Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

August 8, 1994

Mr. William T. Russell, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Document Control Desk

Subject: Reduced Seismic Criteria at Commonwealth Edison Nuclear Facilities

Byron Station Units 1 and 2
NPF-37/66; NRC Docket Nos. 50-454/455
Braidwood Station Units 1 and 2
NPF-72/77; NRC Docket Nos. 50-456/457
Zion Station Units 1 and 2
DPR-39/48; NRC Docket Nos. 50-295/304
Dresden Station Units 2 and 3
DPR-19/25; NRC Docket Nos. 50-237/249
Quad Cities Station Units 1 and 2
DPR-29/30; NRC Docket Nos. 50-254/265
LaSalle County Station Units 1 and 2
NPF-11/18; NRC Docket Nos. 50-373/374

Reference: (a) I. Johnson letter to W. Russell dated March 23, 1994

Dear Mr. Russell:

In reference (a), Commonwealth Edison (ComEd) supplied information to the Nuclear Regulatory Commission in regards to the use of Reduced Seismic Criteria for temporary conditions. On April 28, 1994, representatives of ComEd met with members of your staff to discuss the issue.

In response to questions asked by members of your staff at the meeting, ComEd is providing the answers to six questions along with the ComEd Technical Information document that controls the evaluation of seismic loading for temporary conditions. Also, included in this transmittal are independent assessments of our methodology that were performed by Dr. R. P. Kennedy and Dr. A. Cornell. This information is provided as attachments to this letter.

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To the best of my knowledge and belief, the statements contained in this document are true and correct. In some respects these statements are not based on my personal knowledge, but on information furnished by other ComEd employees, contractor employees, and/or consultants. Such information has been reviewed in accordance with company practice, and I believe it to be reliable.

Please address any further comments or questions regarding this matter to this office.

Respectfully,

Gary G Benes

Gary G. Benes
Nuclear Licensing Administrator
Commonwealth Edison Company

Attachment

cc: G. F. Dick, Byron Project Manager - NRR
R. R. Assa, Braidwood Project Manager, - NRR
C. Y. Shiraki, Zion Project Manger - NRR
J. F. Stang, Dresden Project Manager - NRR
R. M. Pulsifer, Quad Cities Project Manager - NRR
A. T. Gody, LaSalle Project Manager - NRR
G. Bagchi, Civil Engineering & Geo Sciences Branch Chief - NRR
H. Peterson, Senior Resident Inspector - Byron
S. G. Dupont, Senior Resident Inspector - Braidwood
J. D. Smith, Senior Resident Inspector - Zion
M. N. Leach, Senior Resident Inspector - Dresden
T. E. Taylor, Senior Resident Inspector - Quad Cities
P. G. Brochman, Senior Resident Inspector - LaSalle
G. C. Wright, Engineering Branch Chief - Region III
J. Gavula, Project Engineer - RIII
Office of Nuclear Facility Safety - IDNS

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RESPONSE TO NRC QUESTIONS ASKED AT APRIL 28, 1994 ComEd/NRR MEETING

REC'D W/LTR DTD 8/8/94...9408150288

ComEd Response to NRC Questions asked at April 28, 1994 ComEd/NRR Meeting

Attached are the NRC questions and ComEd responses on ComEd's Seismic Accelerations for Temporary Conditions Criteria based on the meeting of April 28, 1994 in Rockville, Maryland. These questions are based on our understanding developed during the meeting. ComEd has not received an official list of questions regarding this matter from the NRC.

Question 1: Clarify how the ComEd proposed Seismic Loading for Temporary Condition criteria maintains the same risk exposure as the licensing basis Safe Shutdown Earthquake, SSE?

Response 1: Probability has always had an essential role in seismic risk analysis. It is used to define the two basic design earthquakes, the OBE and SSE. All ComEd nuclear plants are licensed to a peak design horizontal SSE ground acceleration value of a_{SSE}. For permanent installations as reflected in the licensing basis criteria in the UFSAR, these criteria do not address determination of accelerations for temporary conditions because the design requirements of Appendix A to 10CFR Part 100 do not apply to temporary conditions as illustrated by the fact that temporary conditions are not addressed either in these requirements or the NRC guidance documents.

Under these conditions, the appropriate seismic criteria for temporary conditions are as different from any other criteria for temporary conditions which cause the plant to differ from its description in the UFSAR. That is if the temporary conditions do not result in an unreviewed safety question, they can be made without prior NRC approval. ComEd has developed an approach based on the probability of exceeding a_{SSE} per year (p_{SSE}) which can be used to determine when temporary conditions do not result in an unreviewed safety question.

A summary of the basic reasoning for our methodology is given below to clarify how the same risk exposure as that of the plant's licensing basis is maintained. This methodology forms the basis for a 50.59 evaluation to ensure that the temporary condition will not result in an unreviewed safety question.

Using any of the available seismic hazard curves, i.e. EPRI/SOG or LLNL, the value of probability p_{SSE} of exceeding the a_{SSE}, can be determined. The values of a_{SSE} and p_{SSE} as determined from the median curves of EPRI/SOG and LLNL are listed in Table 1-1 for the six ComEd sites. Since the plants are deterministically designed to a_{SSE}, ComEd considers the value of p_{SSE} to represent a reasonable measure of accepted risk exposure using the seismic hazard curves.

The scale factors in the ComEd proposal are based on a constant probability approach, which maintains the probability of exceeding the scale factor within the temporary duration equal to the site annual acceleration probability of p_{SSE}. In this case, the proposed scale factors maintain the same risk exposure as the plant licensing basis.

Dr. C. Allin Cornell, in his third party review of ComEd's scale factors has found them to be acceptable. However, Dr. Cornell chose to calculate these factors using a risk averaging method. This method is described in Dr. Cornell's letter of April 25, 1994. Figure 1-1 shows an illustration of the risk averaging concept. Table 1-2 compares the scale factors determined by risk averaging versus the results from the constant probability approach. We conclude that Dr. Cornell's alternative approach does not result in an accurate determination of comparative risk for the following reasons:

To obtain the comparison shown in Table 1-2, the following values are used for the parameters in Figure 1-1:

$p_{limit}=2p_{SSE}$

$p_l=p_{SSE}$

p_h= as determined from risk averaging

The parameter $p_{limit}= 2p_{SSE}$ is particularly significant. It shows that ComEd scale factors is associated with a frequency of exceedance per year that is smaller than $2p_{SSE}$,(because risk averaging scale is smaller than ComEd scale factors at $p_{limit}=2p_{SSE}$).

Tables 1-3, and 1-4 list the median and 85 percentile values of p_{SSE} for the six ComEd sites. The values in Table 1-3 are obtained from the EPRI/SOG hazard curves; the values in Table 1-4 are based on the LLNL hazard curves. These tables show that the 85 percentile is at least 2.9 times the median value in Table 1-3, and it is at least 4.5 times the median value in Table 1-4. As a result, the factor of 2 obtained through risk averaging is well within the expected range of variation of p_{SSE}.

Conclusion: The probability of exceeding design basis acceleration, p_{SSE}, is considered as a measure of seismic risk. Constant probability approach is used to determine ComEd scale factors. Therefore, the risk exposure for temporary condition is the same as for the permanent plant installation. When risk averaging method is used, the risk associated with the ComEd scale factors is determined to be about $2p_{SSE}$, which is well within the uncertainty band of the p_{SSE} for each station. As a result, the scale factors are considered to have the same risk exposure as the licensing basis acceleration a_{SSE}.

Question 2a: Clarify how ComEd administratively controls all temporary conditions at a plant?

Response 2a: ComEd has prepared and issued the Technical information Document, TID-MS-25 to all six nuclear sites. There are provisions in this procedure to document the description, location, and the safety related system or component impacted by each temporary condition. In addition, each site has its own unique administrative procedure with similar requirements.

Question 2b: Specify how ComEd keeps track of total risk exposure resulting from all the temporary conditions in the plant?

Response 2b: Currently, the total number of times temporary conditions occur in a year is not tracked. For each unit, this information can be recorded from the documentation available for individual cases.

The TID-MS-25 establishes "Temporary Condition Log" for each unit to track the temporary conditions that occur.

Question 3: Failure of temporary scaffolding can affect components on both trains. Clarify how this situation is managed by ComEd?

Response 3: The erection of scaffolding in safety related areas are controlled by TID-MS-01, and the specific site procedures. The scaffolding installed adjacent to operating components in safety related areas are seismically qualified using the scale factors for acceleration and the UFSAR allowables. Therefore, seismically qualified scaffolding will not affect operation of a component on any given train. Considering the basis for scale factors discussed under Response 1, the treatment of scaffolding is similar to current design of permanent installations. It is noted that the structural evaluation of permanent installations does not have specific requirements because of parallel trains and multiplicity of components.

Question 4: NRC is concerned that the proposed ComEd criteria may not be appropriate for all the temporary conditions in the plant. Clarify how all other types of temporary conditions are being addressed?

Response 4: TID-MS-25 defines temporary conditions as those activities that have a planned duration. The TID also provides examples of temporary conditions that typically occur in ComEd plants. One advantage of the "Temporary Condition Log" in the TID-MS-25 is that it provides an opportunity to programmatically trend and evaluate the types of temporary conditions that actually occur.

Question 5: For certain temporary condition duration, the ComEd scale factors imply ground acceleration levels less than the Operating Base Earthquake (OBE). Clarify how this condition meets the requirements of 10CFR Part 100?

Response 5: Technically, ComEd has scale factors that apply to SSE for evaluation with SSE FSAR allowables. There are also OBE scale factors for evaluation with OBE FSAR allowables. The OBE and SSE scale factors are derived such that the probability of exceeding these factors within the duration is the same as the probability of exceeding a_{OBE} and a_{SSE} in one year, respectively.

ComEd's basis for acceptability of scale factors is provided, in summary form, under Response 1. Because this basis applies equally to the OBE and the SSE, there is no specific significance for a SSE condition-reduced-acceleration that is less than a_{OBE}.

Question 6: The scale factors in the ComEd method are based on the EPRI/SOG median hazard curves. Clarify how the use of recent LLNL curves would influence these results?

Response 6: Appendix C of TID-MS-25 provides comparison of scale factors determined from mean and median hazard curves of both EPRI/SOG and LLNL (1993). Table 6-1 taken from Appendix C, provides comparisons for Braidwood Station. Please note the following:

There is very little difference between factors determined from the mean or median curves of each study,i.e., EPRI/SOG or LLNL (1993).

The results from the median curve of EPRI/SOG are the conservative values of all results. For this reason median EPRI hazard curves are used to determine the scale factors for six ComEd sites.

The No Seismic Load Duration (NSLD) values in Table 3 of TID-MS-25 depend on the annual hazard curve used in the calculation. Table 6-2 compares the NSLD values for Braidwood Station, determined from the median and mean curves of EPRI/SOG and LLNL (1993) to use conservative information.

The NSLD values in Table 3 of TID-MS-25 are based on the smaller durations obtained from the mean hazard curves of EPRI/SOG and LLNL.

Table 1-1

Values of a_{SSE} and P_{SSE} for CECo Stations

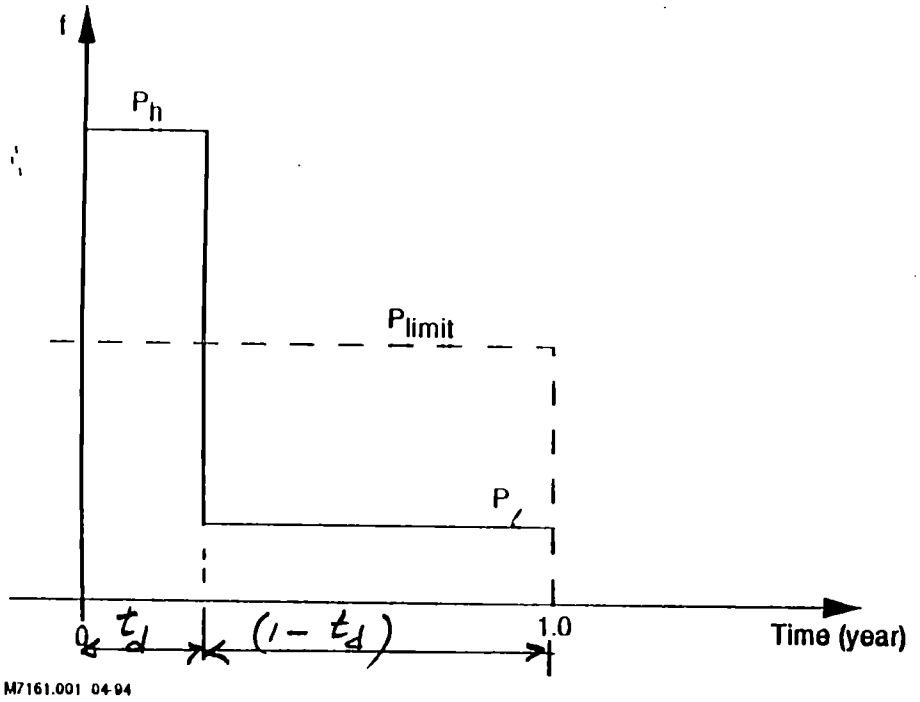
Station	a_{SSE} (g Unit)	P_{SSE}* EPRI/SOG	P_{SSE}* LLNL (1993)
Byron	0.20	1.4×10^{-5}	1.8×10^{-5}
Braidwood	0.20	1.2×10^{-5}	1.85×10^{-5}
Zion	0.17	6.5×10^{-5}	3.6×10^{-5}
LaSalle	0.20	5.0×10^{-5}	3.2×10^{-5}
Dresden	0.20	1.2×10^{-5}	2.1×10^{-5}
Quad Cities	0.24	0.43×10^{-5}	0.60×10^{-5}

P_{SSE} = Probability of exceeding a_{SSE} in one year

* Based on median hazard curves

Figure 1-1

An Illustration of Risk-Averaging Concept



f = rate of exceeding evaluation-basis acceleration per year

p_h = annual rate of exceedance during t_d

p_l = annual rate of exceedance during balance of the year $(1 - t_d)$

p_{limit} = acceptable average rate of exceedance per year

Concept:

$$t_d\, p_h + (1 - t_d)\, p_l = p_{limit} \times 1$$

Table 1-2

Values of $SF(t_d)$ for Case 1 and Comparison to Constant Probability Approach

t_d (year)	Byron		Braidwood		Zion		LaSalle		Dresden		Quad Cities	
	1	p	1	p	1	p	1	p	1	p	1	p
0.50	0.61	0.78	0.61	0.77	0.54	0.67	0.64	0.77	0.62	0.77	0.70	0.82
0.333	0.52	0.65	0.51	0.64	0.48	0.53	0.53	0.64	0.54	0.64	0.63	0.71
0.167	0.40	0.45	0.41	0.46	0.37	0.39	0.41	0.44	0.42	0.46	0.48	0.53
0.083	0.27	0.31	0.31	0.33	0.26	0.26	0.32	0.34	0.31	0.32	0.36	0.38

Notes: 1 is Case 1, risk-averaging with $p_{limit} = 2p_{SSE}$
p is the constant probability approach

TABLE 1-3

Values of P_{SSE} for CECo Stations and Its Upper Uncertainty Band (EPRI/SOG Annual Hazard Curves)

Station	P_{SSE} Median	P_{SSE} 85th Percentile	R
Byron	1.4×10^{-5}	4.0×10^{-5}	2.9
Braidwood	1.2×10^{-5}	3.6×10^{-5}	3.0
Zion	6.5×10^{-5}	20.0×10^{-5}	3.1
LaSalle	5.0×10^{-5}	20.0×10^{-5}	4.0
Dresden	1.2×10^{-5}	3.5×10^{-5}	2.9
Quad Cities	0.43×10^{-5}	1.6×10^{-5}	3.7

R = Ratio (85th Percentile) ÷ (Median)

TABLE 1-4

Values of P_{SSE} for CECo Stations and Its Upper Uncertainty Band (LLNL 1993 Annual Hazard Curve)

Station	P_{SSE} Median	P_{SSE} 85th Percentile	R
Byron	1.8×10^{-5}	11.0×10^{-5}	6.1
Braidwood	1.85×10^{-5}	8.4×10^{-5}	4.5
Zion	3.6×10^{-5}	22.0×10^{-5}	6.1
LaSalle	3.2×10^{-5}	21.0×10^{-5}	6.6
Dresden	2.1×10^{-5}	10.0×10^{-5}	4.8
Quad Cities	6.0×10^{-5}	37.0×10^{-5}	6.2

R = Ratio (85th Percentile) ÷ (Median)

TABLE 6-1

Comparison of SSE Scale Factors, $SF(t_d)$, Determined from Different Annual Hazard Curves (Braidwood Station)

Duration t_d (Year)	Mean Hazard Curve		Median Hazard Curve	
	EPRI/SOG	LLNL (1993)	EPRI/SOG	LLNL (1993)
1.00	1.00	1.00	1.00	1.0
0.50	0.75	0.70	0.77*	0.74
0.333	0.60	0.58	0.64*	0.61
0.167	0.42	0.36	0.46*	0.40
0.083	0.29	0.24	0.33*	0.27

* Envelopes values for the duration

TABLE 6-2

Comparison of Values of No-Seismic-Limit-Duration (NSLD), Determined from Different Annual Hazard Curves (Braidwood Station)

Hazard Curve	NSLD (Hours)
EPRI/SOG, Mean	83
LLNL (1993), Mean	108
EPRI/SOG, Median	62
LLNL (1993), Median	81