Florida, the Ecology Party of Florida and Nuclear Information and Resource Service (Feb. 6, 2009) ("Petition").

[2] The specific allegations at issue in this dispute are described below and detailed in the proposed form of order provided consistent with 10 C.F.R. § 2.323(b) as Attachment 1.

I. Procedural Posture

This proceeding involves Progress's application (the "Application" or "COLA"), dated July 28, 2008, for a combined license to construct and operate the proposed Levy Nuclear Plant ("Levy") in Levy County, Florida. After the Board held oral argument in this proceeding on April 20 and 21, 2009,[3] on July 8, 2009, the Board issued LBP-09-10 admitting Contentions 4, 7 and 8 "as restated and narrowed [by the Board] in Attachment A" to LBP-09-10.[4] On July 20, 2009, Progress appealed LBP-09-10.[5]

On July 23, 2009, the Board denied Progress's motion of July 15, 2009 to suspend the disclosure obligations of the parties pending resolution of the Progress appeal, stating that "the Board firmly believes that it is all the more imperative that the few remaining discovery obligations be promptly performed and vigorously enforced."[6] The Initial Scheduling Order required that "[o]n or before October 29, 2009, the parties and the NRC Staff shall file any motions to compel or challenges regarding the adequacy of any mandatory disclosure ... concerning any disclosures occurring prior to that date."[7] Upon a joint motion of Progress and Joint Intervenors, the Board extended this deadline to November 30, 2009.[8]

II. Relevant Law

In accordance with the Initial Scheduling Order, Progress, the Joint Intervenors, and the NRC Staff provided mandatory disclosures by September 1, 2009. Initial Scheduling Order at 4. NRC regulations require that the disclosures identify witnesses "upon whose opinion the party bases its claims and contentions … and a copy of the analysis or other authority upon which that person bases his or her

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[3] Progress Energy Florida, Inc. (Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2), Official Transcript (Apr. 20-21, 2009) ("Tr.").

[4] Progress Energy Florida, Inc. (Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2), LBP-09-10, 70 N.R.C. __ (slip op. at 107) (July 8, 2009) ("LBP-09-10").

[5] Because the appeal was based in part on extension of a recent Commission decision in a materials licensing proceeding to this reactor licensing proceeding, it was an interlocutory appeal pursuant to 10 C.F.R. § 2.311(d)(1) rather than a motion for reconsideration pursuant to 10 C.F.R. § 2.323(e).

[6] Licensing Board Order (Denying Motion to Suspend Discovery) at 2 (July 23, 2009) (unpublished).

[7] Progress Energy Florida, Inc. (Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2), LBP-09-22, 70 N.R.C. __ (slip op. at 7) (Aug. 27, 2009) ("Initial Scheduling Order").

[8] Licensing Board Order (Granting Motion for Extension of Time) (Oct. 27, 2009) (unpublished).

opinion." 10 C.F.R. § 2.336(a)(1). In this case of first impression, the Board should order Joint Intervenors to: (i) comply with mandatory disclosures pursuant to 10 C.F.R. § 2.336(a)(1); (ii) disclose expert reports adequate to meet their burden of going forward; and (iii) not fail to comply if that materially impacts the Applicant's hearing preparations. This motion follows the Board Orders that any motion to compel arising from a dispute with the initial disclosure be filed by November 30, 2009.

A. Revisions Issued In 2004 To The Hearing Regulations Contain Several Revisions To Focus Informal Proceedings

In 2004, the Commission issued a thorough revision of the regulations governing informal proceedings to achieve its goal that NRC adjudications be focused on specific, well-defined issues and avoid developing a large, unfocused evidentiary record and receiving evidence that is unreliable or of questionable relevance. The revision added mandatory disclosures as an essential element of the informal hearing procedures. 10 C.F.R. § 2.336(a). Another element extensively discussed by the Commission was the change from requiring areas of concern to requiring well-supported, specific contentions. Specifically, the Commission stated:

> The Commission believes that there is a need to take some action to improve the management of the adjudicatory process to avoid needless delay and unproductive litigation. Using less formal hearing processes with simplified procedures for most types of proceedings along with a requirement for well-supported specific contentions in all cases can improve NRC hearings, limit unproductive litigation, and at the same time ease the burdens in hearing preparation and participation for all participants. In the final rule, well-supported, specific contentions will be required in all proceedings, just as they are now required under the Commission's formal hearing procedures. See § 2.309(f). Petitioners generally have been able to meet the current specific contention requirements and the Commission would not expect the application of those requirements to informal proceedings to adversely affect public participation. Indeed, by focusing litigation efforts on specific and well defined issues, all parties will be relieved of the burden of having to develop evidence and prepare a case to address possibly wide-ranging, vague, undefined issues.

Final Rule: Changes to the Adjudicatory Process, 69 Fed. Reg. 2,182, 2,188 (Jan. 14, 2004). Specific contentions coupled with mandatory disclosure of supporting evidentiary bases for the contentions was expected to be a significant enhancement over relying solely on formal discovery mechanisms.

> The Commission believes that the tiered approach to discovery set forth in the proposed rule represents a significant enhancement to the Commission's existing adjudicatory procedures, and has the potential to significantly reduce the delays and resources expended by all parties in discovery. At the foundation of the Commission's approach are the provisions in Subparts C and G which provide for mandatory disclosure of a wide range of information, documents, and tangible things relevant to the contested matter in the proceeding, and the NRC's provisions for broad public access to documents in § 2.390. The mandatory disclosure provisions, which were generally modeled on Rule 26 of the Federal Rules of Civil Procedure, have been tailored to reflect the nature and requirements of NRC proceedings. Mandatory disclosure of information relevant to the contested matter … should reduce or avoid the need to draft often-complex discovery requests such as interrogatories, prepare for time consuming and costly depositions, and engage in extended litigation over the responsiveness of a party to a discovery request. Reducing the burden of discovery may enhance the participation of ordinary citizens in the discovery process, since they often do not have the resources to engage in protracted litigation over discovery.

Id. at 2,194.

Management of discovery by the Boards is an essential case management tool. Discovery serves the dual purposes of avoiding surprise at hearing and narrowing issues. Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), LBP-83-17, 17 N.R.C. 490, 493-94 (1983). While the Commission expressed optimism that the mandatory disclosure (tiered with the hearing file not in dispute here) would reduce the efforts of the Parties associated with discovery, the Commission provided its Boards with the flexibility to allow other discovery mechanisms or fashion other appropriate relief if mandatory disclosure did not meet the Commission's goals. Specifically, the Commission stated, "Strong case management is an integral part of an efficient and effective hearing process. The Commission expects presiding officers/boards to manage all adjudications carefully and attentively. Tools to be used to this end are reflected in the final rule." 69 Fed. Reg. at 2,188. These tools include sanctions for a continuing unexcused failure to comply with the mandatory disclosure obligations. 10 C.F.R. § 2.336(e). These sanctions allow for the use of the discovery provisions of 10 C.F.R. Part 2, Subpart G as needed. 10 C.F.R. § 2.336(e)(1). In response to comments that case management tools were insufficient and that regulations should set firm deadlines for proceedings, the Commission found that fixed deadlines would likely create counter-productive restrictions on Boards, stating:

> The Commission does not believe that a rule of general applicability such as part 2 should establish mandatory and inflexible schedules for the conduct of proceedings…. Moreover, the Commission believes that strong case management and control by the ASLBP and its presiding officers—using the tools and reflecting the policies in the Commission's Policy Statement on the Conduct of Adjudicatory Proceedings and in the rules of practice—and the Commission's ongoing oversight of presiding officers and Licensing Boards are the key to the efficient and effective conduct of hearings.

69 Fed. Reg. at 2,197. Sanctions for failure to comply with mandatory disclosure at the beginning of the proceeding are part of case management tools to allow the Boards to regulate the pace of proceedings.

B. Mandatory Disclosure Provisions Are Required At The Beginning Of Informal Proceedings

The initial mandatory disclosures are intended to be complete. This conclusion is reflected in the plain language of the regulation, the supporting explanation by the Commission, and the regulatory structure. If the disclosures are not complete when initially made, Board intervention is appropriate.

1. The disclosure at 10 C.F.R. § 2.336(a)(1) requires evidentiary information from those parties with claims or contentions. To the extent a party has claims or contentions,[9] the disclosure obligations under 10 C.F.R. § 2.336(a)(1) are absolute.[10] The failure to provide the initial disclosure is subject to sanctions that do not depend on any elements of willfulness or active withholding: (a) the sanctions of either dismissal or use of the discovery provisions of Subpart G are available for the continued unexcused failure to comply,[11] and (b) the sanctions of limiting evidence or testimony are available for failure to provide any document or witness name without good cause.[12]

These tools are available to the Boards to exercise efficient and effective case management. Commission policy reflects that efficient management of the pre-trial discovery process is the foundation

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[9] Generally, the parties with claims or contentions will be intervenors, not applicants.

[10] Contrast the absolute language of 10 C.F.R. § 2.336(a)(1) with the conditional language of other disclosure obligations, including: (i) 10 C.F.R. § 2.336(a)(2) that limits the disclosure of relevant documents to those in a party's "possession, custody, or control;" (ii) 10 C.F.R. § 2.336(b) that limits the NRC staff's disclosure "to the extent available;" and (iii) 10 C.F.R. § 2.336(d) that subsequent disclosure be made when "developed or obtained."

[11] 10 C.F.R. § 2.336(e)(1).

[12] 10 C.F.R. § 2.336(e)(2).

of the overall progress of a proceeding. Policy on the Conduct of Adjudicatory Proceedings, CLI-98-12, 63 Fed. Reg. 41,872, 41,875 (1998). If appropriate, intervenors may eschew compliance with 10 C.F.R. § 2.336(a)(1) only if the Board finds that such non-compliance is either excusable or has good cause.

There is no apparent asymmetry in this provision as it reflects the long-standing case law that the applicants are entitled to discovery against the intervenors. Other Boards have found that because the applicants have put forward considerable amount of information in the application, "[d]iscovery of the foundation upon which a contention is based is not only clearly within the realm of proper discovery, but also necessary for an applicant's preparation of hearing."[13] Requiring that intervenors have more disclosure obligations is appropriate given the information provided by the applicant in a docketed application.

2. The explanation of the regulation reinforces the plain meaning of 10 C.F.R. § 2.336(a)(1) that the intervenor's disclosure obligation is absolute. The Commission explained that the initial disclosure would be at the beginning of the proceeding, stating:

> The final rule provides that in all adjudicatory proceedings (whether formal or informal), the parties must exchange relevant documents and other information at the beginning of the proceeding. *See* §§ 2.336, 2.704. Parties other than NRC staff are also required to exchange the identity of expert witnesses, as well as existing reports of their opinions.

69 Fed. Reg. at 2,189.[14] This initial disclosure should contain enough detail to allow challenging the credibility of the experts. Id. n. 4.

3. The structure of the regulations is also consistent with initial disclosures being complete at the beginning of the proceeding. The regulatory structure provides for sanctions based on

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[13] Seabrook, LBP-83-17, 17 N.R.C. at 494 (citation omitted); see also, Commonwealth Edison Co. (Byron Station Units 1 and 2) LBP-81-30A, 14 N.R.C. 364, 369 (1981); Kerr-McGee Chemical Corp. (West Chicago Rare Earths Facility), LBP-86-4, 23 N.R.C. 75, 81 (1986).

[14] Where only one party has claims and contentions, the naming of expert witness and providing of their reports would be unilateral.

failure to provide the required disclosure or name witnesses. 10 C.F.R. § 2.336(e).[15] No other discovery mechanisms are available to the Parties or the NRC Staff in informal hearings. 10 C.F.R. § 2.1203(d). While there is a continuing duty to provide any information or documents subsequently developed or obtained,[16] the regulations do not require parties to perform such further inquiry.[17] If Board intervention is not requested when initial disclosures are incomplete, there is no provision in the regulations to raise subsequent objections.[18]

C. Intervenors Have The Burden Of Going Forward

The Intervenors have the burden of going forward on the contentions they raised.[19] These longstanding obligations were preserved in the 2004 revisions of the informal hearing procedures. The Commission explained that both the applicants and intervenors have respective burdens, stating:

> The Commission emphasizes that the ultimate burden of proof (risk of nonpersuasion) remains with the applicant and/or the proponents of particular actions in these proceedings. Moreover, a party sponsoring a contention bears the burden of going forward with evidence sufficient to show that there is a material issue of fact or law, such that the applicant/proponent must meet its burden of proof. Where cross-examination is not permitted, each party must bear its burden by going forward with affirmative evidentiary presentations and testimony, its rebuttal evidence and rebuttal testimony, and well-developed questions that the party suggests the presiding officer pose to the

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[15] These sanctions are specified in the subsection headed "Governing Discovery." To the extent that headings provide any interpretative guidance, the heading supports application of the sanctions at the beginning of the proceeding rather than later in the hearing process such as if the sanctions were under 10 C.F.R. § 2.337, "Evidence at a hearing." Furthermore, the heading supports that discovery sanctions do not involve an element of willfulness, such as if the sanctions were under 10 C.F.R. § 2.320, "Default."

[16] 10 C.F.R. § 2.336(d).

[17] In contrast, see the schedule guidance provided for disclosure of expert reports in formal hearings at 10 C.F.R. § 2.704(b)(3).

[18] The alternate interpretation that there is no management of discovery, not even by the Board, leaves the proceedings incoherent. As discussed above, the Commission recognized that the management of discovery is a foundation of efficient and effective proceedings. In deleting the roles of the Parties and NRC Staff in discovery management in informal proceedings, the Commission intended to simplify the proceedings; there is every indication that management by the Board was intended, not precluded. Obviously, if the initial disclosure is adequate, there is no need for Board intervention.

[19] See Philadelphia Electric Co. (Limerick Generating Station, Units 1 & 2), ALAB-262, 1 N.R.C. 163, 191 (1975); Commonwealth Edison Co. (Zion Station, Units 1 and 2), ALAB-226, 8 A.E.C. 381, 388-89 (1974); Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-05-12, 61 N.R.C. 319, 326 (2005).

> witnesses. Thus, the responsibility for developing an adequate record for decision is on the parties, not the presiding officer. The presiding officer is responsible for overseeing the compilation of the record and for ensuring that the record is sufficiently clear and understandable to the presiding officer such that he or she can reach an initial decision. However, the parties are responsible for ensuring that there is sufficient evidence on-the record to meet their respective burdens. The presiding officer will take the compiled record, clarified by action of the presiding officer as necessary so that it is understandable for the presiding officer's deliberations, and based upon that record determine whether the parties have met their respective burdens.

69 Fed. Reg. at 2,213. While a contention's bases may include evidentiary support, it need not. LBP-09-10 at 44. Where the contention as pled does not meet the burden of going forward, the initial disclosure should. As the Commission explained when describing the role of initial disclosure, the expert witness reports are to be disclosed to allow the formulation of challenges to the expertise and credibility of expert witnesses. 69 Fed. Reg. at 2,189 n. 4. An essential aspect of the credibility of an expert is the reliability of the expert's method and analysis.

In 2004, the previous considerations by the Board in restricting or barring evidence were expanded to include "unreliable." 10 C.F.R. §§ 3.319(e) and 2.333(b); 69 Fed. Reg. at 2,223, 2,224.[20] The reliability of an expert is based on evaluating the foundational analysis from the methods and procedures of science, not the ultimate conclusions. Virginia Electric & Power Co. (North Anna Nuclear Power Station, Units 1 and 2), ALAB-555, 10 N.R.C. 23, 26-27 (1979). Therefore, Boards look to the Federal Rules of Evidence ("FRE") for guidance in determining if an expert is qualified. Duke Power Co. (William B. McGuire Nuclear Station, Units 1 and 2), ALAB-669, 15 N.R.C. 453, 475 (1982). Other Boards have looked to FRE 702 and associated case law (Daubert)[21] to ensure the record does not become unwieldy and full of evidence of marginal relevance and poor reliability.[22] Unless analysis or other

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[20] These changes are consistent with the requirement that Boards admit only relevant, material, and reliable evidence that is not unduly repetitious. 10 C.F.R. § 2.337(a).

[21] Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993).

[22] See, e.g., Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-05-20, 62 N.R.C. 187, 228 (2005) and LBP-05-22, 62 N.R.C. 328, 357 (2005); Duke Cogema Stone & Webster (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-05-4, 61 NRC 71, 80 (2005) (citing Daubert, 509 U.S. at 587-90). These cases identify the standards applicable at summary disposition

authority adequate to provide an evidentiary basis for the intervenors' expert opinions is provided, the applicant cannot prepare a challenge to the reliability of an expert; and hence the expert's credibility. An expert's conclusory opinions as the sole disclosure is contrary to the Commission's expectations discussed above.

The Commission's goals include fostering public confidence in its adjudications. See, e.g., 69 Fed. Reg. at 2,182. Just as juries may put unwarranted reliance on expert opinions warranting the Supreme Court to call on judges to serve a gatekeeper role,[23] the Boards should serve a similar gatekeeper role with regard to the evidentiary record in NRC proceedings. Public confidence is not fostered by a record replete with junk science.

D. A Motion To Compel Will Follow Where The Failure To Make Disclosures Impacts Other Parties' Ability To Prepare For The Hearing

As explained above, the initial disclosure for those with claims or contentions must be complete. The regulations state that sanctions should follow unless the failure to comply is either excused or has good cause. Whether the Board should excuse non-compliance is informed by longstanding case law. Other Boards have found that the appropriate trigger is when the delay in discovery affects the ability of the applicant to prepare its case, not when the intervenors have their case ready. A party is not excused from compliance because it has not fully completed its investigation. 10 C.F.R. § 2.336(c); Kerr-McGee, LBP-86-4, 23 N.R.C. at 82.

Applicants are entitled to discovery against intervenors in order to obtain the information necessary for the applicant to meet its burden of proof. Pennsylvania Power & Light Co. (Susquehanna Steam Electric Station, Units 1 and 2) ALAB-613, 12 N.R.C. 317, 338 (1980). Discharging this burden is impossible if the applicant cannot effectively inquire into the position of intervenors. Commonwealth Edison Co. (Byron Station, Units 1 and 2) LBP-81-52, 14 N.R.C. 901, 903 (1981). With regard to an

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and this Board should find applicable to determine the adequacy of initial disclosure under 10 C.F.R. § 2.336(a)(1) in this case of first impression.

[23] Daubert, 509 U.S. at 599-600.

environmental contention, the Environmental Impact Statement ("EIS") prepared by the NRC Staff is the document ultimately challenged. LBP-09-10 at 26-27 & nn. 21, 22. However, like all other members of the public, the applicant's input into the EIS is during the public comment period on the draft EIS. 10 C.F.R. § 51.73. In order for the applicant to effectively provide comments for the EIS, disclosure of the analysis or other authority that provide the evidentiary basis for the opinion of the intervenors' expert prior to the draft EIS is necessary. Otherwise, the applicant can not influence the EIS until the hearing, where the Board may be called on to amend the final EIS *pro tanto*.[24]

E. A Motion To Compel Must Identify The Issues In Dispute With Specificity

A motion to compel cannot be based on generic complaints that the other party has not met an obligation. The dispute must be identified with specificity. Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), LBP-82-116, 16 N.R.C. 1937, 1941, 1950 (1982); see generally 10 C.F.R. § 2.705(h)(1). This motion provides this detail required, below and in Attachment 1.

F. A Motion To Compel Provides The Offending Party Appropriate Notice Prior To Sanctions

The offending party should be put on notice prior to issuing sanctions for failing to comply with mandatory disclosures. The Commission explained that these sanctions would be issued similar to the analogous practice at the Environmental Protection Agency ("EPA"):

> Section 2.336 authorizes the presiding officer to impose sanctions against parties who fail to comply with this general discovery provision, including prohibiting the admission into evidence of documents or testimony that a party failed to disclose as required by this section unless there was good cause for the failure (this sanction is similar to that provided in the rules of practice of the Environmental Protection Agency, 40 CFR 22.19(a), 22.22(a)).

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[24] See Allied-General Nuclear Services (Barnwell Nuclear Fuel Plant Separations Facility), ALAB-296, 2 N.R.C. 671, 680 (1975); Louisiana Power & Light Co. (Waterford Steam Electric Station, Unit 3), LBP-82-100, 16 N.R.C. 1550, 1571 n.20 (1982).

69 Fed. Reg. at 2,225. As recognized by the Commission, these sanction provisions regulate discovery similar to EPA practice.[25] By analogy to EPA proceedings, prior to excluding or limiting testimony under 10 C.F.R § 2.319(e) as unreliable testimony, there should be notice to the intervenors, such as by a discovery order, that they have not met the burden of going forward.

III. The Need For An Orderly Proceeding Warrants The Board To Enforce Clear Standards For Adequate Mandatory Disclosure

Progress believes that the Joint Intervenors' initial disclosure pursuant to 10 C.F.R. § 2.336(a)(1) is deficient because no analysis or other authority is provided with regard to certain specific conclusory allegations[26] of its Petition and is inconsistent with the Joint Intervenors prior filings to the NRC. Because these inconsistencies materially interfere with the ability of Progress to prepare for the hearing and engender a significant risk of unfair surprise, the Board should compel Joint Intervenors to comply promptly with the mandatory disclosure requirements.

Contention 4 was admitted based on allegations by Dr. Bacchus. LBP-09-10 at 48. During discovery, intervenors must disclose the bases for such allegations. Susquehanna, ALAB-613, 12 N.R.C. at 339. It is inconsistent to file a conclusory expert opinion but claim to have no supporting expert report. As discussed above, the conduct of an orderly hearing dictates that the bases provided by the Joint

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[25] See, e.g., In re House Analysis & Assocs. & Fred Powell, 4 E.A.D. 501, 512 (E.P.A. Feb. 2, 1993) (Environmental Appeals Board upheld a default order issued against House Analysis & Associates and Fred Powell for failure to comply with an order on prehearing exchange or respond to a motion for a default order); In re Rybond, 6 E.A.D. 614 (E.P.A. Nov. 8, 1996) (Environmental Appeals Board upheld a default order issued against Rybond, Inc. for failure to timely file a prehearing exchange); In re Jiffy Builders, Inc., 8 E.A.D. 315 (E.P.A. May 25, 1999); (Environmental Appeals Board upheld a default order issued based on Jiffy's failure to timely comply with the Presiding Officer's Prehearing Exchange Order requiring Prehearing Hearing Exchange in a timely manner); In re JHNY, Inc., 12 E.A.D. 372 (E.P.A. Sept. 30, 2005) (Environmental Appeals Board upheld a default order and denied JHNY's motion to set aside the default order based on JHNY's failure to timely comply with the Prehearing Order directing the parties to exchange prehearing information); In re Four Strong Builders, Inc., 12 E.A.D. 762 (E.P.A. July 11, 2006) (Environmental Appeals Board upheld the default order for Four Strong Builders' failure to file a prehearing exchange).

[26] The specific allegations at issue in this dispute are described below and detailed in the proposed form of order provided consistent with 10 C.F.R. § 2.323(b) as Attachment 1.

Intervenors be adequate to meet their burden of going forward and be provided promptly or at least prior to when the NRC issues the draft EIS.

NRC regulations require that the disclosures identify witnesses and include "a copy of the analysis or other authority upon which that person bases his or her opinion." 10 C.F.R. § 2.336(a)(1). With regard to Contention 4, the Joint Intervenors have identified Dr. Bacchus as a witness. (Letter from NIRS (M. Olson) of September 1, 2009 (Attachment 2)).[27] While Attachment 2 states that it provides disclosures pursuant to 10 C.F.R. § 2.336(a)(1), in fact, no information in Attachment 2 is identified as analysis or other authority for Dr. Bacchus's opinion.[28] What Progress believes is missing from the disclosures by the Joint Intervenors to date is the analysis or other authority that provides evidentiary bases[29] for Dr. Bacchus's opinion adequate to show the opinion is sufficiently reliable to meet the Joint Intervenors' burden of going forward.

As the Board has stated, Joint Intervenors can meet their disclosure obligation by providing either analysis or documents to provide a basis for the opinion of Dr. Bacchus.[30] The documents described in Attachment 2 are not clearly within the scope of the admitted contention, as many deal with impacts from excavation that was not admitted as the Board narrowed Contention 4 from its submitted version. While Attachment 2 states that the documents are provided pursuant to 10 C.F.R. § 2.336(a)(1), in fact, the documents are apparently disclosed as relevant pursuant to 10 C.F.R. § 2.336(a)(2). Of the documents

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[27] Joint Intervenors' supplements in October and November 2009 identified no additional documents, analysis, or other authority with regard to Contention 4.

[28] With regard to Contention 4, Attachment 2 only provides relevant documents; therefore, the disclosure seems to provide only compliance with 10 C.F.R. § 2.336(a)(2). Specifically, references to the documents prepared by Progress and the State of Florida in Attachment 2 contradict, rather than provide analysis or other authority for Dr. Bacchus's opinions.

[29] The factual or evidentiary bases appropriate for discovery differ from the bases evaluated at the pleading stage. Byron, LBP-81-39A, 14 N.R.C. at 369. At the pleading stage, an expert opinion is tested whether it provides bases for the contention. 10 C.F.R § 2.309(f)(1)(ii) and (v). As discussed in Section II above, during discovery, the analysis or other authority is tested as to whether the expert opinion is reliable. 10 C.F.R. §§ 2.319(e) and 2.336(e)(2).

[30] Licensing Board Order (Granting Motion for Extension of Time), at 2 n.3 (Oct. 27, 2009) (unpublished).

disclosed by Joint Intervenors, only a few are specifically applicable to Levy. Furthermore, those documents specifically applicable to Levy were either prepared by Progress or the State of Florida and support [not contradict] the analysis and conclusions in the COLA. In short, Joint Intervenors have provided no analysis or documents responsive to 10 C.F.R. § 2.336(a)(1).

Attachment 2 provides in neither form nor substance any disclosure with regard to Contention 4 as admitted that is responsive to 10 C.F.R. § 2.336(a)(1). Even if such analysis or other authority is within the relevant documents disclosed by Attachment 2 (and such analysis or other authority is not readily apparent despite study by Progress), it is not appropriate for Progress to have to sift through numerous voluminous documents to divine what may be the analysis or other authority. Commonwealth Edison Co. (Byron Nuclear Power Station, Units 1 and 2), ALAB-678. 15 N.R.C. 1405 n.9 (1982). In this case, the Petition contains several specific allegations where Dr. Bacchus' opinion is conclusory. See, e.g., Tr. at 67-68, 70. In Attachment 2, Joint Intervenors claim they have met 10 C.F.R. § 2.336(a)(1). For the specific conclusory allegations described below and detailed in Attachment 1, they have not.

A. Joint Intervenors Allege LARGE Environmental Impacts From Dewatering And Salt Drift Without Identifying The Resources Noticeably Altered

Dr. Bacchus opines that constructing and operating the proposed LNP project would result in irreversible and irretrievable commitments of resources throughout the site, vicinity, and region of the Levy project and that the environmental harm cannot be repaired or mitigated. This conclusory opinion contradicts the analysis in the COLA that no noticeable alteration due to salt drift or dewatering of any of the environmental resources in the region has been identified.

B. Joint Intervenors Allege Cooling Towers Are Sources Of Large Unregulated Airborne Discharges of Saline Water And Such Salt Drift Is Unusual From Inland Cooling Towers Without Explaining What Is Large Or Unusual

Dr. Bacchus opines that because the Levy site is located in an inland, freshwater floodplain, the salt drift and deposition of astronomical levels of saline water do not constitute normal releases of

contaminants into the environment. This conclusory opinion is contrary to the information found in the COLA and other documents which provide that the drift rate is neither high nor unusual.

C. Joint Intervenors Allege Discharging Off-site Excess Stormwater Causes Irreversible Destruction And Causes Passive Dewatering Without Explanation

Dr. Bacchus opines that water use at the Levy site will dewater the Withlacoochee and Waccasassa Rivers and associated wetlands and uplands. This conclusory opinion is contrary to information provided in the COLA which indicates that the impact to wetlands due to dewatering will be SMALL and that the stormwater drainage system is not a method of passive dewatering.

D. Joint Intervenors Allege Both Monitoring Wells Will Not Prevent Dewatering And Nutrient Concentrations Will Increase Contrary To State Permit Conditions

Dr. Bacchus opines that excessive dewatering effects cannot be prevented by installing either temporary or permanent groundwater wells. Also Dr. Bacchus opines that dewatering at the Levy site will cause all existing nutrient concentrations to increase relative to any water that remains. These conclusory opinions are contrary to the information in the COLA and the permit conditions set forth by the State of Florida for the use of groundwater for the Levy site.

E. Joint Intervenors Allege A Network of Relict Sinkholes Connect Groundwater And Surface Waters Without Explanation

Dr. Bacchus opines that the pond-cypress wetlands and those associated with other natural waters on the site and within the vicinity and region of the proposed LNP project are connected to each other and the underlying Floridan aquifer system through a network of relict sinkholes. This conclusory opinion contradicts the thorough discussion of site geology in the COLA.

IV. <u>Disclosures Should Be Compelled Promptly</u>

Joint Intervenors should be required to provide analysis or other authority that provides an adequate evidentiary basis for the conclusory opinions of Dr. Bacchus as described above. Otherwise, the ability of Progress to comment effectively on the draft EIS is impaired. At this point, the NRC Staff's

schedule for the draft EIS as been delayed; therefore, the impact to Progress's hearing preparations due to the inadequate disclosure by Joint Intervenors is not severe. In order for the Progress to participate meaningfully in the NRC EIS process on the issues within the scope of Contention 4, Progress would need to make an informed decision about the appropriateness of a summary disposition motion compared to commenting on the draft EIS. As such, Joint Intervenors should make an adequate initial disclosure before the NRC issues the draft EIS.

V. Conclusion

For the reasons discussed above, the Board should compel adequate disclosure by the Joint Intervenors consistent with the proposed form of order in Attachment 1.

CERTIFICATION

I certify that I have made a sincere effort to contact the other parties in this proceeding, to explain to them the factual and legal issues raised in this motion, and to resolve those issues. I certify that after this consultation, both the Joint Intervenors and the NRC Staff stated that they objected to this motion and would file replies. This motion also addresses the objections of the Joint Intervenors and the NRC Staff to the extent known from these consultations. If objections not reasonably anticipated are raised, Progress would expect to request permission to respond consistent with 10 C.F.R §§ 2.323(c) and 2.324. Initial Scheduling Order at 10.

Respectfully Submitted,

/Signed electronically by Robert B. Haemer/
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John H. O'Neill, Jr.
Ambrea Watts
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Counsel for Progress Energy Florida, Inc.

November 30, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)		
	)	Docket Nos.	52-029-COL
Progress Energy Florida, Inc.	)		52-030-COL
	)		
(Combined License Application for	)		
Levy County Nuclear Plant, Units 1 and 2)	)	ASLBP No.	09-879-04-COL

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing Motion to Compel Disclosure of Bases for Expert Opinion with Regard to Contention 4, dated November 30, 2009, was provided to the Electronic Information Exchange for service to those individuals on the service list in this proceeding this 30th day of November 2009.

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Robert B. Haemer

Attachment 1
Proposed Form of Order

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)		
	)	Docket Nos.	52-029-COL
Progress Energy Florida, Inc.	)		52-030-COL
	)		
(Combined License Application for	)	ASLBP No.	09-879-04-COL-BDOL
Levy County Nuclear Plant, Units 1 and 2)	)	[DATE]	

ORDER
(Order to Compel Disclosure of Bases for Expert Opinion with Regard to Contention 4)

Progress Energy's Motion dated November 30, 2009 requested that disclosures be compelled from Nuclear Information and Resource Service, the Ecology Party of Florida, and the Green Party of Florida (collectively, "Joint Intervenors") to supplement the initial disclosure by Joint Intervenors with the bases for their expert's opinion with regard to Contention 4. As this proceeding is a Subpart L proceeding, the parties have few discovery obligations. The Board believes that those few discovery obligations should be promptly and vigorously enforced.

An applicant is entitled to prompt disclosure of the factual bases for contentions and evidentiary support for them. See Commonwealth Edison Co. (Byron Station, Units 1 and 2), LBP-81-52, 14 N.R.C 901 (1981). Such disclosure is proper to serve the dual purposes of narrowing the issues for hearing and preventing unwarranted surprise. Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2) LBP-83-17, 17 N.R.C 490, 493-94 (1983). In Contention 4, Joint Intevenors make a number of allegations that the Combined License Application ("COLA"), specifically the Environmental Report ("ER"), is inadequate. Joint Intervenors now state that they currently have no analysis or other authority that form the evidentiary basis for the conclusory allegations in the Bacchus Declaration. It is unacceptable for an expert witness to state ultimate conclusions and then profess an inability to provide any foundation for those conclusions to the litigants. See Virginia Electric & Power Co. (North Anna Nuclear Power Station, Units 1 and 2) ALAB-555, 10 N.R.C 23, 26 (1979). Where a Party's disclosure is inconsistent with the Party's previous assertions, granting a motion to compel is proper. Vermont Yankee

Nuclear Power Corp. (Vermont Yankee Nuclear Power Station) LBP-88-25, 28 N.R.C 394, 397-99 (1988). Because the Applicant would have the nearly impossible task to prepare for hearing without Joint Intervenors disclosure of analysis or other authority that form the foundations of the allegations in their Petition, the Progress motion to compel is granted.

To assist in narrowing the issues and prevent surprise at the hearing, Joint Intervenors shall disclose the analysis or other authority that supports the allegations in Joint Intevenors' expert's opinion with regard to Contention 4 as specified by the Terms of this Order in Section II herein. Consistent with the Initial Scheduling Order, Joint Intervenors shall disclose the analysis or other authority specified herein no later than January 21, 2010. If the NRC Staff issues the draft Environmental Impact Statement in this matter after January 21, 2010, the disclosures ordered herein shall instead be made by that latter date.

I. PROCEDURAL POSTURE

Each party to this proceeding is required to disclose all documents relevant to the admitted contentions. Additionally, NRC regulations require that for parties with claims or contentions the disclosures name witnesses and include "a copy of the analysis or other authority upon which that person bases his or her opinion." See 10 C.F.R. § 2.336(a)(1).

The Initial Scheduling Order, issued on August 27, 2009, required, "On or before October 29, 2009, the parties and the NRC Staff shall file any motions to compel or challenges regarding the adequacy of any mandatory disclosure . . . concerning any disclosures occurring prior to that date."[1] Upon the joint motion of Progress and Joint Intervenors (collectively, the "Parties"), the Board extended this deadline to November 30, 2009.

This Order relates only to witnesses disclosed per 10 C.F.R. § 2.336(a)(1) and the basis for the Joint Intervenors' expert witness opinion with regard to Contention 4. Joint Intervenors have disclosed

[1] Licensing Board Order (Initial Scheduling Order) (Aug. 27, 2009) at 7.

Dr. Sydney Bacchus as their expert witness. Joint Intervenors should not interpret this Order to mean they are required to disclose actual testimony from their expert.[2]

II. TERMS OF ORDER

The Board compels Joint Intervenors to make the following supplements to their mandatory disclosures no later than the date by which the NRC staff issues its draft Environmental Impact Statement in this matter or January 21, 2010, whichever is later.

A. Salt Drift

1. Joint Intervenors allege that "the Levy Nuclear Plant ("LNP") ER proposes to use coastal waters for cooling towers located inland, in and surrounded by freshwater wetlands, floodplains, special aquatic sites and other waters." Petition at 49; Bacchus Declaration at ¶ 41. According to Levy ER § 2.3 (Water) and § 2.3.2.1 (Plant Water Use)[3] and Site Certification Approval[4] ("SCA"), (Construction and Operation), the source of makeup cooling water for LNP would be the Cross Florida Barge Canal ("CFBC"), just west of the Lake Rousseau Lock. Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging the source of makeup cooling water for the LNP is coastal water rather than brackish water with lower saline content.

2. Joint Intervenors allege that "[t]he evaporative loss from the proposed LNP cooling would be 43,814,880 gallons per day (gpd) or 43.8 MGD." Bacchus Declaration at ¶¶ 27, 43. Joint Intervenors allege that, this evaporative loss is, "an aerial 'discharge' of large volumes of saline water." Bacchus Declaration at ¶ 44. Joint Intervenors allege that this "astronomical evaporative loss will include salt drift, which will be contaminating the surrounding wetlands, floodplains, special aquatic sites, and other waters throughout and beyond the site and vicinity of the proposed LNP project. Damage

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[2] Joint Intervenors testimony is due as specified in the Initial Scheduling Order. Initial Scheduling Order at 16-17.

[3] These sections and all other Levy ER Chapter 2 sections are available at ADAMS Accession No. ML092860744.

[4] State of Florida Department of Environmental Protection, Levy Nuclear Power Plant Units 1 & 2 Progress Energy Florida, Conditions of Certification, Plant and Associated Facilities and Transmission Lines, Certified Aug. 26, 2009.

from salt drift would be more significant at this proposed LPN [*sic*] facility because the LNP facility is proposed to be located inland, rather tan on the coast. … [I]t is not possible to mitigate those 'Large' impacts." Bacchus Declaration at ¶ 27.

(a) According to Levy ER § 5.3.3.1.1 (Length and Frequency of Elevated Plumes)[5] and SCA (App. C, Air Permit PSD-FL-403, App. D at D-1), a very small fraction of the water circulating through the LNP1 and LNP2 cooling towers would be carried into the cooling tower plumes as small water droplets. According to the Levy ER, the drift rate will not exceed 0.0005%. Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that the amount of salt drift that will occur at the LNP site is "large volumes of saline water."

(b) According to Levy ER § 5.3.3.1.3 (Solids Deposition), the estimated amount of dissolved solids that could potentially escape from the cooling towers in drift from the LNP cooling towers (for both LNP1 and LNP2 operating simultaneously) is estimated to be 115.7 pounds per hour (lb/hr) during normal operation and 154.26 lb/hr for short-term excursions (as total particulate). The maximum predicated on-site deposition (during normal plant operation) is 10.75 kilogram per hectare per month (kg/ha/mo) (9.68 pounds per acre per month (lb/ac/mo)). According to Levy ER § 5.3.3.2.1 (Salt Drift), analysis resulted in a maximum predicted off-site deposition rate (during normal plant operation) of 6.81 kg/ha/mo (6.13 lb/ac/mo) of total solids at a location due west of the cooling towers at the nearest property boundary. According to Levy ER § 5.3.3.2.1 (Salt Drift), solid deposition off-site from cooling towers, even if it were all salt, is projected to be below the threshold limit of 10 kg/ha/mo (9 lb/ac/mo) as provided in the NRC guidelines[6] and below the level of possible impact identified for a susceptible crop—corn.[7] Joint Intervenors are required to disclose the analysis or other authority that provides the

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[5] This section and all other Levy ER Chapter 5 sections are available at ADAMS Accession No. ML092860747.

[6] Environmental Standard Review Plan, NUREG-1555, § 5.3.3.2, ¶ III.1 at 5.3.3.2-5.

[7] See generally Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437 Vol. 1 § 4.3.4 (identifying corn as the species most susceptible while, in contrast, some species like tobacco and cotton benefit from low level salt drift).

basis for alleging that the projected solid deposition would cause noticeable alternations to any environmental resources that cannot be mitigated.

3. Joint Intervenors allege that, for the proposed location of the LNP facility, in an inland, freshwater flood plain, salt drift and deposition of that magnitude does not constitute normal releases of contaminants into the environment. Bacchus Declaration at ¶ 43. According to EPA Report AP-42, Compilation of Air Pollution Factors, drift is considered in the design of all cooling towers - those that use salt water and those that do not. See Compilation of Air Pollution Factors, EPA Report AP-42, § 13.4 (1995) at 13.4-3 (www.epa.gov/ttn/chief/ap42/ch13/index.html). Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that salt drift from inland cooling towers is not a normal release.

4. Joint Intervenors allege that, "despite the outcome of the state's NPDES permit review process, the LNP ER was grossly negligent in ignoring the adverse direct, indirect, and cumulative environmental impacts of salt drift." Bacchus Declaration at ¶ 44. According to the FDEP, salt drift from LNP1 and LNP2 is projected to meet State air emission standards. Specifically, according to the Florida Department of Environmental Protection ("FDEP"), the estimated total dissolved solids concentration of 25,000 parts-per-million for the new cooling towers and a circulating flow rate of 531,100 gallons per minute, and the best available control technology ("BACT") for mechanical draft cooling towers is based upon drift eliminators and established a limit of 0.0005% for drift rate. SCA, App. C, Air Permit PSD-FL-403, App. D at D-1. Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that the State permitting process ignores salt drift impacts.

5. Joint Intervenors allege that, "abnormal released cooling-tower salt drift contaminants into the environment would cause irreparable harm to water quality throughout the site, vicinity and region of the proposed LNP project." Bacchus Declaration at ¶ 45. Specifically, Joint Intervenors allege there would be "LARGE" rather than "SMALL" impacts to wetlands, flood plains, special aquatic sites and other waters. Bacchus Declaration at ¶ 26. Also, Joint Intervenors allege that "it is not possible to mitigate those 'LARGE' impacts." Bacchus Declaration at ¶ 27. According to Levy ER

§ 5.3.3.2.1 (Salt Drift), no noticeable alteration due to salt drift of any of the environmental resources in the region encompassing the LNP site has been identified. Joint Intervenors are required to disclose the analysis or other authority that describes the noticeable alteration of wetlands, flood plains, special aquatic sites, and other waters which they allege is caused by salt drift.

B. Passive Dewatering

1. Joint Intervenors allege that "any of the proposed on-site water use . . . including for […] stormwater ponds, would result in irreversible destruction of the wetlands, flood plains, special aquatic sites and other waters. . . . throughout and beyond the vicinity of the proposed LNP project." See Bacchus Declaration at ¶ 26.

(a) According to Levy ER § 5.2.1.1 (Freshwater Streams), only if there is an accumulation of stormwater in excess of the capacity of the stormwater detention ponds, would the excess stormwater be added to the cooling tower basins for discharge with the cooling tower blowdown. Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that this limited use of excess stormwater accumulation would cause irreversible destruction.

(b) According to Levy ER § 5.2.1.5 (Wetlands), compliance with the FDEP permit requirements would ensure that wetlands will not be directly impacted due to operation of the stormwater detention ponds. Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that the FDEP permit requirements are inadequate to preclude irreversible adverse impacts to wetlands, flood plains, special aquatic sites and other waters.

2. Joint Intervenors allege that the adverse, direct, indirect and cumulative environmental impacts of the "water use and other dewatering required for the proposed LNP project . . . will dewater the Withlacoochee and Waccasassa Rivers and associated wetlands and uplands." Bacchus Declaration at ¶ 33.

(a) According to Levy ER § 4.2.1.5 (Wetlands),[8] "[t]he location for the LNP will require filling of the land surface, thereby altering current drainage patterns…[c]learing vegetation around the LNP site and within the associated corridors will affect the wetlands on the site…Soil removed from excavations may be used as either fill for wetlands areas or backfill." The impact on important ecological habitats from these fill activities is assessed to be MODERATE. Levy ER § 4.3.1.1.2 (Terrestrial Habitat). The impact to wetlands due to dewatering is assessed to by SMALL. Levy ER § 4.2.2.2 (Wetlands). Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that on-site water use or other dewatering, rather than addition of fill, will result in noticeable alternation of wetlands resources of the site, the Withlacoochee and Waccasassa Rivers, and associated uplands.

(b) According to Levy ER § 5.2.1.1 (Freshwater Streams), the stormwater drainage system will result in net recharge to the aquifer and not be a method of passive dewatering. Except for excavations for plant construction that are not within the scope of Contention 4 as admitted, Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that any system planned for construction for the Levy facility, including the stormwater drainage system, will dewater the Withlacoochee and Waccasassa Rivers and associated wetlands and uplands.

C. Active Dewatering

1. Joint Intervenors allege that "excessive dewatering effects cannot be prevented by installing and monitoring groundwater wells, regardless of whether those wells are temporary or permanent." Bacchus Declaration at ¶ 26. According to the SCA (Aquifer Testing and Groundwater Impact Analysis), modeling of aquifer drawdown due to maximum potential groundwater use will be performed in accordance with State of Florida guidance. The State of Florida conditions for the use of ground water for the Levy site include the following conditions:

[8] This section and all other Levy ER Chapter 4 sections are available at ADAMS Accession No. ML092860746.

1. At least 18 months prior to initial operation, Progress will submit a final Ground Water Monitoring plan that must be a comprehensive submittal tailored to water facilities operations. The plan shall include: well construction details and well depths; ground water flow direction(s); frequency of monitoring, parameters and determinations for parameters, water sampling and chemical analysis protocol; pre- and postoperational monitoring requirements; potential offsite & onsite influences of contamination sources; soil types and lithology above and below water level; ½ mile survey of potable wells around the facility; cones of depression of water supply wells or wellfields within the facility that may affect the monitor well locations; and any other information that is significant to this project. SCA, Part XXVII, § I.1.
2. Twelve months prior to facility operation, Progress shall begin sampling the pre-operational monitoring wells in accordance with the conditions of certification and the approved ground water monitoring plan prepared in accordance with Rule 62-520.600, F.A.C. SCA, Part XXVII, § I.12.
3. Upon placing facility in operation, Progress shall begin sampling the post-operational monitoring wells in accordance with the conditions of certification and the approved ground water monitoring plan prepared in accordance with Rule 62-520.600, F.A.C. SCA, Part XXVII, § I.13.
4. Monitoring shall continue for at least five years of groundwater use of at least 1.25 million gallons per day (average annual daily withdrawal quantity) total from all the wells. SCA, Part XXVIII, § A.2.a.i.
5. Progress will stop or reduce withdrawals if water levels in aquifers fall below the minimum levels established by Florida. SCA, Part XXVIII, § B.8.
6. After construction of wells, Progress will perform post-construction testing that will include confirm certain parameter values used in the groundwater flow model. SCA, Part XXVIII, § B.8.
7. Wetlands and other surface waters may not be adversely impacted as a result of the water use authorized by these conditions of certification. If unacceptable adverse impacts occur, Progress will mitigate the adverse impacts or other action will be taken. SCA, Part XXVIII, §§ A.9.g, B.11, and B.12.

Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that State of Florida conditions on the use of groundwater are inadequate to prevent excessive dewatering effects.

2. Joint Intervenors allege that by "dewatering these OFWs and associated aquatic and terrestrial ecosystems, the proposed LNP project would result in 'LARGE' and irreversible adverse impacts." Bacchus Declaration at ¶ 33. According to Levy ER § 5.2.1.4 (Groundwater) and § 5.2.2.3 (Groundwater Use), no noticeable alterations due to groundwater pumping of any the environmental resources in the region encompassing the Levy site have been identified. Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that dewatering will noticeably

alter any environmental resource associated with the Withlacoochee and Waccasassa Rivers and associated wetlands and uplands, and specifically identify the resource noticeably altered.

D. General

1. Joint Intervenors allege that "constructing and operating the proposed LNP project would result in irreversible and irretrievable commitments of resources throughout the site, vicinity and region of the proposed LNP project" and "that environmental harm cannot be repaired or mitigated." Petition at 64; Bacchus Declaration at ¶ 69. According to the Levy ER § 5.2.1.4 (Groundwater), § 5.2.2.3 (Groundwater Use), and § 5.3.3.2.1 (Salt Drift), no noticeable alterations due to salt drift or groundwater pumping of any of the environmental resources in the region encompassing the Levy site have been identified. Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that dewatering or salt drift from the Levy Project will result in irreversible and irretrievable impacts on environmental resources in the site, vicinity, or region of the Levy Project.

2. Joint Intervenors allege that "by dewatering the wetlands, floodplains, special aquatic sites, and other waters throughout the site, vicinity and region of the proposed LNP project, all existing nutrient concentrations will increase relative to any water that remains." Bacchus Declaration at ¶ 36. The Levy SCA conditions require groundwater monitoring for nutrient sampling and the representative natural background quality be the prevailing standard (See SCA Coastal and Aquatic Managed Areas). Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that dewatering at Levy will increase nutrient concentrations.

3. Joint Intervenors allege that the "pond-cypress wetlands and those associated with other natural waters on the site and within the vicinity and region of the proposed LNP project are connected to each other and the underlying Floridan aquifer system through a network of relict sinkholes." Bacchus Declaration at ¶ 30; see also id. at ¶ 29. The geography of the site and region is extensively discussed in ER Chapters 2.2 (Land) and 2.6 (Geology). Joint Intervenors are required to disclose the analysis or other authority that provides the basis for alleging that pond-cypress wetlands and

those associated with other natural waters on the site and region of the Levy Project are connected to the Floridan aquifer system through a network of relict sinkholes.

It is so ORDERED.

FOR THE ATOMIC SAFETY AND LICENSING BOARD

_____

Alex S. Karlin, Chairman
ADMINISTRATIVE JUDGE

Rockville, Maryland
[DATE]

Attachment 2
Joint Intervenors Initial Disclosure

September 1, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY LICENSING BOARD

In the Matter of	)	
	)	
PROGRESS ENERGY FLORIDA	)	
	)	Docket Nos. 52-029 COL
	)	52-030 COL
(Levy County Nuclear Station	)	
Units 1 & 2)	)	
	)	

Co-Interveners Mandatory Disclosure of Documents September 1, 2009,
Levy County Units 1 & 2 COL

Affidavit of Mary Olson

Under 10 CFR 2.336 (a)(1) the Green Party of Florida, the Ecology Party of Florida and Nuclear Information and Resource Service disclose the following and the attached documents (A - F) information to Progress Energy of Florida via Counsel John O'Neal at Pillsbury, Winthrop, Shaw, Pittman, LLP and to the Staff of the Nuclear Regulatory Commission via Office of General Counsel, Jody Martin and Sara Kirkwood.

I, Mary Olson, as representative of the interveners personally attest that to my knowledge this disclosure (including attachments A- F) is current as of August 31, 2009, that it is the result of an honest and good-faith effort of all reflected herein to catalog and report the relevant documents and experts with whom we are working as of

August 31, 2009.

_____(*Electronically signed by)*_____
Mary Olson, NIRS Southeast Regional Coordinator
on behalf of
The Green Party of Florida,
The Ecology Party of Florida and
Nuclear Information and Resource Service

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September 1,2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY LICENSING BOARD

In the Matter of	)	
	)	
PROGRESS ENERGY FLORIDA	)	
	)	Docket Nos. 52-029 COL
	)	52-030 COL
(Levy County Nuclear Station	)	
Units 1 & 2)	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "Co-Interveners Mandatory Disclosure of Documents September 1, 2009" from the Green Party of Florida, The Ecology Party of Florida and Nuclear Information and Resource Service were provided via email to those individuals listed below 1st day of September, 2009.

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/signed electronically by Mary C Olson/
Mary C. Olson

Cara Campbell and Gary Hecker

September 1, 2009 Mandatory Disclosure Attachment A

INTERVENORS' INITIAL DISCOSURES FOR CONTENTION 4

Contention 4:

1. Testifying Witnesses

The Intervenors have not identified all persons who may testify on their behalf, in addition to Dr. Sydney Bacchus. Dr. Bacchus was disclosed previously when the Intervenors provided her affidavit, with supporting exhibits and a list of additional supporting documents, with their petition to intervene. Dr. Bacchus, an expert in hydroecology and other relevant fields, will be testifying regarding Contention 4A 1-5, 4B and 4C 1-4, as described in "ATTACHMENT A" on page 109 of the July 8, 2009 NRC Order (LBP-09-10) for Progress Energy Florida, Inc. Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2 (Docket No. 52-029-COL, 52-030-COL). Dr. Bacchus' qualifications are described in her curriculum vitae (CV), a copy of which was attached to her affidavit as Exhibit A. As a summary and in order to list the documents at his disposal, that may or may not be used in this proceeding, we state the following:

Dr. Sydney Bacchus began testifying as an expert on wetland and other environmental impacts of proposed nuclear power plants for the State of Florida in the 1970s. Since that time, she has testified in dozens cases regarding wetland and other environmental impacts in Florida and other areas of the southeastern US. She also has been in an oversight position for state agencies regarding wetland, marine and aquatic restoration and testified as an expert in such restoration projects and proposals. Additionally, she has conducted scientific research and authored or co-authored more than 30 peer-reviewed publications, books and book chapters related to Contentions A through C in "ATTACHMENT A". Relevant peer-reviewed publications and her contact information are provided in her CV.

2. Documents

A description of documents relevant to Contention 4A-C and previously disclosed with Dr. Bacchus' Affidavit is provided in Attachment A. A copy of documents A-J was provided with Dr. Bacchus' Affidavit. The remaining previously disclosed documents listed in Attachment A are publicly-available and also are included in Dr. Bacchus' library. A description of additional documents relevant to Contention 4A-C not previously disclosed is provided in Attachment B.

Attachment A
List of Previously Disclosed Documents Relevant to Contention 4

Documents Previously Disclosed and Produced as Exhibits with Bacchus Affidavit:

A. Bacchus, Ph. D., Curriculum Vitae

B. 1997 Cumulative Effects Report Synopsis:
Council on Environmental Quality. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Executive Office of the President; What are Cumulative Impacts? Synopsis of the U. S. Council on Environmental Quality

C. LNP ER Fig. 4.1-4 100-Year Flood Zone Map

D. Florida Department of Environmental Protection letter for Tarmac Mine application, 11/19/08

E. Nonmechanical Dewatering of the Regional Floridan Aquifer System. 2006

F. SWFWMD Water Use Permit Application for LNP, 6/2/08

G. Scientists point to forests for carbon storage solutions. 2008

H. Sea-level Rise from Global Climate Disruption Impacts,12/3/08

I-1 Florida Solar Energy Center: Rooftop Solar PV
I-2 California Solar Energy Center: Rooftop Solar PV

J. Decoupling Alternative: Stimulating Smarter Utilities, 1/30/09

Additional Previously Disclosed Documents Relevant to Contention 4:

Bacchus. 1998. Determining Sustainable Yield in the Southeastern Coastal Plain: A Need for New Approaches. pp. 503-519 in: J. Borchers and C. D. Elifrits (eds.) Current Research and Case Studies of Land Subsidence: Proceedings of the Joseph F. Poland Symposium.

Bacchus. 2000. Uncalculated impacts of unsustainable aquifer yield including evidence of subsurface interbasin flow. Journal of American Water Resources Association 36(3):457-481.

Bacchus et al. 2003. Near infrared spectroscopy of a hydroecological indicator: New tool for determining sustainable yield for Floridan aquifer system. Hydrological Processes 17:1785-1809.

Bacchus, S. T., D. D. Archibald, K. O. Britton, and B. L. Haines. 2005. Near infrared model development for pond-cypress subjected to chronic water stress and *Botryosphaeria rhodina*. Acta Phytopathologica et Entomologica Hungarica 40(2-3):251-265.

Bacchus, S. T. 2007. More inconvenient truths: Wildfires and wetlands, SWANCC and Rapanos. National Wetlands Newsletter 29(11):15-21.

Swancar, A., T.M. Lee and T.M. O'Hare. 2000. Hydrogeologic setting, water budget, and preliminary analysis of ground-water exchange at Lake Starr, a seepage lake in Polk County, Florida. U.S. Geological Survey Water-Resources Investigations Report 00-4030. 65 pp.

Attachment B
List of Additional Documents Relevant to Contention 4

1. Baker, Alan E., *Levy County Aquifer Vulnerability Assessment - Part II of (FAVA) project*, Advanced GeoSpatial, Tallahassee, FL, July, 2008, p. 1- 41
2. http://www.swfwmd.state.flu.us/data/gis/layer_library/category/potmaps
Potentiometric maps for Florida – All Years
3. http://groundwaterwatch.usgs.gov Groundwater monitoring wells for:
Tidewater – site # 290743082341501
Crackertown – site # 2902300824112501
4. Southwest FL Water Management District, The Water Quality Monitoring Program, *The Hydrology and Water Quality of Select Springs in the Southwest Florida Water Management District*, May 2001, pp. 29 – 41
5. Progress Energy, *Basic Pathways for Gaseous and Liquid Radioactive Effluent Releases to the Public*, Levy Nuclear Plant Unit 1 &2, Part 3 – Environmental Report, Fig. 6.2-1,
6. Jones, George W., and UpChurch, Sam B., *Origin of Nutrients in Ground Water Discharging from The Kings Bay Springs*, Ambient Ground- water Quality Monitoring Program, Southwest Fl Water Management District, July 1994
7. *Florida Geological Survey, springs of Florida*, Bulletin # 66, pp. 562 – 564,
8. Parker, Gerald G., *The Hydrogeology and Problems of Peninsular Florida*, pp 2 – 13,
9. Southwest Fl Water Management District, *Ground – water Resource Availability Inventory*, Citrus County, Florida, August, 1987, pp. 5 – 37 and 82.
10. Natural Resources Conservation Services, Soil Survey of Levy County Fl., United States Department of Agriculture, September 1996.
11. Southwest FL Water Management District, Coastal *Ground- Water Quality Monitoring Network/ Water – Use Permitting Report, Vol 5, March 2005*
12. Southwest Florida Water Management District- Agency Report, Progress Energy Florida, Inc., Levy County Units 1 & 2, Site Certification Application No. PA-08-51
13. Integrated Water Quality Assessment for Florida: 2008 305(b) Report and 303(d) List Update, FDEP 10-2008 with reference to Water Quality Assessment Report, Withlacoochee, 2006.
14. Groundwater Conditions in the Lower Withlacoochee River-Cross Florida Barge Canal Complex Area, USGS, 1972 Glen L. Faulkner
15. Salt Water Movement in the Lower Withlacoochee-CFBC Complex, Peter Bush, 1973 for USGS
16. *Water Chemistry: Vol. 1 in a Series*, Mote Marine Laboratory for SWFWMD, 1986
17. *Cross Florida Greenway: Watershed Evaluation of Alternative Flow Scenarios Using Hydrodynamic Models*, Janicki Environmental for SWFWMD, 2008
18. *Withlacoochee River Comprehensive Watershed Management Plan*, 2001, SWFWMD
19. Florida Division of Administrative Hearings Case No. 96-1723, Final Order SAVE THE MANATEE CLUB, INC., and FRIENDS OF THE GREENWAY, (Petitioners) vs. CITRUS RECREATIONAL MARINA, INC., and FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION, (Respondents).
20. Gulf Hammock Photos, a Power Point presentation containing 16 photographs of Big King Spring and Spring Run Creek.

21. FDEP Electric Power Plant Site Certification Staff Analysis Report, Progress Energy Florida Levy Nuclear Plant, PA 08-51
21. Synopsis of the U.S. Council of Environmental Quality 1997 Cumulative Effects Report
22. Atlas of Florida, Florida State University Press; November, 1981
23. The *GULF HAMMOCK EVALUATION REPORT*, LEVY COUNTY, FL prepared by Division of State Lands Staff Acquisition and Restoration Council Liaison Staff and Florida Natural Areas Inventory, Final: JUNE 4, 2004.
24. Levy County Evaluation and Appraisal Report, May 2006, Levy County Planning Department

CURRICULUM VITAE

Sydney T. Bacchus, Ph. D.

EDUCATION

9/91-12/99 - Ph.D.	Institute of Ecology, UGA, Athens, GA 30602-2202 Major Field of Study: Hydroecology Dissertation Topic: Determining sustainable aquifer yield, ecological impacts of anthropogenic groundwater perturbations Committee Chairman: Dr. George Brook
9/89-6/91 (predoctoral)	Department of Geology, University of South Florida, Tampa, FL predoctoral courses in Hydrology, Geochemistry, and Water Quality University of Central Florida, Orlando, FL predoctoral courses in Bryology and Zoogeography
3/77 - M.S.	Florida State University, Tallahassee, FL 32306 Major Field of Study: Botany/Ecology, including water chemistry Thesis Topic: Marsh and aquatic vascular plant communities under tidal influence, Wakulla and St. Marks Rivers, Florida.
6/72 - B.S.	Florida State University, Tallahassee, FL 32306 Major: Biology & Design Minor: Chemistry & Humanities

PROFESSIONAL WORK EXPERIENCE

9/89 - present	Hydroecologist, Applied Environmental Services, LLC P. O. Box 174, Athens, GA 30603-0174 appliedenvirserv@mindspring.com
6/99 - 12/99	Fellowship, US EPA, National Exposure Research Laboratory 960 College Station Road Athens, GA 30605-2700
5/98-9/98	Internship, US EPA, National Exposure Research Laboratory 960 College Station Road Athens, GA 30605-2700
9/92-3/98	Hydroecologist, US EPA, Region 4, Science and Ecological Support Div. 980 College Station Road Athens, GA 30605-2700 (Co-operative Education Program - alternating quarters)
1/89-9/89	Senior Scientist I, Post, Buckley, Schuh & Jernigan, Inc. 800 N. Magnolia Avenue, Suite 600 Orlando, FL 32803
3/87-12/88	Lead Env. Specialist (IV), St. Johns River Water Management District Orlando Regional Office 618 E. South Street, Suite 200, Orlando, FL 32801
11/84-3/87	Jurisdictional Specialist, Jurisdictional Evaluation Section, FDER 2600 Blair Stone Road, Tallahassee, FL 32301
12/81-11/84	Marine/Aquatic Ecologist, Florida Natural Areas Inventory 254 E. Sixth Avenue, Tallahassee, FL 32303
2/80-12/81	Field Project Director (Environmental Specialist IV) Water Resources Restoration & Preservation Section, FDER, Tallahassee
11/77-2/80	Marine Biologist (Environmental Specialist III) Water Resources Restoration & Preservation Section, FDER, Tallahassee

4/77-11/77	Rules Coordinator (Environmental Specialist II) Office of Coastal Zone Coordination, FDER, Tallahassee
1975-1976	Research Assistant Drake Wilson Spoil Island Project, U.S. Army Corps of Engineers (COE) Project Director: Dr. William Kruczynski
1975-1976	Research Assistant St. Marks National Wildlife Refuge, St. Marks, FL 32355 Project Director: Culver S. Gidden

ADDITIONAL EXPERIENCE

Summer 1975	Research Assistant (*Labrunia danae* research project in the Bahamas) FSU, Department of Biology, Tallahassee, FL 32306 Research Directors: Dr. William Herrnkind & Gregg Stanton
Fall 1978	Research Assistant (seagrass research off the west coast of Florida) FSU, Department of Biology, Tallahassee, FL 32306 Research Directors: Dr. Richard Iverson & Henry Bittaker
1989-1992	Instructor for Federal Jurisdictional Wetlands Training Seminars, Southeastern U.S.

Professional Work Experience:

During my employment of approximately eight years with the predecessor agency for the Florida Department Environmental Protection (formerly known as Florida Department Environmental Regulation) I served as Rules Coordinator for the Office of Coastal Zone Coordination the first year, ensuring compliance with federal Coastal Zone Management requirements. Subsequently, I provided oversight for the state-supported restoration projects throughout Florida for the Water Resources Restoration and Preservation Section, initially for coastal projects, then as the Field Project Director over all projects.

Later, during my employment with the Jurisdictional Section of that agency, I evaluated wetlands throughout the State of Florida. On numerous occasions my technical expertise was required by that agency to evaluate sites where various levels of "disturbance" had occurred. In those cases, my responsibility was to determine what the pre-existing condition had been at those sites. Representatives from U. S. Environmental Protection Agency (EPA), and later, the COE frequently were present during those field evaluations, and my findings generally were comparable to their findings.

I also have been employed as the Marine and Aquatic Ecologist for the Florida Natural Areas Inventory (FNAI) Program. I was responsible for evaluating habitat of concern throughout the state and providing guidance to various state agencies and private entities regarding regulatory issues affecting those lands, as well as assisting in prioritizing state purchase of environmentally-sensitive lands. My evaluations included all types of lakes, streams, and coastal areas, as well as habitat for federally-listed species throughout Florida.

My duties and responsibilities as the Lead Environmental Specialist for the St. Johns River Water Management District for approximately two years involved reviewing all environmental aspects of permit applications submitted to that agency's central Florida office. Those reviews included evaluating the impacts of proposed projects on federally-listed species, as well as addressing issues of compliance with environmental regulations. The environmental aspects included training other environmental reviewers regarding wetlands and environmental regulations.

As the Senior Scientist and subsequently the Hydroecologist in the private sector for approximately 10 years, my duties and responsibilities included those similar to the ones I had conducted for the government agencies. During that time, my duties and responsibilities also focused on environmental impacts associated with anthropogenic groundwater alterations.

I have had direct oversight or involvement in evaluating adverse impacts of activities on Endangered Species, Threatened Species, and Species of Special Concern, such as the bald eagle (*Haliaeetus leucocephalus*), the West Indian manatee (*Trichechus manatus latirostris*), wood storks (*Mycteria americana*), all species of sea turtles occurring in Florida (all federally-endangered), the Eastern indigo snake (*Drymarchon corais couperi*), the Florida black bear (*Ursus americanus floridanus*), and the Florida scrub jay. For example, I have been involved in evaluating adverse impacts of proposed roadway projects on wood storks and the Florida black bear.

For approximately six years I was employed as a Hydroecologist for the Ecological Support Division of the United States EPA in Region IV, which has oversight for Florida, Georgia, Alabama, Louisiana and numerous other states. My duties and responsibilities included evaluations of wetlands, streams, and lakes. Among the evaluations that I conducted were detailed laboratory analyses, using techniques developed at that facility. I also provided input regarding the interaction between ground water and surface water. My comments regarding the catastrophic adverse environmental impacts that would result from the proposed location of a well field for Albany, Georgia, located in proximity to the Swamp of Toa, resulted in reconsideration of the proposed location. Ultimately the well field was relocated further east. The State of Georgia recently purchased a significant portion of the Swamp of Toa for protection.

Subsequently, I completed an Internship and Fellowship for the EPA's National Exposure Research Laboratory during 1998 and 1999. My duties and responsibilities for that Research Laboratory included developing research techniques and methods for remediation of hazardous compounds. My professional work experience also has included instruction and training for regional, state, federal, and private employees regarding wetlands in the southeastern coastal plain.

SELECTED PEER-REVIEWED PUBLICATIONS

Bacchus, S. T. 2007. More inconvenient truths: Wildfires and wetlands, SWANCC and Rapanos. National Wetlands Newsletter 29(11):15-21.

Bacchus, S. T. 2006. Nonmechanical dewatering of the regional Floridan aquifer system. pp. 219-234 *in:* R.S. Harmon and C. Wicks (eds.) Perspectives on karst geomorpholgy, hydrology, and geochemistry – A tribute volume to Derek C. Ford and William B. White. Geological Society of America Special Paper 404.

Bacchus, S.T. 2005. Adverse Environmental Impacts of Artificial Recharge Known As "Aquifer Storage and Recovery" (ASR) in Southern Florida: Implications for Everglades Restoration, http://www.thethirdplanet.org/downloads.html, 106 pp.

Bacchus, S. T. and P. J. Barile. 2005. Discriminating sources and flowpaths of anthropogenic nitrogen discharges to Florida springs, streams and lakes. Environmental Geoscience 11(4):293-316.

Bacchus, S. T., D. D. Archibald, K. O. Britton, and B. L. Haines. 2005. Near infrared model development for pond-cypress subjected to chronic water stress and *Botryosphaeria rhodina.* Acta Phytopathologica et Entomologica Hungarica 40(2-3):251-265.

Bacchus, S. T., D. D. Archibald, G. A. Brook, K. O. Britton, B. L. Haines, S. L. Rathbun, and M. Madden. 2003. Near infrared spectroscopy of a hydroecological indicator: New tool for determining sustainable yield for Floridan aquifer system. Hydrological Processes 17:1785-1809.

Bacchus, S. T. 2002. The 'ostrich' component of the multiple stressor model: Undermining Florida. pp. 669-740 *in:* J. W. Porter and K. G. Porter (eds.) Everglades, Florida Bay, and Coral Reefs of the Florida Keys: An Ecosystem Sourcebook. CRC Press.

Bacchus, S. T. 2001. Knowledge of groundwater responses - A critical factor in saving Florida's threatened and endangered species. Part I: Marine ecological disturbances. Endangered Species Update 18(3):79-90.

Bacchus, S. T. 2000a. Predicting nearshore environmental impacts from onshore anthropogenic perturbations of ground water in the southeastern Coastal Plain, USA. pp. 609-614 *in:* Interactive Hydrology: Proceedings of the 3rd International Hydrology and Water Resources Symposium of the Institution of Engineers, Australia, 20-23 November 2000 Perth, Western Australia.

Bacchus, S. T. 2000b. Uncalculated impacts of unsustainable aquifer yield including evidence of subsurface interbasin flow. Journal of American Water Resources Association 36(3):457-481.

Bacchus, S. T., T. Hamazaki, K. O. Britton and B. L. Haines. 2000. Soluble sugar composition of pond-cypress: A potential hydroecological indicator of groundwater perturbations. Journal of American Water Resources Association 36(1):1-11.

Samson, S. A. and **S. T. Bacchus.** 2000. Water marketing: The other side of the coin. Water Resources Impact 2(6):15-16.

Susarla, S., **S. T. Bacchus**, G. Harvey and S. C. McCutcheon. 2000. Phytotransformation of perchlorate contaminated waters. Environmental Technology 21:1055-1065.

Susarla, S., **S. T. Bacchus**, G. Harvey and S. C. McCutcheon. 2000. Uptake and transformation of perchlorate by vascular plants. Toxicological and Environmental Chemistry 74:29-47.

Bacchus, S. T. 1999a. New Approaches for Determining Sustainable Yield from the Regional Karst Aquifer of the Southeastern Coastal Plain. Ph. D. Dissertation, University of Georgia, Athens, GA. 172 pp.

Bacchus, S. T. 1999b. Cumberland Island National Seashore: Linking offshore impacts to mainland withdrawals from a regional karst aquifer. pp. 463-472 *in:* K. J. Hatcher (ed.) Proceedings of the 1999 Georgia Water Resources Conference, held March 30-31, 1999, at The University of Georgia, Athens, GA.

Bacchus, S. T. 1999c. The missing component in forest hydrology models. pp. 586-589 *in:* K. J. Hatcher (ed.) Proceedings of the 1999 Georgia Water Resources Conference, held March 30-31, 1999, at The University of Georgia, Athens, GA.

Bacchus, S. T., Susarla, S., N. L. Wolfe, G. Harvey and S. C. McCutcheon. 1999. Predicting field performance of herbaceous species for phytoremediation of perchlorate. American Chemical Society Division of Environmental Chemistry, Proceedings of the 218th ACS National Meeting, New Orleans, LA August 22-26, 1999, 39(2)98-100.

Susarla, S., **S. T. Bacchus**, S. C. McCutcheon and N. L. Wolfe. 1999. Phytotransformation of perchlorate and identification of metabolic products in *Myriophyllum aquaticum*. International Journal of Phytoremediation 1:97-107.

Susarla, S., **S. T. Bacchus** and S. C. McCutcheon. 1999. Phytotransformation of perchlorate using parrot-feather. Soil and Groundwater Cleanup Magazine. Feb/March:20-23.

Susarla, S., **S. T. Bacchus**, S. C. McCutcheon and N. L. Wolfe. 1999. Potential Species for Phytoremediation of Perchlorate. U. S. Environmental Protection Agency Report EPA/600/R-99/069, Athens, GA. 38 pp. + app.

Tsumura, Y., N. Tomaru, Y. Suyama and **S. T. Bacchus.** 1999. Genetic diversity and differentiation of *Taxodium* in the south-eastern United States using cleaved amplified polymorphic sequences. Heredity 83:229-238.

Bacchus, S. T. 1998a. Preliminary Evaluation of the Hydrobiological Monitoring Station Control Wetlands in the Green Swamp Wilderness Preserve, Florida - Reconnaissance Report. Institute of Ecology, University of Georgia, Athens, GA. 38 pp. (not peer-reviewed due to submittal constraints)

Bacchus, S. T. 1998b. Determining Sustainable Yield in the Southeastern Coastal Plain: A Need for New Approaches. pp. 503-519 *in:* J. Borchers and C. D. Elifrits (eds.) Current Research and Case Studies of Land Subsidence: Proceedings of the Joseph F. Poland Symposium.

Miller, O. K., Jr. and **S. T. Bacchus.** 1998. A Gymnopilus on pond-cypress bark in Florida. Mycotaxon April-June:211-215.

Bacchus, S. T. 1997a. Subsidence Features, and Premature Decline and Death of Trees in Cumberland National Seashore Wilderness Area, Georgia. Reconnaissance Report to the National Park Service. 29 pp.

Bacchus, S. T. 1997b*. Premature decline and death of trees associated with a man-made lake and groundwater withdrawals in Albany, Georgia. pp. 280-286 *in:* K. J. Hatcher (ed.) Proceedings of the 1997 Georgia Water Resources Conference, held March 20-22, 1997, at The University of Georgia, Athens, GA.

Bacchus, S. T., G. A. Brook and T. Hamazaki. 1997. Early Signs of Stress in Wetland Vegetation as an Indicator of Unsustainable Groundwater Use in the Southeastern Coastal Plain. Technical

Completion Report ERC 02-97, USDI/USGS Project 1434-HQ-96-GR02664, in cooperation with the Environmental Resources Center, Georgia Institute of Technology, Atlanta, GA. 50 pp. + app.

Bacchus, S. T. 1996a**. Hydroecological approaches for determining and monitoring sustainable yield of groundwater resources in karst aquifers. pp. 619-626 *in*: Proceedings of the International Conference on Water Resources and Environment Research, October 29-31, 1996, Kyoto, Japan.

Bacchus, S. T. 1996b. Production of volatile hydrocarbons after mechanical wounding of mature pond-cypress and pine: Are increased concentrations an indication of stress from groundwater perturbations? *in*: INTECOL's V International Wetlands Conference, Perth, Australia September, 22-28, 1996. (abs)

Bacchus, S. T. and G. A. Brook. 1996. Geophysical Characterization of Depressional Wetlands: A First Step for Determining Sustainable Yield of Groundwater Resources in Georgia's Coastal Plain. Technical Completion Report, the University of Georgia, Athens, Georgia, in Cooperation with the Environmental Resources Center, Georgia Institute of Technology, Atlanta, GA. pp. 36 + app.

Bacchus, S. T. 1995a. Potential for reduced infiltration and recharge on a local scale following cover type conversions in the Southeastern Coastal Plain. pp. 207-210 *in:* K. J. Hatcher (ed.) Proceedings of the 1995 Georgia Water Resources Conference, held April 11 and 12, 1995, at The University of Georgia, Athens, GA.

Bacchus, S. T. 1995b**. Improved assessment of baseline conditions and change in wetlands associated with groundwater withdrawal and diversion. pp. 158-167 *in:* K. J. Hatcher (ed.) Proceedings of the 1995 Georgia Water Resources Conference, held April 11 and 12, 1995, at The University of Georgia, Athens, GA.

Bacchus, S. T. 1995c. Groundwater levels are critical to success of prescribed burns. pp. 117-133 *in*: Proceedings 19th Tall Timbers Fire Ecology Conference. Fire in Wetlands: A Management Perspective. Tall Timbers Research, Inc., Tallahassee, FL.

Bacchus, S. T. 1994. Initial use of potential ecological indicators to detect subsurface drainage in wetlands of the Southeastern Coastal Plain, U.S.A. pp. 299-308. *in:* Stanford, J. A. and H. M. Valett (eds.) Proceedings of the Second International Conference on Ground Water Ecology. American Water Resources Association, Herndon, VA.

Miller, D., **S. T. Bacchus** and H. Miller. 1993. Chemical differences between stressed and unstressed individuals of baldcypress (*Taxodium distichum*). Florida Scientist 56(3)178-184.

Bacchus, S. T. 1992. Apparent response of baldcypress (*Taxodium distichum*) to short-term inundation during the growing season. Proceedings of the Nineteenth Annual Conference on the Restoration and Creation of Wetlands.

Bacchus, S. T. 1991. The importance of ecological factors in successful restoration and creation of wetlands. Proceedings of the Eighteenth Annual Conference on the Restoration and Creation of Wetlands.

Bacchus, S. T. 1989. Complications arising from the incorporation of a muck layer into created wetlands. Proceedings of the Sixteenth Annual Conference on the Restoration and Creation of Wetlands. pp. 10-23.

GRANTS, RESEARCH, AWARDS, SCHOLASTIC HONORS, AND ACHIEVEMENTS

1993 Odum Research Award

1994 $125,000 one-year grant award for Hydrologic Restoration of Tosohatchee State Reserve

1994 invited speaker re: subsurface drainage of wetlands for Second International Groundwater Ecology Conference

1994 invited speaker re: subsurface drainage of wetlands for American Water Resources Association regional meeting

1994/95 USEPA Merit Scholarship Award

1995 USGS/Georgia Water Resources Research Grant for geophysical evaluation of depressional wetlands

1995 invited speaker re: subsurface drainage of wetlands for Georgia Water Resources Conference

1995 invited speaker re: subsurface drainage of wetlands for FWS, GDNR, COE, former SCS

1995 selected by National Science Foundation & Japan to conduct hydrologic research in Japan

1995** awarded "Best Paper of the Year"/applied sciences from UGA Institute of Ecology

1996 USGS/Georgia Water Resources Research Grant for hydroecologic evaluation of wetlands

1996 USFWS Grant for investigation of near infrared reflectance as an objective means of assessing water stress in pond-cypress

1996 invited speaker re: hydroecological responses of pond-cypress INTECOL V International Wetlands Conference Perth, Australia

1996 invited speaker re: hydroecological responses of pond-cypress for the International Conference on Water Resources and Environment Research, Kyoto, Japan

1997* Georgia Water Resources John "Alec" Little Water Resources Scholarship for Science and Engineering

1997** awarded "Best Paper of the Year"/applied sciences from UGA Institute of Ecology (shared)

1997 invited speaker re: subsurface destruction of wetlands and damage to barrier islands for Smithsonian, DC

1997 invited speaker re: subsurface drainage of wetlands for Georgia Water Resources Conference

1998 invited speaker re: subsidence in depressional wetlands of the southeastern coastal plain at the Symposium on Current Research and Case Studies of Land Subsidence in California

1998 selected for Peer Review of hydrologic issues related to the proposed mining of Trail Ridge in the vicinity of the Okefenokee National Wildlife Refuge

1999 invited speaker re: subsurface drainage of wetlands for Georgia Water Resources Conference

1999 invited speaker re: offshore groundwater flow and seepage for the 22nd General Assembly of the International Union of Geodesy and Geophysics/International Association of Hydrological Sciences, Birmingham, England

2000 invited speaker re: nearshore responses from onshore groundwater perturbations for Geological Society of America SE Conference, Charleston, SC

2000 invited speaker re: phytoremediation using vascular plants for International Conference of Contaminated Soil Sediment and Water, San Diego, CA

2000 invited speaker re: impact of groundwater perturbation on (1) invasion & spread of nuisance species and (2) conservation for Association of Southern Biologists

2000 invited speaker re: restoration factors for linked karst aquifer-wetland systems for International Conference of Geological Society of America/Reno, NV

2000 invited speaker re: predicting nearshore environmental impacts associated with onshore anthropogenic perturbations of ground water for Hydro 2000: Interactive Hydrology, the 26th National and 3rd International Hydrology and Water Resources Symposium of the Institution of Engineers, Australia

2001 guest lecturer, USGS Restin Headquarters: Environmental impacts of groundwater mining and injected wastes on the Everglades, Florida Bay, and the coral reefs

2001 guest lecturer, Mote Marine Lab, Summerland Key, FL: Environmental impacts of groundwater mining and injected wastes on the Everglades, Florida Bay, and the coral reefs

2001 guest lecturer, National Park Service/Everglades National Park: Predicting coastal environmental impacts associated with perturbations of groundwater in karst aquifers

2001 guest lecturer, Green Design Council/Boca Raton: Predicting coastal environmental impacts associated with perturbations of groundwater in karst aquifers

2001 guest lecturer, Volusia/Flagler Environmental Action Committee: Groundwater responses: stepping back to see the big picture

2001 invited speaker, National Natural Areas Association Conference, Cape Canaveral, FL: The unseen destroyer of terrestrial and nearshore natural diversity

2002 invited speaker, Southwide Forest Disease Workshop, 1/7/02, Daytona Beach, FL, Impacts of groundwater alterations on forested ecosystems

2002 guest lecturer, Volusia County League of Women Voters, Daytona Beach, FL, Groundwater responses: stepping back to see the big picture

2002 guest lecturer, Daytona Beach Community College, Arts and Sciences Dept., Groundwater responses: stepping back to see the big picture

2002 guest lecturer, Stetson University, Geography and Environmental Sciences Dept., Groundwater responses: stepping back to see the big picture

Research and Publication Awards:

Two of the publications listed in my CV won awards as "Best Paper of the Year" in the "Applied Science" category (denoted by double asterisks in my CV). A third publication was responsible, in part, for my receipt of the John "Alec" Little Water Resources Scholarship for Science and Engineering in 1997 (denoted by a single asterisk in my CV). That award is presented once every two years by the Georgia Water Resources Association to a graduate student in the field of Science or Engineering whose research and community service have provided the most significant contribution to solving a water resource problem in the southeastern region. The panel of judges for that award includes professional staff from the USGS. The paper involved in that Water Resources Scholarship specifically deals with adverse impacts from anthropogenic alterations of ground water, one of the forms of damage to wetlands that I had observed extensively throughout Florida as the result of direct, indirect, and cumulative impacts of General and Individual projects authorized/permitted under Section 404 (CWA).

Initially, my involvement in the project in Georgia that was the subject of the Water Resources Award was as a wetland expert for a development project in which the consulting firm had failed to identify wetlands within the first phase of a multi-phased project, and had begun construction of the first phase prior to obtaining the required Section 404 permits from the COE for the entire project. At the time of my initial involvement, I had predicted that additional environmental damage, beyond the footprint of the activities that had been initiated prior to my arrival, would occur after several years and as a result of direct, indirect, and cumulative impacts from the activities that required Section 404 permits from the COE. Subsequent inspections approximately six years later revealed that the predicted environmental damage had occurred, and included dead and declining trees. Construction activities had not resumed prior to my subsequent inspections because the COE permitting issues had not been resolved by the time of my subsequent inspections.

Research Focus:

One of the aspects of my research has been the role of anthropogenic alterations of ground water in predisposing trees to pathogens. Predisposition was described by Yarwood in 1959 as "an internal degree of susceptibility resulting from external causes" and "the tendency of nongenetic factors, acting prior to infection, to affect the susceptibility of plants to disease". The phenomenon of predisposition in plants is comparable to predisposition in animals, including man.

Much of my research has involved forested depressional wetlands in the southeastern coastal plain physiographic province. The southeastern coastal plain includes the entire State of Florida, in addition to portions of other southeastern states. Pond-cypress generally is the dominant tree species of forested depressional wetlands in the southeastern coastal plain. It is a deciduous conifer (a cone-bearing tree that is leafless in the winter). Pond-cypress became established in the southeastern coastal plain following the most recent drop in sea level during the Pleistocene epoch. In addition to dehiscing (dropping) its leafy branchlets during dormancy in the winter, pond-cypress has evolved a mechanism for dehiscence (leaf drop) during periods of water stress, to avoid water loss due to transpiration. Periods of reduced (or no) leaf canopy during the growing season, however, result in reduction in the tree's energy reserves, which reduces tree vigor. One specific role of my research has been to develop methods for using pond-cypress trees as ecological indicators of anthropogenic groundwater alterations.

International Conferences and Related Scientific Speaking Engagements:

My research on adverse impacts associated with anthropogenic groundwater perturbations, and my development of techniques for using pond-cypress as a hydroecological indicator of these perturbations, led to invitations to present technical research papers on those topics at the Second International Groundwater Ecology Conference in 1994; the 1996 INTECOL V International Wetlands Conference (Perth, Western Australia); the 1996 International Conference on Water Resources and Environment Research (Kyoto, Japan); the biennial Georgia Water Resources Conferences in 1995, 1997, and 1999; the 1998 Joseph F. Poland Symposium on Current Research and Case Studies of Land Subsidence (California); and the 3rd International Hydrology and Water Resources Symposium of the

Institution of Engineers: Interactive Hydrology (Perth, Western Australia), in addition to less prestigious conferences.

Also as a result of my research, I have been invited to present seminars about the adverse environmental impacts of anthropogenic groundwater alterations to the American Water Resources Association Regional Meeting (Georgia) in 1994; a special meeting of the United States Fish and Wildlife Service (FWS), Georgia Department of Natural Resources, COE, and former United States Soil Conservation Service (Georgia) in 1995; and the Smithsonian Institute (Washington, D. C.) in 1997.

Honors and Achievements:

In 1995, I was honored by being one of a total of 50 Engineering and Science graduate students in the nation selected by the **National Science Foundation** to study abroad, with Research Scientists in Japan. The selection of students for this award primarily is based on the contribution of the student's research to the field of Engineering or Science. I also was nominated as a **Technical Advisory Member** in the field of Hydrology for the proposed mining of Trail Ridge in the vicinity of the Okefenokee National Wildlife Refuge, and was selected to serve as a Peer Reviewer for proposed mining issues related to that field. A "no mining" scenario recently was imposed for Trail Ridge. The "no mining" scenario was selected, in part, because of significant adverse impacts that would occur to wetlands in the Okefenokee Swamp if one of the primary local recharge areas (Trail Ridge) was mined.

PROFESSIONAL AFFILIATIONS

Association for the Environmental Health of Soils
American Geophysical Union
American Water Resources Association
Geological Society of America
Scientific Committee on Oceanic Research/
Land-Ocean Interactions in the Coastal Zone
The Hydrogeology Consortium

My involvement with professional Societies and other organizations is related to large-scale problems associated with interactions of ground water and surface water, anthropogenic groundwater alterations, and the ecological implications of those alterations. One example of such organization is the International Scientific Committee on Oceanic Research Working Group, of which I was an Associate Member. The purpose of this organization was to evaluate the magnitude of submarine groundwater discharge and its influence on coastal oceanographic processes.

September 1, 2009 Mandatory Disclosure Attachment C

August 28, 2009

Declaration of Marvin Resnikoff, Ph.D. in Support of Contention 7 and 8 by Nuclear Information and Resource Service, the Green Party of Florida and the Ecology Party of Florida.

After carefully reviewing the petition by NIRS, *et al*, as it concerns Contentions 7 and 8, I adopt and fully support the contentions and their bases, and am prepared to testify in that regard.

I add the following supporting statements. The petition notes that there is no site to which the proposed Levy site reactors can dispose of class B, C and greater than class C low-level waste. Having been involved in every licensing application for proposed low-level facilities in the United States, and also the proposed intermediate level repository in Canada, it is clear that it will be difficult to license new facilities to dispose of low-level waste. This is primarily because closed facilities at Maxey Flats (KY), West Valley (NY) and Sheffield (IL) have leaked and require continual and expensive maintenance and remediation.

Progress Energy Florida has not examined the implications of indefinite storage of low-level waste, as the petition makes clear. This is not a simple operation; some utilities have had difficulty preventing leaks and contamination from occurring. At the now closed Connecticut Yankee reactor, the waste processing system contaminated the underlying aquifer with high concentrations of strontium-90 from the low-level waste processing system. Thus, there is a real possibility that storage would lead to environmental contamination and also an increase in occupational exposures.

Greater than class C waste poses an even more difficult problem. No repository for high-level waste and greater than class C waste is presently available. I have worked for the State of Nevada as a technical consultant since 1986. In my opinion, it is highly unlikely that the proposed Yucca Mountain repository would operate. The national and State political climate does not favor its operation. Therefore, as has occurred at several decommissioned reactors, it is likely that greater than class C waste will be stored in dry storage casks, and similar to spent fuel, will remain so for the indefinite future.

September 1, 2009 Mandatory Disclosure -- Attachment D

Resume of Marvin Resnikoff, Ph.D.

Dr. Marvin Resnikoff is Senior Associate at Radioactive Waste Management Associates and is an international consultant on radioactive waste management issues. He is Principal Manager at Associates and is Project Director for dose reconstruction and risk assessment studies of radioactive waste facilities and transportation of radioactive materials. Dr. Resnikoff has concentrated exclusively on radioactive waste issues since 1974.

He has conducted dose reconstruction studies of oil pipe cleaners in Mississippi and Louisiana, residents of Canon City, Colorado near a former uranium mill, residents of West Chicago, Illinois near a former thorium processing plant, and residents and former workers at a thorium processing facility in Maywood, New Jersey. He has also served as an expert witness for plaintiffs in Karnes County, Texas, Milan, New Mexico and Uravan, Colorado, who were exposed to radioactivity from uranium mining and milling activities. He is continuing to work on personal injury cases involving former workers and residents at the ITCO and other oil pipe cleaning yards in Louisiana and Texas. He also evaluated radiation exposures and risks in worker compensation cases involving former workers at Maywood Chemical Works thorium processing plant. He also served as an expert witness in a case involving the Port St. Lucie reactors and brain cancer developed by two children and in a case involving clean-up of an abandoned radioactive materials processing facility in Webster, Texas. He is presently working on several land contamination cases in Louisiana, Texas and New York. In June 2000, he was appointed to a Blue Ribbon Panel on Alternatives to Incineration by DOE Secretary Bill Richardson.

In addition to dose reconstruction and land contamination cases, Dr. Resnikoff also works on the risk of transporting radioactive material. Under a contract with the State of Utah, Dr. Resnikoff was a technical consultant to DEQ on the proposed dry cask storage facility for high-level waste at Skull Valley, Utah. He assisted the State on licensing proceedings before the Nuclear Regulatory Commission. He has also prepared studies on transportation risks and consequences for the State of Nevada and the Nevada counties: Clark, White Pine, Lander and Churchill. In addition, at hearings before state commissions and in federal court, he investigated proposed dry storage facilities at the Point Beach (WI), Prairie Island (MN), Palisades (MI), Maine Yankee, Connecticut Yankee and Vermont Yankee reactors. He is presently working for the State of Nevada on Yucca Mountain repository issues before the Nuclear Regulatory Commission (NRC). He is also serving as an expert witness for Earthjustice on a proposed NRC license for a food irradiator at the Honolulu, Hawaii airport.

He has conducted studies on the remediation and closure of the leaking Maxey Flats, Kentucky radioactive landfill for Maxey Flats Concerned Citizens, Inc. and of the leaking uranium basin on the NMI/Starmet site in Concord, Massachusetts under grants from the Environmental Protection Agency. He co-authored a study on the cost of remediating the former West Valley, New York reprocessing plant site. He also conducted studies of the Wayne and Maywood, New Jersey thorium Superfund sites and proposed low-level radioactive waste facilities at Martinsville (Illinois), Boyd County (Nebraska), Wake County (North Carolina), Ward Valley (California) and Hudspeth County (Texas). He investigated phosphogypsum plants in Florida, Texas and Alberta, Canada, and served as an expert witness in a personal injury case involving a Texas phosphogypsum worker. He also served as an expert witness for CRPE, a public interest groups, regarding the proposed expansion of the Buttonwillow, California NORM landfill. He is presently working

for Earthjustice re. the licensing of an irradiation facility near the Honolulu airport in Hawaii.

In Canada, he conducted studies on behalf of the Coalition of Environmental Groups and Northwatch for hearings before the Ontario Environmental Assessment Board on issues involving radioactive waste in the nuclear fuel cycle and Elliot Lake tailings and the Interchurch Uranium Coalition in Environmental Impact Statement hearings before a Federal panel regarding the environmental impact of uranium mining in Northern Saskatchewan. He also worked on behalf of the Morningside Heights Consortium regarding radium-contaminated soil in Malvern and on behalf of Northwatch regarding decommissioning the Elliot Lake tailings area before a FEARO panel. He conducted a study for Concerned Citizens of Manitoba regarding transportation of irradiated fuel to a Canadian high-level waste repository. He is presently working for Greenpeace reviewing the environmental assessment for a proposed intermediate level waste repository under Lake Huron, and for the Provincial Womens Council of Ontario on radioactive waste management costs in a proceeding before the Ontario Energy Board.

In February 1976, assisted by four engineering students at State University of New York at Buffalo, Dr. Resnikoff authored a paper that, according to *Science*, changed the direction of power reactor decommissioning in the United States. His paper showed that power reactors could not be entombed for long enough periods to allow the radioactivity to decay to safe enough levels for unrestricted release. The presence of long-lived radionuclides meant that large volumes of decommissioning waste would still have to go to low-level or high-level waste disposal facilities. He assisted public interest groups on the decommissioning of the Yankee-Rowe, Diablo Canyon, Big Rock Point and Haddam Neck reactors.

He was formerly Research Director of the Radioactive Waste Campaign, a public interest organization conducting research and public education on the radioactive waste issue. His duties with the Campaign included directing the research program on low-level commercial and military waste and irradiated nuclear fuel transportation, writing articles, fact sheets and reports, formulating policy and networking with numerous environmental and public interest organizations and the media. He is author of the Campaign's book on "low-level" waste, *Living Without Landfills*, and co-author of the Campaign's book, *Deadly Defense, A Citizen Guide to Military Landfills*.

Between 1981 and 1983, Dr. Resnikoff was a Project Director at the Council on Economic Priorities, a New York-based non-profit research organization, where he authored the 390-page study, *The Next Nuclear Gamble, Transportation and Storage of Nuclear Waste*. The CEP study details the hazard of transporting irradiated nuclear fuel and outlines safer options.

Dr. Resnikoff is an international expert in nuclear waste management, and has testified often before State Legislatures and the U.S. Congress. He has extensively investigated the safety of the West Valley, New York and Barnwell, South Carolina nuclear fuel reprocessing facilities. His paper on reprocessing economics (Environment, July/August, 1975) was the first to show the marginal economics of recycling plutonium. He completed a more detailed study on the same subject for the Environmental Protection Agency, "Cost/Benefits of U/Pu Recycle," in 1983. His paper on decommissioning nuclear reactors (Environment, December, 1976) was the first to show that reactors would remain radioactive for several hundred thousand years. In March 2004, Dr. Resnikoff was project director and co-author of a study of groundwater contamination at DOE facilities, Danger Lurks Below.

Dr. Resnikoff has prepared reports on incineration of radioactive materials, transportation of irradiated fuel and plutonium, reprocessing, and management of low-level radioactive waste. He has served

as an expert witness in state and federal court cases and agency proceedings. He has served as a consultant to the State of Kansas on low-level waste management, to the Town of Wayne, New Jersey, in reviewing the cleanup of a local thorium waste dump, to WARD on disposal of radium wastes in Vernon, New Jersey, to the Southwest Research and Information Center and New Mexico Attorney General on shipments of plutonium-contaminated waste to the WIPP facility in New Mexico and the State of Utah on nuclear fuel transport. He has served as a consultant to the New York Attorney General on air shipments of plutonium through New York's Kennedy Airport, and transport of irradiated fuel through New York City, and to the Illinois Attorney General on the expansion of the spent fuel pools at the Morris Operation and the Zion reactor, to the Idaho Attorney General on the transportation of irradiated submarine fuel to the INEL facility in Idaho and to the Alaska Attorney General on shipments of plutonium through Alaska. He was an invited speaker at the 1976 Canadian meeting of the American Nuclear Society to discuss the risk of transporting plutonium by air. As part of an international team of experts for the State of Lower Saxony, the Gorleben International Review, he reviewed the plans of the nuclear industry to locate a reprocessing and waste disposal operation at Gorleben, West Germany. He presented evidence at the Sizewell B Inquiry on behalf of the Town and Country Planning Association (England) on transporting nuclear fuel through London. In July and August 1989, he was an invited guest of Japanese public interest groups, Fishermen's Cooperatives and the Japanese Congress Against A- and H- Bombs (Gensuikin).

Between 1974 and 1981, he was a lecturer at Rachel Carson College, an undergraduate environmental studies division of the State University of New York at Buffalo, where he taught energy and environmental courses. The years 1975-1977 he also worked for the New York Public Interest Group (NYPIRG).

In 1973, Dr. Resnikoff was a Fulbright lecturer in particle physics at the Universidad de Chile in Santiago, Chile. From 1967 to 1973, he was an Assistant Professor of Physics at the State University of New York at Buffalo. He has written numerous papers in particle physics, under grants from the National Science Foundation. He is a 1965 graduate of the University of Michigan with a Doctor of Philosophy in Theoretical Physics, specializing in group theory and particle physics. Dr. Resnikoff is a member of the American Public Health Association and the Health Physics Society.

Contact Information

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EXPERIENCE:

April 1989 - present **Senior Associate**, Radioactive Waste Management Associates, management of consulting firm focused on radioactive waste issues, evaluation of nuclear transportation and military and commercial radioactive waste disposal facilities.

1978 - 1981; 1983 - April 1989 **Research Director**, Radioactive Waste Campaign, directed research program for Campaign, including research for all fact sheets and the two books, *Living Without Landfills*, and *Deadly Defense*. The fact sheets dealt with low-level radioactive waste landfills, incineration of radioactive waste, transportation of high-level waste and decommissioning of nuclear reactors. Responsible for fund-raising, budget preparation and project management.

1981 - 1983 **Project Director**, Council on Economic Priorities, directed project which produced the report *The Next Nuclear Gamble*, on transportation and storage of high-level waste.

1974 - 1981 **Instructor**, Rachel Carson College, State University of New York at Buffalo, taught classes on energy and the environment, and conducted research into the economics of recycling of plutonium from irradiated fuel under a grant from the Environmental Protection Agency.

1975 - 1976 **Project Coordinator**, SUNY at Buffalo, New York Public Interest Research Group, assisted students on research projects, including project on waste from decommissioning nuclear reactor.

1973 **Fulbright Fellowship** at the Universidad de Chile, conducting research in elementary particle physics.

1967 - 1972 **Assistant Professor of Physics**, SUNY at Buffalo, conducted research in elementary particle physics and taught range of graduate and undergraduate physics courses.

1965 - 1967 **Research Associate**, Department of Physics, University of Maryland, conducted research into elementary particle physics.

EDUCATION

University of Michigan	PhD in Physics, June 1965
Ann Arbor, Michigan	M.S. in Physics, Jan 1962
	B.A. in Physics/Math, June 1959

Updated 11/30/09

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Declaration of Diane D'Arrigo, Radioactive Waste Project Director, Nuclear Information and Resource Service

August 31, 2009

RE: Contentions 7 and 8 on so-called "low-level" nuclear waste generated by the proposed Levy County nuclear power reactors.

As Nuclear Information and Resource Service radioactive waste project director since 1986, and staff for the Radioactive Waste Campaign in the early 1980s, I have closely watched the efforts in the US by the nuclear power industry and its regulators to site and open new radioactive disposal sites.

At this time there are only 2 operating disposal sites for Classes A, B and C so-called "low level" radioactive waste. In addition there is one, in Utah, that takes essentially Class A, the least concentrated (but still long lasting) radioactive waste. Since the closure of the Barnwell, South Carolina site in July 2008 (to all but South Carolina, New Jersey and Connecticut generators), California radioactive waste generators do not have access for disposal of Class B or C or for Greater than Class C "low level" radioactive waste. Barnwell only takes from the Atlantic Compact generators; Hanford only takes from Northwest Compact (Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington and Wyoming) and Rocky Mountain Compact (Colorado, Nevada, New Mexico) generators.

Under US Nuclear Regulatory Commission (10 CFR 61.55) and compatible agreement state regulations, Class A is the least concentrated, with B and C more concentrated and GTCC (Greater Than Class C) being even more concentrated with only case by case acceptance at "low-level" nuclear waste sites.

Nuclear power reactors generate, during operation and after closure during decommissioning, enormous amounts (in terms of radioactivity) of Class B and C, and Greater than C radioactive waste, the most concentrated of the so-called "low-level" radioactive waste.

The accumulation of radioactive waste and radioactivity have the potential to pose serious health, safety, environmental and security problems especially because of unpredictable climate change.

Nuclear reactors that are not in a compact could defacto end up storing the waste onsite indefinitely whether or not it is processed on or off site.

REFERENCES

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High Level Dollars, Low Level Sense, Makhijani et al, Institute of Energy and Environmental Research

Radioactive Waste: Politics, Technology and Risk, Ronnie D. Lipschutz, Union of Concerned Scientists, 1980.

Conference of Radiation Control Program Directors, E-5 Report on Status of Low Level Radioactive Waste Disposal Sites.

U.S. Nuclear Regulatory Commission, Commissioners Briefing on Low-Level Radioactive Waste 4/17/09

Department of Energy Documents of the Low Level Radioactive Waste Division 1981-1999. Including State by State Assessments of LLRW Received at Operating Disposal Facilities, annual reports1987 -1999.

DOE MIMS Database of radioactive waste received at operating disposal facilities.

DOE, NYSERDA, Revised DEIS for Decommissioning and/or Long Term Stewardship at the West Valley Demonstration Project and WNY Nuclear Service Center DOE/EIS-0226-D, November 2008.

DOE DEIS for Completion of the West Valley Demonstration Project and Closure or Long-Term Management of Facilities at the WNY Nuclear Service Center, January 1996 DOE/EIS-0226D

National Academy of Sciences Studies on “Low-Level” Nuclear Waste

CRCPD Studies on “Low-Level” Radioactive Waste

Ward Valley Studies by NAS, State of California, USGS, Committee to Bridge the Gap

Congressional Research Service “low-level” radioactive waste reports

GAO “low-level” radioactive waste reports

Low Level Radioactive Waste Compact Commission websites and updates.

Tennessee Dept of Environment and Conservation licenses and amendments to licenses.

BREDL comments on IMPACT proposed incinerator.

Review of Fuel Failures in Water Cooled Reactors, International Atomic Energy Commission, IAEA technical report 388, 1998.

September 1, 2009 Mandatory Disclosure – Attachment F

Diane D'Arrigo
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1988- Present RADIOACTIVE WASTE PROJECT DIRECTOR, Nuclear Information and Resource Service, Washington, D.C.

1986-1988 REGULATORY OVERSIGHT COORDINATOR, Nuclear Information and Resource Service, Washington, D.C.

Track, analyze and report on federal agencies' and Congressional policies, rulemaking and proposals regarding radioactive waste, radiation and nuclear energy issues. Coordinate national and support local initiatives and responses regarding radioactive waste. Publicize federal and international programs that increase public risk and exposure to radioactive waste and radioactivity.

Provide information and assistance to concerned community groups and individuals, local and state officials involved in siting of disposal facilities for nuclear waste including so-called "low-level" radioactive waste.

Track national, international and state efforts to deregulate/prevent deregulation of radioactive waste to destinations not controlled for radioactivity. Track reactor specific rulechanges, amendments, rulemaking.

1985-1986 ANALYTICAL CHEMIST, Ecology and Environment, Cheektowaga, NY

1984-1985 CHEMICAL RESEARCH ASSISTANT, Great Lakes Laboratory, Buffalo, NY
Chemical research on toxic and carcinogenic compounds.

1982-1984 RESEARCH ASSOCIATE, Sierra Club Radioactive Waste Campaign, Buffalo, NY
Prepared and presented scientific testimony before federal, state, county and local legislatures and agencies. Commented on proposed rules. Researched, wrote and edited educational materials including fact sheets, brochures, slide shows, and research papers for the public on complicated technical issues. Conducted community outreach programs. Organized regional and local workshops.

1981-1982 CHEMIST, FMC, Inc. Research and Development, Middleport, NY

Research, analysis and synthesis of chemicals to be tested for biological activity. Regularly used IR, NMR, UV, TLC, HPLC and GC for identification and quantification.

1980 COMMUNITY ORGANIZER, Citizens Alliance, Massapequa Park, NY
Trained community residents in building and maintaining an active chapter of the statewide Citizens Alliance, focussing on energy, toxics and housing issues.

1979-1980 FIELD SUPERVISOR, CANVASSER, New York Public Interest Research Group, Buffalo, NY

EDUCATION AND SPECIAL STUDY

1978 B.S. Chemistry, Course Concentration in Environmental Studies.William Smith College, Geneva, NY
1981 Environmental Law Course, University of NY at Buffalo.

Attachment 3
Compilation of Air Pollution Factors
EPA Report AP-42, § 13.4
(1995)

13.4 Wet Cooling Towers

13.4.1 General[1]

Cooling towers are heat exchangers that are used to dissipate large heat loads to the atmosphere. They are used as an important component in many industrial and commercial processes needing to dissipate heat. Cooling towers may range in size from less than $5.3(10)^6$ kilojoules (kJ) ($5[10]^6$ British thermal units per hour [Btu/hr]) for small air conditioning cooling towers to over $5275(10)^6$ kJ/hr ($5000[10^6]$ Btu/hr) for large power plant cooling towers.

When water is used as the heat transfer medium, wet, or evaporative, cooling towers may be used. Wet cooling towers rely on the latent heat of water evaporation to exchange heat between the process and the air passing through the cooling tower. The cooling water may be an integral part of the process or may provide cooling via heat exchangers.

Although cooling towers can be classified several ways, the primary classification is into dry towers or wet towers, and some hybrid wet-dry combinations exist. Subclassifications can include the draft type and/or the location of the draft relative to the heat transfer medium, the type of heat transfer medium, the relative direction of air movement, and the type of water distribution system.

In wet cooling towers, heat transfer is measured by the decrease in the process temperature and a corresponding increase in both the moisture content and the wet bulb temperature of the air passing through the cooling tower. (There also may be a change in the sensible, or dry bulb, temperature, but its contribution to the heat transfer process is very small and is typically ignored when designing wet cooling towers.) Wet cooling towers typically contain a wetted medium called "fill" to promote evaporation by providing a large surface area and/or by creating many water drops with a large cumulative surface area.

Cooling towers can be categorized by the type of heat transfer; the type of draft and location of the draft, relative to the heat transfer medium; the type of heat transfer medium; the relative direction of air and water contact; and the type of water distribution system. Since wet, or evaporative, cooling towers are the dominant type, and they also generate air pollutants, this section will address only that type of tower. Diagrams of the various tower configurations are shown in Figure 13.4-1 and Figure 13.4-2.

13.4.2 Emissions And Controls[1]

Because wet cooling towers provide direct contact between the cooling water and the air passing through the tower, some of the liquid water may be entrained in the air stream and be carried out of the tower as "drift" droplets. Therefore, the particulate matter constituent of the drift droplets may be classified as an emission.

The magnitude of drift loss is influenced by the number and size of droplets produced within the cooling tower, which in turn are determined by the fill design, the air and water patterns, and other interrelated factors. Tower maintenance and operation levels also can influence the formation of drift droplets. For example, excessive water flow, excessive airflow, and water bypassing the tower drift eliminators can promote and/or increase drift emissions.

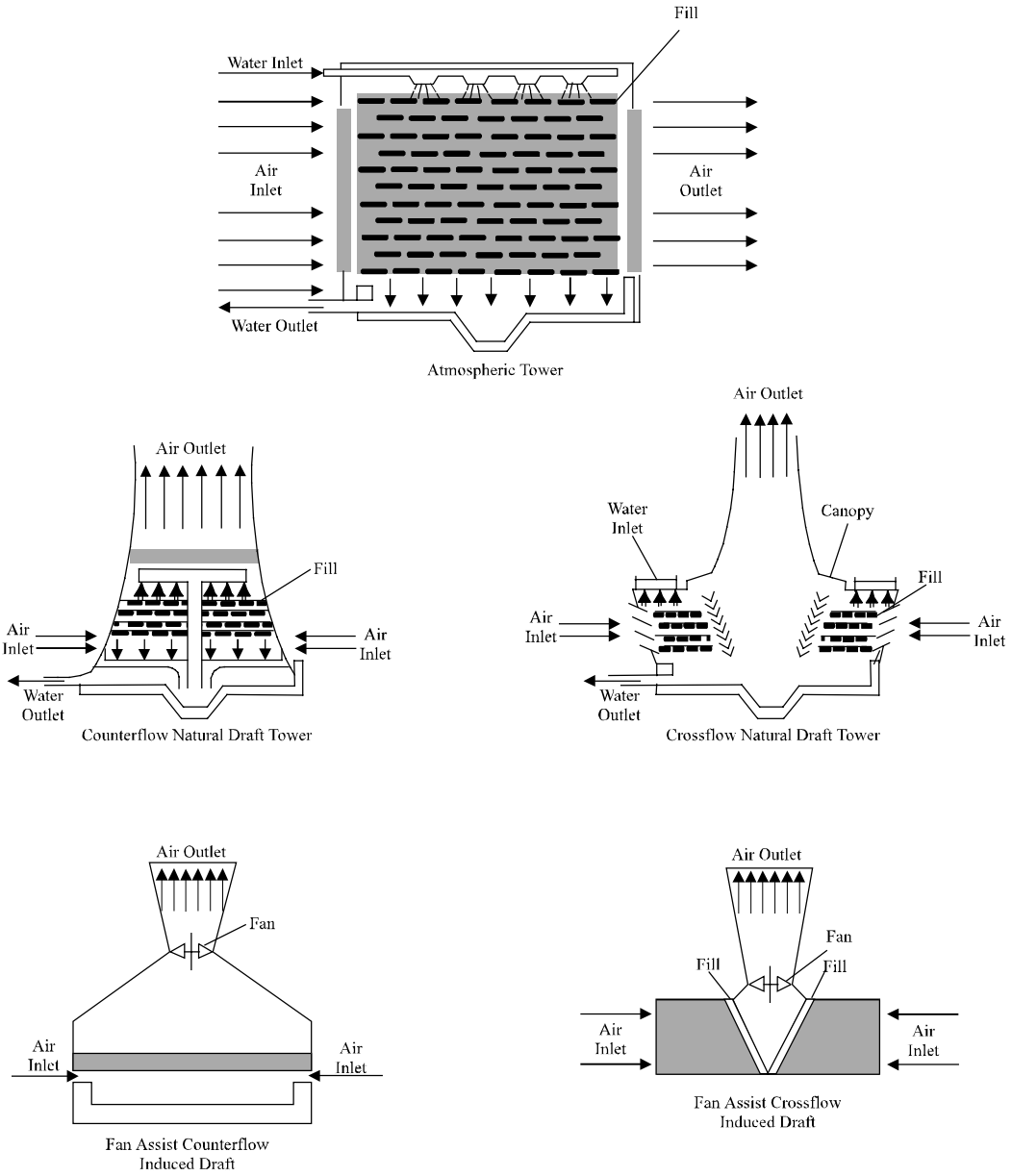

Figure 13.4-1 Atmospheric and natural draft cooling towers.

Because the drift droplets generally contain the same chemical impurities as the water circulating through the tower, these impurities can be converted to airborne emissions. Large drift droplets settle out of the tower exhaust air stream and deposit near the tower. This process can lead to wetting, icing, salt deposition, and related problems such as damage to equipment or to vegetation. Other drift droplets may evaporate before being deposited in the area surrounding the tower, and they also can produce PM-10 emissions. PM-10 is generated when the drift droplets evaporate and leave fine particulate matter formed by crystallization of dissolved solids. Dissolved solids found in cooling tower drift can consist of mineral matter, chemicals for corrosion inhibition, etc.

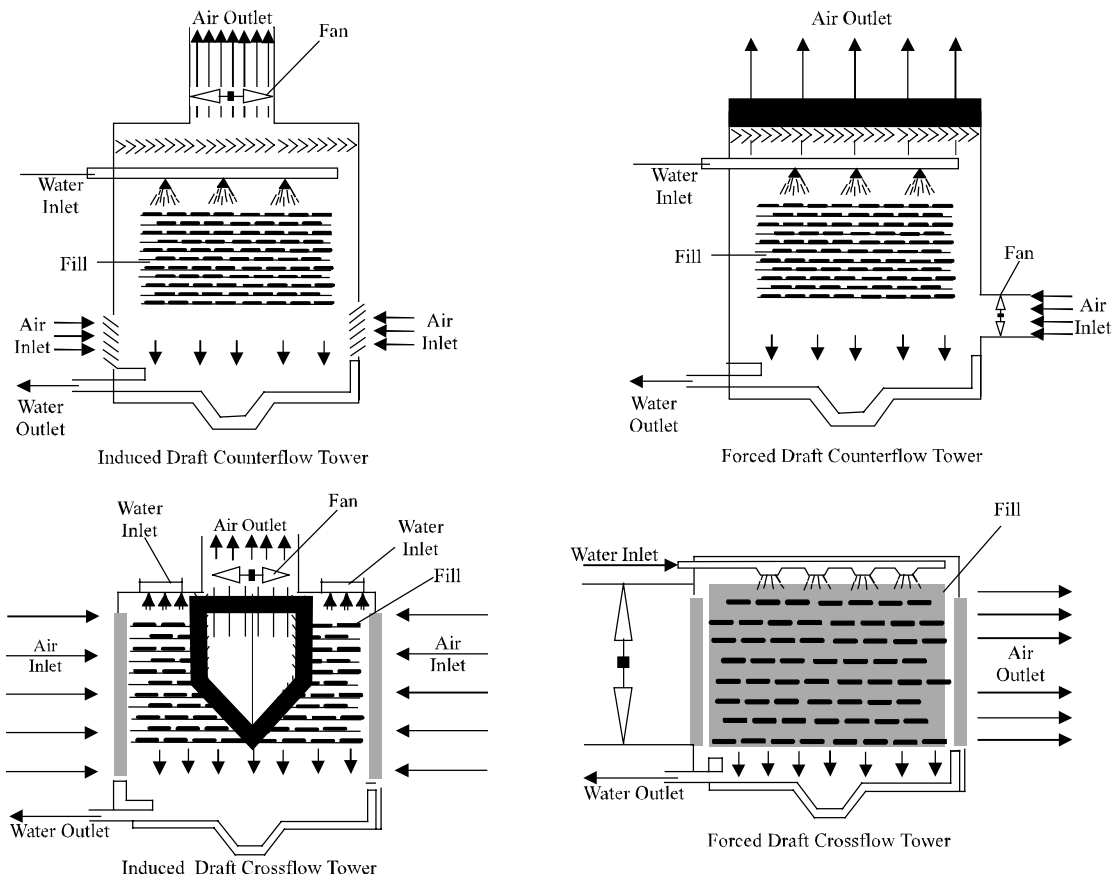

Figure 13.4-2. Mechanical draft cooling towers.

To reduce the drift from cooling towers, drift eliminators are usually incorporated into the tower design to remove as many droplets as practical from the air stream before exiting the tower. The drift eliminators used in cooling towers rely on inertial separation caused by direction changes while passing through the eliminators. Types of drift eliminator configurations include herringbone (blade-type), wave form, and cellular (or honeycomb) designs. The cellular units generally are the most efficient. Drift eliminators may include various materials, such as ceramics, fiber reinforced cement, fiberglass, metal, plastic, and wood installed or formed into closely spaced slats, sheets, honeycomb assemblies, or tiles. The materials may include other features, such as corrugations and water removal channels, to enhance the drift removal further.

Table 13.4-1 provides available particulate emission factors for wet cooling towers. Separate emission factors are given for induced draft and natural draft cooling towers. Several features in Table 13.4-1 should be noted. First, a *conservatively high* PM-10 emission factor can be obtained by (a) multiplying the total liquid drift factor by the total dissolved solids (TDS) fraction in the circulating water and (b) assuming that, once the water evaporates, all remaining solid particles are within the PM-10 size range.

Second, if TDS data for the cooling tower are not available, a source-specific TDS content can be estimated by obtaining the TDS data for the make-up water and multiplying them by the cooling tower cycles of concentration. The cycles of concentration ratio is the ratio of a measured

Table 13.4-1 (Metric And English Units). PARTICULATE EMISSIONS FACTORS FOR WET COOLING TOWERS[a]

Tower Type[d]	Total Liquid Drift[b]				PM-10[c]		
	Circulating Water Flow[b]	g/daL	lb/10^3 gal	EMISSION FACTOR RATING	g/daL[e]	lb/10^3 gal	EMISSION FACTOR RATING
Induced Draft (SCC 3-85-001-01, 3-85-001-20, 3-85-002-01)	0.020	2.0	1.7	D	0.023	0.019	E
Natural Draft (SCC 3-85-001-02, 3-85-002-02)	0.00088	0.088	0.073	E	ND	ND	—

[a] References 1-17. Numbers are given to 2 significant digits. ND = no data. SCC = Source Classification Code.

[b] References 2,5-7,9-10,12-13,15-16. Total liquid drift is water droplets entrained in the cooling tower exit air stream. Factors are for % of circulating water flow (10^{-2} L drift/L [10^{-2} gal drift/gal] water flow) and g drift/daL (lb drift/10^3 gal) circulating water flow. 0.12 g/daL = 0.1 lb/10^3 gal; 1 daL = 10^1 L.

[c] See discussion in text on how to use the table to obtain PM-10 emission estimates. Values shown above are the arithmetic average of test results from References 2,4,8, and 11-14, and they imply an effective TDS content of approximately 12,000 parts per million (ppm) in the circulating water.

[d] See Figure 13.4-1 and Figure 13.4-2. Additional SCCs for wet cooling towers of unspecified draft type are 3-85-001-10 and 3-85-002-10.

[e] Expressed as g PM-10/daL (lb PM-10/10^3 gal) circulating water flow.

parameter for the cooling tower water (such as conductivity, calcium, chlorides, or phosphate) to that parameter for the make-up water. This estimated cooling tower TDS can be used to calculate the PM-10 emission factor as above. If neither of these methods can be used, the arithmetic average PM-10 factor given in Table 13.4-1 can be used. Table 13.4-1 presents the arithmetic average PM-10 factor calculated from the test data in References 2, 4, 8, and 11 - 14. Note that this average corresponds to an effective cooling tower recirculating water TDS content of approximately 11,500 ppm for induced draft towers. (This can be found by dividing the total liquid drift factor into the PM-10 factor.)

As an alternative approach, if TDS data are unavailable for an induced draft tower, a value may be selected from Table 13.4-2 and then be combined with the total liquid drift factor in Table 13.4-1 to determine an apparent PM-10 factor.

As shown in Table 13.4-2, available data do not suggest that there is any significant difference between TDS levels in counter and cross flow towers. Data for natural draft towers are not available.

Table 13.4-2. SUMMARY STATISTICS FOR TOTAL DISSOLVED SOLIDS (TDS) CONTENT IN CIRCULATING WATER[a]

Type Of Draft	No. Of Cases	Range Of TDS Values (ppm)	Geometric Mean TDS Value (ppm)
Counter Flow	10	3700 - 55,000	18,500
Cross Flow	7	380 - 91,000	24,000
Overall[b]	17	380 - 91,000	20,600

[a] References 2,4,8,11-14.
[b] Data unavailable for natural draft towers.

References For Section 13.4

1. *Development Of Particulate Emission Factors For Wet Cooling Towers*, EPA Contract No. 68-D0-0137, Midwest Research Institute, Kansas City, MO, September 1991.

2. *Cooling Tower Test Report, Drift And PM-10 Tests T89-50, T89-51, And T89-52*, Midwest Research Institute, Kansas City, MO, February 1990.

3. *Cooling Tower Test Report, Typical Drift Test*, Midwest Research Institute, Kansas City, MO, January 1990.

4. *Mass Emission Measurements Performed On Kerr-McGee Chemical Corporation's Westend Facility*, Kerr-McGee Chemical Corporation, Trona, CA, And Environmental Systems Corporation, Knoxville, TN, December 1989.

5. Confidential Cooling Tower Drift Test Report For Member Of The Cooling Tower Institute, Houston, TX, Midwest Research Institute, Kansas City, MO, January 1989.

6. Confidential Cooling Tower Drift Test Report For Member Of The Cooling Tower Institute, Houston, TX, Midwest Research Institute, Kansas City, MO, October 1988.

7. Confidential Cooling Tower Drift Test Report For Member Of The Cooling Tower Institute, Houston, TX, Midwest Research Institute, Kansas City, MO, August 1988.

8. *Report Of Cooling Tower Drift Emission Sampling At Argus And Sulfate #2 Cooling Towers*, Kerr-McGee Chemical Corporation, Trona, CA, and Environmental Systems Corporation, Knoxville, TN, February 1987.

9. Confidential Cooling Tower Drift Test Report For Member Of The Cooling Tower Institute, Houston, TX, Midwest Research Institute, Kansas City, MO, February 1987.

10. Confidential Cooling Tower Drift Test Report For Member Of The Cooling Tower Institute, Houston, TX, Midwest Research Institute, Kansas City, MO, January 1987.

11. *Isokinetic Droplet Emission Measurements Of Selected Induced Draft Cooling Towers*, Kerr-McGee Chemical Corporation, Trona, CA, and Environmental Systems Corporation, Knoxville, TN, November 1986.

12. Confidential Cooling Tower Drift Test Report For Member Of The Cooling Tower Institute, Houston, TX, Midwest Research Institute, Kansas City, MO, December 1984.

13. Confidential Cooling Tower Drift Test Report For Member Of The Cooling Tower Institute, Houston, TX, Midwest Research Institute, Kansas City, MO, August 1984.

14. Confidential Cooling Tower Drift Test Report, Midwest Research Institute, Kansas City, MO, November 1983.

15. *Chalk Point Cooling Tower Project*, Volumes 1 and 2, JHU PPSP-CPCTP-16, John Hopkins University, Laurel, MD, August 1977.

16. *Comparative Evaluation Of Cooling Tower Drift Eliminator Performance*, MIT-EL 77-004, Energy Laboratory And Department of Nuclear Engineering, Massachusetts Institute Of Technology, Cambridge, MA, June 1977.

17. G. O. Schrecker, *et al.*, *Drift Data Acquired On Mechanical Salt Water Cooling Devices*, EPA-650/2-75-060, U. S. Environmental Protection Agency, Cincinnati, OH, July 1975.

Attachment 4
State of Florida
Department of Environmental Protection
Levy Nuclear Power Plant Units 1 & 2
Progress Energy Florida
Conditions of Certification, Plant and Associated Facilities and Transmission Lines
Certified Aug. 26, 2009
("SCA")

The document that makes up Attachment 4 is approximately 22 MB in size. It is provided in a separate electronic file. Initial Scheduling Order at 20.

Attachment 5
Environmental Standard Review Plan
NUREG-1555, § 5.3.3.2

U.S. NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

5.3.3.2 TERRESTRIAL ECOSYSTEMS

REVIEW RESPONSIBILITIES

Primary—Appendix B

Secondary—Appendix B

I. AREAS OF REVIEW

This environmental standard review plan (ESRP) directs the staff's identification and evaluation of impacts to terrestrial ecosystems induced by the operation of heat dissipation systems, especially cooling towers and cooling ponds. The scope of the review directed by this plan will be limited to consideration of the operational aspects of heat dissipation systems in sufficient detail to form a basis for assessing potential operational impacts.

Review Interfaces

The reviewer for this ESRP should obtain input from or provide input to reviewers for the following ESRPs, as indicated:

- ESRP 2.4.1. Obtain descriptive material on the terrestrial ecology of the site and vicinity to support the analyses made in ESRP 5.3.3.2.
- ESRP 3.4.2. Obtain specific information about the cooling system necessary to assess impacts to the terrestrial environment.
- ESRP 5.3.3.1. Obtain information about heat dissipation to the atmosphere necessary to determine impacts to the terrestrial environment.

- ESRP 5.10. Provide a list of measures and controls to limit adverse impacts to terrestrial biota that are to be evaluated in regard to the licensing process and a list of applicant commitments to limit these impacts.

- ESRP 6.5.1. If potential adverse impacts due to heat-dissipation are predicted, then provide preoperational baseline monitoring program elements.

- ESRP 9.4.1. Provide a list of adverse environmental impacts that could be mitigated or avoided through use of alternative heat dissipation system designs or operational procedures, and assist in determining appropriate alternatives.

- ESRP 10.1. Provide a summary of the unavoidable impacts to terrestrial ecosystems that are predicted to occur as a result of operation of heat-dissipation systems.

- ESRP 10.2. Provide a summary of irreversible and irretrievable commitments of terrestrial biota that are predicted to occur as a result of the operation of heat-dissipation systems.

Data and Information Needs

The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:

- concentration and chemical composition of dissolved and suspended solids in cooling tower basins or spray canals on a seasonal basis (from ESRP 3.4.2)

- isopleths of deposition at ground levels on a seasonal basis. Isopleths should extend to values at least as low as 1 kg/ha/mo (from the environmental report [ER] and ESRP 5.3.3.1).

- a list and description of the "important" terrestrial species and habitats that may be affected by the heat-dissipation system (from ESRP 2.4.1)

- descriptions of natural and managed plant communities on the site and within offsite isopleths above 20 kg/ha/yr (from ESRPs 2.4.1, 5.3.3.1, and the site visit)

- annual precipitation and its dissolved solid concentration within the drift field (from the ER)

- prediction of increased frequency and distribution of fog and icing (from ESRP 5.3.3.1)

- shoreline vegetation expected to develop along the shore of new cooling lakes and ponds (from the ER and consultation with Federal, State, and local agencies)

- proposed other uses of cooling ponds and reservoirs (from the ER).

II. ACCEPTANCE CRITERIA

Acceptance criteria for the review of impacts on terrestrial ecosystems from the heat dissipation system are based on the relevant requirements of the following:

- 10 CFR 51.45 with respect to ERs and the analysis of potential impacts contained therein
- 10 CFR 51.75 with respect to analysis of impacts on the terrestrial environment affected by the issuance of a construction permit
- 10 CFR 52, Subpart A, with respect to analysis of impacts on the terrestrial environment affected by the issuance of an early site permit
- 10 CFR 51.95 with respect to the preparation of supplemental environmental impact statements (EISs) in support of the issuance of an operating license
- Endangered Species Act of 1973, as amended, with respect to identifying threatened or endangered species and critical habitats and formal or informal consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service
- Fish and Wildlife Coordination Act of 1958 with respect to consideration of fish and wildlife resources and the planning of development projects that affect water resources

Regulatory guidelines and specific criteria to meet the regulations and identified above are as follows:

- Regulatory Guide 4.2, Rev. 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976), contains guidance for the preparation of ERs. With respect to the heat-dissipation system, it specifies that detailed descriptions of the expected effects of the system on the local environment with respect to fog, icing, precipitation modifications, humidity changes, cooling-tower blowdown and drift, and noise should be included in the ER. The reviewer should ensure that the appropriate data and analyses are provided in the ER.
- Regulatory Guide 4.7, Rev. 2, *General Site Suitability for Nuclear Power Stations* (NRC 1998), contains guidance on factors that should be considered in the site-selection process. In specific regard to cooling-tower drift, this guide states "The potential loss of important terrestrial species and other resources should be considered."
- Regulatory Guide 4.11, Rev. 1, *Terrestrial Environmental Studies for Nuclear Power Stations* (NRC 1977), contains technical information for the design and execution of terrestrial environmental studies, the results of which may be appropriate for inclusion in the applicant's ER. The reviewer should ensure that the appropriate results concerning potential effects of the heat-dissipation system on the terrestrial environment are included in the ER.

Technical Rationale

The technical rationale for evaluating the applicant's impacts from heat-dissipation systems to terrestrial ecosystems is discussed in the following paragraph:

> The EIS needs to include the results of an analysis that considers the environmental effects of the proposed heat dissipation system and the alternatives available for reducing or avoiding adverse environmental effects. Any environmental benefits that may result from the operation of the heat dissipation system should also be included. Following the acceptance criteria listed above will help ensure that the environmental impacts of the proposed heat-dissipation system are considered with respect to matters covered by such standards and requirements.

III. REVIEW PROCEDURES

The depth and extent of the input to the EIS will be governed by the environmental characteristics of the terrestrial ecology that could be affected by operation of the station's heat dissipation systems and by the magnitude of the expected impacts to the terrestrial environment.

The most apparent effects of heat dissipation systems on terrestrial ecosystems are those associated with cooling-tower or spray pond operation. These include the effects of vapor plumes, icing, and salt drift on the terrestrial ecosystems. The potential for bird collision with cooling towers should be addressed by the reviewer for ESRP 4.3.1. To date, at stations using once through cooling systems, no adverse impacts to terrestrial ecosystems have occurred that require mitigating actions. In circumstances where once through cooling is proposed, the analysis may terminate without further consideration unless unusual environmental circumstances make more analysis necessary.

(1) Consider the impacts of drift deposition on plants.

- Drift deposition has the potential for adversely affecting plants, but the tolerance levels of native plants, ornamentals, and crops are not known with precision.
- General guidelines for predicting effects of drift deposition on plants suggest that many species have thresholds for visible leaf damage in the range of 10 to 20 kg/ha/mo of NaCl deposited on leaves during the growing season.
- These effects can be altered by the frequency of rainfall, humidity, type of salt, and sensitivity of species.
- Use maps of the site and vicinity showing drift isopleths that were produced by recognized drift-dispersion models to define areas of possible botanical injury.

- Use an order-of-magnitude approach, as follows, to analyze operational impacts from salt drift:

  - Deposition of salt drift (NaCl) at rates of 1 to 2 kg/ha/mo is generally not damaging to plants.

  - Deposition rates approaching or exceeding 10 kg/ha/mo in any month during the growing season could cause leaf damage in many species.

  - Deposition rates of hundreds or thousands of kg/ha/yr could cause damage sufficient to suggest the need for changes of tower-basin salinities or a reevaluation of tower design, depending on the amount of land impacted and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.

(2) Consider the detrimental effects increased fogging could have on local vegetation if the increase in humidity induces an increase in fungal or other phytopathological infections. Increased icing can cause physical damage to vegetation due to increased structural pressure on tree branches or by damaging fruit or leaf buds.

- Use an order of magnitude approach as follows to analyze operational impacts from fog or ice:

  - Fogging or icing of vegetation on the order of a few hours per year is generally not severe.

  - Fogging or icing on the order of tens of hours per year may cause detectable damage to vegetation.

  - Fogging or icing occurring for hundreds of hours per year could be severe enough to suggest the need for design changes, depending on the amount of land impacted and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.

- Consider soil salinization:

  - The risk from this source is generally considered to be low.

  - In arid areas (deserts), salts could accumulate in soils over long time intervals and cause damage.

(3) Consider the impact to terrestrial biota when new shoreline habitats are created along ponds and reservoirs built for cooling purposes. Riparian tree/shrub communities that form around these new ponds or reservoirs may attract "important" species.

If endangered or threatened species could be affected, agency level formal or informal consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act is required.

IV. EVALUATION FINDINGS

Input to the EIS should accomplish the following objectives: (1) public disclosure of any expected impact to the terrestrial ecosystem as a result of the operation of the heat dissipation system, (2) presentation of the basis of staff analysis of the project, and (3) presentation of staff conclusions, evaluations, and conditions regarding terrestrial ecosystems. These conclusions should include

- a list of adverse impacts of cooling-system heat dissipation to terrestrial ecosystems
- a list of the impacts for which there are measures or controls to limit adverse impacts and associated measures and controls
- the applicant's commitments to limit these impacts
- the staff's evaluation of the adequacy of the applicant's measures and controls to limit adverse impacts.

This information should be summarized by the reviewer for ESRP 5.10.

Evaluation of impacts should result in one of the following conclusions:

- *The impact is minor, and mitigation is not warranted.* If the degree of impact falls into the first order category (a few hours of icing or fogging each year or a few kilograms of salt drift per hectare per year), the reviewer may conclude that these impacts are not of sufficient magnitude to warrant further evaluation.
- *The impact is adverse, but can be mitigated by design and procedure modifications.* If the degree of impact falls within the second-order category (a few tens of hours per year increase in fog or ice or a few tens of kilograms of salt drift deposition per hectare per year), the reviewer may conclude that the effects are adverse and that mitigating actions should be considered. For these cases, the reviewer should consult with the Environmental Project Manager (EPM) and the reviewer for ESRP 9.4.1 for verification that the modifications are practical and will lead to an improvement in the benefit-cost balance. The reviewer should prepare a list of verified modifications and measures and controls to limit the corresponding impact. These lists should be given to the reviewer for ESRP 5.10.
- *The impact is adverse and is of such magnitude that it should be avoided, if it cannot be mitigated.* If the degree of expected impacts falls within the third order category (hundreds of hours of increase in fog and ice or hundreds of kilograms of salt drift per hectare per year), the reviewer may conclude that the impacts of operation are sufficiently adverse that consideration of alternative designs or locations to avoid the impact is warranted. When impacts of this nature are identified, the reviewer should inform the EPM and the reviewer for ESRP 9.4.1 that an analysis and evaluation of alternative designs or procedures is needed. The reviewer should participate in any such analysis and evaluation of alternatives that would avoid the impact and that could be considered practical. If no

such alternatives can be identified, the reviewer should provide this conclusion to the reviewer for ESRP 10.1.

V. IMPLEMENTATION

The method described herein will be used by the staff in evaluating conformance with the Commission's regulations, except in those cases in which the applicant proposes an acceptable alternative for complying with specified portions of the regulations.

VI. REFERENCES

10 CFR 51.45, "Environmental report."

10 CFR 51.75, "Draft environmental impact statement—construction permit."

10 CFR 51.95, "Supplement to final environmental impact statement."

10 CFR 52, Subpart A, "Early Site Permits."

Endangered Species Act, as amended, 16 USC 1531 et seq.

Fish and Wildlife Coordination Act Amendment, 16 USC 661 et seq.

U.S. Nuclear Regulatory Commission (NRC). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Rev. 2, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1977. *Terrestrial Environmental Studies for Nuclear Power Stations*. Regulatory Guide 4.11, Rev. 1, Washington, D. C.

U.S. Nuclear Regulatory Commission (NRC). 1998. *General Site Suitability for Nuclear Power Stations*. Regulatory Guide 4.7, Rev. 2, Washington, D. C.

Attachment 6

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

NUREG-1437, Vol. 1, § 4.3.4

NUREG–1437
Vol. 1

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Main Report

Final Report

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Division of Regulatory Applications
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

tower discharges on water quality are considered to be impacts of small significance and because the changes would be costly, the staff does not consider the implementation of these potential mitigation measures to be warranted. Effects of cooling tower discharges on water quality are all Category 1 issues.

4.3.3 Aquatic Ecology

Cooling towers have been suggested as mitigative measures to reduce known or predicted entrainment and impingement losses (see, for example, Barnthouse and Van Winkle 1988). The relatively small volumes of makeup and blowdown water needed for closed-cycle cooling systems result in concomitantly low entrainment, impingement, and discharge effects (see Section 4.2.2 for a more complete discussion of these effects regarding once-through cooling systems). Studies of intake and discharge effects of closed-cycle cooling systems have generally judged the impacts to be insignificant (NUREG/0720; NUREG/CR-2337). None of the resource agencies consulted for this GEIS (Appendix F) expressed concerns about the impacts of closed-cycle cooling towers on aquatic resources.

However, even low rates of entrainment and impingement at a closed-cycle cooling system can be a concern when an unusually important resource is affected. Such aquatic resources would include threatened or endangered species or anadromous fish that are undergoing restoration. For example, concern about potential impacts of the Washington Nuclear Project (WNP-2) on chinook salmon has been raised by the Washington Department of Fisheries (Cynthia A. Wilson, Washington Department of Fisheries, letter to G. F. Cada, ORNL, Oak Ridge, Tennessee, July 5, 1990). Although entrainment, impingement, and thermal discharges are not believed to be a problem at WNP-2, the importance of the Columbia River salmon stocks are such that the resource agency feels that monitoring should continue. Similarly, the Pennsylvania Fish Commission has expressed concern about future entrainment and impingement of American shad by the Limerick Generating Station, the Susquehanna Steam Electric Station, Three Mile Island Nuclear Station, and Peach Bottom Atomic Power Station (Dennis T. Guise, Pennsylvania Fish Commission, letter to G. F. Cada, ORNL, Oak Ridge, Tennessee, July 3, 1990). In all cases, losses of American shad at these power plants are minimal or nonexistent, but periodic monitoring has been recommended to ensure that no future problems occur as the anadromous fish restoration efforts continue.

It is unlikely that the small volumes of water withdrawn and discharged by closed-cycle cooling systems would interfere with the future restoration of aquatic biota or their habitats. Effects of operation of closed-cycle cooling systems on aquatic organisms are considered to be of small significance if changes are localized and populations in the receiving waterbody are not reduced. In considering the effects of closed-cycle cooling systems on aquatic ecology, the staff evaluated the same issues that were evaluated for open-cycle systems (Table 4.1): impingement of fish and shellfish, entrainment of fish and shellfish early life stages, entrainment of phytoplankton and zooplankton, thermal discharge effects, cold shock, effects on movement and distribution of aquatic biota, premature emergency of aquatic insects, stimulation of nuisance organisms, losses from predation, parasitism, and disease, gas supersaturation of low

dissolved oxygen in the discharge, and accumulation of contaminants in sediments or biota. Based on reviews of literature and operational monitoring reports, consultations with utilities and regulatory agencies, and comments on the draft GEIS, these potential effects have not been shown to cause reductions in the aquatic populations near any existing nuclear power plants. None of the regulatory and resource agencies expressed concerns about the cumulative effects on aquatic resources of closed cycle cooling system operations at this time, although some recommended continued monitoring in view of efforts to restore fish populations. Effects of all of these issues are considered to be of small significance for all plants. No change in operation of the cooling system is expected during the license renewal term, so no change in effects of cooling towers on aquatic biota is anticipated. Effects of entrainment, impingement, and discharges from closed-cycle cooling systems could be reduced by reducing the plant's generation rate, or by operating additional wastewater treatment systems. However, because the effects of cooling tower withdrawals and discharges on aquatic organisms are considered to be impacts of small significance and because the changes would be costly, the staff does not consider the implementation of these potential mitigation measures to be warranted. The effects of closed-cycle cooling system operation on aquatic biota are all Category 1 issues.

4.3.4 Agricultural Crops and Ornamental Vegetation

The issue addressed by this section is the extent to which the productivity of agricultural crops near nuclear plants may be reduced by exposure to salts or other effects (e.g., icing, increased humidity) resulting from cooling-tower operation. The approach to evaluating this issue was as follows: first, based on a literature review, potential impacts of salts in general (whether from cooling towers or other sources such as wind-blown salts near seashores) are described according to the rate of salt deposition to earth and the relative sensitivity of different types of crops (Section 4.3.4.1); then, the data generated by monitoring programs at a representative subset of specific nuclear plants were reviewed (Section 4.3.4.2). The subset includes 10 of the 11 nuclear power plants with mechanical-draft cooling towers. Mechanical-draft towers are the focus of this section because impacts of drift deposition and icing are more likely to occur near these towers than at natural-draft towers. Drift from natural-draft towers is released at greater heights, disperses more widely, and therefore deposits on earth at lower rates or concentrations. Data were also found and reviewed for 8 of the 17 plants with natural-draft cooling towers (Table 4.1). The coal-fired Chalk Point Plant was also included in the analysis because extensive monitoring of cooling-tower-drift effects has been conducted there and because this plant uses brackish water for cooling and represents a case with comparatively high potential for drift impacts from natural-draft towers. The only nuclear plant that has a natural-draft tower and uses brackish water for cooling is Hope Creek in New Jersey. It is included among the plants that were reviewed.

The following standard of significance is applied to the effects of cooling tower operation on agricultural crops and ornamental vegetation. The impact is of small significance if under expected operational conditions measurable productivity losses (either quantity or

quality of yield) do not occur for agricultural crops; and measurable damage (either visual or to plant function) does not occur for ornamental vegetation.

4.3.4.1 Overview of Impacts

4.3.4.1.1 Ambient Salts and Cooling-Tower Drift

Agricultural crops can be affected by chemical salts and biocides in cooling tower drift and drift-induced or plume-induced ice formation. Increased fogging, cloud cover, and relative humidity resulting from cooling-tower operation have little potential to affect crops, and adverse effects have not been reported. Generally, drift from cooling towers using fresh water has low salt concentrations and, in the case of mechanical draft towers, falls mostly within the immediate vicinity of the towers (ANL/ES-53), representing little hazard to vegetation off-site. Typical amounts of salt or total dissolved solids in freshwater environments are around 1000 ppm (ANL/ES-53). In arid environments, competition for water resources can result in the use of relatively low-quality or saline water for cooling, and the potential for drift-induced damage to surrounding vegetation may be greater (McBrayer and Oakes 1982). For example, source water for cooling at Palo Verde in Arizona is withdrawn from an onsite reservoir containing treated sewage effluent of relatively high salinity. As a result, cooling tower basin water also had high salinity levels including 10,000 to 26,000 ppm total dissolved solids, 3,400 to 7,000 ppm Cl^-, and 2,700 to 8,600 ppm Na^+ (NUS-5241). High salt levels also occur at plants on the coasts or coastal bays. Brackish cooling water used by the Chalk Point coal-fired plant in Maryland contained 11,000 to 26,000 ppm total soluble salts and 6,600 to 18,000 ppm Cl^- (Mulchi and Armbruster 1983). Nuclear plants with cooling towers use fresh water, except for the Hope Creek Plant in New Jersey, which uses saline water. At the Crystal River Plant, Florida, which currently uses brackish water in once-through cooling, a helper cooling tower has been constructed to cool water in a canal that receives discharge from five fossil and one nuclear units.

Talbot (1979) has concluded that adequate estimates of natural background levels of atmospheric salt loading (naturally occurring drift) and rates of deposition thereof are not available for points remote from oceans. In field measurements at a wet cooling tower, A. Backhaus et al. (1988) estimated that up to 60 percent of the chemical contents in the sample came from atmospheric aerosols and not from the tower. Therefore, observed deposition is not all drift from cooling towers (Talbot 1979). Recent work (ORNL/TM-11121) has quantified background aerosol deposition for a dozen sites throughout the country, but deposition for most locations remains poorly known.

Salts from cooling towers are deposited on vegetation by (1) wind-driven impaction, (2) droplet and particulate fallout, and (3) rainfall (Talbot 1979; CONF-740302, 1975b). In high-salt environments such as a windy seashore, impaction is usually the most important process, delivering 10 times more salt to vegetation than does fallout. Increasing wind speeds and salt concentrations increase impaction, hence increasing vegetation injury (Talbot 1979). In most humid environments, rainwater will wash off salts deposited on vegetation (ANL/ES-53), but exposure can be significant during periods between rainfalls.

4.3.4.1.2 Effects of Salt Drift

Plants damaged by salt drift may have acute symptoms, including necrotic or discolored tissue, stunted growth, or deformities (Talbot 1979; Hoffman et al. 1987). Chronic effects are less obvious but may include some degree of chlorosis and reduced growth (Talbot 1979) or increased susceptibility to disease and insect damage (Hosker and Lindberg 1982).

Climatic conditions affect plants' ability to tolerate salt (Talbot 1979; Maas 1985). The degree of injury is related to the salt content in the leaves, but hot or dry weather conditions and water stress are critical in inducing injury (most crops can tolerate greater salt stress during relatively cool and humid weather) (Maas 1985).

Among the factors that affect the plant's foliar accumulation of salt are physical characteristics of the leaves (Maas 1985; CONF-740302, 1975d; Taylor 1980), type and concentration of salt, ambient temperature and humidity, and length of time the leaf remains wet (Maas 1985). Because salt on foliage is apparently absorbed from solution, high humidity, which retards evaporation, enhances salt uptake (CONF-740302, 1975d; McCune et al. 1977; Talbot 1979; Grattan et al. 1981). Because precipitation and dew affect salt deposition, uptake, and resultant injury, dose exposure is difficult to predict (Talbot 1979; Grattan et al. 1981; McCune et al. 1977; EPA-600/3-76-078).

Plant species and crop varieties vary significantly in their tolerance to drift deposition and to soil salinity (Talbot 1979; Maas 1985). In general, salt uptake, plant injury, and reduction in crop yield have been shown to increase with increasing levels of airborne salt or deposition and with time of exposure (CONF-740302, 1975b; Mulchi and Armbruster 1981; Maas; Grattan et al.; EPA-600/3-76-078). Some plants, however, have shown a slight increase in vegetative productivity [e.g., tobacco at < 4 kg/ha (3.6 lb/acre) per week (Mulchi and Armbruster 1983) and cotton at 8 kg/ha (7 lb/acre per week) (Hoffman et al. 1987)]. Based on experimental exposures, a yield reduction of 10 percent has been estimated for deposition levels as low as 4.7 kg/ha (4.2 lb/acre) per week to corn, a species sensitive to foliar salt injury (Mulchi and Armbruster 1981). Relationships between experimental levels of salt deposition, foliar concentrations of sodium and chloride, and corn yield show that yield may be slightly reduced even at rates as low as 2 kg/ha (1.8 lb/acre) per week (Mulchi and Armbruster 1981). Also, bush beans can have reduced yield depending on the age of plants, with older plants being most sensitive (EPA-600/3-76-078). Deposition rates near nuclear-plant towers, according to available deposition data (Section 4.3.5.1.2), appear to be generally below the rates that would affect sensitive agricultural crops.

Talbot (1979) tabulated salt deposition amounts known to induce acute toxicity symptoms in vegetation (Table 4.2). Corn was the most sensitive crop, showing injury above 1.8 kg/ha (1.6 lb/acre) per week; the least sensitive was pinto beans, showing injury above 253 kg/ha (226 lb/acre) per week. Armbruster and Mulchi (1984) showed that foliar salt deposition of 3.2 to 8.8 kg/ha (2.9 to 7.9 lb/acre) per week increased foliar chloride content and damaged foliage of corn, with the higher deposition reducing the yield of grain by as much as 11 percent. They found similar results for soybeans, with bean yields

Table 4.2 Estimates of salt-drift deposition rates estimated to cause acute injury to vegetation

Species	Deposition above which injury is expected (kg/ha/week)
Crops and ornamental plants	
Zea mays (corn)	1.82
Glycine hispida var York (soybean)	7.28
Gossypium hirsutum (cotton)	8.0
Medicago sativa (alfalfa)	15.7
Forsythia intermedia var spectabilis (forsythia)	189.6
Phaseolus vulgaris var Pinto (pinto bean)	252.8
Albizzia julibrissin rosea (mimosa)	379.2
Koelreutaria paniculata (golden rain tree)	568.8
Native species	
Cornus florida (flowering dogwood)	1.2 (in Maryland) 47.4 (in New York)
Fraxinus americana (white ash)	1.3 (in Maryland) 18.9 (in New York)
Tsuga canadensis (Canadian hemlock)	9.4
Pinus strobus (white pine)	189.6
Quercus prinus (chestnut oak)	379.2
Robinia pseudoacacia (black locust)	379.2
Acer rubrum (red maple)	474.0
Hammamelis virginiana (witch hazel)	1042.8

Source: Adapted from Talbot 1979 and Hoffman et al. 1987.
Note: To convert kg/ha to lb/acre, multiply by 0.8924.

reduced by as much as 7 percent at the highest deposition rate.

W. C. Hoffman et al. (1987) experimentally exposed cotton and cantaloupe in the arid environment near Palo Verde to foliar salt deposition rates of 8 to 415 kg/ha (7 to 370 lb/acre) per year total salt and alfalfa to depositions up to 829 kg/ha (740 lb/acre) per year. They found foliar injury in alfalfa only at the highest deposition level but no injury to cantaloupe or cotton despite increases in foliar Na^+ and Cl^-. Yields of cantaloupe and alfalfa were not reduced, but 415 kg/ha (370 lb/acre) per year reduced cotton boll production and seed cotton yield by approximately 25 percent.

The burning quality of tobacco is known to be adversely affected by elevated Cl^-. Experiments have shown that burning quality, or length of time the leaf will burn, is impaired by increasing experimental doses of salt deposition (Mulchi and Armbruster 1983). A 17 percent reduction in burning quality was estimated for a Cl^- deposition of 5 kg/ha (4.5 lb/acre) per week, based on regression relationships of deposition, leaf chloride concentration, and leaf burn (Mulchi and Armbruster 1983).

Field studies of the effects of salt drift have been conducted at the Turkey Point plant and the coal-fired Chalk Point plant. Hindawi et al. (EPA-440/5-86-001) investigated field exposures of bean and corn plants to saltwater drift from a test cooling tower and power spray module at the Turkey Point plant. Salt concentrations in tissues of bean and corn plants increased with time during three weeks of exposure and decreased exponentially with distance from the salt drift source. Some injury to leaves was visible at the site of greatest exposure.

The coal-fired Chalk Point plant has a relatively high potential impact from natural-draft cooling towers because brackish water is used for cooling. Other than the Hope Creek plant, all nuclear plants with natural-draft towers use fresh water for cooling. Deposition rates at Chalk Point were measured at 12 monitoring sites at distances of from 1.6 km to 9.6 km (1 to 6 miles) from the towers during their initial 5 years of operation (Mulchi et al. 1982). No increased deposition resulting from cooling-tower operation was detected at these distances. Deposition rates at the sites ranged from about 0.5 to 1.2 kg/ha (0.4 to 1 lb/acre) per month for NaCl, which comprises most of the solids in the brackish cooling water. Monitoring sites, which were established to study effects on agricultural crops, were not located in areas closer to the towers because no active cropland was in these areas and because the plant, located on a peninsula on the Patuxent River, is bounded by water except to the north and north-northwest. Most drift probably deposits in the river.

A study of tobacco plants 3 years after Chalk Point cooling towers began operating failed to find any increase in leaf salt content that could be attributed to drift (Mulchi and Armbruster 1983). Chloride levels in tobacco and chloride and sodium levels in corn and soybeans at 1.6 km (1 mile), the closest distance crops were grown to the Chalk Point towers, were within the range of preoperational values and were no higher than levels found up to 9.6 km (6 miles) from the towers (Mulchi et al. 1982; Mulchi and Armbruster 1983).

4.3.4.1.3 Effects on Soils

Drift deposition also has the potential to damage vegetation by soil salinization. Soil salinization does not usually occur in areas where rainfall is sufficient to leach salts from the soil profile. In arid regions, however, such as at Palo Verde, cooling tower drift has the potential to increase soil salinity and thus affect native and agricultural plants (McBrayer and Oakes 1982). Salinity of irrigated soils in arid regions may also be increased by drift, even though such soils already have a high salinity resulting from salts in irrigation water and high evaporation rates. Responses of crop plants to soil salinity appear to be poorly correlated to their tolerance to foliar-applied salts (Grattan et al. 1981; Maas 1985).

In an experiment in a more humid environment, salts were applied to soils to simulate drift deposition from the Chalk Point coal-fired plant with brackish water cooling towers. One-time applications of 14–112 kg/ha (13–100 lb/acre) NaCl affected leaf Cl^- in corn and soybeans but resulted in no visible damage or reduction in yield (Armbruster and Mulchi 1984). These soil salt treatments also increased soil pH and extractable cations (Armbruster and Mulchi 1984), but leaching by winter precipitation returned soil to pretreatment status.

In humid environments, effects of drift deposition on soils appear transitory if they can be detected at all. Field measurements of the effects of the operating cooling towers at Chalk Point showed no changes in soil chemical elements at distances of 1.6 to 9.6 km (1 to 6 miles) (Mulchi et al. 1982). In a study of five saltwater cooling towers near Galveston Bay, Texas, salt deposition up to 746 kg/ha/year was found within 100 m (328 ft) of the towers, with levels decreasing to <52 kg/ha (46 lb/acre) per year at 434 m (1424 ft) (Wiedenfeld et al. 1978). Weekly deposition ranged from 4.27 kg/ha (3.81 lb/acre) per week to 58.8 kg/ha (52.5 lb/acre) per week. In the survey, salt content of the soil at 104 m (341 ft) from the towers returned to previous levels when towers were shut down during the winter.

4.3.4.2 Plant-Specific Operational Data

Annual reports of environmental monitoring for vegetation damage at nuclear plants were reviewed. Vegetation monitoring included detailed measurements of vegetation structure and composition on permanent plots, aerial infrared photography with subsequent field surveys for vegetation injury, or general surveillance. Vegetation damage ranging from foliar chlorosis to defoliation can be identified on false-color infrared aerial photographs (NUREG/CR-1231). Vegetation monitoring for drift effects has been conducted at 18 nuclear plants. Most of the nuclear plants are not located close to agricultural areas, but six of the plants monitored crops, pasture, orchards, or ornamental vegetation. None reported visible damage to ornamental vegetation or reduction in crop yield (Table 4.3).

A detailed study at Palo Verde in Arizona showed that, after 6 years of operation, no change in agricultural soils attributable to cooling tower emissions occurred. Although significant increases or decreases occurred in some soil parameters at some monitoring locations, these changes appear unrelated to cooling-tower operation and were believed to have been caused by irrigation management, cropping, and fertilizer application. At the conclusion of the 6-year study, no significant effects on

Table 4.3 Results of nuclear facility monitoring for cooling-tower drift effects on terrestrial vegetation

Plant	Vegetation effects	Type of monitoring
	Natural draft	
Arkansas	No visible damage; no foliar chemical changes after one year	Aerial photography; foliar chemistry; orchard, native trees
Beaver Valley	No visible damage	Aerial photography; soil pH and conductivity; native vegetation
Byron	No visible damage	Aerial photography; crops; woody, ornamental, and native vegetation
Callaway	No visible damage	Aerial photography; permanent vegetation plots; native trees
Davis-Besse	No visible damage	Aerial photography; soil chemistry; native vegetation
Hope Creek	No visible damage after one year; no foliar chemical changes after one year	Ground survey; foliar chemistry; soil chemistry; native vegetation
Three Mile Island	No visible damage	Visual inspection; crops and native vegetation
Trojan	No visible damage	Aerial photography; pasture, ornamental and native vegetation
	Mechanical draft	
Catawba	Possible ice damage to loblolly pine < 61 m (200 ft) from towers	Aerial photography; ground survey; native trees
Duane Arnold	No visible damage	Visual inspection; native vegetation
Edwin I. Hatch	No visible damage	Aerial photography; permanent vegetation plots; native vegetation

Table 4.3 (continued)

Plant	Vegetation effects	Type of monitoring
Joseph Farley	No visible damage	Aerial photography; native vegetation
Palisades	Severe ice damage < 61 m (200 ft) from towers; some icing beyond 250 m (820 ft); sulfate injury < 150 m (492 ft) from towers; change in vegetation caused by damage to trees	Aerial photography; permanent vegetation plots; native vegetation
Palo Verde	No visible damage; foliar salt concentrations increased on site	Aerial photography; foliar chemistry; soil chemistry; crops and native vegetation
Prairie Island	Frequent ice damage to oaks adjacent to towers; change in canopy structure caused by ice damage; reduced viability in acorns from oaks near towers	Aerial photography; ground survey; acorn viability survey; native vegetation
River Bend	No visible damage	Aerial photography; permanent vegetation plots; native vegetation
Fort Saint Vrain	No visible damage	Aerial photography; crops; native vegetation
Washington	No foliar chemical changes	Foliar chemistry; soil chemistry; native vegetation

crops or native vegetation had been noted, and the study was discontinued (Halliburton NUS 1992).

At the Palisades plant in Michigan, concern was expressed by owners of nearby fruit orchards about possible effects of elevated humidity on the incidence of disease, particularly apple scab, in their orchards. The concern was that increased humidity could result in the need for increased applications of disease-control sprayings and thus increase orchard operating costs. NRC staff recommended a survey program to assess impacts of cooling-tower moisture on yield, quality, and frequency of disease-control sprayings (NRC 1978). Weather conditions encouraging apple scab are temperatures of 17 to 24°C (63 to 75°F) and

>85 percent relative humidity for 9 h or more. A study was conducted to determine these weather conditions near Palisades cooling towers and in more distant areas (Ryznar et al. 1980). Long-term weather records from weather stations outside the influence of the Palisades cooling towers were analyzed. In addition, a network of meteorological stations was established in the vicinity of the Palisades plant. No increase in weather occurrences favoring apple scab was observed that could be related to Palisades operation.

4.3.4.3 Conclusion

Monitoring results from the sample of nuclear plants and from the coal-fired Chalk Point plant, in conjunction with the literature review and information provided by the natural resource agencies and agricultural agencies in all states with nuclear power plants, have revealed no instances where cooling tower operation has resulted in measurable productivity losses in agricultural crops or measurable damage to ornamental vegetation. Because ongoing operational conditions of cooling towers would remain unchanged, it is expected that there would continue to be no measurable impacts on crops or ornamental vegetation as a result of license renewal. The impact of cooling towers on agricultural crops and ornamental vegetation will therefore be of small significance. Because there is no measurable impact, there is no need to consider mitigation. Cumulative impacts on crops and ornamental vegetation are not a consideration because deposition from cooling tower drift is a localized phenomenon and because of the distance between nuclear power plant sites and other facilities that may have large cooling towers. This is a Category 1 issue.

4.3.5 Terrestrial Ecology

This section addresses the impact of cooling tower drift on natural plant communities (Section 4.3.5.1) and the impact of bird mortality resulting from collisions with natural-draft cooling towers (Section 4.3.5.2).

4.3.5.1 Effects of Cooling-Tower Drift

This section addresses the extent to which natural plant communities near nuclear plants are affected by exposure to salts, icing, or other effects (e.g., fogging and increased humidity) caused by operation of cooling towers. The approach to evaluating this issue is the same as that used for evaluating the impact on agricultural crops in Section 4.3.4.

4.3.5.1.1 Overview of Impacts

The potential impacts of cooling tower operation on native vegetation are similar to those for agricultural crops, including salt-induced leaf damage, growth and seed yield reduction, and ice-induced damage (see Section 4.3.4). In addition, native vegetation may suffer changes in community structure (Talbot 1979) in response to ice damage or differences in species tolerances to drift. Increased fogging and relative humidity near cooling towers have little potential to affect native vegetation, and no such impacts have been reported.

The following standard of significance is applied to the effects of cooling tower operation on natural plant communities. The impact is of small significance if no measurable degradation (not including short-term, minor, and localized impacts) of natural plant communities results from cooling tower operation.