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NEW YORK, N.Y. 10019

February 4, 1983

Re: Indian Point Unit No. 2
Docket No. 50-247

Indian Point Unit No. 3
Docket No. 50-286

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

ATTN: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing

Seismic Capacity of Indian Point Containment Buildings

The purpose of this letter is to bring you current on developments relating to the risk of the Indian Point plants as determined by our Indian Point Probabilistic Safety Study (IPPSS) consultants. You will recall that in a December 23, 1982 letter addressed to John D. O'Toole, you requested a seismic re-analysis of the Unit 2 containment building fragilities beyond that contained in the March 5, 1982 version of IPPSS. After receipt of your request, such analysis was performed by Structural Mechanics Associates (SMA) as presented in Attachment A. The Indian Point Unit 3 (IP-3) containment building was also reviewed since, aside from the ramp soil loading on the containment wall for IP-2, the design approaches are the same. The re-analysis is based on design calculations and results of a dynamic analysis and structural drawings not previously considered.

The new information revealed large conservatisms in the seismic design which had not previously been quantified, and which were not included in the summary design report information previously employed by SMA. Our consultants advise that these conservatisms included:

1. The design method used for determining mode shape and frequency, and base shear loads.

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2. The actual use of a greater amount of reinforcing steel bars in the containment building walls than modeled in the earlier design stress calculations.

3. Greater Unit 2 design soil loading area than as-built, where actual earth ramp load is localized.

The results of the re-analysis show that the median seismic ground acceleration capacities of the containments are at least 2.9g for IP-2 and 2.4g for IP-3. The earlier analysis presented in the IPPSS showed these values to be 1.1g and 1.7g respectively.

The impact of the new results essentially eliminates the possibility of containment failure from a seismic event. Even when accounting for the uncertainty associated with the new median acceleration values, indicated above, the containments would not fail at accelerations up to the upper bound acceleration of 0.8g. The result is that sequences leading to the Z-1Q release category no longer apply to either unit at Indian Point. Since release category Z-1Q was one of the major contributors to estimated early fatalities at IP-2, we revised the IPPSS calculations of estimated early fatalities to show the reduction. The societal risk curves for Indian Point 2 are shown in attached Figures III-1a through III-1e for each index analyzed. Similarily, the societal risk curves for Indian Point 3 are shown in Figures III-2a through III-2e. These risk curves supersede those set forth in Amendment 1 to IPPSS, and will be incorporated in subsequent IPPSS amendments.

These revised analyses, together with the revised seismic and fire analysis set forth in Amendment 1 to the IPPSS, provide new risk assessments for the Indian Point units, and have been included in probabilistic testimony provided by the licensees in the pending Indian Point Proceeding, which is charged with assessing the current, up-to-date risk of the Indian Point units. We therefore include NRC Staff Counsel as a recipient of this letter in order to supply further justification for risk assessments included in testimony currently offered by licensees in the proceeding. We recognize that at the Alburquerque meeting regarding IPPSS held on October 13, 1982 the Staff also committed to presenting its risk testimony in the proceedings based upon current assessments, and supply the above information for such purposes as well.

If you have any questions, please feel free to contact the undersigned.

Very truly yours,

J. P. Bayne
Executive Vice President
Power Authority of the State
of New York

John D. O'Toole
Vice President
Consolidated Edison Company
of New York, Inc.

attach.
cc: Janice Moore, Esq.

STRUCTURAL MECHANICS ASSOCIATES
A Calif. Corp.

SMA 12901.01

5160 Birch Street, Newport Beach, Calif. 92660 (714) 833-7552

December 30, 1982

Mr. H. F. Perla
Pickard, Lowe and Garrick, Inc.
17840 Skypark Boulevard
Irvine, California 92714

Dear Hal:

At your request, we have reevaluated the capacity of the Indian Point Unit 2 containment building to withstand seismic excitation. Capacities have been developed assuming no retaining wall exists between the soil backfill on the east side of the structure and also assuming a retaining wall is in-place so that no soil loads occur on the containment. The evaluation of the new seismic capacities was based on several new items of design information which were not available for the original investigation. These include:

1. Westinghouse dynamic analysis results showing frequencies, mode shapes, and floor response spectra.

2. UE&C containment design calculations.

3. Structural drawings showing wall meridional and hoop reinforcing steel, dome reinforcing steel, additional seismic reinforcement (partial height only), base mat reinforcing steel, and backfill and grading plan.

These items of information indicate significant conservatism exists in several areas which was not apparent from the initial review of available design reports and subsequent conversations with UE&C personnel.

One area of conservatism exists in the determination of the seismic design loads. The original design calculations were based on a modified Rayleighs method to estimate the fundamental mode shape and frequency. The spectral acceleration was based on the 2% damped Housner spectrum. However, the base shear was calculated by factoring the total structure mass by spectral acceleration rather than the modal mass. The design base shear was then distributed to the model nodes in proportion to the ratio of the product of the nodal mass and the height above the base to the sum of this product at all nodes. Higher modes were not considered. In order to evaluate the effect of the above assumption, a simple lumped-mass model of the containment was developed using the model properties from the original UE&C design analysis, and a response spectrum analysis was conducted. This analysis indicates that approximately 30% less base shear is expected compared with the original design assumption or, in other words, a factor of safety of 1.4 exists for modeling.

An increase in the factor of safety due to the strength of the reinforcing steel was also indicated from a review of the structural drawings. It is not clear how the effective steel area of the inclined steel as reported in the containment design report was originally developed, but it appears to be quite conservative. Shear failure is currently expected to initiate at Elevation 48'-0".

The treatment of the soil loading on the containment structure also appears to have been developed in a conservative manner. A maximum backfill height above the top of the base mat of approximately 52 feet occurs at the service road. The backfill at the wall drops off rapidly to the local plant grade elevation of 17'-6" over approximately 90% of arc towards the north. The effective backfill is reduced even more rapidly towards the south due to the presence of the fuel storage and fan house buildings. The top of Unit 2 Containment base slab is at Elevation 43'-0" so that only backfill loads above that elevation are of concern. Based on this configuration, approximate dynamic lateral earth pressures were developed using the limit equilibrium method.

Inclusion of the soil loads results in a slight decrease in the strength capacity due to the nonseismic shear loads due to the backfill in addition to the dynamic loads. The overall effect of inclusion of the soil loads on the seismic capacity of the containment building is a net reduction in the median effective ground accelertion of approximately 14%. Median factors of safety and expected variabilities associated with failure of the Unit 2 containment building with and without the presence of a retaining wall are shown in Tables A and B, respectively.

The seismic design loads in the Unit 3 containment building are the same as for the Unit 2 structure without the backfill loads. Shear failure is expected to initiate at Elevation 43'-0". Table C reflects the modeling factor of safety of 1.4 and other minor revisions in order to maintain consistency between the Units 2 and 3 capacities.

I hope this provides the information you requested. If you have any questions, or if you require any further details, please do not hesitate to call either Phil Hashimoto or myself.

Very truly yours,

STRUCTURAL MECHANICS ASSOCIATES, INC.

Philip S Hashimoto

for Donald A. Wesley
Vice President

DAW:rlf
Attachments

TABLE A

SHEAR FAILURE OF UNIT 2 CONTAINMENT W/O BACKFILL LOADS (REVISED)

Item	Median F.S.	β_R	β_U	β_C
Strength	5.3	0.11	0.20	0.23
Inelastic Energy Absorption	2.2	0.16	0.21	0.26
Spectral Shape	1.4	0.19	0.06	0.20
Damping	1.0	0.10	0.10	0.14
Modeling	1.4	0	0.10	0.10
Modal Combination	1.0	0.09	0	0.09
Combination of Earthquake Components	0.93	0.14	0	0.14
Soil-Structure Interaction	1.0	0	0.05	0.05
Total	21	0.33	0.33	0.47

Median Acceleration Capacity = 21 (0.15g)*
= 3.1g

* Where 0.15g is the design SSE peak ground acceleration

TABLE B

SHEAR FAILURE OF UNIT 2 CONTAINMENT W/BACKFILL LOADS (REVISED)

Item	Median F.S.	β_R	β_U	β_C
Strength	5.0	0.11	0.21	0.24
Inelastic Energy Absorption	2.2	0.16	0.21	0.26
Spectral Shape	1.4	0.19	0.06	0.20
Damping	1.0	0.10	0.10	0.14
Modeling	1.4	0	0.10	0.10
Modal Combination	1.0	0.09	0	0.09
Combination of Earthquake Components	0.93	0.14	0	0.14
Soil-Structure Interaction	1.0	0	0.05	0.05
Backfill	0.89	0.09	0.17	0.19
Total	18	0.35	0.38	0.52

Median Acceleration Capacity = 18 (0.15g)*
= 2.9g

* Where 0.15g is the design SSE peak ground acceleration

TABLE C

SHEAR FAILURE OF UNIT 3 CONTAINMENT (REVISED)

Item	Median F.S.	β_R	β_U	β_C
Strength	6.0	0.13	0.20	0.24
Inelastic Energy Absorption	2.2	0.16	0.21	0.26
Spectral Shape	1.4	0.19	0.06	0.20
Damping	1.0	0.10	0.10	0.14
Modeling	1.4	0	0.10	0.10
Modal Combination	1.0	0.09	0	0.09
Combination of Earthquake Components	0.93	0.14	0	0.14
Soil-Structure Interaction	1.0	0	0.05	0.05
Total	24	0.34	0.33	0.47

Median Acceleration Capacity = 24 (0.10g)*
= 2.4g

* For the Unit 3 containment building, the factors of safety were based on the OBE since the OBE governed the design for this building.

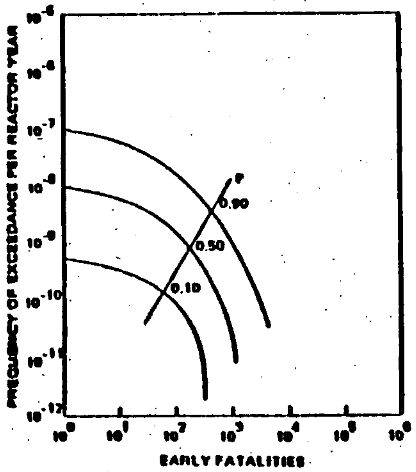

Figure III-1a

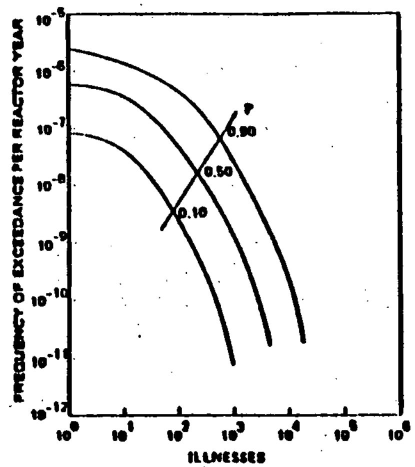

Figure III-1b

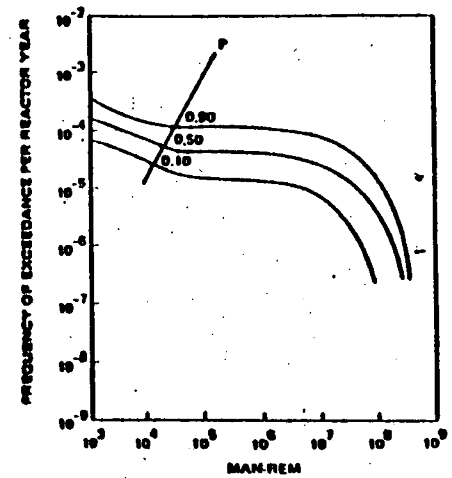

Figure III-1c

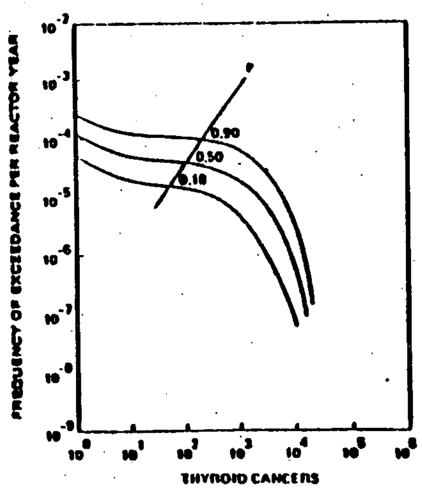

Figure III-1d

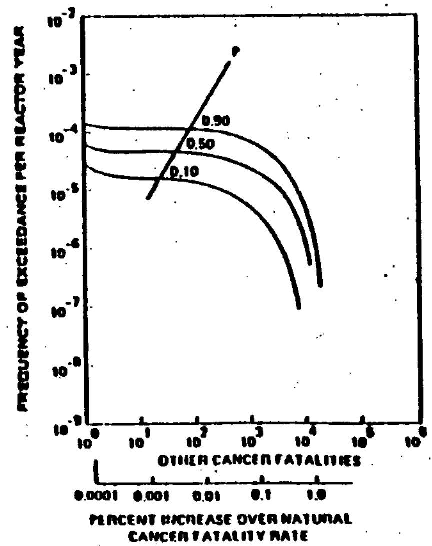

Figure III-1e

Figure III-1. Indian Point 2 Societal Risk Curve

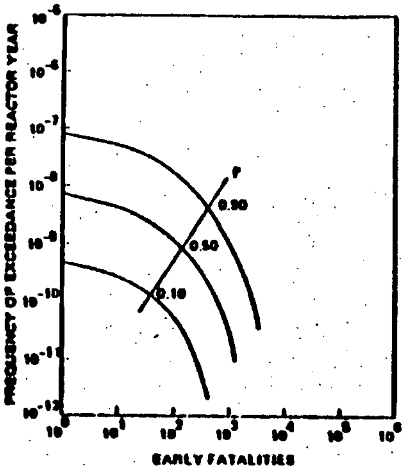

Figure III-2a

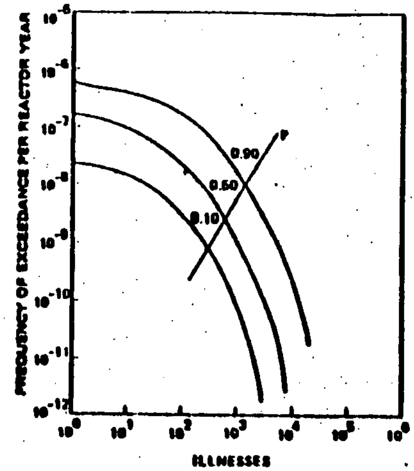

Figure III-2b

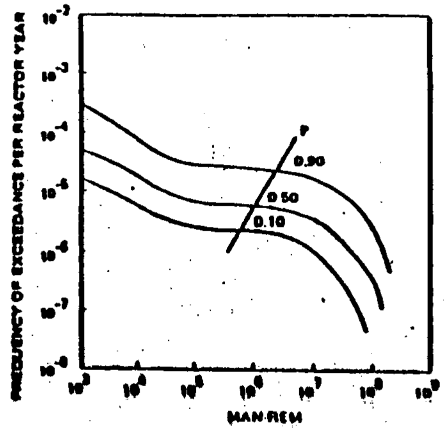

Figure III-2c

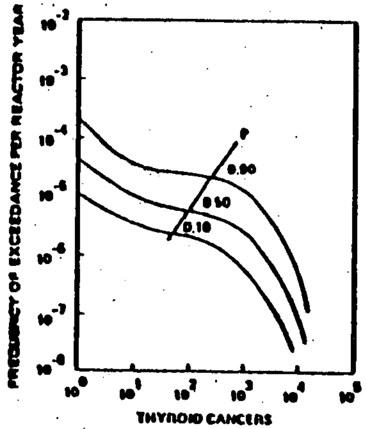

Figure III-2d

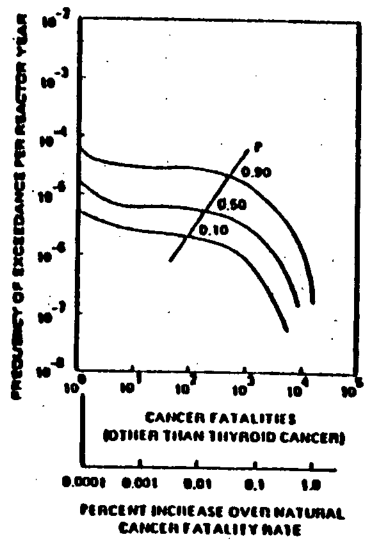

Figure III-2e

Figure III-2. Indian Point 3
Societal Risk Curve