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NL-14-072

May 19, 2014

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11545 Rockville Pike, TWFN-2F1
Rockville, MD 20852-2738

SUBJECT: Response to Request for Information Regarding Planned Audit for Near Term Task Force Recommendation 2.1: Flooding Hazard Reevaluation Report (TAC Nos. MF3313 and 3314)
Indian Point Unit Numbers 1, 2, and 3
Docket Nos. 50-247 and 50-286
License Nos. DPR-26 and DPR-64

REFERENCE:
1. Entergy Letter (NL-13-156), Entergy's Required Response for NTTF Recommendation 2.1: Flooding - Hazard Reevaluation Report, Dated December 23, 2013
2. NRC letter, Request for Additional Information Regarding Planned Audit for Near Term Task Force Recommendation 2.1: Flooding Hazard Reevaluation Report (TAC Nos. MF3313 and 3314), dated May 5, 2014

Dear Sir or Madam:

In Reference (1), Entergy Nuclear Operations, Inc. (Entergy) submitted a response to the Near Term Task Force Recommendation 2.1: Flooding Hazard Reevaluation Report in response to the Nuclear Regulatory Commissions (NRC's) request for information pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f). In reviewing the Flooding Hazard Reevaluation Report (FHRR), the NRC determined that additional information was required to complete the review and support a planned audit (Reference 2). The attachment to this letter provides a response to this request.

A010
NRR

There are no new commitments contained in this submittal. If you have any questions regarding this confirmation of receipt, please contact Mr. Robert Walpole, Manager, Regulatory Assurance at (914) 254-6710.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 19, 2014.

Respectfully,

JAV/sp

Attachment: Response to NRC Request for Additional Information Regarding FHRR

Enclosure: Hard drive with electronic information

cc: Mr. Douglas Pickett, Senior Project Manager, NRC NRR DORL
Mr. William M. Dean, Regional Administrator, NRC Region 1 w/o enclosure
NRC Resident Inspectors Office w/o enclosure
Mr. John B. Rhodes, President and CEO, NYSERDA w/o enclosure
Ms. Bridget Frymire, New York State Dept. of Public Service w/o enclosure

ATTACHMENT TO NL-14-072

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

REGARDING FHRR

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2, AND 3
DOCKET NOS. 50-247, AND 50-286

NRC Request For Additional Information Regarding FHRR

The Nuclear Regulatory Commission (NRC) staff requests that the licensee provide the following figures and files used in the development of the Flooding Hazard Reevaluation Report (FHRR). Input and output files are requested in their native file format (*.xlsx, *.out, etc.). Adobe Acrobat Portable Document Files (PDFs) are not requested to be submitted unless specifically requested in that format. The staff also requests that the licensee provide clarification regarding the scope of, and input parameters for, the integrated assessment.

Local Intense Precipitation, Riverine Flooding, and Dam Failure

NRC staff requests that the licensee provide the following figures and files used in the development of the FHRR Sections 3.1, 3.2, and 3.3.

1. General
   - High-resolution figures from FHRR: 2.1-2, 2.1-3, 3.1-1, 3.4-52 (combined effect event)
   - Figures 3.2-1 & 3.3-1 with the Hudson River shown prominently

Response: The requested documents are in the "General Figures" folder of the enclosed electronic files. Note that Figure 3.1-1 is a FLO-2D output file and cannot be improved.

2. Local Intense Precipitation Flood
   - Input files for FLO-2D modeling (in native FLO-2D format)
   - Minimum output: Summary.out file from FLO-2D modeling (in native FLO-2D format)
   - Sufficient output from FLO-2D modeling to review licensee's results independent of the FHRR and electronic reading room modeling (in native FLO-2D format):
     - MAXWSELEV.out
     - DEPTH.out
     - CHVOLUME.out
     - CHANMAX.out
     - CROSSMAX.out
     - HYCROSS.out
     - CROSSQ.out
     - HYCHAN.out
     - HYDROSTRUCT.out
     - VELTIMEC.out
     - VELTIMEFP.out
     - TIMDEP.out

Response: The requested documents are in the "RAI LIP" folder of the enclosed electronic files. The bullet item 1, above, is the subdirectory "C1 Inputs for FLO 2D.zip", and bullet items 2 and 3 are in subdirectory "C2 Outputs for FLO 2D.zip."

3. Riverine Probable Maximum Flood (PMF)
   - HEC-HMS input files (in native format)
   - HEC-RAS input file (in native format)
   - Calibration sets for HEC-HMS and HEC-RAS (in native format)

- Sufficient output to review licensee's results independent of FHRR and electronic reading room (ERR) (in native format)
  - HEC-HMS *.DSS
  - HEC-HMS *.OUT
  - HEC-RAS *.O## - output files
  - HEC-RAS *.R## - restart files (depending on how the initial conditions are specified)
  - HEC-RAS *.DSS

Response: The requested documents are in the "RAI PMF Hydrology" and "RAI PMF Hydraulics" folders of the enclosed electronic files. The bullet items 1 and sub-bullets 1 and 2 of item 4, are in the "RAI PMF Hydrology\PMF" directory. The bullet item 2 and sub-bullets 3, 4, and 5, are in "RAI PMF Hydraulics" directory. Note that no restart files were used. Bullet item 3 is in the "RAI PMF Hydrology\Calibration" and "RAI PMF Hydraulics" directories.

4. Dam Breach Flood
   - HEC-HMS input files (in native format)
   - HEC-RAS input files (in native format)
   - Sufficient output to review licensee's results independent of FHRR and ERR (in native format)
     - HEC-HMS *.DSS
     - HEC-HMS *.OUT
     - HEC-RAS *.O## - output files
     - HEC-RAS *.R## - restart files (depending on how the initial conditions are specified)
     - HEC-RAS *.DSS

Response: The requested documents are in the " RAI Dam Failure" folder of the enclosed electronic files. The bullet 1 items are in the "RAI Dam Failure\HMS\IPEC_Cascade_Breach = small dams near IPEC" and the "RAI Dam Failure\HMS\IPEC_Dam_Breach = small dams near IPEC" subfolders. The bullet 2 items are in the "RAI Dam Failure\HEC RAS" subfolder. Bullet 3, sub-bullets 1 and 2 are in the "RAI Dam Failure\HMS\IPEC_Cascade_Breach = small dams near IPEC" subfolder. Bullet 3, sub-bullets 3, 4, and 5 are in the "RAI Dam Failure\HEC RAS" subfolder (no restart files were used).

5. High resolution graphics from select files in the ERR:
   a. 38-9196956 (IPEC Probable Maximum Flood on Hudson River - Hydrology Calculation: topography file INDIAN_POINT_TOPO_PLAN.pdf as a large printed map or other large format.
   b. 32-9196321 (Flood Haz Re-eval-Local Intense Precipitation – Generated Flood Flow and Elevations at IPEC; several problematic figures from Appendices A and B. In Appendix A, there are four figures: A-1 for maximum water surface elevations, A-2 for maximum depth, A-3 for maximum velocity, and A-4 grid cell number. In Appendix B, there is only one figure, B-1 for the topographic survey.

Response: The requested documents are in the "General Figures" and "LIP Figures" folders of the enclosed electronic files for items a. and b., respectively.

Storm Surge

NRC staff requests that the licensee provide the following additional information related to the evaluation of storm surge:

1. NRC staff requests that the licensee provide the ADCIRC models files — as listed below — that were applied in the development of probable maximum storm surge as stated in FHRR Section 3.4.2.4. Input and output files are requested in their native file format (*.xlsx, *.out, etc.). PDFs of files are requested to not be submitted unless specifically requested in that format.

#	Files	Description
1	Fort.13	ADCIRC Nodal Attribute File
2	Fort.14	ADCIRC Grid and Boundary Information File
3	Fort.15	ADCIRC Model Parameter and Periodic Boundary Condition File
4	Fort.22	Wind input files developed for storms simulated in ADCIRC (discussed on page 3-35 of FHRR Report)
5	Land class data	Defines land use in mesh region
6	Documentation	Reports developed the document mesh development (changes from FEMA coastal study mesh) and model validation and execution
7	Storm Validation data	Storm validation forcing files (wind/pressure, fort.22) and measurements for comparison

Response: The requested documents are in the "ADCIRC Files" folder in the attached electronic storage. There are separate subfolders for deterministic, probabilistic, and combined event calculations' input and output files. Model file directories each include a readme file with more information on how to navigate the input/output files

- Land class data is not a direct input to ADCIRC. Water friction against ocean bottom, surface canopy coefficient and surface directional effective roughness (which are parameters specified in the nodal attributes file (Fort.13)) were derived from land cover data. The source of the land cover data used is discussed in the FEMA Land Cover Data Report (see "ADCIRC Files" and subfolder "Documentation").

- Changes from the FEMA coastal study mesh are described in the Probabilistic Storm Surge Calculation (32-9213352-000), Section 2.4 under the heading "ADCIRC Grid Development and Nodal Attribute Assignments"

- For Documentation of FEMA coastal study, see "ADCIRC Files" and subfolder "Documentation".

- For Storm Validation data, see "ADCIRC Files" and subfolder "Storm Validation" as per notes below.

- ADCIRC Files\Storm Validation\Measurements = Text files from NOAA tide gages for Sandy and Irene

2. Provide input files (in native format) necessary to recreate two of the SLOSH and ADCIRC model results in Tables 3.4-10 and 3.4-12.

Response: The requested documents are in the "SLOSH Files" and "ADCIRC Files" folders in the attached electronic storage. The input files to recreate the results in Tables 3.4-10 and 3.4-12 are in the "SLOSH Files\Probabilistic_JPM" and "ADCIRC Files\Probabilistic Storm Surge Analysis" subdirectories, respectfully.

3. NRC staff requests the licensee provide the information listed below related to the probabilistic evaluation of storm surge. In conjunction with the items below, staff requests that the licensee include supporting information to assist the staff in identifying relevant information provided as part of the RAI response such as provision of (1) indices describing the content of various input/output files and (2) field titles (e.g., column headers and row identifiers) for datasets and tables of information. Input and output files, as well as any supporting information, are requested in their native file format (e.g., *.xlsx, *.txt, etc.). Tables of information are requested to be provided in a format suitable for import into mathematical software packages (e.g., delimited text files or spreadsheets). PDFs of files are not requested to be submitted unless specifically requested in that format.
   - Input data (e.g., HURDAT database) used to support development of probability distributions for storm parameters and examination of parameter correlations.
   - Computer codes and input/output files (e.g., files referenced in Section 6.6.2 and Appendix E of AREVA Document No. 32-9207390-000) used to process storm data, compute probability distributions for storm parameters, and examine parameter correlations.
   - Tabulation of the events (including event dates) used to compute the omni-directional storm rate (as referenced in Section 6.2 of AREVA Document No. 32-9213352-000).
   - Tabulation of all storm parameter combinations and resulting surge elevations evaluated using SLOSH and (as applicable) ADCIRC (as referenced in Section 2.2 of AREVA Document No. 32-9213352-000).
   - Spreadsheet used for JPM calculations (as referenced in Appendix H of AREVA Document No. 32-9213352-000).

Response:

The requested documents are in the "Probabilistic Storm Surge Documentation" and "Stage_Frequency_Curve_Calculation" folders in the attached electronic storage. Item 1 is in the "Probabilistic Storm Surge Documentation" subfolder "HURDAT2" file "hurdat2-atlantic-1851-2012.txt." Item 2 is in the "Probabilistic Storm Surge Documentation" subfolder "APP-E_32-9207390-000." Item 3 is in the "Probabilistic Storm Surge Documentation" subfolder and the GIS file used to query the HURDAT storm tracks shapefile is in the "Omnidirectional_Rate" subfolder. Item 4 is in the "Stage_Frequency_Curve_Calculation" folder, Tab "Joint_Probabilities." Item 5 is in the "Stage_Frequency_Curve_Calculation" folder tabs "SLOSH-Surge-Frequency" and "ADCIRC-Surge-Frequency."

Integrated Assessment

NRC staff requests that the licensee provide the following additional information related to the scope of and input parameters for the integrated assessment:

1. The NRC staff noted that the cover letter of the FHRR states the following: "Entergy will, in accordance with Reference 1, Recommendation 2.1, Item 2, perform an integrated assessment and submit to NRC an Integrated Assessment Report within two years." The licensee is requested to clarify which flood hazard mechanisms will be included in the Integrated Assessment.

Response

Indian Point Nuclear Generating Unit 2 & Unit 3 Integrated Assessment will include the following flood hazard mechanisms:

- Local Intense Precipitation (LIP)
- Flooding on Rivers and Streams
- Dam Failure
- Storm Surge
- Combined Effects

2. Background: The March 12, 2012, 50.54(f) letter, Enclosure 2, requests the licensee to perform an integrated assessment of the plant's response to the reevaluated hazard if the reevaluated flood hazard is not bounded by the current design basis. Flood scenario parameters from the flood hazard reevaluation serve as the input to the integrated assessment. To support efficient and effective evaluations under the integrated assessment, NRC staff will review flood scenario parameters as part of the flood hazard reevaluation and document results of the review as part of the staff assessment of the flood hazard reevaluation.

   Request: The licensee is requested to provide the flood height and associated effects (as defined in Section 9 of JLD-ISG-2012-05) that are not described in the flood hazard reevaluation report for mechanisms that trigger an Integrated Assessment. This includes the following quantified information for each mechanism (as applicable):

   - Flood height,
   - Wind waves and runup,
   - Hydrodynamic loading, including debris,
   - Effects caused by sediment deposition and erosion (e.g., flow velocities, scour),
   - Concurrent site conditions, including adverse weather,
   - Groundwater ingress, and
   - Other pertinent factors

Response

Flooding on Rivers and Streams flood height of 14.6 ft exceeds the CLB flood height of 12.7 ft however remains below site grade of 15.0 ft. (FHRR 3.2.3). Dam Failures flood height of 14.9 ft exceeds the CLB of 7.2 ft however does not does not exceed site grade of 15.0 ft. (FHRR4.1.3.2). Local Intense Precipitation maximum flood heights are 19.0 ft in the Unit 2 transformer area and 19.2 ft in the Unit 3 transformer area. Flood height in other areas vary as discussed in the FHRR section 3.1.2.1.3. Water

depth and flow velocities do not result in debris or hydrodynamic loading. Storm Surge and combined effects flood height are 15.8 ft Stillwater, 16.3 ft wave crest and 17.7 ft runup. Refer to FHRR table 3.4-12 for the $2x10^{-6}$ annual exceedance probability flood heights. Hydrostatic loads, hydrodynamic loads, debris impact loads, wave loads are evaluated and included in the FHRR section 3.4.2.6.2 subsequent to table 3.4-2.

3. Background: The March 12, 2012, 50.54(f) letter, Enclosure 2, requests the licensee to perform an integrated assessment of the plant's response to the reevaluated hazard if the reevaluated flood hazard is not bounded by the current design basis. Flood scenario parameters from the flood hazard reevaluation serve as the input to the integrated assessment. To support efficient and effective evaluations under the integrated assessment, the NRC staff will review flood scenario parameters as part of the flood hazard reevaluation and document results of the review as part of the staff assessment of the flood hazard reevaluation.

   Request: The licensee is requested to provide the applicable flood event duration parameters (see definition and Figure 6 of the Guidance for Performing an Integrated Assessment, JLD-ISG-2012-05) associated with mechanisms that trigger an integrated assessment using the results of the flood hazard reevaluation. This includes, as applicable, the warning time the site will have to prepare for the event (e.g., the time between notification of an impending flood event and arrival of floodwaters on site) and the period of time the site is inundated for the mechanisms that are not bounded by the current design basis. The licensee is also requested to provide the basis or source of information for the flood event duration, which may include a description of relevant forecasting methods (e.g., products from local, regional, or national weather forecasting centers) and/or timing information derived from the hazard analysis.

Response

For Local Intense Precipitation, the warning time is discussed under section 5.1.6 of the FHRR with triggering from National Weather Service quantitative precipitation forecast (QPF). QPF provides continental US rainfall as isohyets in varying increments. When QPF forecast for 24 hour rainfall exceed 5" (less than the LIP event), plant procedures trigger installation of pre-staged sandbags in each transformer yard. From the notification until the sandbags in the transformer yard are in place is expected to be no more than 4 hours. Duration of the site above the protected elevation is depicted in the FHRR figures 3.1.2 and 3.1.3. From beginning of the LIP event until water is below the normal level where sandbag protection is no longer needed is 6 hrs and inundation ends.

Flood event duration parameters are for the combined event of Storm Surge, 25-year storm-related river flood, antecedent 10% exceedance tide, and coincident wind-generated wave activity. The hurricane will be forcast to reach the area of the site more than 48 hours in advance. About 48 hours prior to hurricane impact, preparation begins which is estimated to be completed in no more than 24 hours. Flooding duration is less than 4 hrs. After that time, flood waters recede below site grate. Refer to the FHRR section 5.0.

ENCLOSURE TO NL-14-072

HARD DRIVE WITH ELECTRONIC INFORMATION

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2, AND 3
DOCKET NOS. 50-247, AND 50-28