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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

DOCKETED
USNRC

BEFORE THE COMMISSION

'84 AGO 24 P4:14

In the Matter of)
)
METROPOLITAN EDISON COMPANY)
)
(Three Mile Island Nuclear)
Station, Unit No. 1))

Docket No. 50-28902
(Restart)

UNION OF CONCERNED SCIENTISTS' OBJECTION TO WAIVER OF SUBCOOLING
CRITERIA AND COMMENTS ON NRC STAFF'S SAFETY EVALUATION OF SUBCOOLING
CRITERIA FOR ACTUATING OR THROTTLING HIGH PRESSURE INJECTION (SECY-84-237)

INTRODUCTION

On July 27, 1984, the parties were served with a memorandum from the Secretary enclosing SECY-84-237, dated June 14, 1984, and a three-page "Safety Evaluation" written by the NRC staff. The staff documents purport to justify the approval of GPU's request to operate TMI-1 in violation of the conditions set by the Appeal Board, which were themselves a substantial and unauthorized relaxation of the conditions for safe operation set by the Commission in its August 9, 1979, Order and Notice of Hearing governing restart of TMI-1.

The relaxation of the subcooling margin criterion from the 50°F margin set by the Commission to an effective 1.6°F subcooling margin should not be permitted because it is unsafe and manifestly inconsistent with the lessons learned from the TMI-2 accident.

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BACKGROUND

The requirement for maintaining a subcooled condition in the reactor coolant system stems directly from the TMI-2 accident. During the TMI-2 accident, the operator prematurely throttled the high pressure injection system. This action, in combination with the stuck open pressurizer relief valve, resulted in a condition of inadequate core cooling which was not recognized for a long period of time.

If the water in the reactor coolant system is not subcooled (i.e., temperature less than the boiling point for the existing pressure), the steam formed will collect in the high points of the hot leg piping and block natural circulation cooling. To preclude the failure to recognize such conditions in the future, two short-term requirements were promulgated.

One requirement was that each PWR was directed to install instrumentation "to provide on-line indication of coolant saturation condition." NUREG-0578, p. A-12 The staff stated that "[t]he purpose of the subcooling meter is to provide a continuous indication of margin to saturation. This is an important diagnostic tool for the reactor operators." Staff Ex. 1 (NUREG-0680), p. C8-17.

The other short-term requirement was that licensees were ordered to review the actions directed by the emergency procedures and training instructions to ensure that operating procedures specify that the high pressure injection system remains in operation until "all hot and cold leg temperatures are at least 50 degrees below the saturation temperature for the existing RCS pressure." IE Bulletin 79-05A, quoted in Staff Ex. 1, p. C2-4.

These two requirements were subsequently incorporated in the Commission's August 9, 1979, Order and Notice of Hearing as short-term actions, item 8 ("The licensee shall comply with the Category A

recommendations as specified in Table B-1 of NUREG-0578.") and item 2 ("The licensee shall provide for NRC review and approval of all applicable actions specified in IE Bulletins 79-05A, 79-05B, and 79-05C."). Order and Notice of Hearing, CLI-79-8, 10 NRC 141, 144 (1979). All short-term actions must be completed as a condition of restart.

DISCUSSION

The Requirement For A 50°F Subcooling Margin Was Imposed By The Commission

In characterizing the issue, the staff states that "the installed system does not meet certain Appeal Board-imposed criteria" SECY-84-237 at 1. This is a partial truth; in fact the Commission itself established the following condition for restart of TMI-1:

The licensee shall provide for review and approval of all applicable actions specified in IE Bulletins 79-05A, 79-05B, and 79-05C.
Order and Notice of Hearing, CLI-79-8, 10 NRC 141, 144 (1979).^{1/}

The portion of IE Bulletin 79-05A which specifies the subcooling criteria for actuating or throttling high pressure injection states as follows:

Review the actions directed by the operating procedures and training instructions to ensure that:

* * *

b. operating procedures currently, or are revised to, specify that if the high pressure injection (HPI) system has been automatically actuated because of low pressure condition, it must remain in operation until either:

- (1) both low pressure injection (LPI) pumps are in operation and flowing at a rate in excess of 1000 gpm each and the situation has been stable for 20 minutes, or

^{1/} It should be recalled that this order item was designated as one of the so-called "short-term actions" and therefore must be completed prior to restart. Id. at 143-144.

- (2) The HPI system has been in operation for twenty minutes, and all hot and cold leg temperatures are at least 50 degrees below the saturation temperature for the existing RCS temperature. If the 50 degree subcooling cannot be maintained after HPI cutoff, the HPI shall be reactivated. See Staff Ex. 1 (NUREG-0680), at C2-4, emphasis added.^{2/}

It should be noted at the outset that nothing in the Commission's Order, or the IE Bulletins incorporated therein, states or implies that the required 50°F subcooling margin included an assumption of a 45°F instrument error. The plain language indicates that the requirement is for an actual 50°F subcooling margin before HPI is throttled and reactivation of HPI if actual subcooling becomes less than 50°F.

The entire record of this proceeding was based upon the assumption that, consistent with Commission's Order, the 50°F subcooling criterion would be met. For example, in its Restart SER (NUREG-0680), the staff found GPU in compliance with the Commission's Order Item 2 (Short-Term), IE Bulletins, based on its conclusion "that the licensee has completed the procedure revisions and training required by this item and is in compliance with this part of the [Commission] Order." Staff Ex. 1 (NUREG-0680), at C2-11. Furthermore, certain UCS contentions were resolved on the basis of the assumption that the requirement for a 50°F subcooling criterion would be met. See ALAB-729, 17 NRC 814, 879-881 (1983). In fact, ALAB-729 is based entirely upon a record which was developed on the assumption that a 50°F subcooling margin would be met. The only consideration given to the

^{2/} This provision of IE Bulletin 79-05A was unchanged by IE Bulletin 79-05B except for the addition of the following sentence: "The degree of subcooling beyond 50 degrees F and the length of time HPI is in operation shall be limited by the pressure temperature considerations for vessel integrity." See Staff Ex. 1, at C2-10.

relaxation of this fundamental criterion to 25°F is contained in a single footnote, n. 315 at 17 NRC 881 and, as the following discussion demonstrates, no consideration was given to the safety consequences of reducing the margin to 1.6°F.

Well after the record in this proceeding was closed, GPU notified the Appeal Board that it planned to change the criterion by reducing it from 50°F to 25°F. It was represented to the Appeal Board that the 50°F margin "had been accepted on the assumption of 45°F instrument error" and was thus only intended to be an effective 5°F margin. Accordingly, it was further represented that, since the instrument error would only, in fact, be 20°F, the 25°F margin would still yield an effective 5°F real margin. The Appeal Board accepted this "providing the 20°F error in the TMI-1 instrumentation is not exceeded." ALAB-729, 17 NRC 814, n. 315 at 881.

GPU subsequently informed the staff that it does not meet the Appeal Board's condition of a maximum 20°F instrument error. Instead, the instrument error is now claimed to be 23.4°F, leaving a "real" subcooling margin of only 1.6°F. SECY-84-237, p.1. The staff urges the Commission to approve the GPU request. To do so would be to make an obvious mockery of the Commission's HPI throttling criteria and to permit TMI-1 to operate in a condition where public safety is at undue risk.

Moreover, in presenting this issue to the Commission, the staff only states that "[t]he motivation for the change in criteria is that GPU Nuclear has determined that a reduced subcooling margin allows better plant control during recovery from the events of interest."^{3/} The staff and GPU have

^{3/} Safety Evaluation by the Office of Nuclear Reactor Regulation, Three Mile Island Nuclear Station, Unit 1, Docket 50-289, Subcooling Criteria for Actuating or Throttling High Pressure Injection, (hereinafter "Subcooling SER"), enclosure to SECY-84-237, at 1.

assiduously avoided disclosing that the purpose of reducing the subcooling margin from 50°F to 25°F is because maintenance of a 50° subcooling margin would make it difficult if not impossible to mitigate steam generator tube rupture (SGTR) accidents (presumably the unspecified "events of interest") without exposing the public to unsafe levels of radiation. This is unique to TMI-1 because only TMI-1 has severely degraded steam generators. Because the cracks in the steam generator tubes have not been repaired, an attempt to rapidly cool down following a SGTR accident (the normal procedure in a plant without corroded steam generator tubes) could result in literally pulling the tubes apart. Since a rapid cooldown is not safe, GPU is proposing to reduce the subcooling margin. In GPU's own words, "[m]inimizing subcooling margin means that primary to secondary differential pressure is also minimized, which reduces leakage and offsite doses, making the event more manageable." GPU Nuclear Technical Data Report No. 406, SG Tube Rupture Procedure Guidelines, Rev. 3, p. 31.

Thus, GPU is asking the Commission to allow it, uniquely among B&W PWR's as far as we know, to violate the subcooling criteria necessary for safe recovery from a LOCA because its steam generator repairs are inadequate to allow maintenance of the required margin of safety.

The Record In This Case Does Not Support The Claim That
The 50° Subcooling Criterion Implicitly Assumed 45° Instrument Error.

The Staff claims that the original 50°F subcooling margin criterion "had been accepted on the assumption of a 45°F instrument error and a 5°F margin to saturation, which GPU Nuclear refers to as the 'physical configuration factor'." Subcooling SER, p. 1. This assertion is contrary to the record. There is, in fact, absolutely nothing in the evidentiary record of this case to support such an assertion. As we noted supra, neither the Commission's August

9, 1979, Order and Notice of Hearing nor the IE Bulletins incorporated therein stated, explicitly or implicitly, that the requirement for a 50°F subcooling margin included allowance for a 45°F instrument error. If the staff's and GPU's argument to the contrary were accepted, it would logically follow that the companion requirements of the IE Bulletins, that the HPI system be in operation for at least 20 minutes or the LPI pumps be flowing at 1000 gpm each could be met using a clock with an error of 18 minutes and LPI flow instruments with an error 900 gpm.

GPU now proposes to operate TMI-1 using emergency operating procedures that would permit throttling the high pressure emergency core cooling system when the indicated subcooling margin is 25°F or greater even though the actual subcooling margin could be as little as 1.6°F .^{4/} GPU might just as well propose eliminating the subcooling criteria entirely, since that is the practical effect. An increase in reactor coolant system temperature of only 1.6°F or a decrease in reactor coolant system pressure of only about 2 to 10 psi (depending on RCS temperature) would reduce the subcooling margin to zero. Commission approval of GPU's proposal would make a mockery of the TMI lessons learned requirement.

Insufficient Data Have Been Presented To Support
The Claim That The Instrument Error Is Actually 22.1°F

The Staff's SER describes the process by which GPU attempted to determine the instrument error, but contains no conclusions regarding whether the error of 22.1°F is accurate. Subcooling SER, pp. 1-2. Undoubtedly, this

^{4/} As we will demonstrate below, even the 1.6°F margin is highly dubious. If the correct methodology is used to calculate the instrument errors, there is no safety margin remaining at all.

is because the licensee's September 7, 1983, letter cited by the staff contains insufficient information to perform an independent review. For example, the GPU calculations provided as attachments to its September 7, 1983 letter present values for uncertainties or errors attributable to various effects, such as linearity, input voltage, radiation, ambient temperature, but GPU provides no information regarding how the numerical value of those errors was determined. See GPUN Calculation No. 11014-322B-009, Rev. 2 & 3, attached to licensee's letter of September 7, 1983. (These calculations and letter were forwarded to the Commission by a September 27, 1983 letter from licensee's counsel.)

Furthermore, the staff is incorrect in stating that "[f]or two cases, uncertainty values bounded by one standard deviation were used." Subcooling SER, p. 2. The fact is there were three cases - voltage effects, temperature effects, and radiation effects. GPUN Calculation No. 11014-322B-009, Rev. 2, pp. 1, 3. In addition, the staff stated that it "finds that proper justification was provided to validate their use in this analysis." Subcooling SER, p. 2. In fact, the licensee's September 7, 1983 letter provides no justification for using one standard deviation with regard to radiation effects (GPUN Calculation No. 11014-322B-009, Rev. 2, p. 3) and the justification provided for using one standard deviation for temperature effects is incomplete.

With regard to the justification for using only one standard deviation for the temperature effects, GPU relies in part on the alleged existence of redundant heating, ventilation and air conditioning (HVAC) systems. GPUN Calculation No. 11014-322B-009, Rev. 2, p. 1. Unless it is verified that the HVAC systems are safety grade and unless the technical specifications include appropriate limiting conditions for operation (LCO's) and surveillance

requirements to assure operability of the applicable HVAC systems, the reliance on the existence of those HVAC systems as justification for using one standard deviation for the temperature effects is not warranted.

With regard to the radiation effects, the GPU calculation contains no justification and UCS believes there is no justification for using one standard deviation. Furthermore, the staff is clearly in no position to offer an opinion on the adequacy of the licensee's treatment of radiation effects. CLI-84-11 dated July 26, 1984, directed the staff to certify the status of environmental qualification for radiation for certain equipment within 14 days of the date of CLI-84-11. On August 8, 1984, the staff informed the Commission that "the staff currently does not have in its possession the information needed to make such a certification." In addition, the staff stated that in its view "an audit of the appropriate environmental qualification files will be needed prior to making any certification" and that the "licensee has orally advised the staff that it will not be ready to support such an environmental qualification file audit until approximately August 20, 1984." Memorandum for the Commission from William J. Dircks, "Staff Certification of Environmental Qualification for TMI-1 (CLI-84-11)," August 8, 1984. We therefore find it highly questionable that the uncertainty attributable to radiation effects could have been reliably estimated in September, 1983, at the time of GPU's submittal to the staff. Furthermore, since the staff has not determined the adequacy of the environmental qualification for radiation of the temperature and pressure sensors providing inputs to the subcooling margin instruments, the staff cannot independently verify either the validity of the error attributable to radiation effects or the use of the one standard deviation value for radiation effects in GPU's calculations.

The Commission should bear in mind that if GPU's claimed overall subcooling margin error of 23.4°F (22.1° instrument error plus 1.3° physical configuration factor) is incorrect by as little as 7%, the reactor coolant system could be at saturation even with an indicated subcooling margin of 25°F. This is by no means improbable. For example, UCS has recalculated the instrument error using all of GPU's figures except that we substituted two standard deviations for the radiation effects where GPU used one standard deviation. The result is that the calculated total error is 26.8°F (25.5° instrument error plus 1.3° physical configuration factor). That is, if one accepts GPU's error values and calculations, changing only from one to two standard deviations for the radiation effects, the subcooling margin disappears entirely. Since no justification is given for using only one standard deviation for radiation effects (to say nothing of the absence of any attempt to validate the magnitude of error cause by radiation effects), this exercise demonstrates the extreme vulnerability of the GPU and staff position.

In sum, insufficient data is presented by the GPU and the staff to allow an independent evaluation of GPU's claim that the overall subcooling margin error is 23.4°F. One must simply accept it on faith that the calculations were done correctly. Given that the consequences of even a very small mistake would be the total elimination of any subcooling margin at all, the Commission should be unwilling to do so.

GPU Is Requesting What Amounts To An
Exemption From The Rules Governing Other Plants

Commissioner Asselstine has asked whether GPU is seeking to be treated differently from, i.e., less strictly than, all other operating reactors. Insofar as we are aware, the answer is "yes". While UCS has not checked the

licenses for all other reactors, we do know that the situation which prompts GPU to make the request is "unique." That is, no other plant proposes to operate with steam generators so degraded that following the generic B&W Abnormal Transient Operating Guidelines (ATOG) for SGTR accidents would result in undue risk to public health and safety.

The B&W ATOG specify that the difference in temperature between the steam generator tubes and the steam generators shell should be limited, under emergency conditions, to less than 150°F. Babcock & Wilcox Technical Document, "Three Mile Island Unit 1, Abnormal Transient Operating Guidelines," Part I, Section III D, "SGTR," April 24, 1983, pp. 30-41.

In contrast, GPU has recognized that with the corroded, i.e., cracked, condition of the TMI-1 steam generator tubes, the steam generator tube-to-shell temperature difference must be maintained at less than 70°F to limit the propagation of the tube cracks. See GPU Nuclear Technical Data Report, "SG Tube Rupture Procedure Guidelines," TDR No. 406, Rev. 3, December 2, 1983, Section 2.1.2, "Limiting OTSG Tube Stress," pp. 17-18.

Limiting the tube-to-shell temperature difference to less than half that allowable in other B&W plants reduces the rate at which TMI-1 can be cooled down and depressurized. Therefore, to limit the primary to secondary leakage, GPU proposes to lower the subcooling margin from 50°F to 25°F. Id., Section 2.1.4, "Minimum Allowable Subcooling Margin," pp. 20.

It is at best ironic that GPU, which has protested throughout this proceeding being treated differently from other plants, now seeks such special treatment. The Commission should be aware that it has before it only the tip of the iceberg with regard to the steam generator problems. In fact,

operation of TMI-1 with degraded steam generators will require the violation of or exemption from numerous safety limits in addition to the 50°F subcooling margin.^{5/}

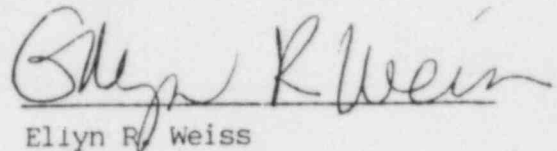
In any case, there is no justification for allowing TMI-1 to operate with a real subcooling margin for purposes of throttling HPI of 1.6°F at best or zero at worst. This reduction of the otherwise required safety margin from 50°F to practically nothing clearly makes recovery from a LOCA problematic. In addition, there is no assurance that it would even be adequate to protect against the consequences of a steam generator tube rupture. Errors, after all can go both ways. If the subcooling instrument reads erroneously high, a subcooling margin may be indicated but not, in fact, exist. On the other hand, if the instrument reads erroneously low, the steam generator tubes may be subjected to differential pressures which will increase the primary to secondary leak rate to a value which is incompatible with protection of the health and safety of the public. Such a situation is patently intolerable.

Thus, if the Commission determines to allow TMI-1 to operate, it must at least require installation of subcooling meters of sufficient accuracy that the condition of the plant can be diagnosed with reasonable certainty. When one recalls that the TMI-2 accident escalated from an innocuous event to

^{5/} These include, to mention just a few, violation of the "fuel pin in compression" limits and the reactor coolant pump net positive suction head limits, deliberate steaming of the affected steam generator(s) until it is anticipated that radiation dose limits for the public will be exceeded (even then, isolation may not be possible), and initiation of the decay heat removal system at 300°F rather than 275°F. Furthermore, there are no safety grade instruments to measure some parameters the operator must control, such as steam generator tube-to-shell temperature difference. See generally GPU Nuclear Technical Data Report, "SG Tube Rupture Guidelines," TDR No. 406, Rev. 3, December 12, 1983.

virtual destruction of the core precisely because of the operators' inability to diagnose the condition of the plant, it is clear that GPU's request to lower the required subcooling margin to essentially zero should be rejected.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Eilyn R. Weiss". The signature is written in dark ink and is positioned above the typed name.

Eilyn R. Weiss
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DATED: August 24, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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In the Matter of)
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