UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555
January 9, 1984

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Docket No.: 50-410

APPLICANT: Niagara Mohawk Power Corporation (NMPC)

FACILTY: Nine Mile Point Nuclear Station, Unit 2

SUBJECT: SUMMARY OF MEETING WITH NIAGARA POWER COPRORATION (NMPC) ON GEOSCIENCE ISSUES.

On October 13, 1983 the NRC staff met with representatives from Niagara Mohawk Power Corporation (NMPC) to discuss the responses to the requests for information in the areas of Geology and Seismology. These requests for information were included in the August 12, 1983 letter from A. Schwencer to G. Rhode.

As a result of the discussion it was concludéd response to Geology requests for information would be submitted in FSAR Amendment 5 on October 27, 1983 for the following numbers 231.1, 231.2, 231.3, 231.5, 231.7, 231.8, 231.13, 231.9, 231.12, 231.14, 231.15. The remaining responses would be submitted by December 1, 1983.

The NRC staff stated a summary of the strongest evidence showing that the cooling tower fault is not a capable fault, should be included in the response to 231.4.

Concerning 230.3 (Seismology) the staff stated that if site-specific spectra for other sites are to be used they should be verified to be the latest site-specific spectra approved by the NRC.

A copy of the request for information from the August 12, 1983 letter referenced above is included as attachment 1.

A list of meeting attendants is included as attachment 2.

Original signed by

Mary F. Haughey, Project Manager
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Attachments:
As stated

cc w/attachments:
See next page

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Nine Mile Point 2

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Nine Mile Point 2
Seismology Questions

230.3 The staff's position has been that the largest historical earthquake, in terms of intensity, in the Central Stable Region which has not been associated with tectonic structure is the March 9, 1937 Anna, Ohio (maximum Modified Mercalli intensity VII-VIII) event. Using this controlling earthquake and following the Standard Review Plan, Section 2.5.2, results in a safe shutdown earthquake (SSE) characterized by a Regulatory Guide 1.60 design response spectrum with a high frequency anchor of 0.19g. This exceeds the SSE proposed for Nine Mile Point Nuclear Station Unit 2 in section 2.5.2.6 of the Final Safety Analysis Report.

In recent operating license reviews the staff has accepted the use of site-specific response spectra developed from earthquake strong-motion records of appropriate magnitude, distance and site conditions to characterize the response spectrum of the SSE. The staff has observed that the 1937 Anna, Ohio earthquake (magnitude (m_b) 5.0-5.3) along with other central United States events have similar magnitudes. Therefore, for the Nine Mile Point Nuclear Station Unit 2 site, a site-specific spectrum would be developed from a suite of strong motion records from magnitude 5.3 ± 0.5 earthquakes recorded at distances less than about 25 kilometers from the source at rock sites. It has been the staff's position that the appropriate representation of the response spectra as derived directly from real time histories is the 84th percentile level. A site-specific spectrum may be computed directly or spectra from other appropriate sites may be utilized (see for example those used for Perry, Wolf Creek and Limerick).

Considering the staff's position, demonstrate the adequacy of the SSE by comparing it to either the Regulatory Guide 1.60 spectrum anchored at 0.19g or a suitable site-specific spectrum.

Q230.4 Regulatory Guide 1.60 states that the vertical design response spectrum values should be 2/3 those of the horizontal design response spectrum for frequencies less than 0.25 Hertz, for frequencies higher than 3.5 hertz the two spectra should be the same, and the ratio should vary between 2/3 and 1 for frequencies between 0.25 and 3.5 hertz. The proposed vertical design response spectrum for Nine Mile Point Unit 2 (FSAR Figure 2.5-84) is 2/3 of the proposed horizontal design response spectrum at all frequencies. Provide a justification for the currently proposed vertical response spectrum.

230.5 In section 2.5.2.4 of the FSAR you assign a maximum Modified Mercalli (MM) intensity of VII to the Attica, N.Y. earthquake of August 12, 1929 and state this suggests a MM intensity of IV at the site from this type event if it were to occur at the closest approach (100 km) of the associated structure (Clarendon-Linden fault) to the site. Numerous seismological references report this earthquake as having had a maximum MM intensity of VIII or a maximum Rossi-Forel intensity of IX. Justify your downgrading of the intensity of this earthquake. Using the higher maximum intensity estimate the vibratory ground motion from this type event occurring at 100 km from the site. Determine if this will effect the seismic design for Nine Mile Point Unit 2.

230.6 Section 2.5.4.5.2 of the FSAR states that all major Category I structures are founded on bedrock except for a Category I electrical ductline and manhole which are founded on structural fill and that fill was also placed beneath certain Category I floor slabs. For all Category I structures founded on fill and/or soil determine if amplification of the vibratory ground motion estimated for the bedrock can occur and determine how large and at what frequencies this amplification will be.

Geology Questions

231.1 Figures 2.5-5 and 2.5-6 are cross-sections with stratigraphic columns that do not conform in groupings with the same units in Figure 2.5-7. Regional and Site Stratigraphic Columns. For example in Fig. 2.5-7, the Oswego Sandstone is a formation in the Lorraine Group while in Fig. 2.5-56, the Oswego lies above the Lorraine. Please correct or explain the inconsistency.

Is the Tribes Hill Formation part of the Beekmantown (Fig. 2.5-7)?

231.2 On Fig. 2.5-7, please provide the rock type or types for all units named as "Formation", and for all Group names that do not have formation subdivisions listed. What, for example, is the Theresa Formation, which is on both generalized regional cross-sections, Fig. 2.5-5, 6 and the Stratigraphic Column (Fig. 2.5-7) but is not mentioned in the text nor described anywhere?

231.3 Figure 361.26-1 of your response to question 361.26 and Figure 2.5-28 of the FSAR are essentially the same with more information on the FSAR diagram. Both show the locations of the high angle faults and related information. Please explain why Trench No. 2 on the earlier Fig. 361.26-1 is located at least 200 ft more northeasterly than on the later Fig. 2.5-28.

231.4 The lengths of the three high-angle faults, the Barge Slip, Drainage Ditch and Cooling Tower faults, as discussed on p. 2.5-54 of the FSAR, have not been conclusively determined.

a. Trench No. 2 beyond the northeast projection of the Cooling Tower fault appears too short to intersect the fault if there is the slightest deviation from a linear trend. Why was this trench not extended north and south, especially considering that the fault appears to change trend from a more northerly trend between Trenches 4 and 5 to slightly more westerly from Trench 4 to Trench 3 and Pit 1 according to Figure 2.5-28. If the fault turned slightly more west of Pit 1, the fault could be too far south to intersect the northwestern-most Trench along the Cooling Tower fault.

b. On two separate occasions, in answer to question 361.26 and in section 2.5.1.2.3 of the FSAR, the statement is made that it is difficult to determine precisely the east-southeast termination of the Cooling Tower fault. Since you postulate that this fault is the

analog of the Drainage Ditch fault and therefore probably of the same length, please explain why a trench could not be dug near or beyond the postulated southeastern terminus, to verify the assumption?

c. Please explain the logic, including geometrical, mechanical or physical principles, that justify the assumption stated in the last full paragraph on p. 2.5-54 that "the length of the Cooling Tower fault is not significantly different from the length of its analog," and that all the faults extend to the same depth.

d. Inasmuch as the determined length of the Cooling Tower fault is based on assumption and not proven, what evidence precludes the possibility that the normal displacement increases with depth, as would be the case if there were recurrent movement through time?

231.5 What is the resolution of the magnetometer, i.e. how large does a basement offset have to be in order to be detected?

231.6 Please explain the basis for the assertion (p. 2.5-56) that the similarity of homogenization temperatures between the vein minerals of the fractures and the quartz clasts of the rock indicates that the deformation occurred after diagenesis. The logic is not obvious inasmuch as quartz clasts originate as igneous, or metamorphic minerals long before sedimentation, diagenesis, brittle fracture and vein mineralization.

231.7 On p. 2.5-60 the absence of mineralization in association with the buckling and reverse-slip displacement on the high-angle faults is used to deduce the near-surface origin of the structures and, by inference, their more recent development. Could the absence of mineralization be the result of continuous creep movements up to the present in a compressional regime which does not permit voids or extension along the structures?

to σ_1 (max. compressive stress to rocks)

231.8 On p. 2.5-62, discussion of the mechanism of reverse-slip displacement is attributed to the secondary effect of buckling instability which is associated with bedding-plane slip. Explain why all the deformation discussed here may not be attributed to bedding-plane slip in the form of creep that may be an on-going process.

231.9 What is the greatest depth at which bedding-plane slip has been detected at or near the site?

231.10 Mechanical theory of buckling (p. 2.5-63)

a. Summarize the reasons why the initial "deflection" in your discussion of the mechanical theory of the origin of the buckles is not simply drag effects of the earlier normal fault displacement on the high-angle fault and therefore not related to the buckling superimposed on the earlier structures.

b. Considering that greater stress is required to cause a new fracture in rock than to cause slip along a pre-existing fracture, explain how, in going from the amplification to rotation stages of buckling, a new fracture is formed at almost the same angle as the pre-existing one. Also discuss the mechanical considerations that would allow a shear fracture to develop at such a high angle (considering the Coulomb-Mohr-Navier theory of shear fracture).

231.11 The absence of evidence for reverse-slip deformation and buckling on the Barge Slip fault is attributed to its southerly dip, which is the only difference mentioned between this fault and the two parallel structures, the Cooling Tower and Drainage Ditch faults. The explanation is conjectural and not convincing. There is, however, another difference, which is the presence between the latter two faults of a low-angle thrust with relatively young movement. Evaluate the likelihood that the reverse-slip and concomitant buckling of the Cooling Tower and Drainage Ditch faults are the result of tangential stresses exerted on the faults by movements of the Radwaste Thrust structure.

231.12 Among the conclusions reached concerning the Cooling Tower fault, it is stated that minor subsurface adjustments may occur within the zone of buckling at a depth within the transition zone (50-200 ft). It is also asserted that these adjustments will not reach the surface because voids in the rock must first be closed. What estimates have been made as to how much movement (vertical or horizontal) may occur? What calculations

have been made to determine the minimum vertical movement necessary to close the voids and then reach the surface? Also provide the justification for the estimates.

231.13 In discussing the seismogenic potential of the Cooling Tower fault (p. 25-68) the assertion is made that the buckle fold is now locked and therefore unable to generate vibratory ground motion. However, this does not preclude the possibility of reverse fault motion on either of the faults bounding the rotated sliver. As your interpretation about downwarping as the initiator of the fault movement is conjectural, discuss the possibility of strain buildup on the Cooling Tower fault by creep on bedding planes and the possible resultant seismic effects of movement on either or both faults.

231.14 p. 2.5-72 - On the first line of the 2nd paragraph in the section on Thrust Faults reference is made to Fig. 2.5-29 in describing where the faults have developed. However, Fig. 2.5-29 is a stratigraphic column of the overburden and not relevant to the subject matter as discussed. Please send the figure you are referencing if it is missing, or correct the reference in the text.

231.15 It is stated that the walls of the intake and discharge tunnels, which have exposed Radwaste-type low angle thrust structures, will be bare and filled with water, with free-standing pipes within. What will be the effects of the long-term exposure of the faults to water on their stability. Is it likely to cause slip along planes of weakness (bedding or faults), locally?

231.16 It is not clear from your discussions about the various structures at the site, what is concluded about the age of the bedding-plane slip which is so prevalent. Although the discussions of both the Cooling Tower high angle fault and Radwaste Thrust fault attribute a role in their formation or deformation to bedding plane slip, the age of the bedding plane slip is not clearly stated, although the implications are that the slip is Pleistocene, either pre-Wisconsinan or related to the Lake Iriquois stage. Please expand your discussion of the bedding-plane slip at the site and in the site region. Include in your discussion but do not limit it to:

(a) the significance of Fig. 3-3 of Appendix 2I which shows bedding plane slip surfaces with a northwestward (updip) sense of movement, being truncated by the Paleozoic high angle faults of the Demster Fault zone;

(b) possible causes of the bedding plane slip.

(c) the possibility that the slip is Paleozoic in origin but renewed movement on preexisting weak gouge and brecciated surfaces provided the paths for glacial meltwater.

(d) In what ways the bedding plane slip may have influenced the structures to which they are related.

231.17 (a) Please provide a plot of the temperature-depth relationships of the minerals used to determine age of the joints and other structures. As there may be differing opinions concerning stability fields, etc., include a discussion justifying your choice of plot in depth determinations.

(b) The conditions of formation of the minerals within the faults or joints, not the joint itself, is postulated on the basis of homogenization temperatures. It is clear from some of the photos in Vol. I of the Fault Investigation (1978) that some of the structures formed in a compressional environment (subhorizontal slickensides) and experienced extension later (mineral coating with 3-dimensional undeformed crystals on the fracture surface). Please comment on the suggestion that the vein minerals have recorded changing stress regimes and suggest continuous or renewed movement through time on preexisting structures, rather than the conditions of formation of the faults, joints, slip planes, or voids.

Attachment 2

October 13, 1983

Geology and Seismology

Nine Mile Pt. 2

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