

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

POWER AUTHORITY OF THE STATE
OF NEW YORK

(Greene County Nuclear Power
Plant)

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Docket No. 50-549

SUPPLEMENTAL TESTIMONY OF NRC STAFF IN
RESPONSE TO CITIZENS TO PRESERVE THE
HUDSON VALLEY, STIPULATED CONTENTION I.B.1.
(EXTERNAL FLOODING)

by

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and
Marcus Greenberg

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1 This testimony is offered in response to Contention I.B.1. of
2 Citizens to Preserve the Hudson Valley, which reads as follows:

3 I. The Preliminary Safety Analysis Report ("PSAR") prepared
4 by the Applicant does not provide reasonable assurance, as required
5 by 10 CFR §§50.35 and 50.40 that (a) the health and safety of the
6 public will not be endangered, and (b) the Applicant is financially
7 qualified to engage in the proposed activities in accordance with the
8 Commission's regulations in the following respects:

9 B. The PSAR is deficient with regard to its description and
10 analysis of the following design features or principal safety considera-
11 tions as required by 10 CFR §50.34:

12 1. Plant design with respect to external flooding
13 phenomena.

14 Title 10 CFR §50.34, Content of Applications; Technical Information,
15 outlines the information to be included in the PSAR. With regard to
16 preliminary design of the facility, 10 CFR §50.34 requires conformance to
17 Appendix A, 10 CFR Part 50, (General Design Criteria for Nuclear Power
18 Plants).

19 For external flooding phenomena, the applicable General Design
20 Criterion in Appendix A is Criterion 2. Regulatory Guide 1.59, Revision 2,
21 "Design Basis Floods for Nuclear Power Plants," interprets General Design
22 Criterion 2 and defines the design basis floods, acceptable to the staff
23 that nuclear power plants should be designed to withstand without loss of
24 capability for cold shutdown and maintenance thereof. Consistent with the

1 criteria of Regulatory Guide 1.59, the following design basis events that
2 could result in external flooding have been analyzed by the applicant for
3 the proposed Greene County site (PSAR, Section 2.4 and Responses to
4 371 questions):

5 1) Combination of a Probable Maximum Flood^{1/} on the Hudson River
6 and a 25-year hurricane surge at The Battery;

7 2) Combination of a Standard Project Flood^{2/} on the Hudson River coinci-
8 dent with the seismic failure of dams and the mean tidal stages at The Battery;

9 3) Combination of a 25-year flood on the Hudson River and a Probable
10 Maximum Hurricane^{3/} at the Battery;

11 1/ The Probable Maximum Flood is the hypothetical flood (peak discharge,
12 volume and hydrograph shape) that is considered to be the most severe
13 reasonably possible, based on comprehensive hydrometeorological applica-
14 tion of probable maximum precipitation and other hydrologic factors favor-
15 able for maximum flood runoff such as sequential storms and snowmelt.

16 2/ The Standard Project Flood is a hypothetical flood that is produced
17 by the critical concentrations of runoff from the most severe combination
18 of precipitation (and snowmelt, if pertinent) that is considered
19 "reasonably characteristic" of the drainage area involved.

20 3/ The Probable Maximum Hurricane is a hypothetical hurricane having that
21 combination of characteristics which will make it the most severe that
22 can reasonably occur in the particular region involved. The hurricane
23 should approach the point under study along a critical path and at an
24 optimum rate of movement which will result in most adverse flooding.

1 4) Combination of the Standard Project Flood on the Hudson River and
2 the Standard Project Hurricane ^{4/} surge at The Battery;

3 5) The Probable Maximum Precipitation ^{5/} at the site.

4 Items 1 through 4 are riverine flooding events effecting the elevation
5 of the Hudson River at the site. Item 5 is a localized precipitation event
6 effecting site water level on the plant yard.

7 Item 1 produces the maximum flood level on the Hudson River at the
8 proposed site. The probable maximum water elevation, including the
9 wind-wave effects, was estimated by the applicant to be 28.5 feet, mean sea
10 level (msl) (PSAR, pages 2.4-17 and 2.4-17A). We independently estimated
11 the flood level produced by a Probable Maximum Flood on the Hudson River

12 4/ The Standard Project Hurricane is a hypothetical hurricane intended to
13 represent the most severe combination of hurricane parameters that is
14 reasonably characteristic of a specified region, excluding extremely rare
15 combinations. It is further assumed that the SPH would approach a given
16 project site from such direction, and at such rate of movement as to
17 produce the highest hurricane surge hydrograph, considering pertinent
18 hydraulic characteristics of the area.

19 5/ Probable Maximum Precipitation is the estimated depth for a given duration,
20 drainage area, and time of year for which there is virtually no risk of
21 exceedance. The probable maximum precipitation for a given duration and
22 drainage area approaches and approximates the maximum which is physically
23 possible within the limits of contemporary hydrometeorological knowledge
24 and techniques.

1 and a 25-year hurricane surge using an unsteady flow model.^{6/} We also
2 estimated the wind-wave effects by methods outlined in the Shore
3 Protection Manual (U.S. Army Coastal Engineering Research Center, 1973).
4 Based on our independent analysis, we conclude that the applicant's estimate
5 is acceptable. Therefore, floods on the Hudson River will not affect the
6 proposed facility due to its relative elevation at 30 feet, mean sea level.

7 Item 5, the Probable Maximum Precipitation at the site was estimated
8 by the applicant to result in a maximum water elevation of approximately
9 30.2 feet, (PSAR, page 2.4-11) mean sea level. The Probable Maximum
10 Precipitation at the site results in the controlling design bases flood
11 elevation for external flooding. Based on our independent evaluation,
12 we conclude that the applicant's estimate is acceptable.

13 Marcus Greenberg. The staff as part of their review concluded that the
14 effects of a local probable maximum precipitation on the plant area and
15 adjacent land west of the plant could result in a total water elevation of
16 30.23 feet msl. The applicant stated that the plant finished grade will be
17 at an elevation of 30.0 feet msl. This is confirmed in Figure 1.2-1 Plot
18 Plan. Therefore, were this probable maximum precipitation to occur, the
19 result could be an additional maximum temporary water depth of 2.7 in. (see
20 §2.4.3 of SER) above plant grade. The applicant stated that all safety related
21 systems and components required for safe shutdown or to mitigate the consequences
22 of an accident would be protected from flooding by locating them in seismic

23 ^{6/} Hydrologic Engineering Center, "Gradually Varied Unsteady Flow
24 Profiles," Department of the Army, Corps of Engineers, 1976.

1 Category I buildings (see Section 3.7 of the SER) with all access to these
2 structures being six inches above plant grade (30.5 feet msl) see
3 Figure 1.2-6 sheets 5 and 6 of 19. He further stated that all construction
4 joints in the exterior walls and mat, such as the lower portion of the
5 annulus building, that would be required to resist water pressure will
6 have water stops. We found these commitments in compliance with our
7 guidelines as stated in Regulatory Guide 1.102 "Flood Protection for
8 Nuclear Power Plants" and in General Design Criterion 2 "Design Bases
9 for Protection Against Natural Phenomena," and, therefore, acceptable.
10 In response to the staff's concern pertaining to the penetrations of the
11 service water lines below grade at the annulus building, the applicant
12 in Revision) committed to sealing these penetrations to prevent in-leakage.
13 The applicant further stated that both the annulus building and the
14 containment structure will have a continuous waterproof membrane below
15 grade so that any potential inleakage due to cracks in the annulus building
16 walls or leaking water stops will be collected in sumps and pumped out.
17 We found this meets the guidelines stated in Regulatory Guide 1.102,
18 "Flood Protection for Nuclear Power Plants," and, therefore, acceptable.
19 As a result of our review and evaluation we concluded that the principle
20 design criteria as stated by the applicant are in compliance with
21 10 CFR §50.34 and, therefore, are acceptable.

22 We conclude that the PSAR has presented the information required in
23 10 CFR §50.34 on external flooding phenomena at the proposed Greene County
24 site.

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Professional Qualifications

I am a Hydraulic Engineer on the staff of the Hydrologic Engineering Section of the Hydrology-Meteorology Branch, Division of Site Safety and Environmental Analysis, Office of Nuclear Reactor Regulation.

My formal education consists of study in meteorology at Lowell Technological Institute, where I received my B.S. in Meteorology in 1969. I am currently enrolled in a graduate program in Environmental and Water Resources Engineering, in the Civil Engineering Department, at the University of Maryland. Major fields of graduate study are surface and groundwater hydrology, water resource systems, and hydrologic analysis.

My present employment with NRC (formerly AEC) dates from 1974 in the area of hydrologic engineering with the Office of Nuclear Reactor Regulation. My responsibilities in the licensing review of nuclear facilities are in the areas of flood vulnerability, water supply, surface and groundwater effect and acceptability of effluents.

From 1973 to 1974, I was an Engineering Assistant with NRC in the areas of hydrology and meteorology. My responsibilities included assisting meteorologists and hydraulic engineers in evaluating the adequacy of design bases for proposed nuclear facilities.

From 1971 to 1972 I was an Engineering Assistant with the General Electric Company in San Jose, California. My responsibilities included performing calculations using computer programs and documenting these programs for a nuclear fuels and materials engineering group.

From 1969 to 1970 I worked as a Computer Programmer with the John Hancock Insurance Company in Boston, Massachusetts. My responsibilities included writing, maintaining, and updating computer programs.

I am a member of the American Society of Civil Engineers. I co-authored a technical paper entitled, "Radionuclide Migration from Low-Level Waste: A Generic Overview." This paper was presented at the Low-Level Waste Management Symposium in Atlanta, Georgia, May 23-27, 1977.