September 13, 1982

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of)
)
CLEVELAND ELECTRIC ILLUMINATING) Docket Nos. 50-440
COMPANY, Et Al.) 50-441
) (Operating License)
(Perry Nuclear Power Plant,)
Units 1 and 2))

OHIO CITIZENS FOR RESPONSIBLE ENERGY
SIXTH SET OF INTERROGATORIES TO NRC STAFF

Ohio Citizens for Responsible Energy ("OCRE") hereby propounds its sixth set of interrogatories to the NRC Staff, pursuant to the Licensing Board's Memorandum and Order of July 28, 1981 (LBP-81-24, 14 NRC 175).

Issue #8

Statement of Purpose: The following interrogatories are designed to ascertain the Staff's assessment of the hydrogen control features to be implemented at Perry and the ability of the Perry containment to withstand a hydrogen explosion.

6-1. What does the Staff consider to be the equivalent of a TMI-2 accident at Perry? Provide the probability of its occurrence and a thorough description of its consequences, including fuel failure modes, effect on containment integrity, and off-site doses to the public at 2, 5, 10, and 50 miles from PNPP.

6-2. What does the Staff consider to be the worst-case accident in terms of H_2 generation at Perry? Provide the probability of its occurrence and a thorough description of its con-

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sequences, including fuel failure modes, effect on containment integrity, and off-site doses to the public at 2, 5, 10, and 50 miles from PNPP.

6-3. Has the Staff (or anyone on its behalf or to its knowledge) performed MARCH code calculations specific to Perry for any accident sequences? If so, produce these analyses. If Perry-specific calculations have not been performed, produce all MARCH code analyses performed for Grand Gulf (most useful are graphical presentations of the calculated parameters versus time, e.g., pp. C-13 to C-44 of NUREG/CR-1659, Volume 4).

6-4. Describe in detail the capabilities and limitations of the MARCH code. Discuss any approximations and assumptions and their bases. Specifically, can the MARCH code account for the effects of steam concentration on hydrogen flammability, effects of containment structures or equipment on flame fronts, effectiveness of the hydrogen control system, and effects of deliberate hydrogen ignition on the containment and equipment therein?

6-5. Commissioner Gilinsky has stated that the Mark III is a weak containment that should be required to be stronger. (47 FR 2300, January 15, 1982). How could the Perry containment be strengthened? Include a cost estimate of all measures that could strengthen the Perry containment.

6-6. SECY-80-107A contains view-graphs presented by General Electric to the NRC which state that containment inerting, hydrogen ignition, recombiners, and purging are all impractical for significant rates of H_2 production. Does

the Staff agree? If not, why not?

6-7. The Commission has stated that hydrogen control methods that do not involve burning provide protection for a wider spectrum of accidents than do those that involve burning (46 FR 62282, December 23, 1981). What are the bases for this statement?

6-8. NUREG/CR-1561 at p. 49 states that spontaneous hydrogen deflagrations or detonations have occurred in the off-gas systems (handling quantities of H_2 due to radiolysis) of of several BWRs (Cooper, Browns Ferry 3, Millstone 1).

(a) What were the magnitudes and consequences of these explosions?

(b) Did these incidents occur because of the failure or inadequacy of the recombiners?

(c) Did the recombiners provide the ignition source?

(d) Are these recombiners similar to those to be used at Perry?

6-9. What is the status of the proposed rule to 10 CFR Part 50, "Interim Requirements Related to Hygrogen Control," 47 FR 62281, December 23, 1981?

6-10. What types of hydrogen control systems are available for preventing H_2 buildup and/or explosion in Mark III containments? Briefly discuss each system, listing the advantages and disadvantages of each. Which system is favored by the Staff? Why?

6-11. It is stated in the discussion of the proposed rule (46 FR 62282) that there are ongoing programs of research pertaining to hydrogen generation, release, burning, and

control. Please list all such research programs. Briefly describe the status of each, along with any interim findings and the expected date of completion and publication of results.

6-12. SECY-80-107 at p. 30 states that the Staff believes that the Mark III containment has a failure pressure of at least twice the design pressure.

(a) Is this estimate based on static or dynamic pressures?

(b) Provide all factual bases and experimental evidence supporting this belief.

6-13. Has the Staff performed any analyses on the ultimate strength of the Perry containment? If so, produce them. Discuss all assumptions, judgements, and approximations made in the analyses and the bases for them.

6-14. At what range of concentrations (volume-%) of H_2 are recombiners of the type to be used at PNPP effective in reducing the H_2 concentration below flammable limits?

6-15. If the recombiners were ineffective in reducing H_2 concentrations, would the recombiners become an ignition hazard? At what H_2 concentration?

6-16. At what range of H_2 concentrations (volume-%) are glow plug igniters effective in reducing H_2 concentrations below flammable limits?

6-17. Does the Staff believe that the igniters could pose a hazard to the integrity of the containment and the equipment therein by causing severe detonations?

6-18. Does the Staff believe that the normal, expected operation of the igniters (controlled ignition) could pose a threat

to the integrity of the containment or the equipment therein by causing high temperatures and cyclic pressure pulses?

6-19. In the Staff's opinion, has the Perry hydrogen control system met the requirements of GDC 41, 42, and 43 of 10 CFR Part 50? List all criteria not met.

6-20. Has the Staff analyzed the Perry containment for sources of ignition? If so, produce the results of the analysis.

6-21. Has the Staff analyzed the Perry hydrogen control system against all applicable regulations, regulatory guides, branch technical positions, and other standards? If so, produce the results of this analysis, especially describing any instances in which criteria and guidelines have not been met. If this analysis has not been performed, when does the Staff intend to do so?

6-22. FSAR Section 6.2.5.2.1 states that delaying the start of the analyzers until 15-60 minutes following the LOCA will avoid exposing the analyzer to severe sample conditions. In the Staff's opinion, can severe conditions persist beyond 15-60 minutes after the LOCA? After transient sequences?

6-23. In the Staff's opinion, for containment H_2 concentrations above 4 vol-%, would the mixers accelerate combustion by providing a uniformly combustible atmosphere in the containment? Why or why not?

6-24. In the Staff's opinion, could the ignition of hydrogen by the glow plugs produce missiles that could damage the containment or equipment therein?

6-25. Provide off-site radiation doses (whole body and thyroid) to the public at 2, 5, 10, and 50 miles from PNPP resulting from containment purge following each of the following accidents:

(a) what the Staff considers to be the equivalent of a TMI-2 accident at Perry;

(b) what the Staff considers to be the worst-case accident in terms of H_2 generation for Perry;

(c) the following accident sequences as defined in NUREG/CR-1659, Volume 4 (RSS Methodology applied to Grand Gulf):

(1) AI

(2) AE

(3) AC

(4) SI

(5) SC

(6) SE

(7) T_1PQI

(8) T_1PQE

(9) $T_{23}PQI$

(10) $T_{23}PQE$

(11) T_1QW

(12) T_1QUV

(13) T_1C

(14) T_1QUW

(15) $T_{23}C$

(16) $T_{23}QW$

(17) $T_{23}QUW$

(18) T23QUV

6-26. In the Staff's opinion, would overpressure from H_2 production alone (no explosion) be sufficient to rupture the containment? From what % metal-water reaction?

6-27. Describe the pressure and temperature transients which would be experienced by the containment from the complete combustion of the following concentrations of hydrogen (vol-%, assume abundant oxygen):

(a) 4%

(b) 6%

(c) 9%

(d) 12%

(e) 18%

(f) 24%

(g) 33%

6-28. Are the results given above based on any experimental data or studies specific to either the Perry or the generic Mark III containment? Produce all such studies.

6-29. List any assumptions made in the preparation of such studies, e.g., regarding the quenching effects of steam/humidity or the effect of containment structures and equipment on flame fronts.

6-30. If the Staff has performed any analyses of the Perry containment, did this analysis consider containment penetrations as possible points of rupture? If not, why not?

6-31. In the Staff's opinion, could blowdown through the suppression pool or direct drywell-to-containment

leakage exceed the capacity of the mixers?

6-32. In the Staff's opinion, could direct drywell-to-containment leakage dissipate hydrogen outside the area from which the recombiners take suction or outside the regions where the igniters are located?

6-33. In the Staff's opinion, would the drywell-to-containment differential pressure ever be great enough (e.g., after upper pool dump) that the mixer compressor head is insufficient to clear the upper suppression pool vents?

6-34. In the Staff's opinion, could the recombiners produce "hot spots" which could adversely affect the containment or equipment therein?

6-35. Does the Staff consider the manual actuation of all components of the Perry H_2 control system acceptable? If so, how can this be justified, since large amounts of H_2 can be produced within minutes of core overheating (NUREG/CR-1651, pp. 36-37; SECY-80-107, p. 6)?

6-36. NUREG/CR-1561 at pp. 36-37 states that once the core temperature exceeds 1400°K, only minutes remain before significant quantities of H_2 are produced. 1400°K corresponds to 2061°F. 10 CFR 50.46(b)(1) limits the cladding temperature to 2200°F. Does this mean that, even if the ECCS Evaluation Model meets this criterion, substantial hydrogen could still be generated? Are 10 CFR 50.46 (b)(2) and (b)(3) consistent with the amounts of hydrogen expected to be generated when the cladding temperature reaches 2200°F?

6-37. List all documents relied upon in answering the above

interrogatories, and list all persons responsible for the answers, along with their professional qualifications.

Respectfully submitted,

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CERTIFICATE OF SERVICE

This is to certify that copies of the foregoing OHIO CITIZENS FOR RESPONSIBLE ENERGY SIXTH SET OF INTERROGATORIES TO NRC STAFF were served by deposit in the U.S. Mail, first class, postage prepaid, this 13th day of Spetember 1982 to those on the service list below.

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