Progress Energy

Serial: NPD-NRC-2008-049
December 9, 2008

10CFR52.79

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 2 AND 3
DOCKET NOS. 52-022 AND 52-023
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 018 RELATED TO VIBRATORY GROUND MOTION

Reference: Letter from Manny Comar (NRC) to James Scarola (PEC), dated September 25, 2008, "Request for Additional Information Letter No. 018 Related to SRP Section 02.05.02 for the Harris Units 2 and 3 Combined License Application"

Ladies and Gentlemen:

Progress Energy Carolinas, Inc. (PEC) hereby submits our response to the Nuclear Regulatory Commission's (NRC) request for additional information provided in the referenced letter.

A partial response to the NRC request is provided in Enclosure 1. Additional submittals are planned by January 9 and February 5, 2009 to provide the remaining responses. See page 1 of Enclosure 1 for details. Enclosure 1 also identifies changes that will be made in a future revision of the Shearon Harris Nuclear Power Plant Units 2 and 3 (HAR) application.

Enclosure 2 provides a list of attachments, including supplemental files on the attached CDs. The supplemental information contained in the files on CD #2 is provided to support the NRC's review of the HAR FSAR but does not comply with the requirements for electronic submission in NRC Guidance Document, "Guidance for Electronic Submissions to the NRC," dated October 29, 2008. The NRC staff requested the files be submitted in electronic format. As discussed with the NRC's project manager responsible for review of the HAR COL application, the information provided on CD #2 is of a nature that is not easily convertible to PDF output files. Furthermore, PEC understands that converting the information to PDF output files would not serve the underlying purpose of the submittal; i.e., to provide the raw, unprocessed data to enable reviewers to evaluate the HAR application.

Figures 1 and 2 on the enclosed CD #1 should be treated as proprietary data subject to governing regulation § 2.390 'Public inspections, exemptions, requests for withholding' (in particular, § 2.390(a)(9)). Per § 2.390(b)(1)(ii), PEC requests that the NRC waive the affidavit requirements and hold the Figures 1 and 2 (Texaco figures of seismic profile and associated interpretations) as proprietary. As discussed in the attached letter from Chevron Corporation, this is the type of information held in confidence by Chevron. Appropriate circumstances exist warranting a waiver to the affidavit requirement because there is inadequate time to obtain an affidavit from Chevron in order to submit these figures on the schedule for responding to NRC RAIs.

Progress Energy Carolinas, Inc.
P.O. Box 1551
Raleigh, NC 27602

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NRO

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (919) 546-6107.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 9, 2008.

Sincerely,

Garry D. Miller
General Manager
Nuclear Plant Development

Enclosure/Attachments

cc (w/2 sets of attached CDs): Mr. Manny Comar, U.S. NRC Project Manager

cc (w/o attached CDs):
U.S. NRC Director, Office of New Reactors/NRLPO
U.S. NRC Office of Nuclear Reactor Regulation/NRLPO
U.S. NRC Region II, Regional Administrator
U.S. NRC Resident Inspector, SHNPP Unit 1

Shearon Harris Nuclear Power Plant Units 2 and 3
Response to NRC Request for Additional Information Letter No. 018 Related to SRP Section 02.05.02 for the Combined License Application, dated September 25, 2008

NRC RAI #	Progress Energy RAI #	Progress Energy Response
02.05.02-1	H-0097	Future submittal – expected by 1/9/09
02.05.02-2	H-0098	Future submittal – expected by 1/9/09
02.05.02-3	H-0099	Future submittal – expected by 1/9/09
02.05.02-4	H-0100	Future submittal – expected by 1/9/09
02.05.02-5	H-0101	Response enclosed – see following pages
02.05.02-6	H-0102	Future submittal – expected by 1/9/09
02.05.02-7	H-0103	Future submittal – expected by 2/5/09
02.05.02-8	H-0104	Response enclosed – see following pages
02.05.02-9	H-0105	Future submittal – expected by 1/9/09
02.05.02-10	H-0106	Future submittal – expected by 2/5/09
02.05.02-11	H-0107	Future submittal – expected by 1/9/09
02.05.02-12	H-0108	Future submittal – expected by 2/5/09
02.05.02-13	H-0109	Response enclosed – see following pages
02.05.02-14	H-0110	Future submittal – expected by 1/9/09
02.05.02-15	H-0111	Future submittal – expected by 1/9/09
02.05.02-16	H-0112	Response enclosed – see following pages
02.05.02-17	H-0113	Response enclosed – see following pages
02.05.02-18	H-0114	Response enclosed – see following pages

Attachments/Enclosures	Associated NRC RAI #	Pages Included or CD #
October 9, 2008 e-mail	02.05.02-5	1 page
Chevron Corporation Letter	02.05.02-8	3 pages
RAI 2.5.2-08 Figure 1	02.05.02-8	CD #1 (Proprietary)
RAI 2.5.2-08 Figure 2	02.05.02-8	CD #1 (Proprietary)
Seismic source boundaries	02.05.02-16	CD #2
Hazard curves	02.05.02-16	CD #2
Soil hazard curves	02.05.02-17	CD #2
Revised FSAR Appendix 2AA	02.05.02-18	9 pages

NRC Letter No.: HAR-NRC-LTR-018

NRC Letter Date: September 25, 2008

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.02-5

Text of NRC RAI:

Section 2.5.2.1.2 describes the justification for relocating one of the significant earthquakes, the February 21, 1916, event with a magnitude mb=5.0, to about 100km west of its current location, placing it further away from the HAR site and cites a personal communication with Dr. Chapman of Virginia Tech as the rationale. However, the Southeastern U.S. Earthquake Catalog (http://www.geol.vt.edu/outreach/vtso/anonftp/catalog/susn2006cat.txt) maintained by the Virginia Tech Seismological Laboratory for which Dr. Chapman is the Director, lists this event as occurring at 35.5N, 82.5W which is the former location also identified in the EPRI and NCEER-91 catalogs. Please explain this discrepancy.

PGN RAI ID #: H-0101

PGN Response to NRC RAI:

Dr. Martin Chapman was contacted concerning this earthquake. He indicated that he did in fact perform a relocation of the event (his e-mail response is attached). He indicated that he sent the results to Dr. Frankel at the USGS, but did not update the SUSN catalog.

It should be noted that the earthquake occurrence rates used in the PSHA for the HAR 2 and 3 sites are those developed in the EPRI-SOG (Reference 2.5.2-201) study (see response to RAI 02.05.02-4), which were computed using the location for this event given in the EPRI-SOG catalog.

Associated HAR COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures:

October 9, 2008 e-mail from Martin Chapman.

NRC Letter No.: HAR-NRC-LTR-018

NRC Letter Date: September 25, 2008

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.02-8

Text of NRC RAI:

The line-drawings shown in Figure 2.5.1-241 represent interpretations of the seismic reflection data. Please provide a copy of the original seismic reflection data for the staff to be able to assess the interpretations shown in the figure.

PGN RAI ID #: H-0104

PGN Response to NRC RAI:

A scanned version of a hardcopy image of the Texaco seismic line 85SD12 was used to develop the line interpretation shown on Figure 2.5.1-241. Per written authorization from Chevron Corporation that permits use of these data with restrictions outlined in Attachment A, the image of the seismic line should be treated as proprietary data subject to governing regulation § 2.390 'Public inspections, exemptions, requests for withholding' (in particular, § 2.390 (a) (9)). Per § 2.390(b)(1) (ii) Progress requests that the Commission waive the affidavit requirements and hold the Attachments B and C (Texaco figures of seismic profile and associated interpretations) as proprietary. As discussed in the attached letter from Chevron Corporation, this is the type of information held in confidence by Chevron. Appropriate circumstances exist warranting a waiver to the affidavit requirement because there is inadequate time to obtain an affidavit from Chevron in order to submit these figures on the schedule for responding to NRC RAIs.

The requested additional figures showing the un-interpreted seismic data and the seismic line with interpretation are provided as Attachments B and C to this RAI response.

Associated HAR COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures:

Attachment A: Chevron Corporation Rights Permission

Attachment B: RAI 2.5.2-08 Figure 1 Seismic Profile 85SD12 across Durham Basin (see CD #1 – Proprietary)

Attachment C: RAI 2.5.2-08 Figure 2 Interpretation of Seismic Profile 85SD12 across the Durham Basin (see CD #1 – Proprietary)

NRC Letter No.: HAR-NRC-LTR-018

NRC Letter Date: September 25, 2008

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.02-13

Text of NRC RAI:

In Section 2.5.2.5.1.4, you stated that two alternative sets of modulus reduction and damping relationships were used in the site response analysis for the HAR site. Please provide further justification of why the Peninsula Ranges modulus reduction and damping relationships are considered appropriate for the HAR site response analysis.

PGN RAI ID #: H-0109

PGN Response to NRC RAI:

The shallowest layers of the HAR site GMRS profiles consist of partially weathered sedimentary rock. Assessing the in-situ strain-dependent dynamic properties of the rock mass is not practical by standard laboratory testing. Therefore, relationships were selected from the literature. One set consists of the rock relationships developed by Silva et al. (Reference 2.5.2-262), as modified by Silva (Reference 2.5.2-263) to account for depth effects. These relationships were in part calibrated by Silva et al. through comparisons of site response analyses with recorded ground motions (Reference 2.5.2-262). The Silva et al. analyses were conducted primarily for western North America sites. To address the uncertainty in the dynamic properties of the partially weathered rock, a second set of relationships, Peninsula Ranges, was selected that exhibits more linear behavior (less modulus reduction at higher strains, lower material damping). The set of Silva et al. (Reference 2.5.2-262) was selected because they had been used by EPRI Reference 2.5.2-264) to model the behavior of sedimentary rocks in the CEUS. The intent of the second set was to examine the effect of more linear modulus reduction and damping relationships on the site response. As shown on FSAR Figure 2.5.2-280, the computed site amplification functions obtained using the two sets of modulus reduction and damping relationships are virtually the same. The results indicate that the site GMRS is relatively insensitive to the uncertainty in the modulus reduction and damping relationships for the partially weathered shallow rock layers.

Associated HAR COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures:

None.

NRC Letter No.: HAR-NRC-LTR-018

NRC Letter Date: September 25, 2008

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.02-16

Text of NRC RAI:

Please provide the boundary coordinates of the seismic sources used for the HAR PSHA calculations in electronic format. Please also provide the calculated mean hazard curves for 0.5, 1, 2.5, 5, 10, 25, and 100 Hz along with their 5%, 16%, 50%, 84%, and 95% percentiles in electronic format.

PGN RAI ID #: H-0112

PGN Response to NRC RAI:

Two sets of electronic files are requested: a) seismic source boundaries; b) hazard curves.

a) Boundary coordinates of the seismic sources used for the HAR PSHA are provided in folder 'geometries', inside subfolders 'CHE' and 'SOG'.
   - Folder CHE contains the geometries of the Charleston source and the East Coast Fault system.
   - Folder SOG contains files HUxxx.GEO, where xxx is the three letters code that identifies each of the six EPRI-SOG Expert teams; i.e., BEC for Bechtel, DAM for Dames & Moore, LAW for Law Engineering, RND for Rondout, WCC for Woodward-Clyde, and WGC for Weston Geophysical. The files list the coordinates of all the sources used for the final HAR PSHA calculations, including the complementary sources. The following text is provided to help identify complementary sources and their use.

Bechtel team

There are no complementary sources. The following is a list of source combinations for the Bechtel team:

1) BZ4 BZ5 H 13 24 E
2) BZ4 BZ5 H F 24 E
3) BZ4 BZ5 H 24 E
4) BZ4 BZ5 N3 13 24 E
5) BZ4 BZ5 N3 F 24 E
6) BZ4 BZ5 N3 24 E
7) BZ4 BZ5 13 24 E
8) BZ4 BZ5 F 24 E
9) BZ4 BZ5 24 E
10) BZ4 BZ5 H 13 24
11) BZ4 BZ5 H F 24

12) BZ4 BZ5 H 24
13) BZ4 BZ5 N3 13 24
14) BZ4 BZ5 N3 F 24
15) BZ4 BZ5 N3 24
16) BZ4 BZ5 13 24
17) BZ4 BZ5 F 24
18) BZ4 BZ5 24
19) BZ4 BZ5 H 13 19 E
20) BZ4 BZ5 H F 19 E
21) BZ4 BZ5 H 19 E
22) BZ4 BZ5 N3 13 19 E
23) BZ4 BZ5 N3 F 19 E
24) BZ4 BZ5 N3 19 E
25) BZ4 BZ5 13 19 E
26) BZ4 BZ5 F 19 E
27) BZ4 BZ5 19 E
28) BZ4 BZ5 H 13 E
29) BZ4 BZ5 H F E
30) BZ4 BZ5 H E
31) BZ4 BZ5 N3 13 E
32) BZ4 BZ5 N3 F E
33) BZ4 BZ5 N3 E
34) BZ4 BZ5 13 E
35) BZ4 BZ5 F E
36) BZ4 BZ5 E
37) BZ4 BZ5 H 13 19
38) BZ4 BZ5 H F 19
39) BZ4 BZ5 H 19
40) BZ4 BZ5 N3 13 19
41) BZ4 BZ5 N3 F 19
42) BZ4 BZ5 N3 19
43) BZ4 BZ5 13 19
44) BZ4 BZ5 F 19
45) BZ4 BZ5 19

46) BZ4 BZ5 H 13

47) BZ4 BZ5 H F

48) BZ4 BZ5 H

49) BZ4 BZ5 N3 13

50) BZ4 BZ5 N3 F

51) BZ4 BZ5 N3

52) BZ4 BZ5 13

53) BZ4 BZ5 F

54) BZ4 BZ5

Dames & Moore team

Sources 4A, 4B, 4C, 4D, and C01 are alternative configurations of source 4.

Sources 53a and 53b are alternative geometries for source 53. In particular, source 53a is the same as 53, but with the area of source 54 removed. It is used whenever source 54 is active. Source 53b is the same as 53a, but with the area of source 52 removed, and is used when both sources 52 and 54 are active.

Source combinations

1) 4 40 54 41 53a
2) 4 40 54 41 53b 52
3) C01+4A+4B+4C+4D 40 54 41 53a
4) C01+4A+4B+4C+4D 40 54 41 53b 52

Law team

C09: complementary of source 8, to be used when source 35 is not active.

C10: complementary of source 8, to be used when source 35 is active

C11: complementary source of 22, it is active when source 107 and source 8 are not.

Source combinations

1) C11 35 17 M27-35
2) C11 35 17
3) C11 35 217 M27-35
4) C11 35 217
5) 107 35 17 M27-35 C10
6) 107 35 17 C10
7) 107 35 217 M27-35 C10
8) 107 35 217 C10

9) 107 17 M27-35 C09
10) 107 17 C09
11) 107 217 M27-35 C09
12) 107 217 C09
13) 107 35 17 M27-35
14) 107 35 17
15) 107 35 217 M27-35
16) 107 35 217
17) 107 17 M27-35
18) 107 17
19) 107 217 M27-35
20) 107 217

Rondout team

C01: complementary of source 49, corresponds to the area of source 49 not included in other source zones.

C02: complementary of source 50, corresponds to the area of source 50 not included in other source zones.

Source combinations:

1) 24 26 28 29 C01 25 27 32 C02
2) 24 26 28 29 C01 25 27 C02

Woodward-Clyde team

Source 29B is mutually exclusive with sources 29 and 29A, and occurs only when source 30 is active.

Source WD24 is background source WB24, modified to exclude the area covered by source 31A. Source WD24 replaces WB24 when source 31A is active.

Source combinations:

1) B24 26 29
2) B24 26 29A
3) B24 26 29B 30
4) B24 26 30
5) B24 27 29
6) B24 27 29A
7) B24 27 29B 30
8) B24 27 30

9) B24 29

10) B24 29A

11) B24 29B 30

12) B24 30

13) D24 31A 26 29

14) D24 31A 26 29A

15) D24 31A 26 29B 30

16) D24 31A 26 30

17) D24 31A 27 29

18) D24 31A 27 29A

19) D24 31A 27 29B 30

20) D24 31A 27 30

21) D24 31A 29

22) D24 31A 29A

23) D24 31A 29B 30

24) D24 31A 30

Weston team

List of complementary sources:

C17: complementary of source 103, to be used when source 23 is active, but source 24 is not.

C18: complementary of source 103, to be used when source 24 is active, but source 23 is not.

C19: complementary of source 103, to be used when both sources 23 and 24 are active.

C20: complementary of source 104, to be used when only source 22 is active.

C21: complementary of source 104, to be used when only source 25 is active.

C22: complementary of source 104, to be used when only source 26 (or C33) is active.

C23: complementary of source 104, to be used when sources 26 (or C33), and 22 are active but 28D is not.

C24: complementary of source 104, to be used when sources 25 and 22 are active.

C25: complementary of source 104, to be used when only source 28D is active.

C26: complementary of source 104, to be used when sources 22 and 28D are active.

C27: complementary of source 104, to be used when sources 25, 22, and 28D are active but C33 is not.

C28: complementary of source 104, to be used when sources 26 (or C33), 22, and 28D are active.

C33: complementary of source 26, to be used when sources 25 is active.

C34: complementary of source 104, to be used when sources 26 (or C33) and 28D are active.

C35: complementary of source 104, to be used when only source 25 is active.

Source combinations:

1) 103 25 C33 22 28D C28
2) 103 25 C33 22 C23
3) 103 25 C33 28D C34
4) 103 25 C33 C22
5) 103 25 22 28D C27
6) 103 25 22 C24
7) 103 25 28D C35
8) 103 25 C21
9) 103 26 22 28D C28
10) 103 26 22 C23
11) 103 26 28D C34
12) 103 26 28D C34
13) 103 26 C22
14) 103 22 C20
15) 103 28D C25
16) 103 104
17) C19 25 C33 22 28D C28 23 24
18) C19 25 C33 22 C23 23 24
19) C19 25 C33 28D C34 23 24
20) C19 25 C33 C22 23 24
21) C19 25 22 28D C27 23 24
22) C19 25 22 C24 23 24
23) C19 25 28D C35 23 24
24) C19 25 C21 23 24
25) C19 26 22 28D C28 23 24
26) C19 26 22 C23 23 24
27) C19 26 28D C34 23 24
28) C19 26 28D C34 23 24
29) C19 26 C22 23 24
30) C19 22 C20 23 24

31) C19 28D C25 23 24
32) C19 104 23 24
33) C18 25 C33 22 28D C28 24
34) C18 25 C33 22 C23 24
35) C18 25 C33 28D C34 24
36) C18 25 C33 C22 24
37) C18 25 22 28D C27 24
38) C18 25 22 C24 24
39) C18 25 28D C35 24
40) C18 25 C21 24
41) C18 26 22 28D C28 24
42) C18 26 22 C23 24
43) C18 26 28D C34 24
44) C18 26 28D C34 24
45) C18 26 C22 24
46) C18 22 C20 24
47) C18 28D C25 24
48) C18 104 24
49) C17 25 C33 22 28D C28 23
50) C17 25 C33 22 C23 23
51) C17 25 C33 28D C34 23
52) C17 25 C33 C22 23
53) C17 25 22 28D C27 23
54) C17 25 22 C24 23
55) C17 25 28D C35 23
56) C17 25 C21 23
57) C17 26 22 28D C28 23
58) C17 26 22 C23 23
59) C17 26 28D C34 23
60) C17 26 28D C34 23
61) C17 26 C22 23
62) C17 22 C20 23
63) C17 28D C25 23
64) C17 104 23

b) File HAR2&3_Rock_Hazard.xls contains the mean and percentiles (5%, 16%, 50%, 84%, and 95%) hazard curves at bedrock conditions for spectral frequencies of 0.5, 1, 2.5, 5, 10, 25, and 100 Hz. The first column lists the ground motion level, the second column lists the mean frequency of exceedance, and the remaining columns list the fractiles for frequency of exceedance.

Associated HAR COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures:

Geometries folder (see CD #2)

File HAR2_and_3_Rock_Hazard.xls (see CD #2)

NRC Letter No.: HAR-NRC-LTR-018

NRC Letter Date: September 25, 2008

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.02-17

Text of NRC RAI:

Please provide soil hazard curves electronically for 10^{-4}, 10^{-5}, and 10^{-6} annual exceedance frequencies as well as in between annual exceedance values for the staff to be able to conduct detailed performance-based confirmatory analysis.

PGN RAI ID #: H-0113

PGN Response to NRC RAI:

The attached Excel file HAR-SOIL-HAZARD.xls contains the hazard curves for the GMRS horizon computed for the HAR2 and HAR 3 sites. These hazard curves were computed using the EPRI (Reference 2.5.2-271) cumulative absolute velocity (CAV) model. The file contains tabs for the seven spectral frequencies defined in the EPRI (Reference 2.5.2-248) ground motion model, 0.5, 1.0, 2.5, 5, 10, 25, and 100 Hz (pga). Each tab contains mean hazard curves for the HAR2 and HAR3 sites. The hazard curves include the specific ground motion levels that represent the mean 10^{-4}, 10^{-5}, and 10^{-6} UHRS developed for the HAR sites at the GMRS horizon.

Associated HAR COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures:

File: HAR-SOIL-HAZARD.xls

NRC Letter No.: HAR-RAI-LTR-018

NRC Letter Date: September 25, 2008

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.02-18

Text of NRC RAI:

The staff also noticed the following discrepancies in Section 2.5.2:

- Section 2.5.2.1.1 states that the Appendix (2AA) lists 225 earthquakes that are within 325 km of the HAR site. Appendix 2AA actually lists 1329 events covering the entire CEUS regions.
- Section 2.5.2.4.1.2 states that updated estimates of the occurrence rates for these earthquakes based on paleoliquefaction data are described in Subsection 2.5.2.4.1.1.1. The information is actually located in Section 2.5.1.1.4.3
- The April 29, 1852, earthquake was felt at Buckingham and Wytheville, Virginia, not in S. Carolina as indicated in FSAR.
- Postulated East Coast Fault System (green outlined area according to figure caption) cannot be seen on Figure 2.5.2-214.

PGN RAI ID #: H-0114

PGN Response to NRC RAI:

1. Appendix 2AA is being updated as part of response to RAI 02.05.02-2 to include moment magnitude estimates. The catalog in Appendix 2AA will be limited to the 200 mile radius around the HAR site to conform the text in FSAR Subsection 2.5.2.1.1.
2. Subsection 2.5.2.4.1.1.1 will be amended to include a description of the occurrence rates.
3. The location of the two cities will be corrected from S. Carolina to Virginia.
4. Missing depiction of East Coast Fault System will be added to FSAR Figure 2.5.2-214.

Associated HAR COL Application Revisions:

The following changes will be made to HAR FSAR Chapter 2 in a future amendment:

1. Replace FSAR Appendix 2AA in its entirety (see Attachments/Enclosures).
2. Revise second paragraph of FSAR Section 2.5.2.4.1.1.1 from:

   "SNC characterizes the occurrence of the repeated large earthquakes at Charleston by a characteristic earthquake model with the size and frequency of the characteristic earthquake defined by the parameters in the logic tree shown on Figure 2.5.2-213 (Reference 2.5.2-230)."

   To read:

"SNC characterizes the occurrence of the repeated large earthquakes at Charleston by a characteristic earthquake model with the size and frequency of the characteristic earthquake defined by the parameters in the logic tree shown on Figure 2.5.2-213 (Reference 2.5.2-230). Two estimates of the frequency of the repeated large earthquakes were provided, one based on the number of earthquakes identified from paleoliquefaction data for the past 2,000 years and one based on the number of earthquakes identified from paleoliquefaction data for the past 5,000 years, with relative weights of 0.8 and 0.2, respectively (Figure 2.5.2-213)."

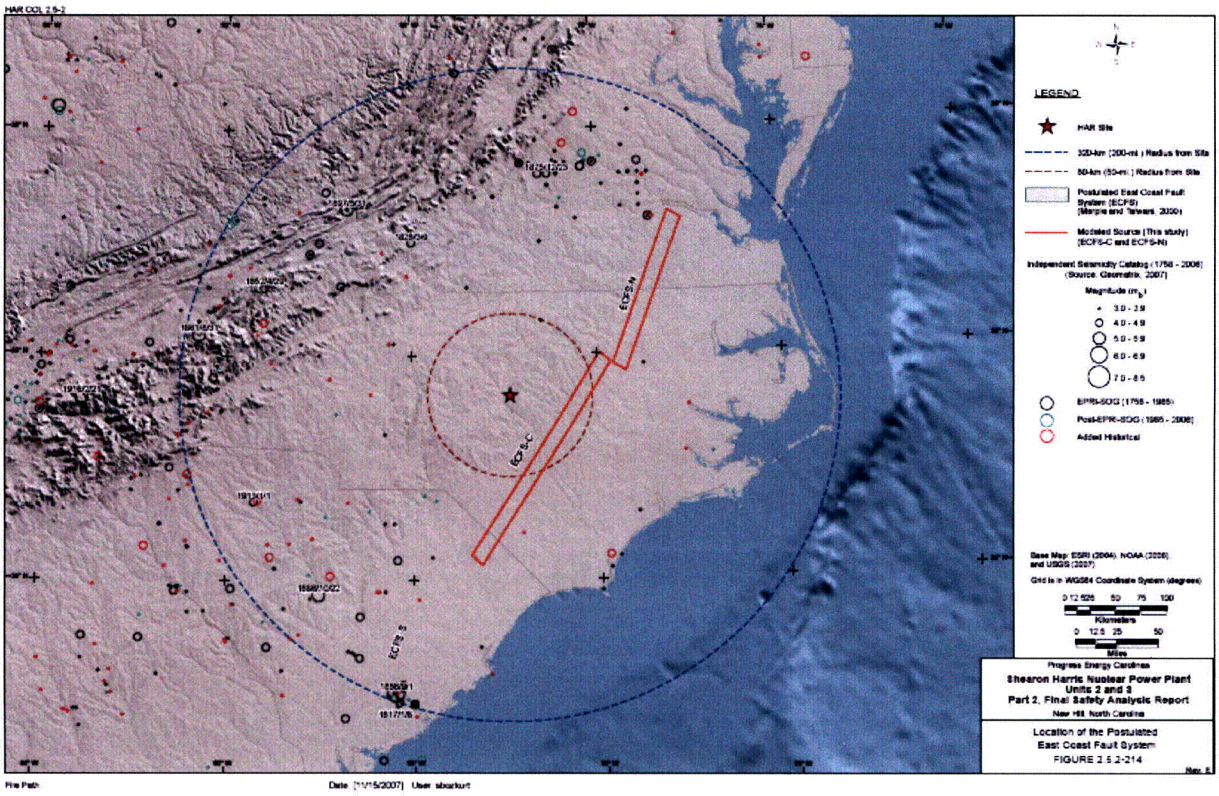
3. Revise third bulleted paragraph of FSAR Section 2.5.2.1.2 from:

   "A moderately strong, widely felt shock occurred on April 29, 1852. At Buckingham and Wytheville, South Carolina, chimneys were reportedly damaged (MMI VI). The felt area extended to Washington, D.C., Baltimore, Maryland, and Philadelphia, Pennsylvania, and included many points in North Carolina, covering approximately 420,000 km^2 (162,163 $mi.^2$). (Reference 2.5.2-215)"

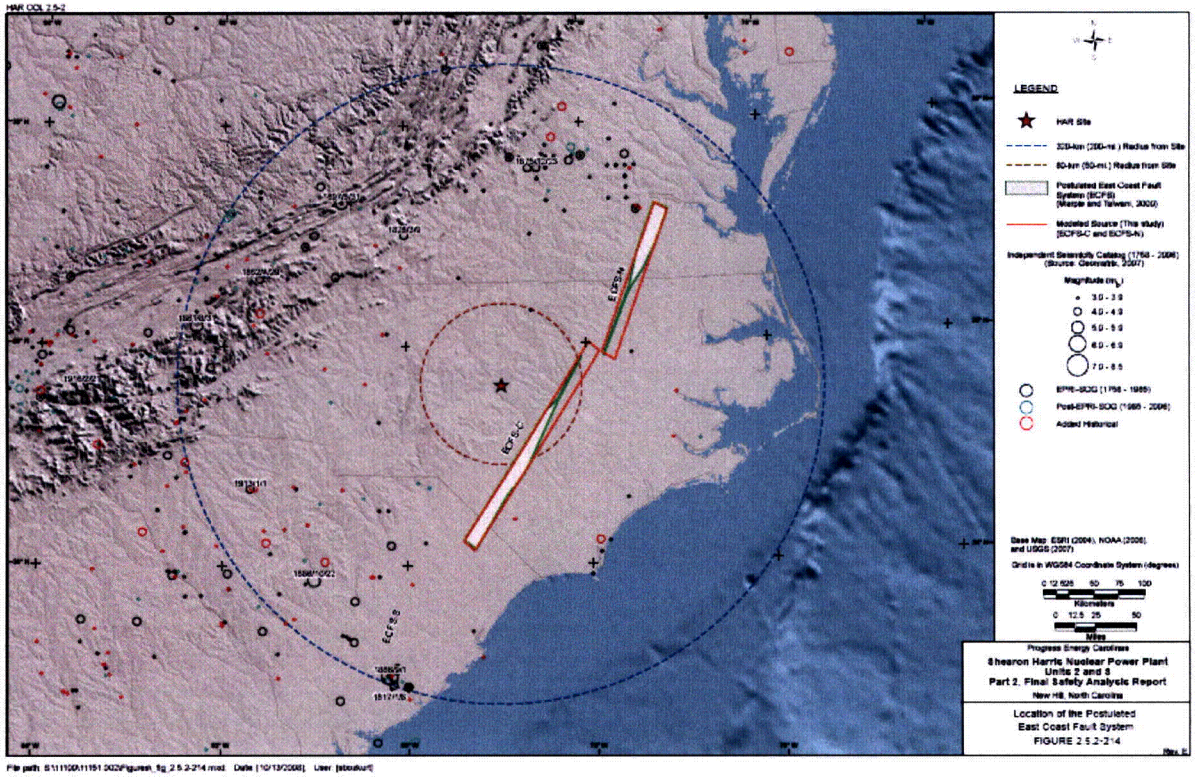
   To read:

   "A moderately strong, widely felt shock occurred on April 29, 1852. At Buckingham and Wytheville, Virginia, chimneys were reportedly damaged (MMI VI). The felt area extended to Washington, D.C., Baltimore, Maryland, and Philadelphia, Pennsylvania, and included many points in North Carolina, covering approximately 420,000 km^2 (162,163 $mi.^2$). (Reference 2.5.2-215)"

4. Revise FSAR Figure 2.5.2-214 from:



To read:



Attachments/Enclosures:

Revised FSAR Appendix 2AA, "Earthquake Catalog"

List of Attachments/Enclosures:

1. NRC RAI # 02.05.02-5 (PGN RAI ID #H-0101):

   October 9, 2008 e-mail from Martin Chapman (1 page)

2. NRC RAI # 02.05.02-8 (PGN RAI ID #H-0104):

   Chevron Corporation Letter dated November 30, 2006, "Rights Permission" (3 pages)

3. NRC RAI # 02.05.02-8 (PGN RAI ID #H-0104):

   RAI 2.5.2-08 Figure 1 Seismic Profile 85SD12 across Durham Basin – pdf file (see CD #1 – Proprietary). Appropriate pre-submission checks have been successfully performed on this file, and it has been found to be compliant with NRC electronic submittal guidelines.

4. NRC RAI # 02.05.02-8 (PGN RAI ID #H-0104):

   RAI 2.5.2-08 Figure 2 Interpretation of Seismic Profile 85SD12 across the Durham Basin – pdf file (see CD #1 – Proprietary) Appropriate pre-submission checks have been successfully performed on this file, and it has been found to be compliant with NRC electronic submittal guidelines.

5. NRC RAI # 02.05.02-16 (PGN RAI ID #H-0112):

   Geometries folder (see CD #2)

6. NRC RAI # 02.05.02-16 (PGN RAI ID #H-0112):

   File HAR2_and_3_Rock_Hazard.xls (see CD #2)

7. NRC RAI # 02.05.02-17 (PGN RAI ID #H-0113):

   File: HAR-SOIL-HAZARD.xls (see CD #2)

8. NRC RAI # 02.05.02-18 (PGN RAI ID #H-0114):

   Revised FSAR Appendix 2AA, "Earthquake Catalog" (9 pages)

From: Martin Chapman [mcc@vt.edu]
Sent: Thursday, October 09, 2008 8:05 AM
To: Bob Youngs
Subject: brainless version

Bob:

Concerning the 1916 "Skyland" North Carolina event, several years ago I used arrival times from all the stations listed in the monthly weather review to instrumentally locate the event. I know the location I got was close to the TN-NC border, probably in the Smoky mountains national park. I communicated all the details of this along with the hypoellipse output file, etc., to Art Frankel at the time, and I guess that is what they are citing. I believe that my instrumental location is at least as good and probably better than what you can find in the various catalogs. The only thing is, I dont have the original work, and I guess I never added the instrumental location to the SEUSSN catalog.

I dont have anything on that 1817 event except what is in the SUSN catalog, which itself probably comes from the USGS state seismicity map series. Stover and Coffman (Seismicity of the United states, 1568-1989 (revised), give the following:

jan 8, 1817 9hr 0min 32.9N 80.0W , magnitude 5.0 based on felt area, attributed to Otto Nuttli, the max intensity was V MM and the felt area was 516,000 sq mi.

the reference they list for all of this is Bollinger and Visvanathan, 1977, The seismicity of South Carolina prior to 1886: usgs Geological Survey professional paper 1028-C, p. 33-42.

--
Martin Chapman
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540-231-5036 / 540-231-3386 (FAX)

Chevron Corporation
6001 Bollinger Canyon Road
San Ramon, CA 94583

November 30, 2006

Fax No. 510 663-4141

Mrs. Alexis Lavine
Project Geologist
Geomatrix Consultants, Inc.
2101 Webster St., Suite 1200
Oakland, CA 94612

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Chevron Corporation

By: Kari H. Endries
Assistant Secretary

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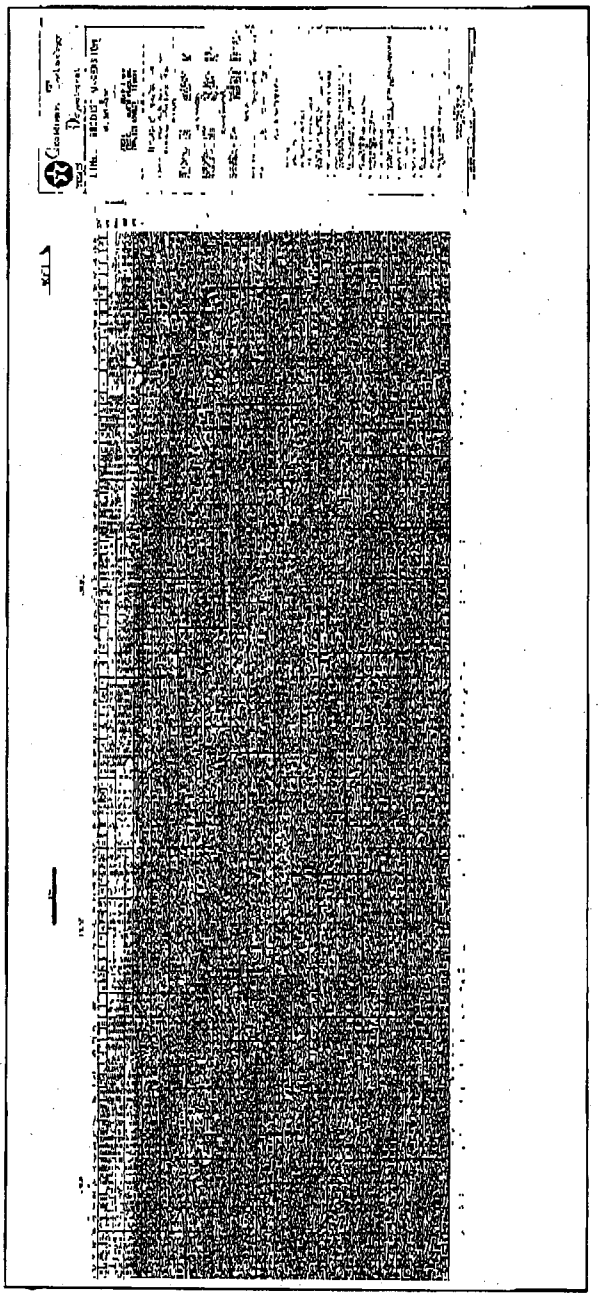
12/11/06

Date

EXHIBIT A



Shearon Harris Nuclear Power Plant Units 2 And 3
COL Application
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Appendix 2AA
Earthquake Catalog

Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth	m_b*	m_b	Type	EPRI Flag	R^1 (km)	M	Mo (dyne-cm)	Event No.
1774	2	21	19	0	0	37.2	-77.4	0	4.7	4.6	EPRI	MAIN	222.85	4.2	2.3E+22	1
1775	3	16	19	15	0	37.7	-78.8	0	3.64	3.3	EPRI	MAIN	229.78	3.1	4.9E+20	2
1791	1	13	9	0	0	37.7	-78.8	0	3.64	3.3	EPRI	MAIN	229.78	3.1	4.9E+20	3
1791	1	15	10	0	0	37.5	-77.5	0	3.64	3.3	EPRI	MAIN	244.72	3.1	4.9E+20	4
1799	4	11	8	20	0	32.9	-80	0	4.74	4.4	EPRI	158	319.47	4.0	1.2E+22	5
1802	8	23	10	0	0	37.4	-79.1	0	3.84	3.5	EPRI	MAIN	196.36	3.3	8.6E+20	6
1807	5	1	9	0	0	37.4	-79.1	0	3.84	3.5	EPRI	MAIN	196.36	3.3	8.6E+20	7
1811	11	27	8	0	0	36.1	-80.2	0	3.64	3.3	EPRI	MAIN	123.11	3.1	4.9E+20	8
1812	2	2	9	30	0	37.6	-77.4	0	3.64	3.3	EPRI	MAIN	258.86	3.1	4.9E+20	9
1812	4	22	4	0	0	37.5	-77.5	0	3.64	3.3	EPRI	184	244.72	3.1	4.9E+20	10
1817	1	8	9	0	0	32.9	-80	0	5.1	5	EPRI	MAIN	319.47	4.5	7.5E+22	11
1820	9	3	8	30	0	33.4	-79.3	0	3.64	3.3	EPRI	MAIN	251.1	3.1	4.9E+20	12
1827	5	11	0	0	0	36.1	-81.2	0	3.64	3.3	EPRI	MAIN	208.52	3.1	4.9E+20	13
1828	3	9	0	0	0	37	-80	0	4.9	4.8	EPRI	MAIN	177.9	4.4	4.1E+22	14
1833	8	27	11	0	0	37.7	-78	0	4.7	4.6	EPRI	MAIN	244.8	4.2	2.3E+22	15
1850	10	17	0	0	0	37.3	-78.4	0	3.64	3.3	EPRI	MAIN	191.48	3.1	4.9E+20	16
1852	4	29	18	0	0	36.6	-81.6	0	5	4.9	EPRI	MAIN	260.41	5.0	3.1E+23	17
1852	11	2	23	35	0	37.6	-78.6	0	4.5	4.4	EPRI	MAIN	220.56	4.0	1.2E+22	18
1853	5	2	14	20	0	38.5	-79.5	0	4.5	4.4	EPRI	MAIN	321.97	4.0	1.2E+22	19
1855	2	2	8	0	0	37	-78.6	0	4	3.9	EPRI	MAIN	154.83	3.6	2.8E+21	20
1856	7	16	13	40	0	37.57	-77.45	0	3.64	3.3	Added		253.66	3.1	4.9E+20	21
1856	12	6	12	0	0	37.22	-77.4	0	3.64	3.3	Added		224.58	3.1	4.9E+20	22
1859	3	22	0	0	0	37.1	-81.5	0	3.44	3.1	EPRI	MAIN	279.8	2.9	2.7E+20	23
1860	1	19	18	0	0	33.68	-80.57	0	4.64	4.3	EPRI	MAIN	263.19	3.9	9.0E+21	24
1861	8	31	5	0	0	36.18	-82.3	0	5.3	5.2	EPRI	MAIN	307.17	5.2	7.9E+23	25

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Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth	m_b*	m_b	Type	EPRI Flag	R^1 (km)	M	Mo (dyne-cm)	Event No.
1862	12	10	20	52	0	37.57	-77.45	0	4.14	3.8	Added		253.66	3.5	2.1E+21	26
1864	12	24	7	0	0	35.12	-77.08	0	4.07	3.73	Added		180.01	3.5	1.7E+21	27
1868	2	22	11	0	0	36.78	-81.75	7	3.74	3.4	Added		280.97	3.2	6.5E+20	28
1868	10	11	0	0	0	36.91	-80.32	0	4.07	3.73	Added		186.85	3.5	1.7E+21	29
1869	1	1	0	0	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	30
1869	3	30	6	45	0	38.14	-78.19	0	4.58	4.24	Added		286.6	3.9	7.5E+21	31
1869	7	14	13	30	0	35.79	-80.89	0	4.07	3.73	Added		175.29	3.5	1.7E+21	32
1872	6	5	3	0	0	37.7	-78	0	4.04	3.7	EPRI	MAIN	244.8	3.4	1.5E+21	33
1872	12	7	12	0	0	36.71	-81.97	0	3.6	3.26	Added		295.62	3.1	4.3E+20	34
1873	10	3	12	45	0	37.2	-78.2	0	3.94	3.6	EPRI	MAIN	186.53	3.3	1.2E+21	35
1874	2	22	0	0	0	35.7	-82.1	0	3.64	3.3	EPRI	502	284.11	3.1	4.9E+20	36
1874	4	14	0	0	0	35.7	-82.1	0	3.64	3.3	EPRI	502	284.11	3.1	4.9E+20	37
1874	5	14	20	30	0	37.2	-77.35	0	4.32	3.98	Added		225.69	3.7	3.5E+21	38
1875	12	23	4	45	0	37.6	-78.5	0	4.9	4.8	EPRI	MAIN	222.03	4.8	1.6E+23	39
1876	12	12	0	0	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	40
1876	12	23	4	45	0	37.4	-77.5	0	3.64	3.3	EPRI	MAIN	235.43	3.1	4.9E+20	41
1878	5	18	0	0	0	36.29	-81.6	0	4.74	4.4	Added		248.69	4.0	1.2E+22	42
1879	10	26	20	0	0	34.37	-81.08	0	3.44	3.1	Added		239.43	2.9	2.7E+20	43
1880	1	28	0	0	0	35.5	-82.2	0	3.44	3.1	Added		293.85	2.9	2.7E+20	44
1884	1	18	8	0	0	34.59	-77.59	0	4.04	3.7	EPRI	MAIN	170.75	3.4	1.5E+21	45
1884	4	0	0	0	0	35.65	-80.45	0	3.6	3.26	Added		134.84	3.1	4.3E+20	46
1885	2	2	12	10	0	36.9	-81.1	0	3.64	3.3	EPRI	MAIN	237.9	3.1	4.9E+20	47
1885	8	6	9	0	0	36.12	-81.83	0	3.74	3.4	EPRI	MAIN	264.39	3.2	6.5E+20	48
1885	10	10	4	35	0	37.7	-78.8	0	4.5	4.4	EPRI	MAIN	229.78	4.0	1.2E+22	49
1886	2	5	2	0	0	35.93	-81.52	0	3.64	3.3	Added		233.48	3.1	4.9E+20	50

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Earthquake Catalog

Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth	m_b*	m_b	Type	EPRI Flag	R[1] (km)	M	Mo (dyne-cm)	Event No.
1886	9	1	2	51	0	33	-80.2	0	6.84	6.8	EPRI	MAIN	315.04	7.1	5.0E+26	51
1886	9	2	23	0	0	34.72	-81.23	0	3.94	3.6	Added		230.51	3.3	1.2E+21	52
1886	9	25	2	0	0	36.7	-80.05	0	3.54	3.2	Added		153.44	3.0	3.7E+20	53
1886	10	22	0	0	0	34.71	-81.66	0	4.44	4.1	Added		266.59	3.8	5.0E+21	54
1886	10	22	14	45	0	33.87	-81.01	0	5.3	5.2	EPRI	767	271.89	4.7	1.4E+23	55
1886	10	31	14	20	0	33.9	-80.39	0	4.24	3.9	Added		233.58	3.6	2.8E+21	56
1886	11	17	0	0	0	34.21	-77.91	0	4.86	4.52	Added		185.6	4.1	1.8E+22	57
1887	5	22	20	45	0	33.9	-80.37	0	4.04	3.7	Added		232.56	3.4	1.5E+21	58
1887	8	2	1	0	0	34.41	-78.83	0	4.14	3.8	Added		137.26	3.5	2.1E+21	59
1887	8	10	7	1	0	33.83	-79.95	0	4.24	3.9	Added		220.76	3.6	2.8E+21	60
1887	8	27	4	56	0	33.52	-81.22	0	4.34	4	Added		313.9	3.7	3.7E+21	61
1888	1	12	9	55	0	34.18	-80.17	0	4.73	4.4	EPRI	767	196.4	4.0	1.2E+22	62
1888	4	5	0	0	0	34.21	-81.53	0	4.74	4.4	Added		283.43	4.0	1.2E+22	63
1888	4	10	0	0	0	34.69	-80.7	0	3.6	3.26	Added		190.37	3.1	4.3E+20	64
1888	8	15	18	30	0	34.37	-81.08	0	3.44	3.1	Added		239.43	2.9	2.7E+20	65
1889	2	5	19	40	0	33.16	-79.2	0	4.24	3.9	Added		276.74	3.6	2.8E+21	66
1889	8	26	0	0	0	35.53	-77.03	0	4.07	3.73	Added		175.01	3.5	1.7E+21	67
1890	9	23	8	20	0	34.04	-80.89	0	4.86	4.52	Added		250.54	4.1	1.8E+22	68
1891	10	13	5	55	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	69
1891	10	26	0	55	0	33	-80.18	0	4.32	3.98	Added		314.38	3.7	3.5E+21	70
1893	7	5	8	10	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	71
1893	9	19	7	5	0	32.9	-80	0	3.64	3.3	EPRI	881	319.47	3.1	4.9E+20	72
1893	11	8	4	40	0	32.9	-80	0	3.64	3.3	EPRI	881	319.47	3.1	4.9E+20	73
1894	1	30	4	5	0	32.9	-80	0	3.64	3.3	EPRI	881	319.47	3.1	4.9E+20	74
1894	6	16	2	16	0	32.9	-80	0	3.64	3.3	EPRI	881	319.47	3.1	4.9E+20	75

Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth	m_b*	m_b	Type	EPRI Flag	R^1 (km)	M	Mo (dyne-cm)	Event No.
1894	12	11	5	27	0	32.9	-80	0	3.64	3.3	EPRI	881	319.47	3.1	4.9E+20	76
1895	3	4	22	0	0	36.1	-80.25	0	3.64	3.3	Added		127.22	3.1	4.9E+20	77
1895	4	27	7	40	0	32.9	-80	0	3.64	3.3	EPRI	881	319.47	3.1	4.9E+20	78
1895	7	25	4	1	0	32.9	-80	0	3.64	3.3	EPRI	881	319.47	3.1	4.9E+20	79
1895	10	6	6	25	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	80
1895	10	7	4	30	0	35.9	-77.5	0	3.84	3.5	EPRI	MAIN	134.9	3.3	8.6E+20	81
1896	2	11	1	45	0	36.3	-78.6	0	3.64	3.3	EPRI	MAIN	80.35	3.1	4.9E+20	82
1896	3	19	8	22	0	32.9	-80	0	3.64	3.3	EPRI	923	319.47	3.1	4.9E+20	83
1896	8	11	5	58	0	32.9	-80	0	3.64	3.3	EPRI	923	319.47	3.1	4.9E+20	84
1896	11	14	8	15	0	32.9	-80	0	3.64	3.3	EPRI	923	319.47	3.1	4.9E+20	85
1897	5	31	18	58	0	37.3	-80.7	0	5.8	5.7	EPRI	MAIN	241.74	5.9	8.2E+24	86
1897	10	22	3	20	0	36.9	-81.1	0	4.44	4.1	EPRI	970	237.9	3.8	5.0E+21	87
1897	12	18	23	45	0	37.7	-77.5	0	4.7	4.6	EPRI	MAIN	263.74	4.2	2.3E+22	88
1899	2	13	9	30	0	37	-81	0	4.5	4.4	EPRI	970	237.55	4.0	1.2E+22	89
1899	3	10	5	45	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	90
1899	12	4	12	48	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	91
1901	12	2	0	26	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	92
1902	5	18	4	0	0	37.3	-80.6	0	3.74	3.4	EPRI	MAIN	236.07	3.2	6.5E+20	93
1903	1	24	1	0	0	32.9	-80	0	4.44	4.1	EPRI	MAIN	319.47	3.8	5.0E+21	94
1907	1	26	6	0	0	37.27	-81.22	0	4.07	3.73	Added		271.86	3.5	1.7E+21	95
1907	2	11	13	22	0	37.7	-78.3	0	4.33	4	EPRI	MAIN	236.76	3.7	3.7E+21	96
1907	4	19	8	30	0	32.9	-80	0	4.24	3.9	EPRI	MAIN	319.47	3.6	2.8E+21	97
1908	8	23	9	30	0	37.5	-77.9	0	3.84	3.5	EPRI	MAIN	227.69	3.3	8.6E+20	98
1910	5	8	21	10	0	37.7	-78.4	0	3.84	3.5	EPRI	MAIN	234.71	3.3	8.6E+20	99
1911	2	10	10	22	0	36.6	-79.4	0	3.64	3.3	EPRI	MAIN	114.05	3.1	4.9E+20	100

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Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth	m_b*	m_b	Type	EPRI Flag	R^1 (km)	M	Mo (dyne-cm)	Event No.
1912	6	12	10	30	0	32.9	-80	0	5.24	4.9	EPRI	MAIN	319.47	4.5	6.3E+22	101
1912	8	8	1	0	0	37.7	-78.4	0	3.64	3.3	EPRI	1203	234.71	3.1	4.9E+20	102
1912	11	17	12	30	0	32.9	-80	0	3.64	3.3	EPRI	1201	319.47	3.1	4.9E+20	103
1913	1	1	18	28	0	34.7	-81.7	0	5.1	5	EPRI	MAIN	270.39	4.5	7.2E+22	104
1914	3	7	1	20	0	34.2	-79.8	0	3.64	3.3	EPRI	MAIN	177.57	3.1	4.9E+20	105
1914	9	22	7	4	0	32.9	-80	0	4.64	4.3	EPRI	1201	319.47	3.9	9.0E+21	106
1915	1	14	9	20	0	36.6	-82.2	0	3.94	3.6	EPRI	MAIN	310.42	3.3	1.2E+21	107
1916	8	26	19	36	0	36	-81	0	3.94	3.6	EPRI	MAIN	188.51	3.3	1.2E+21	108
1921	8	7	6	30	0	37.8	-78.4	0	4.13	3.8	EPRI	MAIN	245.58	3.5	2.1E+21	109
1924	11	13	10	30	0	36.6	-82.2	0	3.44	3.1	EPRI	MAIN	310.42	2.9	2.7E+20	110
1924	12	26	4	30	0	37.3	-79.9	0	3.84	3.5	EPRI	MAIN	203.11	3.3	8.6E+20	111
1925	5	16	1	30	0	37.3	-77.5	0	3.84	3.5	EPRI	MAIN	226.3	3.3	8.6E+20	112
1925	7	14	21	20	0	37.6	-77.5	0	3.64	3.3	EPRI	MAIN	254.17	3.1	4.9E+20	113
1926	7	8	9	50	0	35.9	-82.1	0	3.84	3.5	EPRI	MAIN	285.15	3.3	8.6E+20	114
1927	6	10	7	16	0	38	-79	0	3.94	3.6	EPRI	MAIN	262.75	3.3	1.2E+21	115
1927	11	23	0	50	0	33.9	-78	0	3.64	3.3	EPRI	MAIN	212.44	3.1	4.9E+20	116
1928	10	30	11	45	0	37.5	-77.5	0	3.74	3.4	EPRI	MAIN	244.72	3.2	6.5E+20	117
1928	12	23	2	30	0	35.3	-80.3	0	3.64	3.3	EPRI	MAIN	127.26	3.1	4.9E+20	118
1929	1	3	12	5	0	33.9	-80.3	0	3.64	3.3	EPRI	MAIN	229.07	3.1	4.9E+20	119
1929	12	26	2	56	0	38.1	-78.5	0	3.93	3.6	EPRI	MAIN	276.88	3.3	1.2E+21	120
1930	12	26	3	0	0	34.5	-80.3	0	3.44	3.1	EPRI	MAIN	176.02	2.9	2.7E+20	121
1932	1	5	4	5	0	37.6	-78.4	0	3.44	3.1	EPRI	MAIN	223.85	2.9	2.7E+20	122
1933	12	23	9	40	0	32.9	-80	0	3.84	3.5	EPRI	MAIN	319.47	3.3	8.6E+20	123
1934	12	9	9	0	0	32.9	-80	0	3.64	3.3	EPRI	1823	319.47	3.1	4.9E+20	124
1935	2	10	23	45	0	37.2	-77.4	0	3.64	3.3	EPRI	MAIN	222.85	3.1	4.9E+20	125

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1937	2	3	1	26	0	37.7	-78.7	0	3.94	3.6	EPRI	MAIN	230.5	3.3	1.2E+21	126
1942	10	7	2	15	0	37.6	-78.4	0	3.64	3.3	EPRI	MAIN	223.85	3.1	4.9E+20	127
1943	12	28	10	25	0	33	-80.2	0	3.64	3.3	EPRI	MAIN	315.04	3.1	4.9E+20	128
1945	1	30	20	20	0	32.9	-80	0	3.64	3.3	EPRI	2218	319.47	3.1	4.9E+20	129
1945	7	26	10	32	16	33.75	-81.38	5	4.1	4	EPRI	MAIN	305.4	3.7	3.7E+21	130
1945	10	12	19	0	0	37.5	-78.5	0	3.64	3.3	EPRI	MAIN	211.11	3.1	4.9E+20	131
1947	11	2	4	30	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	132
1948	1	5	3	20	0	37.5	-78.5	0	3.84	3.5	EPRI	MAIN	211.11	3.3	8.6E+20	133
1949	2	2	10	52	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	134
1949	5	8	11	1	0	37.6	-77.6	0	3.94	3.6	EPRI	MAIN	249.7	3.3	1.2E+21	135
1949	6	27	6	53	0	32.9	-80	0	3.64	3.3	EPRI	2372	319.47	3.1	4.9E+20	136
1950	11	26	7	45	0	37.7	-78.3	0	3.64	3.3	EPRI	MAIN	236.76	3.1	4.9E+20	137
1951	3	4	2	55	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	138
1951	3	9	7	0	0	37.6	-77.6	0	3.84	3.5	EPRI	MAIN	249.7	3.3	8.6E+20	139
1951	12	30	7	55	0	32.9	-80	0	3.64	3.3	EPRI	MAIN	319.47	3.1	4.9E+20	140
1952	6	11	20	20	0	36.3	-82.3	0	3.64	3.3	EPRI	MAIN	309.84	3.1	4.9E+20	141
1952	11	19	0	0	0	32.9	-80	0	3.44	3.1	EPRI	MAIN	319.47	2.9	2.7E+20	142
1953	2	7	7	5	0	37.7	-78.1	0	3.64	3.3	EPRI	MAIN	241.82	3.1	4.9E+20	143
1955	1	6	20	30	0	36.6	-82.2	0	3.44	3.1	EPRI	MAIN	310.42	2.9	2.7E+20	144
1955	1	17	12	37	0	37.3	-78.4	0	3.64	3.3	EPRI	MAIN	191.48	3.1	4.9E+20	145
1955	9	28	7	1	41	36.6	-81.3	0	3.84	3.5	EPRI	MAIN	236.07	3.3	8.6E+20	146
1957	5	13	14	24	51	35.8	-82.14	5	4.14	4.1	EPRI	MAIN	288.02	3.8	5.0E+21	147
1958	3	5	11	53	43	34.2	-77.8	0	3.74	3.4	EPRI	MAIN	191.9	3.2	6.5E+20	148
1958	10	23	2	29	44	37.2	-81.9	5	3.04	3	EPRI	*	315.54	2.8	2.1E+20	149
1959	4	23	20	58	39	37.39	-80.68	1	3.8	3.7	EPRI	MAIN	248.32	3.4	1.5E+21	150

Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth	m_b*	m_b	Type	EPRI Flag	R[1] (km)	M	Mo (dyne-cm)	Event No.
1959	7	7	23	17	0	37.3	-80.7	0	3.44	3.1	EPRI	2770	241.74	2.9	2.7E+20	151
1959	8	3	6	8	36	33.05	-80.13	1	4.64	4.6	EPRI	MAIN	307.53	4.2	2.3E+22	152
1959	8	21	17	20	0	37.3	-80.7	0	3.54	3.2	EPRI	2770	241.74	3.0	3.7E+20	153
1959	10	27	2	7	28	34.5	-80.2	0	4.33	4	EPRI	MAIN	169.82	3.7	3.7E+21	154
1960	2	9	14	0	0	35.4	-82.4	0	3.44	3.1	Added		312.89	2.9	2.7E+20	155
1960	3	12	12	47	44	33.07	-80.12	9	4.24	4.2	EPRI	2781	305.12	3.9	6.7E+21	156
1960	7	24	3	37	30	32.9	-80	0	4.04	3.7	EPRI	2781	319.47	3.4	1.5E+21	157
1960	9	4	18	40	0	37.4	-79.3	0	3.64	3.3	EPRI	MAIN	198.32	3.1	4.9E+20	158
1963	1	17	14	26	50	37.3	-80.1	0	3.64	3.3	EPRI	2876	211.16	3.1	4.9E+20	159
1963	5	4	21	1	50	32.97	-80.19	5	3.34	3.3	EPRI	*	317.83	3.1	4.9E+20	160
1963	10	28	22	38	0	36.7	-81	0	3.8	3.7	EPRI	*	218.09	3.4	1.5E+21	161
1964	4	20	19	4	44	33.84	-81.1	3	3.69	3.7	EPRI	MAIN	280.03	3.4	1.5E+21	162
1965	9	9	14	42	20	34.7	-81.2	0	3.38	3.2	EPRI	MAIN	229.1	3.0	3.7E+20	163
1966	5	31	6	18	59	37.66	-78.13	2	4.29	4.3	EPRI	MAIN	236.76	3.9	9.0E+21	164
1968	3	8	5	38	15	37.28	-80.77	8	3.39	3.4	EPRI	MAIN	244.17	3.2	6.5E+20	165
1968	9	22	21	41	18	34.11	-81.48	1	3.09	3.1	EPRI	MAIN	286.25	2.9	2.7E+20	166
1968	11	25	20	0	0	34.1	-77.9	0	3.64	3.3	EPRI	MAIN	196.67	3.1	4.9E+20	167
1969	11	20	1	0	9	37.45	-80.93	5	4.59	4.6	EPRI	MAIN	267.71	4.5	7.2E+22	168
1969	12	11	23	44	37	37.84	-77.67	1	3.59	3.6	EPRI	MAIN	270.56	3.3	1.2E+21	169
1970	9	10	1	41	5	36.02	-81.42	1	3.09	3.1	EPRI	MAIN	226.08	2.9	2.7E+20	170
1971	4	1	5	5	11	37.4	-81.6	0	2.99	3	EPRI	*	306.93	2.8	2.1E+20	171
1971	5	19	12	54	3	33.36	-80.66	1	3.69	3.7	EPRI	MAIN	297.75	3.4	1.5E+21	172
1971	7	31	20	16	55	33.34	-80.63	4	3.79	3.8	EPRI	3389	298.23	3.5	2.1E+21	173
1971	9	12	0	6	27	38.15	-77.59	5	3.59	3.6	EPRI	MAIN	304.83	3.3	1.2E+21	174
1972	1	9	23	24	29	37.4	-81.6	0	3.69	3.7	EPRI	*	306.93	3.4	1.5E+21	175

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1972	2	3	23	11	9	33.31	-80.58	2	4.49	4.5	EPRI	3389	298.81	4.1	1.7E+22	176
1972	9	5	16	0	0	37.6	-77.7	0	3.39	3.4	EPRI	MAIN	245.49	3.2	6.5E+20	177
1973	4	9	23	11	0	37.3	-77.7	0	3.74	3.4	EPRI	MAIN	216.46	3.2	6.5E+20	178
1973	12	19	10	16	8	32.97	-80.27	6	2.99	3	EPRI	*	320.52	2.8	2.1E+20	179
1974	5	30	21	28	35	37.46	-80.54	5	3.59	3.6	EPRI	MAIN	247.06	3.3	1.2E+21	180
1975	3	7	12	45	13	37.32	-80.48	5	3.1	3	EPRI	*	231.33	2.8	2.1E+20	181
1975	4	28	5	46	52	33	-80.22	10	3.12	3	EPRI	3694	315.71	2.8	2.1E+20	182
1975	11	11	8	10	37	37.22	-80.89	1	3.19	3.2	EPRI	*	246.68	3.0	3.7E+20	183
1976	6	19	5	54	13	37.34	-81.6	1	3.29	3.3	EPRI	MAIN	302.78	3.1	4.9E+20	184
1976	9	13	18	54	38	36.62	-80.77	9	4.29	4.3	EPRI	*	196	3.9	9.0E+21	185
1977	1	18	18	29	14	33.06	-80.17	1	2.99	3	EPRI	*	307.8	2.8	2.1E+20	186
1977	2	27	20	5	34	37.9	-78.63	0	3.39	3.4	EPRI	*	253.3	3.2	6.5E+20	187
1977	8	4	4	20	7	33.37	-80.7	9	3.09	3.1	EPRI	*	298.74	2.9	2.7E+20	188
1979	10	8	8	53	52	36.44	-82.08	5	3.59	3.6	Added		294.71	3.3	1.2E+21	189
1980	4	24	6	16	57	34.329	-81.324	3	2.99	3	Added		260.31	2.8	2.1E+20	190
1980	11	5	21	48	14	38.18	-79.9	4	2.99	3	EPRI	*	294.89	2.8	2.1E+20	191
1981	2	11	13	44	16	37.72	-78.44	6	3.39	3.4	EPRI	MAIN	236.15	3.2	6.5E+20	192
1981	4	9	7	10	31	35.51	-82.05	0	3.29	3.3	EPRI	*	280.21	3.1	4.9E+20	193
1981	5	5	21	21	56	35.33	-82.42	10	3.49	3.5	EPRI	MAIN	315.59	3.3	8.6E+20	194
1981	6	3	20	54	22	36.18	-81.67	1	2.99	3	Added		251.69	2.8	2.1E+20	195
1982	4	13	13	4	13	36.51	-82.04	3	3.1	3	EPRI	*	293.64	2.8	2.1E+20	196
1982	7	16	14	16	2	34.32	-81.55	2	3.09	3.1	Added		278.17	2.9	2.7E+20	197
1983	3	25	2	47	11	35.33	-82.46	12	3.29	3.3	EPRI	*	319.2	3.1	4.9E+20	198
1983	11	6	9	2	19	32.94	-80.16	10	3.38	3.3	EPRI	MAIN	320	3.1	4.9E+20	199
1984	8	17	18	5	46	37.868	-78.324	8	4.19	4.2	Added		254.41	3.9	6.7E+21	200

Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth	m_b*	m_b	Type	EPRI Flag	R^1 (km)	M	Mo (dyne-cm)	Event No.
1984	10	22	18	58	41	36.36	-81.68	11	3.3	3.2	EPRI	MAIN	257.81	3.0	3.7E+20	201
1985	6	10	12	22	38	37.248	-80.485	11	3.19	3.2	Post		225.21	3.0	3.7E+20	202
1987	3	16	13	9	27	34.56	-80.94	0	3.09	3.1	Post		216.68	2.9	2.7E+20	203
1988	1	23	1	57	16	32.935	-80.157	7	3.29	3.3	Post		320.42	3.1	4.9E+20	204
1988	2	16	15	26	54	36.561	-82.304	5	3.19	3.2	Post		317.86	3.0	3.7E+20	205
1990	11	13	15	22	13	32.947	-80.136	3	3.19	3.2	Post		318.51	3.0	3.7E+20	206
1991	3	15	6	54	8	37.746	-77.916	17	3.79	3.8	Post		252.26	3.5	2.1E+21	207
1991	4	22	1	1	20	37.941	-80.207	14	3.49	3.5	Post		279.26	3.3	8.6E+20	208
1992	8	21	16	31	55	33.05	-80.116	10	4.19	4.2	Post		307.09	3.9	6.7E+21	209
1993	1	1	5	8	5	35.877	-82.09	3	2.99	3	Post		284.05	2.8	2.1E+20	210
1994	8	6	19	54	12	35.101	-76.786	0	3.79	3.8	Post		206.09	3.5	2.1E+21	211
1995	4	17	13	45	57	32.947	-80.068	10	3.89	3.9	Post		316.44	3.6	2.8E+21	212
1995	6	26	0	36	17	36.747	-81.452	5	3.49	3.5	Post		255.62	3.3	8.6E+20	213
1995	7	7	21	1	2	36.515	-81.873	11	2.99	3	Post		279.68	2.8	2.1E+20	214
1998	4	13	9	56	11	34.61	-80.466	5	3.79	3.8	Post		178.68	3.5	2.1E+21	215
1998	6	5	2	31	1	35.479	-80.821	5	3.19	3.2	Post		169.51	3.0	3.7E+20	216
1998	10	21	5	56	47	37.381	-78.367	13	3.49	3.5	Post		200.95	3.3	8.6E+20	217
2003	5	5	16	32	32	37.716	-78.079	5	3.89	3.9	Post		244.1	3.6	2.8E+21	218
2003	12	9	20	59	19	37.774	-78.1	12	4.49	4.5	Post		249.63	4.1	1.7E+22	219
2004	7	20	9	13	14.44	32.972	-80.248	10	3.09	3.1	Post		319.56	2.9	2.7E+20	220
2005	2	18	14	21	54	34.05	-81.11	5	3.09	3.1	Post		264.33	2.9	2.7E+20	221
2006	9	22	11	22	1	34.7	-79.75	5	3.49	3.5	Post		126.87	3.3	8.6E+20	222
2006	9	25	5	44	25.09	34.746	-79.876	5	3.69	3.7	Post		129.73	3.4	1.5E+21	223
2006	11	2	17	53	2.11	37.2	-81.92	1	4.29	4.3	Post		317.03	3.9	9.0E+21	224
2006	11	23	10	42	57.42	37.157	-81.975	0	4.29	4.3	Post		318.67	3.9	9.0E+21	225