April 9, 2010

MEMORANDUM TO: Richard Raione, Branch Chief
Hydrologic Engineering Branch
Division of Site and Environmental Reviews

FROM: Hosung Ahn, Hydrologist **/RA Henry Jones for/**
Hydrologic Engineering Branch
Division of Site and Environmental Reviews

SUBJECT: SITE AUDIT REPORT RELATED TO SAFETY HYDROLOGIC REVIEW OF THE TURKEY POINT UNITS 6 AND 7 COMBINED LICENSE APPLICATION

Attached is the staff's site audit report on the safety hydrology review of the Turkey Point Units 6 and 7 combined license (COL) application. The audit was conducted on March 22-24, 2010, at the Hampton Inn in Homestead, Florida. The main purpose of this audit was to visit the proposed plant facility site and to discuss safety-related hydrologic topics with the applicant. The staff prepared a list of information needs in advance of the audit and discussed each item with the applicant during the audit. The attachments include a brief audit report with a table containing the information needs with the applicant's response and staff's resolution for each item. Several of the information needs were resolved during the audit, and the resolution of the remaining items, as discussed, will be submitted by the applicant by the end of April 2010.

Enclosures:
As stated

CONTACT: Hosung Ahn, RHEB/DSER/NRO
301-415-1398

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NAME:	HAhn **/RA/**	MHaque**/RA/**	HJones**/RA/**
DATE:	4/5/2010	4/6/2010	4/9/2010

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Attachment A. Report for Turkey Point COLA Safety Hydrology Site Audit

The Hydrology Site Safety Audit for Turkey Point Combined License Application (COLA), near Florida City/Homestead, FL, was conducted on March 22-24, 2010, at the Hampton Inn in Homestead, Florida. The reviewers consisted of staff from the US Nuclear Regulatory Commission (NRC), safety review consultants from the Oak Ridge National Laboratory (ORNL), consultants from the US Geological Survey (USGS) and Texas A&M University, and staff from Florida Power and Light (FPL) and their consultants (Bechtel). Participants from NRC and its consultants were:

NRC	**USGS**	**Bechtel**
Amy Snyder – PM	Gary Patterson	Rebecca Carr
Richard Raione	Eric Geist	Nick Cherish
Hosung Ahn	Jason Chaytor	John Cunliffe
Nebiyu Tiruneh	Patrick Lynett (Texas A&M)	Garrett Day
Mohammad Haque	**FPL**	Lloyd Desotell
Henry Jones	Ray Burski	Yonas Kinfu
Joseph Kanney	Paul Jacobs	Steve Kline
Ian Cozens	George Madden	Loran Matthews
Andrew Kugler	Bill Maher	Mustafa Samad
ORNL	Rick Ortehn	Craig Talbot
Melanie Mayes	Matt Raffenberg	Stew Taylor
Ellen Smith	Rob Regan	Dave Wagner
Vince Neary	Frostie White	Lawrence Young
MHC, Inc	Jack Wilkinson	**PNNL**
Dave McNabb		Robert Bryce
		Paul Thorne
		Lance Vail
		Rochelle Labaiosa

The meeting began on March 22, 2010, with an introduction from Amy Snyder and a presentation from Hosung Ahn (NRC) who discussed scoping and scheduling. Paul Jacobs (FPL) then discussed plant and facility characteristics, future plans and site preparation followed by a discussion by Bob Burtelson (FPL) on wildlife and associated safety considerations on the FPL site with regards to the field trip. Next, David McNabb (McNabb Hydrogeological Consulting Company) presented details for the proposed Underground Injection Control (UIC) system of the site.

Subsequently, all participants toured the principal hydrologic features of the Turkey Point facility. These locations included the proposed site for Units 6 and 7, groundwater monitoring wells, Biscayne Bay, the cooling canals, western interceptor ditch, Card Sound canal, and the L-31E canal.

On the afternoon of Monday March 22, tsunami (FSAR section 2.4.6) and surface water reviews (FSAR Sections 2.4.1 – 2.4.5 and 2.4.7 – 2.4.11) convened separately from groundwater reviews (FSAR sections 2.4.12 – 2.4.13). Tsunami discussions included a conference call with Bechtel geological staff in Maryland and were concluded on March 22.

On Tuesday morning, March 23, the surface water and ground water reviews convened separately and continued to focus on the list of information needs. A conference call was held with FPL's groundwater modeler on Tuesday evening, March 23. By the end of Tuesday, all surface and ground water information needs had been discussed.

On Wednesday morning, March 24, the NRC team members reviewed the calculation packages and references. FPL staff and their consultants were available for questions. In the afternoon, the entire group reconvened and reviewed each item on the list of information needs, applicant responses, and NRC responses to make sure that all parties had a shared understanding of the status of each line item. Consensus was reached on the resolution and the meeting was adjourned around 3 p.m.

Result of Safety Site Audit

Overall, there were 81 Information Needs items (refer to Attachment B). For the groundwater review sections, NRC staff resolved 31 items during the site audit, and resolution of the remaining 10 items will be submitted by the applicant by the end of April 2010. For the surface water review sections (including tsunami), eight items were resolved, and resolution of the remaining 32 items will be submitted by the end of April 2010. Most of these follow up items are anticipated to be resolved by the applicant providing additional or revised text for the FSAR or complete calculation packages for review by NRC staff. One information need item related to tsunamis may result in an RAI due to the time constraints required to do the numerical modeling (2-3 months). Attachment B includes the applicant's response and NRC staff resolution to each information needs item.

Attachment B. Information Needs for Turkey Point COLA Hydrology Safety Site Audit.

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
1	**General**	Hydrology	Provide for review electronic or hard copies of the following references from Turkey Points Units 6 & 7 FSAR: Section 2.4.1: 201, 207, 210, 217, 224; Section 2.4.2: 207, 213, 214; Section 2.4.3: 201, 203; Section 2.4.5: 202, 209; Section 2.4.11: 201, 202, 203; Section 2.4.12: 203, 208, 214, 216, 223, 227, 230, 233, 238, 249; Appendix 2CC: 2, 3, 5, 8, 17, 20; Section 2.4.13: 201, 202. (Note that a few of these items, notably two of the items listed from Section 2.4.2, are published books that are available in many libraries. The only reason to request them is to ensure that they are docketed and made available to the public, if that is a concern for the NRC.)	References will be made available without violating applicable copyright laws. Applicant will set up reading rooms for NRC staff review of calculations and other references.	Resolved.
2	**2.4 – General (but mostly 2.4.1)**	Hydrology	Provide a subject matter expert (SME) to discuss and clarify the use and consistency between the various elevation datums, including NAVD 88, NGVD 29, the Turkey Point Units 6 & 7 DCD reference datum, mean sea level (MSL), and tidal datums such as “mean low water” (used, for example, on FSAR p. 2.4.5-5) as used in reference to gage measurements at Virginia Key and the Miami Harbor Entrance (RG 1.59). The FSAR indicates that at Virginia Key NAVD 88 is 1.6 ft higher than NGVD 29 -- discuss the validity of using this same conversion factor throughout the region (for example, at Lake Okeechobee).	Applicant explained datum conversions and terminology.	Resolved.

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
3	**2.4.2**	Hydrology	Provide an SME to discuss the basis for estimating probable maximum precipitation (PMP) at the Turkey Point site, including the application to south Florida of the southernmost values given in NWS Hydro-meteorological Report No. 51 (HMR 51) and the use of NWS Hydro-meteorological Report No. 52 (HMR 52). Also discuss the basis for using HMR 52 to extend the data to shorter time periods, and the influence of additional rainfall data compiled in the years since HMR 51 and HMR 52 were published.	Applicant described what had been done to evaluate the validity and applicability of the two methods, and noted that no evidence of inadequacies or changes in potential PMP had been detected. Information will be incorporated into the updated FSAR.	Resolved pending submittal of content to be added to the FSAR.
4	**2.4.2**	Hydrology	Provide an SME to discuss the modeling approach (including its conservatism) used to evaluate the probable maximum flooding on-site due to locally intense precipitation, including selection of methods, assumptions about initial conditions and boundary conditions (such as water level in canals outside of site walls), approach to generation of peak flows using the Rational Method, the rationale for the determination of HEC-RAS model options, and values for Manning's roughness coefficient and other input parameters.	Applicant discussed the modeling approach and assumptions. Applicant will provide additional pictorial and text explanation of methods and will provide I/O files.	Resolved pending submittal of the explanation and files.
5	**2.4.2**	Hydrology	Provide an SME to discuss the modeling approach and assumptions for the sheet flow analysis used to predict the maximum depth from the safety structures in the power block (same types of topics as for PMF in the swales).	Applicant explained methodologies and assumptions. Pictorial representation and calculation details will be provided.	Resolved pending submittal.
6	**2.4.2**	Hydrology	Provide an SME to discuss the hydrologic and	Related to Question 4.	Resolved

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
			hydraulic analyses and provide for review calculation packages for the hydrologic and hydraulic analyses done to evaluate probable maximum flooding due to locally intense precipitation.		pending submittal of additional materials (see item 4).
7	**2.4.2**	Hydrology	Provide an SME to clarify the legend and labeling on Fig. 2.4.2-203. The legend does not correspond with flow path arrows, and about half of the subbasins lack flow path arrows. The modeled outlets for each subbasin are not clearly marked, and lines need to be drawn delineating the hydraulic length used in the concentration time calculation.	Applicant will clarify the legend for this diagram and will add omitted information.	Pending submittal of revised figures.
8	**2.4.2**	Hydrology	Provide an SME to discuss the HEC-RAS modeling and make available for review HEC-RAS model files for PMF flows in the four modeled swales.	Related to question 4.	Resolved pending submittal of materials identified for question 4.
9	**2.4.2**	Hydrology	Provide an SME to clarify the location of River Station 0, the downstream boundary cross-section for each of the four HEC-RAS models in Fig. 2.4.2-204. Also, provide tabulated cross-sectional information for River Station 0 similar to what is provided in Table 2.4.2-210.	Related to question 4.	Resolved pending submittal of materials identified for question 4.
10	**2.4.2**	Hydrology	Provide for discussion and review profile sections across the entire site that correspond to HEC-RAS sections in the two swales modeled in the north portion of the site, i.e. 800 (IN6) and 600 (2N3)	Related to question 4. Applicant clarified basis for selection of profile sections. The file will be submitted as	Resolved pending submittal.

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
				part of the I/O package.	
11	**2.4.2**	Hydrology	Provide an SME to discuss the rationale (including its conservatism) for the peak discharge allocation percentage to each cross-section (Table 2.4.2-214).	Applicant provided explanation.	Resolved.
12	**2.4.2**	Hydrology	Provide an SME to discuss the validity of assuming critical depth for the downstream boundary condition for each of the four HEC-RAS models. This implies a free overfall condition at the outlet (perimeter walls) of each of the four modeled swales.	Applicant explained basis for downstream boundary conditions.	Resolved.
13	**2.4.2**	Hydrology	Provide an SME to discuss whether additional cross-sections were added by interpolation and the discuss details of the interpolation, e.g. spacing, number of added sections.	Applicant explained basis for expectation that additional cross-sections could not give more conservative results. Will check validity by evaluating additional interpolated cross-sections, and will report qualitatively on findings.	Pending submittal of additional information.
14	**2.4.2**	Hydrology	Provide an SME to discuss the cross-sections in Fig. 2.4.2-204 and their limitation to portions of the swale as opposed to the full width of the swale.	Applicant explained boundaries of cross-sections.	Resolved.
15	**2.4.2**	Hydrology	Provide an SME to discuss and clarify the legends of the HEC-RAS cross-sections (such as Figure 2.4.2-209), including the meaning of the shading colors (gray and blue).	Additional information will be added to the legends.	Pending submittal of additional information.
16	**2.4.2**	Hydrology	Provide an SME to discuss an approach for assessing combined flooding events for Turkey Point Units 6&7, as described in NRC Regulatory Guide 2.4.2. The	Applicant discussed approach to evaluation of combined events. Will provide	Pending submittal of additional

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
			section “Combined Events Criteria” in that Regulatory Guide states: “The staff reviews the worst flooding at a site that may result from a reasonable combination of individual flooding mechanisms. Some or all of these individual mechanisms could be less severe than their worst-case occurrence but the combination may exceed the most severe flooding effects from the worst-case occurrence of any single mechanism.”	additional discussion of potential impacts of combined events for the updated FSAR.	information.
17	**2.4.3**	Hydrology	Provide an SME to discuss the justification for the conclusion (FSAR page 2.4.3-2) that canal flooding would not influence the flood levels above the estimated probable maximum hurricane level.	Will provide expanded discussion of reasoning for the updated FSAR.	Pending submittal of additional information.
18	**2.4.4**	Hydrology	Provide an SME to discuss the justification for the stated conclusion that any flow that might reach Units 6 & 7 from failure of Herbert Hoover Dike would be very shallow and would not be a source of flooding for the safety-related facilities. *(Wording corrected at request of applicant.)*	Will provide expanded discussion of reasoning for the updated FSAR. Also will address the potential for additional upstream or downstream dams.	Pending submittal of additional information.
19	**2.4.5**	Hydrology	Provide an SME to discuss the basis for estimating (1) initial rise (also called forerunner or sea level anomaly) and (2) expected sea-level rise over the life of the plant. Based on historical records, sea level is stated to have risen at a rate of 0.78 ft per century in the local area (Turkey Point Units 6&7 FSAR page 2.4.5-6). Provide an SME to discuss the various processes and phenomena that have combined to produce this net change in sea level, how this value was used in estimating initial rise and expected future	Applicant explained the basis for initial rise and expected sea-level rise, including the conservatism in the estimates. Applicant will provide discussion (for the updated FSAR) of future sea-level rise relative to plant life expectancy, but will not discuss climate change *per*	Pending submittal of information.

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			sea-level rise, and why it is considered to be appropriate for safety analyses to use 1.0 ft as a nominal long-term sea level adjustment for the future. Discuss how potential sea-level rise due to potential future climate change is accounted for in this analysis.	*se*.	
20	**2.4.5**	Hydrology	FSAR Subsection 2.4.5.1 states that the PMH parameters were established from the historical hurricane from 1851 to 1977 and that these parameters are sufficiently conservative as they include those of the active hurricane period from 1945 to 1970. However, the central pressures of Andrew and Katrina are relatively low. Discuss the potential effects of recent hurricane events after 1977 on these PMH parameters.	Applicant provided discussion.	Resolved.
21	**2.4.5**	Hydrology	Provide an SME to discuss the sensitivity of SLOSH modeling results to the Turkey Point site's location within the curvilinear grid used in the Biscayne Bay implementation of the SLOSH model (the site is near the periphery of the model grid for Biscayne Bay; therefore, the boundary condition and the grid shape could affect the simulation results).	Applicant has provided calculation packages for review and provided discussion.	Resolved pending staff's review of the calculation package.
22	**2.4.5.2.2.5**	Hydrology	Provide an SME to explain why making a 20% adjustment for uncertainty in the SLOSH results makes it unnecessary also to account for the 2.6% effect of probable maximum hurricane (PMH) size on storm surge. The statement and justification in this section are not clear.	Applicant pointed out that the 2.6% effect is for a hurricane larger than the PMH defined by NWS 23, explained that SLOSH is considered to be inherently conservative for large surge heights, and thus	Resolved pending staff's review of the calculation package

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				hurricane size issue is included within the 20% envelope provided by the model.	
23	**2.4.5**	Hydrology	Provide an SME to discuss the changes made in SLOSH to apply the model to this analysis.	Applicant explained that no modification was made to SLOSH.	Resolved.
24	**2.4.5**	Hydrology	Provide for review the SLOSH input, typical output, and calculation packages.	Applicant will provide I/O for review as part of the I/O package.	Resolved pending submittal of calc packages.
25	**2.4.5**	Hydrology	Provide an SME to discuss the large uncertainty in SLOSH modeling (described in Turkey Point Units 6&7 FSAR Section 2.4.5.2.2.5) and possible opportunities to reduce this uncertainty.	Applicant supplied information on validation studies of the model.	Resolved.
26	**2.4.5**	Hydrology	Discuss (i) the potential beach erosion by hurricane, (ii) the hurricane wave forces (both static and dynamic) and their effects on design and operation of safety-related facilities, (iii) the fragility of the retaining wall structure (Turkey Point Units 6&7 FSAR pg. 2.4.6-1) with regard to forces specific to hurricane waves, and (iv) the effects of retaining wall on wave run-up – The submerged wall could rise surge level.	Resolved and related to questions 36 and 39.	Resolved pending the outcome of 36 and 39.
27	**2.4.5.3.2**	Hydrology	Provide an SME to discuss the approach used to estimate the height, period, and run-up of wind waves, including identification of the specific procedures from the Coastal Engineering Manual that used. Also	Applicant provided explanation. Additional information is provided in the calc package detailing	Resolved pending review of the calc

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			provide the calculation packages for review.	equations and specifics.	packages.
28	**2.4.6.1.1 & 2.4.6.1.7**	PMT	Provide a subject matter expert (SME) to discuss how the continental shelf is defined. Is the applicant including the deeper Blake Plateau erosional bench (600-800 m deep) with the narrow continental shelf (<150 m deep)?	Applicant explained their definition. FSAR update	Pending submittal of information.
28-1	**2.4.6.1.1 & 2.4.6.1.5**	PMT	Supply evidence to show that the impact of landslide generated tsunamis along a coastline is considerably reduced away from the main axis of the slide (FSAR pg. 2.4.6-2). For U.S. Atlantic Margin landslides that the applicant identifies (including mass movements along the Blake Escarpment), supply evidence of their propagation, runup, and inundation characteristics at the Turkey Point site, given the specific offshore physiography of the southern U.S. Atlantic Margin. In addition, what is the corresponding runup value at the Turkey Point site from an estimated 3.5 m offshore amplitude at the latitude of Palm Bay, FL for a Caribbean earthquake tsunami source (FSAR pg., 2.4.6-7)?	Applicant will provide explanation and references in updated FSAR. Applicant will provide site-specific analysis with near shore bathymetry.	If not received by the time pSER with RAIs is written staff will issue RAI.
29	**2.4.6.1.1**	PMT	Provide a subject matter expert (SME) to discuss potential landslide tsunami sources local to the Turkey Point site along the western edge of the Bahama Platform, the Florida Straits, Cay Sal Bank, and off the northern coast of Cuba.,	Applicant provided discussion and cited references and reports. Applicant will include the information in the update of the FSAR.	Pending submittal of information.
30	**2.4.6.1.3**	PMT	Provide a subject matter expert (SME) to discuss potential landslide tsunami sources off the carbonate platform edge north of Puerto Rico.	Applicant discussed the various potential landslide tsunamigenic sources. More	Pending submittal of information.

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				specifically Puerto Rican landslide which is important for determining PMT was discussed. The information will be included in the FSAR update.	
31	**2.4.6.1.6**	PMT	Provide a subject matter expert (SME) to discuss whether tsunami water levels at the Turkey Point site were estimated from mid-plate earthquakes occurring along the U.S. Atlantic Margin.	Applicant provided discussion. Applicant will include source characterization for interpolated earthquake sources in the Atlantic Margin. This information will be included in the updated FSAR.	Pending submittal of information.
32	**2.4.6.2**	Tsunami Deposit	Provide a subject matter expert (SME) to discuss available geologic records of “seismic paleotsunami deposits” at the Turkey Point site (e.g., borings/coring/trenching) and how they would be distinguished from non-seismic tsunami and hurricane overwash deposits. Are there geologically conducive locations for the deposition and preservation of tsunami deposits at the Turkey Point site or nearby regions?	Applicant provided discussion of seismic paleotsunami deposits. Applicant will include discussion in the updated FSAR. Additional MacTec geotechnical reports are provided in the COLA Part 11 Enclosures. Additional information in 2.4.12 and 2.5.1 and 2.5.4. The information will include the additional references for lake deposits.	Pending submittal of information.

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33	**2.4.6.3**	Tsunami Source	(Oblique Earthquake Slip Angles): Provide a subject matter expert (SME) to discuss the expected variation in vertical deformation of the sea floor with respect to the earthquake slip angle.	Applicant provided discussion. Detailed discussion on quantitative analysis of vertical displacement dependency on rake OR worst case of 90 degrees rake will be included in the updated FSAR.	Pending submittal of information.
34	**2.4.6.4**	Tsunami Analysis	(1) Provide justification for a qualitative tsunami analysis specific to the Turkey Point site (FSAR pg. 2.4.6-13). (2) Provide a subject matter expert (SME) to discuss the availability of high-resolution topography and bathymetry (e.g., lidar) near the proposed site for tsunami wave modeling.	This is also related to 28-1. For part 1 see 28-1. For part 2 , high resolution topo data is available from NOAA PART 2 is RESOLVED.	Part 1 not resolved and related to 28-1. Part 2 Resolved.
35	**2.4.6.5**	Tsunami Water Levels	(1) Provide a subject matter expert (SME) to discuss the procedure for determining tsunami water levels at the Turkey Point site from offshore tsunami amplitudes, including how a runup amplification factor of 2 is determined (FSAR pg. 2.4.6-16). (2) Provide an SME to clarify whether tsunami water levels from the Hispaniola fault segment of the northern Caribbean subduction zone (not included in FSAR Reference 211) were estimated.	This is also related to 28-1. For part 1 see 28-1. Part 2 with regard to inclusion of data from Hispaniola fault segment. Applicant will provide qualitative discussion which discounts this source OR more quantitative data and analysis.	For part 2 the update is pending submittal of information..
36	**2.4.6.6**	Breakwater Influences	(1) Provide a subject matter expert (SME) to discuss the effect of refraction and focused propagation through and into the natural and artificial channels	Part 1 - is related to 28-1. Part 2 – Applicant will add clarification	Pending submittal of additional

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			(e.g., dredged navigation channel) within Biscayne Bay on nearshore tsunami propagation. (2) Discuss (i) the tsunami wave forces (both static and dynamic) and their consequences on the design and operation of safety-related facilities, (ii) the fragility of the retaining wall structure (FSAR pg. 2.4.6-1) with regard to forces specific to tsunami waves. (3) Discuss the propagation times and durations of critical tsunami events as this information are needed for preparing emergency procedures and probabilistic risk assessment.	to Section 2.4.10 to indicate that the wall would be designed to withstand hydrostatic and hydrodynamic forces. Part 3 – the importance of preparedness is conditional depending on DBF.	material and outcome of 28-1.
37	**2.4.9**	Hydrology	Provide an SME to discuss the uncertainty related to future shoreline changes, including (1) the potential for sea-level rise due to future climate change to increase the rate of shoreline change and (2) the potential for erosion or inundation of the barrier islands that currently help to protect the site of Units 6&7 from wave action.	No discussion will be included about climate change based on applicants and NRC Counsel discussion as reported by the applicant. The discussion will be on sea level rise.	Pending submittal of information.
38	**2.4.9**	Hydrology	Provide an SME to discuss the influence of coastal protection structures, dredging, and other human activities on the stability of the shoreline in the vicinity of the site of Units 6&7.	Applicant will incorporate discussions in the update to the FSAR explaining the proposed plant will not be affected for the operational life.	Pending submittal of information.
39	**2.4.9 (also**	Hydrology	It is stated that Units 6&7 retaining wall structure has a	Applicant stated that the	Resolved,

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
	2.4.14)		top of wall elevation varying from 20 feet to 21.5 feet NAVD 88 (Turkey Point Units 6&7 FSAR page 2.4.9-3). Provide an SME to discuss how the retaining wall design handles hurricane surge up to the probable maximum storm surge and coincidental wave run-up condition, which is calculated to be at elevation 24.8 feet NAVD 88.	structure is not safety related and the detailed design that shows the wall withstands hydrostatic and hydrodynamic surge related forces will be included in the update to the FSAR. Also discussed in question 36.	pending submittal of additional information for Section 2.4.10.
40	**2.4.12**	Hydrology	Provide for review all input/output computer files used for modeling the Biscayne aquifer in the vicinity of Turkey Point and beyond to simulate the localized effects of steady-state, constant-density groundwater flow, the effects of construction dewatering, the effects of construction of Units 6 & 7 (site grade increase and use of cut-off walls for groundwater control), and the operation of the radial collector wells.	1) Calculation package will be provided through reading room by April 30 2) Input/output file will be provided by April 30. 3) Applicant submitted updated modeling result (using pumping tests for radial collector wellss) in SCA to South Florida Water Management District (SFWMD) The updated groundwater modeling report is available at FDEP website, along with the most recent list of questions from SFWMD.	Input/output files for both current (FSAR) and revised (SCA) modeling efforts will be providedby April 30. Calculation packages for the transport analysis and modeling presented in FSAR were reviewed at the site audit.
41	**2.4.12.1, 2.4.12.2**	Hydrology	Discuss subsurface lithology in terms of figures found in Section 2.5 (Figures 2.5.1-203 – 2.5.1-210), showing multiple cross sections (e.g., N-S, E-W) of	Try better connection with 2.5 and other sources of information.	Respond by April 30.

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
			the subsurface geology and hydrology, including lithologies, thicknesses, and depths, based on site-specific investigations and consistent with the current COL, the existing site license, and/or other local resources. Provide an SME to discuss the subsurface geology and hydrology in terms of this figure. Clarify the use of different formation terminology that is found in other reports, such as the Dames and Moore (1971) investigation and the MacTec investigation.	The applicant will provide a road map for this plan by April 30.	
42	**2.4.12.1.3.2**	Hydrology	The statement "The top of the Hawthorn Group occurs at approximately -100 to -200 feet mean sea level (MSL) in the vicinity of the site" (Turkey Point Units 6&7 FSAR page 2.4.12-6) references a USGS Water Resources Investigation for the Floridan aquifer system in Southeastern Florida. Provide site-specific and refined information from sources such as might be found in Section 2.5 (Figures 2.5.1-203 – 2.5.1-210), the existing site license, and/or local groundwater/wastewater investigations to understand the spatial distribution (depth and thickness) of the Hawthorn Group.	Clarify variability using site specific information. Provide further clarification on subsurface lithology at site.	Respond by April 30.
43	**2.4.12.1.3.1**	Hydrology	Turkey Point Units 6&7 FSAR states that the base of the surficial (Biscayne) aquifer is defined by a significant change in hydraulic conductivity, while Fig. 2.4.12-204 suggests that a change in gamma log signature defines the lithologic boundary between the surficial aquifer and the confining unit. Provide an SME to discuss and explain which criteria is used and why.	Explained. Lithologically, the change in gamma signal shows the contact. Hydrogeologically, the change in gamma signal reflects a change in the clay content, which affects the hydraulic conductivity,	Resolved.

ID #	FSAR Section	Discipline	Information Needs	Applicant Response	NRC Response
44	**2.4.12.1.3.3**	Hydrology	Provide an SME to describe the extent to which the Ocala Limestone is present below the site, and its characteristics.	Make consistent the geological formations present between FSAR Sections 2.4 and 2.5.	Resolved.
45	**2.4.12.1.3.3**	Hydrology	"The Upper Floridan aquifer is 200 feet thick in the vicinity of the TP plant." Provide borehole information such as might be found in Section 2.5 (Figures 2.5.1-203 – 2.5.1-210), to support the thickness and distribution of the Upper Floridan, e.g. but not limited to, the aquifer production wells mentioned in Turkey Point Units 6&7 FSAR Section 2.4.12.1.5.3.	No site specific information provided.	Resolved.
46	**2.4.12.1.3.3**	Hydrology	"In many places the middle confining unit is divided into upper and lower units separated by the Avon Park permeable zone." Provide an SME to discuss whether the confining unit itself is separated into upper and lower confining units with a more permeable Avon Park separating them, and/or if the Avon Park consists of multiple low permeability units and a more permeable unit. Provide site-specific or proximal data to support this discussion in addition to the regional USGS report (Reference 206).	These data are regional. No site specific data. The applicant will provide the geologic data from nearby deep well injections and other data (get copies from Stud) NRC and safety consultants will also look at the data.	Respond by April 30 2010.
47	**2.4.12.2.4.3**	Hydrology	Turkey Point Units 6&7 FSAR page 2.4.12-29 states, "The base of the middle confining unit is encountered at a depth of approximately 2460 feet in a well (MDS-I12) drilled in southeastern Miami-Dade County, 230 feet below the top of the Oldsmar Formation," but Fig. 2.4.12-202 shows the top of the Lower Floridan (and	The applicant will provide MDS-I12 data. No site specific data available. David will provide through Paul MDS-112 and Florida	Resolved.

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			base of confining unit) at a depth of 2400 feet and the top of the Oldsmar Formation at a depth approximately 3100 feet. Describe and provide site-specific data, such as from the current investigation, the existing site license, and/or local groundwater/wastewater investigations to refine the spatial distribution (depth and thickness) of the Oldsmar Formation and the relationship with the Lower Floridan aquifer. Provide an SME to discuss the data and analysis.	City DWI data soon. Data were provided at the site audit.	
48	**2.4.12.2.4.3**	Hydrology	Clarify if "the zones that contain highly transmissive dolomite with cavernous porosity are found in the upper to middle part of the Oldsmar Formation in southeastern Florida" (Turkey Point Units 6&7 FSAR page 2.4.12-29) are equivalent to the "boulder zone" into which the wastewater will be injected.	It is part of boulder zone - Clarify on page 29. Provide clarifying wording.	Respond by April 30 2010.
49	**2.4.12.2.4.3**	Hydrology	Turkey Point Units 6&7 FSAR page 2.4.12-29 states that "The base of the middle confining unit is encountered at a depth of approximately 2460 feet in a well (MDS-I12) drilled in southeastern Miami-Dade County, 230 feet below the top of the Oldsmar Formation." This statement seems inconsistent with Fig. 2.4.12-202 which shows the top of the Lower Floridan (and base of confining unit) at a depth of 2400 feet, but the top of the Oldsmar Formation at a depth of maybe 3100 feet. Provide an SME to discuss the placement of the Oldsmar Formation in southeastern Florida.	Similar to #47.	Resolved.

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50	**2.4.12.2.1.3**	Hydrology	Provide for review a figure with better scale and clarity to understand the relative location of the collector wells which are difficult to see on Fig. 2.4.12-218.	Clarify figure caption	Resolved.
51	**2.4.12.2.1.3**	Hydrology	Provide an SME to discuss the use of the Boulder Zone for Class I injection wells, whether all 90 Class I wells inject into the Boulder Zone, and provide the source(s) of information on this topic.	Movement of injectates (saltwater is denser than boulder zone water is discussed in 1991 Ground Water journal vol 29-#2, FDEP report, and EPA 2003 on UIC.	Respond by April 30 2010.
52	**2.4.12.2.1.3**	Hydrology	Provide an SME to discuss the chemical composition of the “plant wastewater” or “treated liquid radioactive waste” from Units 6 & 7 which is proposed for deep well injection.	It is mentioned in ER 3.6m. Also described briefly on this subsection.	Respond by April 30 2010.
53	**2.4.12.2.2.1**	Hydrology	Provide an SME to discuss the Upper and Lower Surficial aquifer with additional lines of evidence to support the theory of an upward gradient in the surficial aquifer other than the limited < one year sampling event. Describe the effects of seasonality (wet season/dry season), the effects of climatic variation (extreme drought or extreme wet years), and the effects of global/regional climatic change that might occur in the lifetime of the plant.	Data collection will be continued and FSAR will be updated correspondingly. Will evaluate upward gradient with additional data available. Impacts to FSAR 2.4.13 may be minimal.	Resolved.
54	**2.4.12.2.2.2**	Hydrology	Provide an SME to discuss the circulation through the surficial aquifer including the influence of the middle confining unit as inferred from the modeling investigation in Appendix 2CC.	Clarified.	Resolved.
55	**2.4.12.2.4**	Hydrology	Turkey Point Units 6&7 FSAR page 2.4.12-22 states	The applicant will look at the	Resolved.

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			"The Boulder Zone packer tests listed in Table 2.4.12-206 (data from the Miami Dade Water and Sewer Authority (MDWASD)) show transmissivities lower than those reported for other regional testing of the Boulder Zone," e.g., hydraulic conductivities shown in Table 2.4.12-205 (from Reference 237, a regional EPA report). Table 2.4.12-206 shows transmissivities of the Boulder Zone to be <100 ft^2/d, while Table 2.4.12-205 shows hydraulic conductivity of the Boulder Zone to be 6500 ft/d (where thickness is 500 feet resulting in transmissivity of 3 million ft^2/d). Provide an SME to discuss which estimates were used in your calculations and modeling, the basis for choosing these estimates, and how uncertainties were considered in your calculations and modeling.	table again. Will provide detailed calculation package.	
56	**2.4.12.2.4**	Hydrology	Turkey Point Units 6&7 FSAR page 2.4.12-22 states that "The depths given on the table [Table 2.4.12-206] suggest that the tests were performed in the interval between the top of the Lower Floridan aquifer and the top of the Boulder Zone as determined from cross section Y-Y in Reference 206." Page 2.4.12-16 of the FSAR states that the Boulder Zone is located between 2000-3400 feet in depth and its thickness is 700 feet. Provide an SME to discuss the basis for suggesting that the tests in Table 2.4.12-206 by the Miami Dade Water and Sewer District (MDWASD) were not in the Boulder Zone, and provide values from any additional tests available to you that were performed by MDWASD or other agencies, such as but not limited	Clarified. Clarify FSAR in the future.	Resolved.

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			to the additional test by MDWASD in which hydraulic conductivity was 4250 feet/d (discussed on p.2.4.12-30).		
57	**2.4.12.2.4**	Hydrology	Provide an SME to discuss the "weighting averages" of hydrogeologic properties in Table 2.4.12-205 in the context of subsurface flow modeling and how these values compare to the actual measured values and values reported in other studies conducted in southern Florida.	The table comes from EPA 2003 report. Clarify the implication of this table and clarify the methods and values used in FSAR.	Respond by April 30 2010.
58	**2.4.12.3.2**	Hydrology	Provide an SME to discuss the potential for upward migration of injectate at Turkey Point considering upward migration has been detected into the USDW at 3 injection well locations in southern Florida and in an additional 7 injection well locations upward migration has been detected but below USDW. Discuss the injection rates and chemical/physical properties of injectate associated with injection wells where upward migration has been detected.	Already discussed.	Resolved.
59	**2.4.12.3.2**	Hydrology	Please provide a clearer description of the location of the Turkey Point injection wells (total of 12 proposed) in the boulder zone and the subsurface stratigraphy at the location. Discuss the basis of determining the location and spacing of the injection wells. Provide an SME to discuss the Turkey Point injection well stratigraphy in comparison to injection wells sites in South Florida where upward migration has been detected.	Explained.	Resolved.
60	**2.4.12.4**	Hydrology	Provide an SME to discuss the monitoring program	Presented in Page 35 – will	Resolved.

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			and the kind of physical and/or water quality changes that the plan will detect in the Biscayne aquifer.	meet state requirements. UIC will be handled in ER.	
61	**2.4.12.4**	Hydrology	Provide an SME to discuss the types of geochemical monitoring of the Floridan aquifer that will be conducted according to the underground injection control regulations (Chapter 62-528 FAC). Describe the conceptual pathway and timeframe from an observed monitoring incident (upgradient migration) to shutdown.	Consider upwelling pathways and estimate effects of this pathway – will consider RAI for FSAR 11 or ER.	Resolved.
62	**2.4.12, Appendix 2CC**	Hydrology	Provide clear figures to replace those in Appendix 2CC. All figures are blurry and writing contained in them is illegible.	NRC reviewer provided the list of unclear figures. The applicant will provide refined figures.	Respond by April 30 2010.
63	**2.4.12, Appendix 2CC**	Hydrology	Provide an SME to discuss the location and operation of the radial collector wells, and the effects on local/regional groundwater flow patterns as inferred from groundwater modeling.	Radial collector wells are not a safety issue.	Resolved.
64	**2.4.12.5, Appendix 2CC**	Hydrology	Provide an SME to discuss and describe the changes to the current site configuration due to the backfill, and the location of the ground surface and the water table after the changes to site grade as inferred from groundwater modeling. Discuss the characteristics of the fill material and the hydrostatic loading at the site under normal and extreme conditions.	Discussed and calculations checked.	Resolved.
65	**2.4.12.2CC 5.2.1**	Hydrology	Although sensitivity analyses were conducted with various vertical hydraulic conductivities, there is no mention of varying the horizontal hydraulic conductivities in the subsurface modeling. Provide an	The flowpath is vertical so horizontal sensitivity is not needed.	Resolved.

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			SME to discuss the absence of information on variability of horizontal hydraulic conductivity.		
66	**2.4.12.2CC 5.2.2**	Hydrology	Provide an SME to discuss the revised shoreline impact on modeling of radial collector wells as the assumptions increase the percentage of flow originating from Biscayne Bay to 95 percent.	Discussed with modelers on conference call in afternoon. Radial collector wells not a safety issue.	Resolved.
67	**2.4.12.5**	Hydrology	Provide an SME to discuss the mechanics, monitoring, and expectations of the dewatering system that is needed during construction, including the plans for disposing of the dewatered water.	Construction dewatering (10000 gpm).	Resolved.
68	**2.4.12.2CC**	Hydrology	Provide an SME to discuss the sensitivity analysis of assumptions/parameters in the groundwater modeling effort specifically for: the assumption that cooling canals are in steady state (need reference), horizontal hydraulic conductivities, dewatering simulations considering failure of cut-off walls and cut-off wall properties, and the selection of WEL package for simulating horizontal well dewatering as opposed to other methods within MODFLOW such as the drain package (DRN) or the multi-node well package (MNW).	Golder publication addressed canals. Dewatering considered failure of cut-off walls. Hydraulic conductivity of cut-off walls was 1 e-8 cm/s (design basis 8.3 e-10 cm/s). Selection of WEL package was simpler and supported by literature use.	Resolved.
69	**2.4.13.1.1**	Hydrology	Provide an SME to discuss the basis of 0.12/0.25 used to adjust the failed fuel rate from the design basis to a conservatively bounding value for this analysis.	From Westinghouse scaling factor (DCD).	Resolved.
70	**2.4.13.1.2**	Hydrology	Provide an SME to discuss the design basis for the 19’ of concrete fill and 3’ thick side walls with respect to migration following an accidental release of effluent	From the foundation design. It is very conservative. Details are in calculation	Resolved.

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			holding tank liquids.	package.	
71	**2.4.13.1.2.1**	Hydrology	Provide an SME to discuss how the L31E Canal and the western interceptor ditch influence groundwater quality west of the canals in the upper portion of the surficial aquifer. Describe how the water level is monitored and/or what controls pumping of water into the western canals to maintain the freshwater hydraulic gradient. Describe how boundary conditions and steady-state groundwater flow are represented in the shallow subsurface flow modeling.	Modeling question. Did monitoring on the west side of the L-31E canal.	Resolved.
72	**2.4.13.1.3**	Hydrology	Provide an SME to discuss the source (i.e., a Table or Figure in Section 2.4.12.2.4) of the hydraulic parameters used in the radioactive release scenario.	Table 2.4.13-202.	Resolved.
73	**2.4.13.1.3.1**	Hydrology	The radioactive release scenario appears to show all radionuclides are below the ECL considering only decay in Table 2.4.13-202. Provide an SME to discuss the uncertainties in this approach and the need for subsequent scenarios.	Discussed.	Resolved.
74	**2.4.13.1.3.2**	Hydrology	Provide an SME to discuss the dilution factor attributed to 4 billion gallons of water in the cooling canals in relation to influencing shallow subsurface modeling, water and radionuclide residence time in the canal, and radionuclide release transport modeling.	Table 2.4.13-203 lists baseline condition plus accidental release. Page 5 3rd paragraph describes three release sources. Consider pathway to Biscayne Bay as downward gradient pathway.	Resolved.
75	**2.4.13.1.3.2**	Hydrology	The contribution of tritium from the accidental release	Same as #74.	Resolved.

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			is determined to be negligible compared to the existing tritium concentrations in the canals. Provide an SME and documentation to discuss if this tritium concentration is below the ECL.		
76	**2.4.13.1.3.3**	Hydrology	Provide an SME to discuss factors that might have produced the range in distribution coefficients (K_d) in Table 2.4.13-204. Add a citation for the source of this data and the methods used to derive the data.	Kd report is available for staff's review. It was produced by ANL using standard methods.	Resolved.
77	**2.4.13.1.3.3**	Hydrology	Provide an SME to discuss and explain whether the geometric mean or the lowest measured distribution coefficients (K_d) (from Table 2.4.13-204) were used in the simulation considering decay and adsorption.	Did not use adsorption.	Resolved.
78	**2.4.13.1.3.4**	Hydrology	Provide the input parameters used in the RESRAD modeling and the list of output results.	Did not use RESRAD but used values form RESRAD manual.	Resolved.
79	**2.4.13.1.3.4**	Hydrology	Provide an SME to discuss and describe how the non-default value of 25% for fish, based on likelihood that a fisherman would also fish outside of the contaminated area, and that fish are not confined to the contaminated area, is the most conservative approach.	Default value is 50%, but 25% is not more conservative. Refer to Table A-1 from Reg Guide 1.109.	Respond by April 30 2010.
80	**11.2.3.5**	Radioactive waste management	Provide an SME to discuss the transport modeling for the off-site hypothetical water supply well located in Boulder Zone presented in this section (9776 ft NW of proposed injection wells; off FPL property). Provide information and assumptions associated with modeling the travel time for the injectate to reach the off-site receptor well for comparison to MODFLOW	They were described in two calculation packages. No model was used for boulder zone transport (relies on a simple calculation which was provided in site audit). Pathway to surficial aquifer is	Resolved.

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			and RESRAD modeling assumptions presented in FSAR Sections 2.4.12 and 2.4.13 .	not plausible.	