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October 12, 1971

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Re: Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
AEC Docket 50-247

Dear Mr. Roisman:

We enclose a copy of Applicant's responses to the Section C questions contained in your letter of September 16, 1971.

Very truly yours,

LeBoeuf, Lamb, Leiby & MacRae
Attorneys for Applicant

By Leonard M. Trosten
Leonard M. Trosten
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Enclosure

cc w/enc: Samuel W. Jensch, Esq.
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Honorable Louis J. Lefkowitz
Secretary, AEC (2)
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20 hearing

Consolidated Edison Company of
New York, Inc.

Indian Point Station, Unit No. 2
AEC Docket No. 50-247

Applicant's Responses to Section
C Questions Contained
in Letter From
Citizens Committee for the
Protection of the Environment
Dated September 16, 1971

October 12, 1971

Q. "C.1 p. 3 - How is it more conservative to ignore the effect of core geometry distortion in reaching the 2300°F peak temperature? Does the 2300°F peak temperature calculated for the double-ended pipe break, cold-leg, disregard the effect of core geometry distortion?"

A. Westinghouse has performed extensive experimental and analytical studies to determine the core geometry deformation that may occur following a loss of coolant accident and the effects of such distortion on the peak clad temperature. These studies resulted in the following conclusions:

1. Flow blockage does not cause a deterioration of the heat transfer coefficient even for localized complete blockages of the flow channels.
2. Localized temperature increases above the no blockage temperature were calculated because of rod-to-rod contact. For these regions the maximum temperature rise was calculated to be less than 100°F.
3. Fuel rod integrity is maintained for peak clad temperatures below 2700°F and local per cent of zirc-water reaction lower than 16%.

The 2300°F peak clad temperature calculated for the double ended pipe break, cold leg, does not include the effect of core geometry distortion. Thus, based on the above reasons a minimum safety margin of at least 300°F exists between the calculated conservative temperature and the safe operation limits. The effect of core geometry distortion is not, therefore, ignored. It is accounted for in setting the maximum fuel element cladding temperature limit set forth in the Interim Emergency Core Cooling Systems Criteria, June 19, 1971, Section IV A.1. The calculations performed by Westinghouse are in accordance with procedures set forth in the Interim Criteria, Appendix A, Part 3 and in the documents referenced therein.

Q. "C.2 p. 3 - Compare the two Westinghouse rod burst programs with the ORNL rod burst studies as reported in ORNL - 4635 this year."

A. The results of the tests reported in the ORNL - 4635 report indicate that the greatest average blockage was 48% of the coolant area. This compares favorably with the maximum average blockage of 55% observed in the Westinghouse Multi-Rod Burst Test. The higher value of blockage measured in the Westinghouse tests can be justified by the radial temperature distribution obtained in these tests being more uniform than in the ORNL tests.

Q. "C. 3 p. 5 - In what manner was the SATAN-V Code compared to the semiscale tests 845-851 and what differences in results as to any reported phenomena occurred in those tests than what was predicted by the SATAN-V Code?"

A. The semiscale test 848 was analyzed using the SATAN Code. The comparison of the test results with the results of SATAN Code calculations indicates good agreement between the measured and calculated pressure and flow transients. The results of the SATAN Code calculations confirm the test results that indicate that the water injected in the lower plenum was discharged and none of the accumulator water was stored in the lower plenum of the vessel.

Q. "C.4 pp. 9-10 - How does this analysis take account of steam pressure delaying accumulator water reaching the core either by holding it in the loop or sweeping it out of the loop and away from the core both during and after blowdown?"

A. The following assumptions are used in evaluating the accumulator water injection transient. Each of these assumptions is conservative since it either delays the reflooding of the core or reduces the flow rate into the core.

1. All of the accumulator water injected during blowdown is discarded.
2. The pressure losses through the venting paths are maximized by conservatively calculating the loop and pump resistances and by assuming that a high fraction of the core inlet flow is entrained in the core and carried through the loops to the break.
3. The accumulator water is assumed to completely fill the cold leg pipe thus forming a plug that prevents venting of the steam generated in the core during the accumulator injection phase.

Q. "C. 5 p. 10 - To what extent is the assumption regarding water remaining in the downcomer region and lower plenum different from the most conservative assumptions used previously in the FSAR in analyzing the ECCS performance and upon what basis are changes made?"

A. The testimony presented July 13, 1971 shows an additional conservatism above that presented in the FSAR in the consideration of the amount of water remaining in the bottom plenum. Upon the completion of the blowdown part of the transient, the amount of water that was injected by the accumulators during the blowdown transient is totalled and subtracted from the bottom plenum and downcomer water inventory. This conservatism is based on the worst possible route that the accumulator water could take - directly out the break.

Q. "C. 6 p. 10 - Upon what basis are the post-LOCA pre-reflooding-of-the-core conditions assumed to be as stated on this page? List tests and/or analyses to support these conclusions."

A. Upon completion of blowdown, the pressure in the reactor vessel is less than or equal to that of the containment. For this condition, the accumulator water will be deposited in the bottom plenum of the reactor vessel because of the pressure gradient in that direction. These conditions are consistent with those embodied in the procedures set forth in the Interim Criteria, Appendix A, Part 3, in general, and with the assumption set forth in Appendix A, Part 3, Paragraph 5.

Q. "C. 7 pp. 10-12 - Provide the figures, tests results and analyses which support the assumptions upon which the effect of the steam (both during and after blow-down) on the reflooding rate is calculated."

A. As referenced on page 11, the FLECHT test results were used in the analysis to obtain the reflooding heat transfer coefficient. This heat transfer coefficient is a function of flooding rate, water subcooling, linear power density, clad temperature, and pressure. The flooding rate is determined by the resistance of the broken and intact loops and this resistance is taken in a conservative manner assuming the pump rotor is locked (the pump resistance is the predominant resistance). Other resistances (steam generator, loop, and core) are based upon design values, which have been shown to be conservative from operating plant data. Linear power density is calculated with a 20% conservatism on decay heat, pressure is reduced conservatively below that calculated for the containment design, inlet water temperature is conservatively taken to be 30°F higher than calculated, and the clad temperature is calculated using conservative fuel rod properties.

Q. "C. 8 p. 12 - Compare the performance of the accumulators following blowdown as they are affected by steam with the performance of the accumulators during blowdown as affected by steam. For instance, how does quantity and pressure of steam differ and how does the path the steam takes differ?"

A. For accumulator injection during the reflooding time period, the steam is conservatively assumed to be vented through the broken loop. In reality the steam will flow through the intact loops due to the condensation of steam, mixing, and driving force pressure drop maintained by the downcomer height of water. For accumulator injection during blowdown the pressure is higher in the unbroken loops compared to the break location. Thus, accumulator water and steam will tend to flow toward the core and thus, the break location. Some condensation of the steam will also occur in this phase. This accumulator water that was injected during blowdown was assumed conservatively to bypass the core and go out the break. Thus, during blowdown and reflood conservative calculations were made because condensation was neglected.

These conservative assumptions are consistent with the procedures and constraints set forth in the Interim Criteria, Appendix A, Part 3, Paragraph 7 (a).