

PMLevyCOLPEm Resource

From: Anderson, Brian
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Cc: LevyCOL Resource; McGovern, Denise
Subject: NRC presentation - Levy County ACRS full committee
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Bob –

Attached is the NRC staff's presentation for Thursday's full committee meeting with ACRS.

FYI,
Brian

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United States Nuclear Regulatory Commission

Protecting People and the Environment

Levy County Units 1 and 2 COL Application

Staff Presentation to
ACRS Full Committee

December 1, 2011

Levy County COL Review Team

- Technical Reviewers
 - Dr. Stephanie Devlin, Seismologist
Geoscience and Geotechnical Engineering Branch
 - Pravin Patel, Structural Engineer
Structural Engineering Branch
 - Tony Bowers, Emergency Preparedness Specialist
New Reactor Licensing Branch, Office of Nuclear Security and Incident Response
- Project Manager
 - Brian Anderson

Staff Presentation

- COLA Overview
- Geology, Seismology, and Geotechnical Engineering
- Foundation Design and Seismic Analyses
- Emergency Planning

Levy County COLA Overview

- Third AP1000 COL application presented to ACRS
 - Revision 19 of the AP1000 DCD is incorporated by reference
- No site-specific departures or exemptions
- Utilizes a greenfield site
- Does not have any associated Limited Work Authorization (LWA) or Early Site Permit (ESP)
- No open items

Levy County Units 1 and 2
COL Application

Staff Presentation to ACRS Full Committee

Section 2.5
Geology, Seismology, and Geotechnical
Engineering

December 1, 2011

Basic Geologic & Seismic Information, Surface Faulting

- **Primary concern for FSAR Sections 2.5.1 and 2.5.3 is the potential for occurrence of karst and related dissolution features at the Levy site**
 - Applicant identified karst and related dissolution features as the only potential geologic hazard in the site area.
 - Capable tectonic structures and surface faulting are of negligible concern because the entire Florida Platform, which contains the site region, has been tectonically stable for the last 145.5 Ma.
 - Outcrops are sparse, so core and geophysical borehole logs were examined during multiple site audits (April and September 2009, February 2010) for assessing the occurrence of karst and related dissolution features at the site.

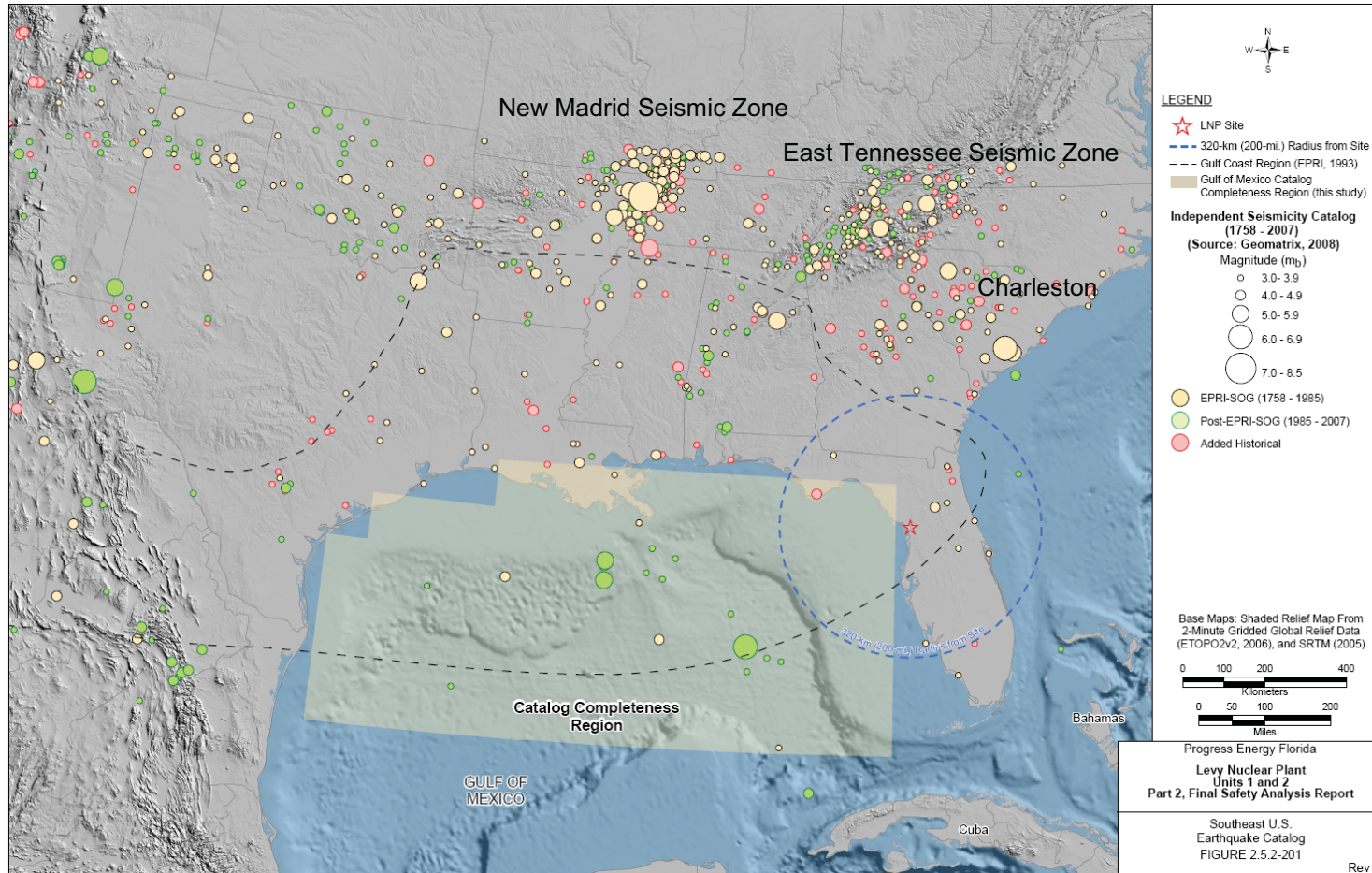
Factors for Staff Assessment of Karst

- Low core recovery zones: Based on new borehole data, staff confirmed low-recovery zones in original site characterization boreholes were soft, laterally discontinuous, weathered zones in the normal stratigraphic sequence of the Avon Park Formation, not dissolution voids.
- Thickness of Quaternary sediments: Increased thickness of Quaternary deposits seen in some site borings likely related to deposition in paleochannels, not in collapse features.
- Dissolution rates: Upper 150 m (500 ft) of the Avon Park is primarily dolomitized limestone, so less susceptible to dissolution than pure limestone. Calculated dissolution rate for pure limestone at Crystal River 3 was $6E-3$ percent over a 60-year plant life, so potential for dissolution of dolomitized Avon Park at the Levy site is negligible during life of the plant.

Factors for Staff Assessment of Karst Cont'd.

- Springs: No springs in the Avon Park in the site vicinity indicates a lack of subsurface conduits for rapid groundwater flow.
- Lateral extent of voids: Maximum lateral void extent in the Avon Park calculated to be 1.6m (5.3ft) from actual grout uptake. Maximum lateral extent then conservatively estimated to be 3m (10ft) based on increasing actual grout uptake volumes by 50% for vertical fractures and 100% for horizontal bedding.
- Fracture and bedding plane intersections: Borehole data show no evidence of extensive, dissolution-enlarged, interconnected fractures or bedding planes in the subsurface at the site location.
- Geologic mapping License Condition: License Condition relates to both tectonic (i.e., faulting) and non-tectonic (i.e., collapse and subsidence due to dissolution) deformation features. It provides a final check for evidence of dissolution voids at the site location.

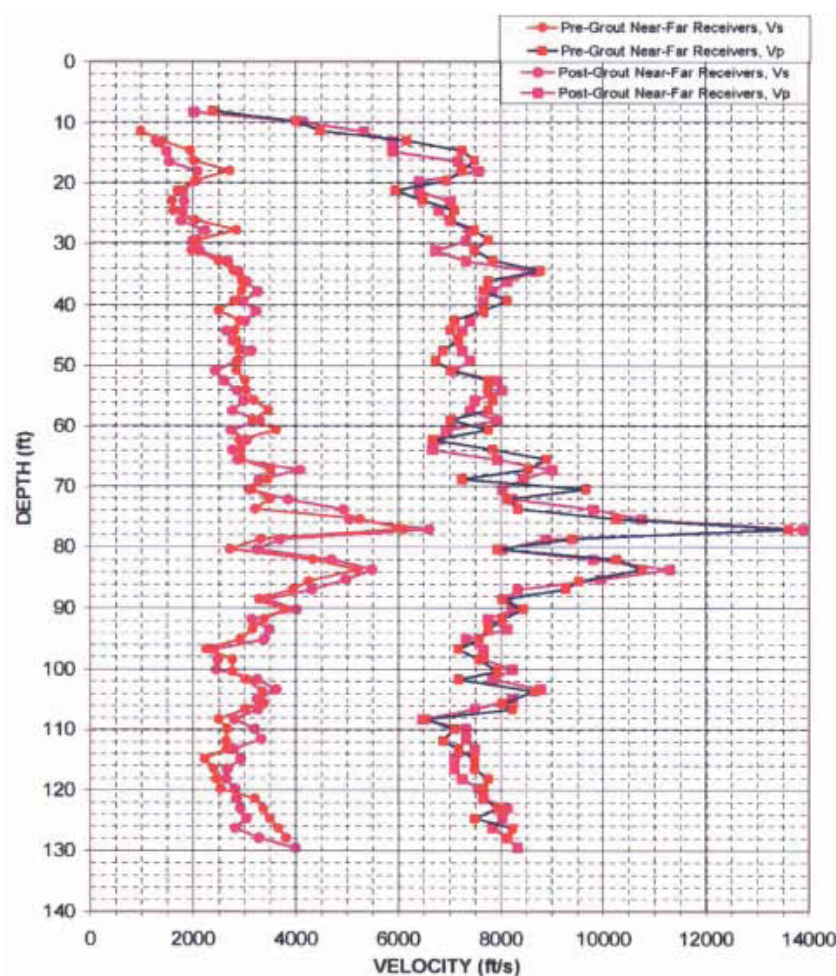
Updated Seismicity Catalog



EPRI-SOG historical earthquake catalog complete from 1627-1984. Applicant updated it with seismicity from 1985 through December 2006 using more current seismicity catalogs. No earthquakes with $m_b > 4.3$ occurred in the site region.

Grouting Program and Seismic Wave Velocities

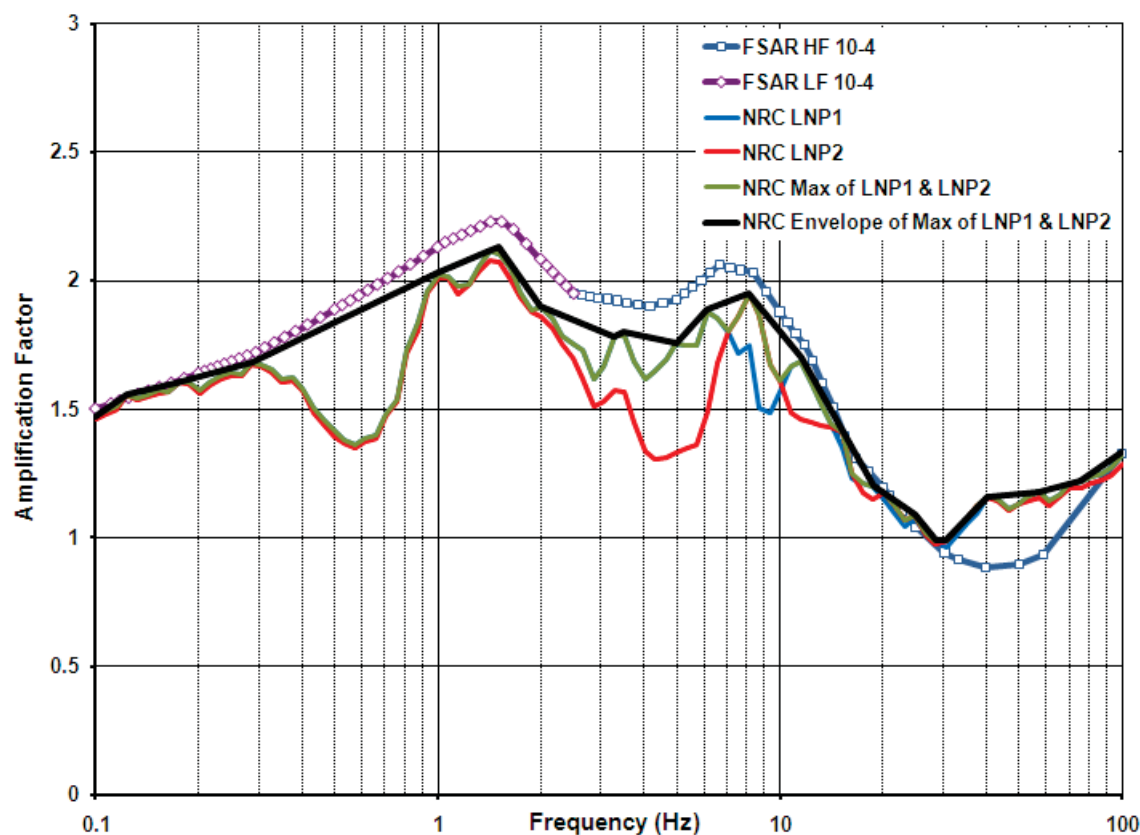
- Issue: Staff was concerned that seismic wave velocities are the same before and after the applicant's grouting program.
- Resolution: Applicant's grout test program measured velocities pre- and post-grouting. Measurements demonstrate that the grouting program do not alter the measurements of seismic wave velocities. Therefore, this issue is resolved.



Pre- and post-grouting seismic wave velocity measurements (AFSER Figure 2.5.2-9)

Confirmatory Analysis of Site Response Calculations

- Site amplification functions were calculated for both LNP Unit 1 and 2 profiles and later enveloped to provide a conservative estimate.
- NRC Staff performed an independent site response analysis and confirmed the applicant's results.



Applicant's functions equal to or exceed the staff's in frequency ranges 0.1 to 30 Hz and 80 to 100 Hz. The staff's function exceeds the applicant's in frequency range 30 to 75 Hz. This exceedance is not significant, and is related to limitations of the different methods applied. (AFSER Figure 2.5.2-12)

Summary of NRC Safety Evaluation Results for Stability of Subsurface Materials and Foundations

- Dolomitization of the Avon Park Formation decreases dissolution rate, and no large dissolution cavities occur in the subsurface at the site location based on borehole data.
- Two-phase grouting from elevations -24ft to -99ft will inhibit percolation of meteoric water at the site location.
- Bearing capacity of the Avon Park is adequate to support static and dynamic loads.
 - Applicant's analysis assumed a 10 ft x 10 ft cavity beneath the 35-ft thick RCC bridging mat that will replace the Avon Park from +11ft to -24ft.
 - Applicant's sensitivity analyses varied locations of cavities and showed no detrimental effects on foundation rock stability.
- Settlement and differential settlement are below AP1000 DCD limits.
- Liquefaction is not possible under the nuclear island due to properties of the Avon Park Formation.
 - Liquefiable ground outside the nuclear island will either be removed and replaced with engineered backfill or stabilized with drains to prevent liquefaction.

Levy County Units 1 and 2 COL Application

Staff Presentation to ACRS Full Committee

Chapter 3 – Design of Structures, Components, Equipment, and Systems

December 1, 2011

Design Ground Motion Response Spectra

- **Issue:** Engineering backfill needed to raise the plant grade to be consistent with DCD soil profiles required site specific analysis.
- **Resolution:** The Staff performed confirmatory site response analyses and checked the minimum required ground motions per 10CFR Part 50, Appendix S.
 - Both the FIRS and surface PBSRS are well below the AP1000 CSDRS and HRHF.

Site Specific Soil Structure Analysis

- **Issue:** LNP free field response analysis showed that the AP1000 CSDRS for the vertical seismic excitation does not envelope the design grade deterministic surface spectra in the high frequency range.
- **Resolution:** The applicant developed an SSI model to compute ISRS for the site-specific soil profile and foundation geometry.
 - The applicant demonstrated that the LNP ISRS are enveloped by the AP1000 generic ISRS at all of the six NI key nodes with sufficient margin.

Maximum Relative Displacement Between the Nuclear Island and the Adjacent Building Foundation

- **Issue:** Applicant computed the probable maximum relative displacement between the NI and adjacent building foundations. The seismically induced lateral deformation of soils surrounding the drilled shafts needed to be incorporated into the analyses in addition to shaft deformation.
- **Resolution**
 - Maximum relative displacement computed by the applicant is 0.7 inches.
 - The computed displacement between the NI and adjacent building is less than the 2.0 inch gap required per the DCD.
 - Interaction between NI and adjacent buildings is not a concern.

Drilled Shaft Foundations Design and Installation

- **Issue**
 - The seismic Category II and non safety-related adjacent buildings are supported on drilled shaft foundations. NRC staff requested additional information related to the design methodology of the drilled shafts supporting the structures adjacent to the NI.
- **Resolution**
 - The applicant demonstrated that the backfill provides lateral support to the drilled shafts.
 - A description of construction sequence and practices to be used for construction of the drilled shafts was provided in the FSAR.
 - An ITAAC was proposed to ensure that the as-built design provides adequate vertical and horizontal capacity and stiffness.
 - The applicant demonstrated that the seismic separation between buildings is adequate to prevent interaction with the NI structures.

RCC Strength and Constructability Verification Program

- **Issue:** Roller Compacted Concrete (RCC) bridging mat (classified as safety-related) will be used to transmit the NI loads under static and dynamic conditions to the karst foundation.
 - Additional information required to demonstrate that the RCC Bridging Mat is capable of transferring the NI loads while providing the desired level of performance.
 - The applicant's Construction Verification Program did not initially address the capability of the as-placed material to transfer design forces across the bedding joints.
- **Resolution**
 - The RCC construction will follow standard industry guidance with additional enhancements related to Quality Assurance.
 - Nominal strength capacities established during conceptual design phase using ACI 349-01, 318-08 and USACE EM 1110-2-2006. Failure probability consistent with industry codes.
 - Finite Element Modeling of the RCC Bridging Mat was used to confirm capacities greater than expected loading conditions.
 - The applicant demonstrated that the stresses in the bridging mat will remain within code allowable limits and is therefore assured of performing its required function.
 - A detailed test plan describes the quality control and inspection to occur during production.
 - Post-COL RCC and bedding mix strength verification and constructability testing will be performed on a large test pad at the site prior to production of the RCC Bridging Mat.
 - License Condition for post-COL RCC testing.

Roller Compacted Concrete Strength and Constructability Verification Program (cont'd)

- **Issue:** During pre-COL mix design testing program, the concrete in the test panels did not attain the desired compressive and tensile strength. The applicant attributed the low strength of the cored cylinders from test panels that require the use of small mixing and compaction equipment.
- **Resolution**
 - Use mixing, placement, and compaction equipment consistent with USACE EM 1110-2006 and comparable to that used in large successful commercial projects.
 - Biaxial shear test results on block samples yielded shear strengths at least 1.67 times max design shear demand despite low compressive strength.
 - Post-COL RCC and bedding mix strength verification and constructability testing will be performed on a large test pad at the site prior to production of the RCC Bridging Mat.
 - License Condition for post-COL RCC testing.
 - ITAAC for RCC.

Levy County Units 1 and 2 COL Application

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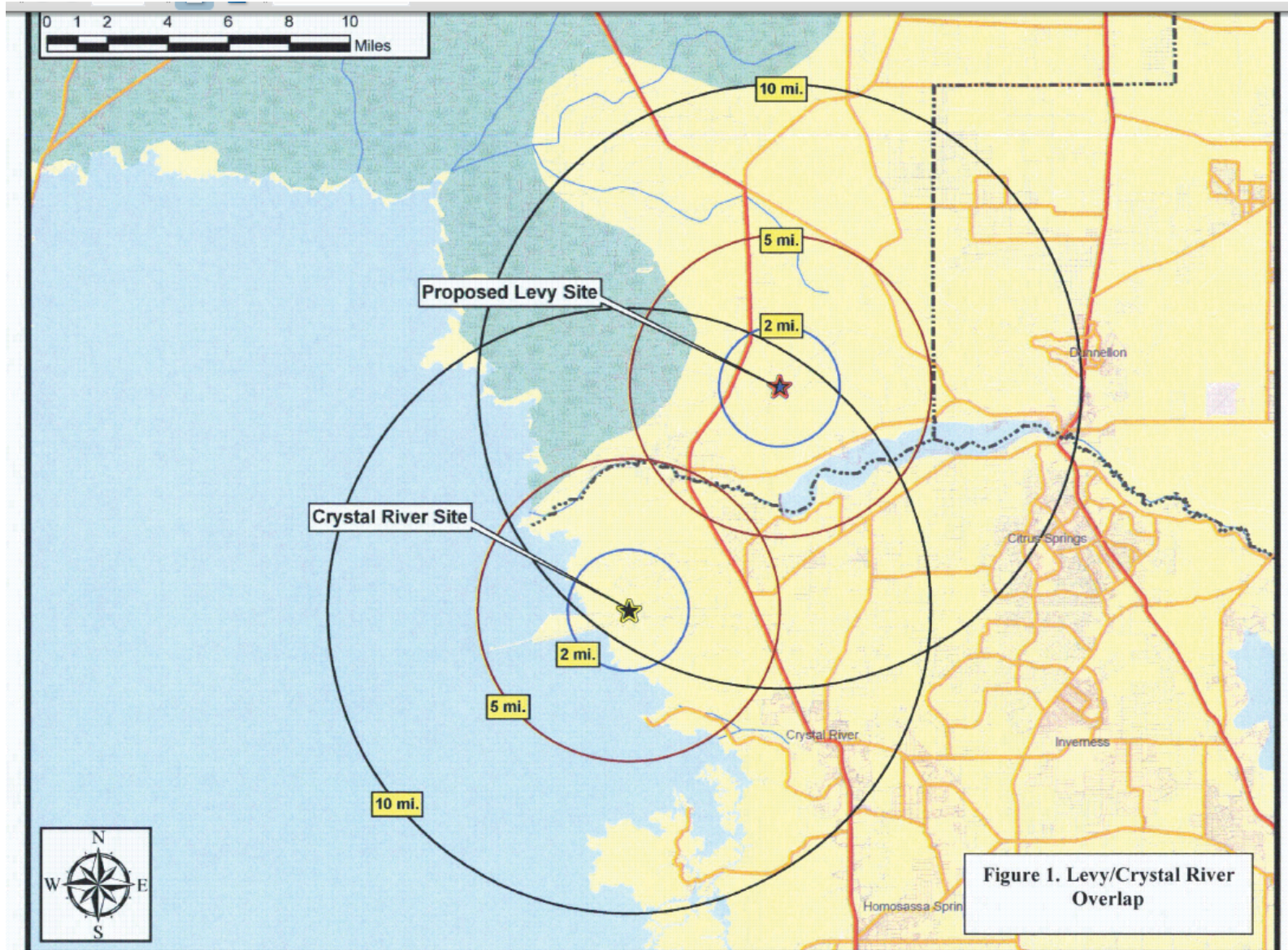
Section 13.3 - Emergency Planning

December 1, 2011

Emergency Planning

- No Open Items
- Approximately 30 Confirmatory Items
- Emergency Response Facilities
 - Technical Support Center and Operational Support Center
 - No Departure from AP1000 Design Control Document
 - Emergency Operations Facility
 - Existing facility approved for use by Crystal River 3 (CR3)
 - Proposed shared facility between the Levy Nuclear Plant (LNP) and CR3

Overlapping Emergency Planning Zones



Emergency Planning

- Conclusions
 - Reasonable assurance exists for the offsite plans
 - LNP Combined License (COL) application includes post-COL activities, including EP Inspection Tests Analyses and Acceptance Criteria that are necessary and sufficient to provide reasonable assurance for onsite plans
 - With the additional information and proposed textual revisions provided in response to the staff's requests for additional information, the NRC staff finds that the applicant addressed the required information relating to EP