

September 26, 1997

SECY-97-217

FOR: The Commissioners

FROM: L. Joseph Callan /s/  
Executive Director for Operations

SUBJECT: PROPOSED GENERIC LETTER ENTITLED "ASSURANCE OF  
SUFFICIENT NET POSITIVE SUCTION HEAD FOR EMERGENCY  
CORE COOLING AND CONTAINMENT HEAT REMOVAL PUMPS,"  
AS REVISED TO REFLECT PUBLIC COMMENTS

PURPOSE:

The purpose of this information paper is to inform the Commission, in accordance with the guidance in a memorandum dated December 20, 1991, from Samuel J. Chilk to James M. Taylor regarding SECY-91-172, "Regulatory Impact Survey Report-Final," of the staff's intent to issue the subject generic letter.

The subject generic letter requests that addressees submit information relating to the adequacy of the net positive suction head (NPSH) available for emergency core cooling system (ECCS) and containment heat removal pumps when the suction for the pumps is from the containment sump or suppression pool, or for any pumps necessary for recirculation cooling of the core and containment. In particular, the staff is concerned that some

plants have taken credit for containment overpressure to satisfy NPSH requirements, thus possibly creating an inconsistency with the plants' licensing bases. The generic letter, therefore, also requests information regarding each addressee's use of containment overpressure.

The requested information will enable the NRC to determine whether the current NPSH analyses for reactor facilities are consistent with their respective current licensing bases. A copy of the proposed generic letter is attached.

#### DISCUSSION:

As a result of recent inspection activities, licensee notifications, and licensee event reports, the NRC staff has identified a safety-significant issue that has generic implications and warrants action by the NRC to ensure that the issue is adequately addressed and resolved. The issue is that the NPSH available for ECCS (including core spray and decay heat removal) and containment heat removal pumps may not be adequate under all design-basis accident scenarios.

In some cases, this inadequacy may be a result of changes in plant configuration, operating procedures, environmental conditions, or other operating parameters over the life of the plant. In other cases, a plant's NPSH analysis may not bound all postulated events for a sufficient time, or assumptions used in the analysis may be nonconservative or inconsistent with assumptions and methodologies traditionally considered acceptable

by the staff. For example, some licensees have recently discovered that they must take credit for containment overpressure to meet the NPSH requirements of ECCS and containment heat removal pumps. In the examples the NRC staff is familiar with, the need for crediting this overpressure in NPSH analyses has arisen because of changes in plant configuration and operating conditions, and/or errors in previous NPSH calculations.

The current NPSH analyses (including any corresponding containment pressure analysis) may not be available to the staff in docketed material because some licensees have changed their analyses. Consequently, this generic letter requests that addressees identify whether their current NPSH analysis differs from the most recent analysis that has been approved by the staff.

The generic letter is considered necessary for the following reasons:

(1) there is a high risk significance associated with the potential common-mode failure of ECCS pumps that could result from a sustained loss of NPSH, given an initiating event; (2) all plants are susceptible to changing plant conditions (e.g., a change in the physical plant, a change in operating parameters) that could require an NPSH reanalysis and the possible use of containment overpressure; and (3) recently, several plants have had especially notable problems with NPSH. On May 9, 1997, the licensee for Monticello voluntarily commenced a shutdown after determining that even with credit for containment overpressure, the blockage of the ECCS suction strainers that is postulated to occur during a design-basis loss-of-coolant-accident could degrade the available NPSH to a point at which the ability to adequately cool the reactor core would come into question. Furthermore, the licensee for the Haddam Neck plant found that 21 psig of containment overpressure is required to meet residual heat removal pump NPSH requirements for the alternate recirculation flowpath, and described the NPSH problem as one of the most safety-significant issues at the plant. Finally, the licensee for the Maine Yankee plant found that the facility is only able to meet its containment spray pump NPSH requirements for a reduced power level.

The proposed generic letter was originally classified as an "urgent" communication and was transmitted to the Committee To Review Generic Requirements (CRGR) by a memorandum from Ashok C. Thadani to Edward L. Jordan, dated January 6, 1997. The CRGR was briefed on the proposed generic letter on January 9, 1997, during CRGR meeting number 298. Following the briefing and incorporation of its comments, the CRGR endorsed the issuance of the proposed generic letter on January 17, 1997. However, on the basis of feedback from the Deputy Executive Director for Operations, the generic letter was reclassified as "non-urgent" and was published in the *Federal Register* on February 20, 1997 (62 FR 7806), to solicit public comments. Twelve distinct comments were received. A copy of the staff's resolution of these comments will be made available in the public document room and is attached. Please note that the staff has subsequently decided to (a) extend the period for submittal of all the requested information to 90 days in response to comments received since the public comment period ended, and (b) reduce the level of detail of the information being requested.

The ACRS reviewed the proposed generic letter during its 442nd meeting on

June 12, 1997. In a letter to Mr. L. J. Callan dated June 17, 1997, ACRS

Chairman Seale stated that the Committee supports the issuance of the Generic

Letter, and commented that (1) the staff needs to define the acceptance criteria for corrective actions, (2) credit for containment overpressure should not be allowed because it may not be available during shutdown and containment bypass sequences, and (3) the inspection program needs to be made more effective as the instances of noncompliance identified in the draft generic letter had remained undetected for many years. Mr. Callan replied to Mr. Seale on August 15, 1997 stating that (1) the staff shares the ACRS' concern about loss of NPSH during bypass sequences, (2) neither the NRC nor industry has considered credit for overpressure during shutdown, (3) for other sequences, the acceptability of credit for overpressure must be addressed on the basis of the probability and consequences of specific bypass scenarios, (4) the staff will followup on the GL responses with selected inspections based on NPSH margin, and (5) the staff would be pleased to brief the Committee on the power reactor

inspection program. In a subsequent letter dated September 9, 1997, the ACRS expressed remaining concerns regarding NPSH credit for overpressure, expressed a desire to continue discussion of the subject with the staff, and accepted the offer to be briefed on the inspection program.

The staff intends to issue this generic letter approximately 5 working days after the date of this information paper.

L. Joseph Callan  
Executive Director  
for Operations

Attachment: 1. Proposed Generic Letter 97-XX  
2. Staff Resolution of Public Comments

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D. C. 20555-0001

September , 1997

**NRC GENERIC LETTER 97-XX:           ASSURANCE OF SUFFICIENT NET  
  POSITIVE SUCTION HEAD FOR EMERGENCY  
  CORE COOLING AND CONTAINMENT HEAT  
  REMOVAL PUMPS**

Addressees

All holders of operating licenses for nuclear power plants, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Purpose

The U. S. Nuclear Regulatory Commission (NRC) is issuing this generic letter (GL) to request that addressees submit information necessary to confirm the adequacy of the net positive suction head (NPSH) available for emergency core cooling (including core spray and decay heat removal) and containment heat removal pumps.

Background

As a result of recent inspection activities, licensee notifications, and licensee event reports (LER), the NRC has identified a safety-significant issue that has generic implications and warrants action by the NRC to ensure that the issue is adequately addressed and resolved. The issue is that the NPSH available for emergency core cooling system (ECCS) (including core spray and decay heat removal) and containment

heat removal pumps may not be adequate under all design-basis accident scenarios.

In some cases, this inadequacy may be a result of changes in plant configuration, operating procedures, environmental conditions, or other operating parameters over the life of the plant. In other cases, a plant's NPSH analysis may not bound all postulated events for a sufficient time, or assumptions used in the analysis may be non-conservative or inconsistent with assumptions and methodologies traditionally considered acceptable by the staff. For example, some licensees have recently discovered that they must take new or additional credit for containment overpressure to meet the NPSH requirements of the emergency core cooling system and containment heat removal pumps. In the examples the NRC staff is familiar with, the need for crediting this overpressure in NPSH analyses has arisen because of changes in plant configuration and operating conditions, and/or errors in prior NPSH calculations. As a result, the overpressure being credited by licensees may be inconsistent with the plant's respective licensing basis.

Current NPSH analyses (including any corresponding containment pressure analyses) may not be available to the staff in docketed material (such as final safety analysis reports) because some licensees have changed their analyses. Consequently, this generic letter requests that addressees provide current information regarding the NPSH analyses for emergency core cooling and containment heat removal pumps. This generic letter applies only to ECCS and containment heat removal pumps that meet the following criteria:

- 1) pumps that take suction from the containment sump or suppression pool following a design-basis loss-of-coolant accident (LOCA) or secondary line break, or
- 2) pumps used in "piggyback" operation that are necessary for recirculation cooling of the reactor core and containment (that is, pumps that are supplied by pumps which take suction directly from the sump or suppression pool).

New NPSH analyses are neither requested nor required to be performed to respond to this information request. However, new NPSH analyses may be warranted if an addressee determines that changes in plant design or procedures have occurred which may have reduced the available NPSH. In such cases, each affected addressee must take appropriate corrective action to restore its facility to compliance, in accordance with the requirements stated in Appendix B to 10 CFR Part 50.

The following is a sample of the NRC staff's recent findings concerning the NPSH issues addressed by this generic letter.

#### Haddam Neck

In 1986 and 1995, the licensee identified conditions for which the NPSH available for residual heat removal (RHR) pumps may be insufficient when the pumps are operating in the emergency core cooling mode. In 1986, the licensee determined that the only extant NPSH analysis, which was performed in 1979 as part of the Systematic Evaluation Program, did not properly account for hydraulic losses in suction piping. As a result, that analysis erroneously indicated that containment overpressure was not needed to satisfy NPSH requirements for the pumps in the recirculation mode of operation. A subsequent analysis showed that the licensee needed to take credit for 41.36 kPa (6 psig) of containment overpressure. In another analysis conducted in 1995 using increased service water temperature, the licensee found that additional containment overpressure was necessary to meet NPSH requirements for the same pumps. This additional overpressure constituted a significant fraction of the peak calculated containment accident pressure.

On August 30, 1996, the licensee reported in LER 96-016 that calculations recently performed to determine the NPSH available for the RHR pumps may have been in error for the alternate, short-term recirculation flow path, because of insufficient containment overpressure for a period of pump operation. The licensee attributed this error to its failure to fully analyze

the containment pressure and sump temperature responses under design-basis accident conditions.

### Maine Yankee

In July and August 1996, an NRC Independent Safety Assessment Team (ISAT) conducted an inspection to determine if Maine Yankee was operating in conformance with its design and licensing bases. During that inspection, the ISAT identified potential weaknesses in the NPSH analysis conducted by the licensee for the containment spray pumps. These potential weaknesses included concerns regarding the validity of the containment sump temperature analysis, incorrect calculation of bounding pump suction head losses, and use of a hot-fluid correction factor to reduce NPSH requirements.

The licensee's calculation of record, performed in 1995 for a power level of 2700 thermal megawatts (Mwt) and which does not include the hot-fluid correction factor, indicates that the available NPSH for the containment spray pumps would be below the required NPSH for the first 5 minutes after pump suction is switched from the refueling water storage tank to the recirculation sump. When the licensee repeated the analysis using the hot-fluid correction factor (the use of which the ISAT viewed as a non-conservative assumption as implemented by Maine Yankee), the available NPSH was only slightly greater than the required NPSH for the same 5-minute period. For the remainder of the transient, the licensee's analysis showed that NPSH available to the containment spray pumps would exceed the amount required. As a basis for the contention that the containment spray pumps were operable despite the 5-minute period with available NPSH below the required NPSH, the licensee cited recent pump tests showing that the pumps could operate for a 15-minute period with NPSH below the required value without damage to the hydraulic performance or mechanical integrity of the pumps.

The licensee performed another analysis for a power level of 2440 Mwt, which showed that adequate NPSH margin would be available for the containment spray pumps in the recirculation mode of

operation. This analysis did not include use of the hot-fluid correction factor. The ISAT concluded that it was appropriate to consider the containment spray pumps operable at a power level of 2440 MWt.

### Pilgrim

As indicated in the NRC safety evaluation for licensing of the Pilgrim plant, and in documents referenced by that evaluation, containment overpressure was not necessary to satisfy RHR and core spray pump NPSH requirements at the time of licensing. When the plant was modified in 1984, the licensee's safety evaluation related to the modification stated that the available NPSH was determined assuming (1) maximum debris loading conditions on the sump strainers for the RHR and core spray pumps and (2) no credit for containment overpressure. The licensee reaffirmed this assumption on April 14, 1994, in its response to NRC Bulletin 93-02, "Debris Plugging of Emergency Core Cooling Suction Strainers," dated March 23, 1993, stating that the NPSH available to the residual heat removal and core spray pumps was analyzed assuming no overpressure condition in the torus.

However, in an analysis conducted by the licensee in 1995 in support of a proposal to raise the design seawater injection temperature to 75°F, credit was needed and taken for containment overpressure. At the time of this analysis, the licensee also indicated that the assumption of no overpressure in the torus, stated in its response to Bulletin 93-02, was incorrect. This example illustrates that the potential exists that other licensees may have made modifications to their plants that could be inconsistent with the plant's licensing basis, and could reduce the NPSH available to the ECCS pumps.

### Crystal River, Unit 3

In July 1996, an NRC inspection team conducted an Integrated Performance Assessment of Crystal River, Unit 3. As part of that assessment, the team reviewed the licensee's calculation which established the minimum post-LOCA reactor building water level

required to ensure that adequate NPSH would be available for the reactor building spray pumps. When the team compared this level with the minimum predicted level, they found that for one of the pumps, there was only a slight difference between the available water level and the level required to ensure adequate NPSH during the post-accident recirculation phase of pump operation.

The team found that the licensee used non-conservative assumptions in calculating the available NPSH for the spray pump. For example, the licensee failed to account for uncertainty in data regarding the required NPSH, as well as for uncertainties associated with the hydraulic resistance of check valves in the spray lines. In addition, the licensee used a hot fluid correction factor to reduce the required NPSH without considering the effects of non-condensable gases in the pumped fluid. Conservative assumptions included in the licensee's calculation were those detailed in Regulatory Guide (RG) 1.1, "Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal System Pumps," dated November 2, 1970 (originally Safety Guide 1), regarding the use of maximum reactor building fluid temperature and lack of credit for containment overpressure.

The team concluded that the non-conservative assumptions used in the licensee's NPSH calculation raise questions concerning the cavitation-free operation of reactor building spray pump 1B during the recirculation phase of operation. However, the team also concluded that this issue did not constitute an immediate safety concern since the licensee's calculations conservatively assumed no credit for containment overpressure and used the maximum expected reactor building water temperature.

### Dresden

By letter dated January 13, 1997, the licensee for Dresden submitted a license amendment request for approval of 13 kPa (2 psig) of containment overpressure for the first 10 minutes following a design-basis LOCA. This overpressure is necessary to compensate for an NPSH deficiency for the low pressure coolant injection (LPCI) and core spray pumps. The licensee identified

the need for overpressure after discovering that an incorrect value for the ECCS suction strainer head loss had been used in the design-basis NPSH calculation. As part of a design-basis review, the licensee determined that the actual head loss across the suction strainers was 1.8 m (5.8 feet) for clean strainers, rather than the 0.30 m (1 foot) head loss assumed in Dresden's original design basis as documented in the FSAR and vendor drawings.

Because the licensee could not determine with certainty if overpressure was part of the original Dresden licensing basis, the licensee concluded that the use of overpressure constituted an USQ and therefore requested staff approval to credit overpressure. In a license amendment dated January 28, 1997, the staff approved the requested use of 13 kPa (2 psig) of containment overpressure. In a subsequent license amendment issued on April 30, 1997, the staff approved the use of a maximum of 65 kPa (9.5 psig) of containment overpressure for NPSH, for the first 240 seconds following a design-basis LOCA. The need for this greater amount of overpressure arose primarily because of a higher calculated suppression pool temperature than that used in the analysis to support 13 kPa (2 psig) of overpressure.

### Monticello

In a report submitted to the NRC on April 15, 1997, pursuant to 10 CFR 50.72, the licensee for Monticello reported that the NPSH available to its core spray pumps may not meet the required NPSH under all accident conditions. The licensee discovered this possibility during a review of ECCS pump NPSH requirements, when a higher head loss than had previously been assumed for the ECCS suction strainers was calculated. During discussions with the licensee, the staff learned that the head loss across the suction strainers is approximately 3.57 m (11.7 feet) per 38,000 liters/minute (10,000 gpm), rather than the 0.3048 m (1 foot) per 38,000 liters/minute (10,000 gpm) assumed in the original design-basis analysis.

The licensee determined that for a recirculation line break with a single failure of the LPCI loop select logic, and with credit for containment overpressure, the core spray pumps would have an NPSH deficit and the LPCI pumps would have approximately 0.15 m (0.5 feet) of margin in NPSH. Following discovery of the NPSH condition, the licensee conducted an operability evaluation of the LPCI and core spray pumps, and made this evaluation available to the staff for review. Subsequently, on May 9, 1997, the licensee for Monticello commenced a voluntary shutdown of the plant because of the possible NPSH deficit for the ECCS pumps that would occur as a result of postulated clogging of the ECCS suction strainers under design-basis LOCA conditions.

#### Related Generic Communications

On October 22, 1996, the staff issued Information Notice (IN) 96-55, "Inadequate Net Positive Suction Head of Emergency Core Cooling and Containment Heat Removal Pumps Under Design Basis Accident Conditions," to alert addressees to recent discoveries by licensees of possible scenarios for which the NPSH available for ECCS and containment heat removal pumps is insufficient. Earlier INs describing similar events include IN 87-63, "Inadequate Net Positive Suction Head in Low Pressure Safety Systems," dated December 9, 1987, and IN 88-74, "Potentially Inadequate Performance of ECCS in PWRs During Recirculation Operation Following a LOCA," dated September 4, 1988.

#### Discussion

It is important that the emergency core cooling (including core spray and decay heat removal) and containment spray system pumps have adequate NPSH available to ensure that the systems can reliably perform their intended functions under all design-basis LOCA conditions. Inadequate NPSH could cause voiding in the pumped fluid, resulting in pump cavitation. While some ECCS and containment heat removal pumps can operate for relatively short periods of time while cavitating, prolonged operation of any pump under cavitation conditions can cause pump damage with potential

common-mode failure of the pumps. Such common-mode failure would result in the inability of the ECCS to provide adequate long-term core cooling and/or the inability of the containment spray system to maintain the containment pressure and temperature below design limits.

This generic letter addresses situations in which the NPSH available to the ECCS and containment heat removal pumps may be inadequate as a result of changing plant conditions and/or errors and non-conservative assumptions in NPSH calculations. In some cases, NPSH reanalyses conducted to support plant modifications may result in a substantial reduction of margin in available NPSH or a change in the original design basis of the plant. In particular, recent examples indicate that licensees have credited containment overpressure to satisfy NPSH requirements in response to changing plant conditions and errors discovered in earlier NPSH calculations.

RG 1.1 establishes the regulatory position that emergency core cooling and containment heat removal systems should be designed so that adequate NPSH is provided to system pumps assuming maximum expected temperatures of pumped fluids and no increase in containment pressure from that present before any postulated LOCAs. NRC Standard Review Plan (SRP) 6.2.2, "Containment Heat Removal Systems" (NUREG-0800, Revision 4, dated October 1985) clarifies RG 1.1 by stating that the NPSH analysis should be based on the assumption that the containment pressure equals the vapor pressure of the sump water, in order to ensure that credit is not taken for containment pressurization during the transient. As part of licensing and Systematic Evaluation Plan reviews, the NRC staff has, in the past, selectively allowed limited credit for a containment pressure that is above the vapor pressure of the sump fluid (i.e., an overpressure) to satisfy NPSH requirements on a case-by-case basis.

#### Requested Information

On the basis of the preceding discussion and examples, addressees are requested to review, for each of their respective reactor

facilities, the current design-basis analyses used to determine the available NPSH for the emergency core cooling (including core spray and decay heat removal) and containment heat removal pumps that meet either of the following criteria:

- 1) pumps that take suction from the containment sump or suppression pool following a design-basis LOCA or secondary line break, or
- 2) pumps used in "piggyback" operation that are necessary for recirculation cooling of the reactor core and containment (that is, pumps that are supplied by pumps which take suction directly from the sump or suppression pool).

Based on this review, within 90 days from the date of this generic letter, addressees are requested to provide the information outlined below for each of their facilities. New NPSH analyses are neither requested nor required.

1. Specify the general methodology used to calculate the head loss associated with the ECCS suction strainers.
2. Identify the required NPSH and the available NPSH.
3. Specify whether the current design-basis NPSH analysis differs from the most recent analysis reviewed and approved by the NRC for which a safety evaluation was issued.
4. Specify whether containment overpressure (i.e., containment pressure above the vapor pressure of the sump or suppression pool fluid) was credited in the calculation of available NPSH. Specify the amount of overpressure needed and the minimum overpressure available.
5. When containment overpressure is credited in the calculation of available NPSH confirm that an appropriate containment pressure analysis was done to establish the minimum containment pressure.

### Required Response

Within 30 days from the date of this generic letter, each addressee is required to submit a written response indicating (a) whether or not the requested information will be submitted, and (b) whether or not the requested information will be submitted within the requested time period. Addressees who choose not to submit the requested information, or are unable to submit the information within the requested period, must describe in their response an alternative course of action that is proposed to be taken, including the basis for the acceptability of the proposed alternative.

After reviewing responses to this generic letter, the NRC staff will notify individual addressees if concerns are identified with regard to their facilities.

Addressees should submit the required written response to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D. C. 20555-0001, under oath or affirmation under the provisions of Section 182a, Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f).

### Backfit Discussion

This generic letter only requests information from addressees under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). The requested information will enable the staff to determine whether addressees' NPSH analyses for the emergency core cooling (including the core spray and decay heat removal) and containment heat removal system pumps conform with the current licensing basis for their respective facilities, including the licensing safety analyses and the principal design criteria which require and/or commit that safety-related components and systems be provided to mitigate the consequences of design-basis accidents.

In particular, 10 CFR 50.46(a)(1)(i), which addresses the ECCS acceptance criteria for light-water nuclear power reactors,

requires in part that the calculated cooling performance of the ECCS following a postulated LOCA conforms to the criteria set forth in 10 CFR 50.46, including provisions for peak cladding temperature and long-term cooling. The potential for loss of adequate NPSH for ECCS pumps, and the cavitation that would result, raises the concern that the ECCS would not be capable of maintaining the peak cladding temperature below acceptable limits, and/or would not be capable of providing core cooling over the duration of postulated accident conditions, as required by 10 CFR 50.46.

Furthermore, the licensing bases of some plants credit the operation of containment sprays for pressure control as well as for fission product control. The potential for the loss of adequate NPSH for containment spray pumps, and the cavitation that would result, raises the concern that containment spray would not be capable of reducing and maintaining the containment pressure and temperature below design values and would not be capable of reducing the radiological dose consequences consistent with plants' licensing bases.

Considering the safety significance of removing heat from the containment atmosphere and cooling the reactor core following a design-basis accident, the requested information is needed to verify addressee compliance with licensing-basis commitments regarding the performance of emergency core cooling (including core spray and decay heat removal) and containment heat removal system pumps. The evaluation required by 10 CFR 50.54(f) to justify this information request is included in the preceding discussion.

#### Federal Register Notification

A notice of opportunity for public comment was published in the *Federal Register* on February 20, 1997 (62 FR 7806) to solicit public comments on the draft of this generic letter. A total of 17 comments were received from interested parties, including one industry group, one legal group affiliated with the nuclear power

industry, and two licensees. When redundant comments are considered, 12 distinct comments were identified by the staff. Copies of the staff evaluation of these comments have been made available in the NRC Public Document Room.

### Paperwork Reduction Act Statement

This generic letter contains information collections that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget, approval number 3150-0011, which expires on August 31, 2000.

The public reporting burden for this collection of information is estimated to average 200 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The NRC is seeking public comment on the potential impact of the collection of information contained in the generic letter and on the following issues:

1. Is the proposed collection of information necessary for the proper performance of the functions of the NRC, including whether the information will have practical utility?
2. Is the estimate of burden accurate?
3. Is there a way to enhance the quality, utility, and clarity of the information to be collected?
4. How can the burden of the collection of information be minimized, including the use of automated collection techniques?

Send comments on any aspect of this collection of information, including suggestions for reducing this burden, to the Information and Records Management Branch, T-6 F33, U.S. Nuclear Regulatory

Commission, Washington DC 20555-0001, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0011), Office of Management and Budget, Washington, DC 20503.

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

If you have any questions about this matter, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Jack W. Roe, Acting Director  
Division of Reactor Program Management  
Office of Nuclear Reactor Regulation

Technical contact: William O. Long, NRR  
(301) 415-3026  
E-mail: wol@nrc.gov

Richard M. Lobel, NRR  
(301) 415-2865  
E-mail: rml@nrc.gov

Lead project manager: T. J. Kim, NRR  
(301) 415-1392  
E-mail: tjk3@nrc.gov

STAFF RESOLUTION OF PUBLIC COMMENTS RECEIVED  
ON DRAFT GENERIC LETTER ENTITLED  
"ASSURANCE OF SUFFICIENT NET POSITIVE SUCTION HEAD FOR EMERGENCY  
CORE COOLING  
AND CONTAINMENT HEAT REMOVAL PUMPS" (62 FR 786, February 20,  
1997)

The staff received a total of 17 comments on the draft generic letter entitled "Assurance of Sufficient Net Positive Suction Head For Emergency Core Cooling and Containment Heat Removal Pumps." Of these, 5 were redundant, leaving 12 distinct comments focusing primarily on clarification of the information requested in the generic letter. The majority of the comments came directly from utilities or from the Nuclear Energy Institute (NEI), and one comment came from the Nuclear Utility Backfitting and Reform Group (NUBARG) associated with the law offices of Winston and Strawn. The following discussion provides the comments received and the NRC staff's response to these comments. The staff's responses state clearly whether, and how, the generic letter was revised to reflect a particular comment.

I. Carolina Power and Light Company (CP&L)

Comment 1: "The proposed generic letter requests the Net Positive Suction Head (NPSH) analyses and assumptions for Emergency Core Cooling and Containment Heat Removal pumps. If the analyses are determined not to be in compliance with the Commission's rules and regulations, the affected addressees are expected to take corrective action, as appropriate, in accordance with 10 CFR 50, Appendix B, to restore the facility to compliance. Rather than providing the NRC with the details of the analyses, CP&L suggests that it would be more appropriate for the licensees to confirm that the NPSH calculations are consistent with the analyses and assumptions in the Final Safety Analysis Report (FSAR). This approach would focus the evaluation onto

determining the extent to which the plant configuration agrees with the licensing basis. Therefore, CP&L suggests that the proposed generic letter be revised to have the addressees provide the results of those evaluations and any changes to the Updated Final Safety Analysis Report, if appropriate, rather than the details of the analyses. "

Response: The proposed generic letter has been revised in a manner which significantly reflects this comment.

Comment 2: "If comment No. 1 above is not incorporated, CP&L suggests that the 'Requested Information' section of the proposed generic letter be revised in accordance with the following comments: "

a) "Paragraph (1) (d): CP&L suggests that the request for a comparison with the 'original licensing-bases analysis' be revised to be a comparison with the 'most current NRC reviewed and approved licensing bases for which a Safety Evaluation was issued.' There may have been Safety Evaluations subsequent to the original, and a comparison with potentially out-of-date information serves no purpose and could be misleading and confusing. "

Response: The staff agrees with this comment, and has revised the generic letter to request that addressees compare the design-basis NPSH analysis with the most current NRC-reviewed and approved analysis for which a safety evaluation was issued.

b) "Paragraph (3): For completeness, CP&L suggests the addition of the words 'and pressure control' after the words 'heat removal' in the first sentence. Both temperature and pressure are important parameters in the calculation of available NPSH, and the subparagraph (3) (c) addresses the pressure issue by requesting information of containment spray use. "

Response: The proposed generic letter has been significantly revised. That language has been deleted from the "Requested Information" section.

c) "Paragraph (3) (a): CP&L suggests that the NRC clarify what is meant by the term 'multipliers' in the sentence: 'Identify the heat transfer correlations that were used, and specify whether or not multipliers were used to calculate the transfer of energy to the heat sinks in the containment.' "

Response: The proposed generic letter has been significantly revised. The "multipliers" request has been deleted from the "Requested Information" section.

d) "Paragraph (3) (c): CP&L suggests that the NRC consider whether information concerning closed loop cooling systems which exchange heat from the RHR system (or other containment heat removal systems) to the Service Water system should also be requested, for completeness. To omit this would result in an incomplete data base which may then require an additional request for information at some time in the future."

Response: The proposed generic letter has been significantly revised. That language has been deleted from the "Requested Information" section.

## II. Illinois Power

Comment 1: "The Generic Letter should clarify that if bounding values are used in the analyses, then time history analyses are not required. It should be sufficient that bounding values are used."

Response: The proposed generic letter has been revised to reduce the level of detail of information being requested. Addressees will not be requested to furnish information with this level of detail in their initial responses. However, after reviewing the

initial information, the staff may find it necessary to request additional information, at which time this comment will be considered.

Comment 2: "The Generic Letter should clarify that decay heat removal is only required to be analyzed for NPSH concerns when the suction source for the pump is from the suppression pool or reactor building sump. "

Response: The focus of the staff's concern relates to the recirculation phase and to the credit for containment overpressure. Although NPSH for pumps taking suction from a cold storage tank (e.g., refueling water storage tank or condensate storage tank) must be assured, that concern is not encompassed by the proposed generic letter. The staff has revised the generic letter to clarify that the scope of information requested applies only to emergency core cooling system (ECCS) and containment heat removal pumps that meet either of the following criteria:

- 1) pumps that take suction from the containment sump or suppression pool following a design-basis LOCA or secondary line break, or
- 2) pumps used in "piggyback" operation that are necessary for recirculation cooling of the reactor core and containment (that is, pumps that are supplied by pumps which take suction directly from the sump or suppression pool) (See Comment 3 from NEI).

Comment 3: "Item 1[1](e) proposes to require identifying what quality assurance procedures and engineering program controls were in place when the current NPSH analysis was performed. In our opinion, this requested information is excessive. It should be sufficient to request that licensees ensure their analyses are correct. "

Response: The staff agrees and has revised the proposed generic letter accordingly.

### III. Nuclear Energy Institute (NEI)

Comment 1: "The proposed generic letter requests that addressees provide information on NPSH analyses within 60 days from the date of the generic letter. Recent generic letters requesting a similar level of information have provided a response period ranging from 90 days to 180 days. The abbreviated response period of the proposed generic letter, if maintained, will necessitate a re-prioritization of licensee-planned activities. The issues identified in the proposed generic letter do not warrant such a short response period. The proposed generic letter requests the collection and submittal of a considerable amount of information. Sufficient time should be allowed to prepare the information requested by the proposed generic letter."

"The safety issues in the proposed generic letter were previously identified through NRC Information Notice (IN) 96-55, 'Inadequate Net Positive Suction Head of Emergency Core Cooling and Containment Heat Removal Pumps Under Design Basis Accident Conditions.' Licensees were asked to review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Licensee evaluations of IN 96-55 would have already prompted any required short-term actions."

"The response period should be increased to at least 90 days to allow sufficient time for the collection and preparation of the requested information."

Response: The proposed generic letter has been revised to specify a 90-day response period and the scope of information requested has been reduced.

Comment 2: "Item (1) under the Requested Information section of the proposed generic letter states:

`Provide the NPSH analysis and assumptions for each pump, and, in particular ....'

This request continues with a specification of the "particular" information that is being sought by the NRC staff. "

"The presence of the second `and' in the above request makes it unclear whether submittal of the "particular" information will fully satisfy the request or whether additional information on `NPSH analysis and assumptions' is requested. Forwarding of comprehensive analysis packages would appear to be more than what is intended, at least from reading the Discussion section.

Please provide clarification on the requested information by identifying whether a response to the specific requests (i.e., "particulars") will satisfy the information request. If not, please identify what parts of the NPSH analysis are needed."

Response: The proposed generic letter has been revised to reduce the level of detail of information being requested. Addressees will not be requested to furnish information with this level of detail in their initial response. However, after reviewing the initial information, the staff may find it necessary to request additional information.

Comment 3: "Item (1) under the Requested Information section of the proposed generic letter requests `analysis and assumptions for each pump ....' "

"Plant analyses are often performed with the recognition that groups of redundant pumps (e.g., High Pressure Safety Injection, Containment Spray) may be in operation. Information on individual pump operation may not be available. Plants may also have pump configurations in which one or more pumps do not take direct

suction from the containment sump or the suppression pool, but are supplied by a pump. "

"The information request should be modified to allow licensees to provide information for groups of pumps when applicable to the analysis. Also, please clarify whether the information request is limited to pumps that take suction directly from the containment sump or suppression pool. "

Response: The proposed generic letter has been revised to reduce the level of detail of information being requested. Addressees will not be requested to furnish information of this level of detail in their initial response. However, after reviewing the initial information, the staff may find it necessary to request additional information.

Comment 4: "Item (1)(a) under the Requested Information section of the proposed generic letter states:

'Specify, as a function of time, the required NPSH and the available NPSH. '

The analyses used to determine NPSH make use of conservative assumptions to define required and available NPSH values. The use of these assumptions can result in a single, maximum required NPSH and a single, minimum available NPSH. These are compared to ensure that adequate NPSH is available throughout the required time frame. To provide NPSH values as a function of time might require the performance of a new separate analysis. "

"The information request should be modified to acknowledge the submittal of bounding NPSH values as an acceptable response to this request. "

Response: See the staff's response to Comment 1 from Illinois Power.

Comment 5: "Item (1)(d) under the Requested Information section of the proposed generic letter states:

`Specify if the *current* licensing-basis NPSH analysis is different from the original licensing-basis analysis, . . . .'

The original licensing-basis analysis might have been replaced by a subsequent analysis which has been reviewed and approved by the NRC. Where this is the case, the above request could potentially result in a comparison to out-of-date information. "

"The generic letter should clarify the above request to specify whether the original licensing-basis analysis or the most current NRC reviewed and approved analysis should be used. "

Response: See the staff's response to Comment 2a from Carolina Power and Light Company.

Comment 6: "Item (1)(e) under the Requested Information section of the proposed generic letter states:

`Specify any quality assurance procedures and engineering program controls in place when the current NPSH analysis was performed.'

This request in its current form is very broad and appears to be inconsistent with the stated purpose of the information request, which is ` . . . to determine if the NPSH analyses for reactor facilities are consistent with their respective current licensing basis. ' "

"NRC staff should review the purpose of this request and either remove the request or provide a clearer specification of the information requested and the basis for the request. "

Response: See the staff's response to Comment 3 from Illinois Power.

Comment 7: "In at least one instance, a licensee has submitted written NPSH analysis documentation to the NRC and has received an NRC safety evaluation report for the same."

"The generic letter should be modified to allow reference to previously submitted and accepted NPSH analysis information."

Response: If addressees know that the staff is already in possession of any requested information, they may state that fact in their response to the generic letter. The staff has revised the generic letter to reflect the response to this comment.

Comment 8: "The focus of the proposed generic letter, as identified in the Requested Information section, is on NPSH analyses for events in which the emergency core cooling or containment heat removal pumps take suction from the containment sump or the suppression pool. This focus excludes analyses for secondary system pipe breaks as they do not result in pump suction from the containment sump or the suppression pool."

The Background section of the proposed generic letter states:

`This generic letter applies only to ECCS and containment heat removal pumps that take suction from the containment sump or suppression pool following a loss-of-coolant accident (LOCA) or secondary line break.' "

"The Requested Information section of the proposed generic letter, under item (1)(b) states:

`Identify the postulated pipe breaks that were analyzed if a spectrum of primary and secondary system pipe break sizes and locations was considered ....' "

"Please provide clarification that the analysis information requested in the proposed generic letter is limited to those time

frames during which the emergency core cooling and containment heat removal pumps are taking suction from the containment sump or the suppression pool. It is also recommended that the words `or secondary line break' be deleted from the Background section and that `and secondary' be deleted from the Requested Information section."

Response: The information in the comment regarding the pump suction source has always been the intent of the generic letter. Consequently, the staff has revised the generic letter to clarify that the information request applies only to ECCS and containment heat removal pumps that take suction from the containment sump or suppression pool following a LOCA, or are required for recirculation cooling of the reactor core and containment (See the staff's response to Comment 2 from Illinois Power).

The comment also addressed the issue of secondary line breaks. If, in the event of a steam or feedwater line break, containment spray pumps would have to eventually operate in a recirculation mode, adequacy of NPSH must be analyzed. The staff thus has no reason to exclude secondary breaks from the scope of information requested. Consequently, the staff has not revised the generic letter with regard to this requirement.

#### IV. Winston and Strawn - Nuclear Utility Backfitting and Reform Group (NUBARG)

Comment 1: "We recommend that the NRC not issue the proposed Generic Letter until completion of a backfitting analysis pursuant to 10 CFR §50.109. Absent the requisite backfitting analysis, the Staff cannot justify the need for the information and any new requirements imposed on licensees through a new interpretation of plant licensing and design bases (e.g., imposition of General Design Criteria to pre-GDC-licensed plants). The backfitting analysis should include justification for applying the request to all plants. Alternatively, if the Staff believes that it has additional information or insights

useful to licensees, a supplement to Information Notice 96-55 could be issued rather than the proposed Generic Letter, or the concerns could be addressed through rulemaking. "

Response: It is not the intent of the generic letter to impose new requirements or new interpretations of plant licensing and design bases on licensees. Rather, the intent of the generic letter is to request information appropriate to the staff's recognition of licensees' increased reliance on containment overpressure, as a result of errors in the NPSH calculation or changes in plant design, to satisfy NPSH requirements. The generic letter constitutes a request for information only.

The comment specifically addressed application of General Design Criteria (GDC) to plants licensed before the promulgation of those criteria ("pre-GDC" plants). The staff notes that "pre-GDC" plants were reviewed and approved using criteria that were essentially the same as the GDC. In the Statement of Considerations for the proposed GDC, the Commission stated that "these General Design Criteria would not add any new requirements, but are intended to describe more clearly present Commission requirements to assist applicants in preparing applications." This view was reiterated in SECY-92-223, "Resolution of Deviations Identified During the Systematic Evaluation Program," dated June 19, 1992. Finally, the staff notes that the introduction to 10 CFR Part 50, Appendix A, states that the GDC "establish minimum requirements for the principal design criteria for water-cooled nuclear power plants *similar in design and location* to plants for which construction permits have been issued by the Commission" (emphasis added). This reinforces the view that the GDC were not completely new requirements, but rather represented a codification of existing NRC review and approval practices. Therefore, mention of the GDC in the backfit discussion of the generic letter does not impose new requirements on any licensed

plant. Rather, the GDC simply formalize previously existing licensing requirements and practices.

With regard to the mention of 10 CFR 50.46 in the backfit discussion in the generic letter, the staff notes that addressees are required to meet either 10 CFR 50.46, GDC 35, or both. The only plants that may not need to meet 10 CFR 50.46 would be those plants without Zircaloy fuel cladding. In such cases, the particular plant would need to meet criteria very similar to those in 10 CFR 50.46, and would still need to comply with GDC 35, which specifies that a facility must have a system to provide "abundant emergency core cooling."

Finally, 10 CFR 50.54(f) states that, "Except for information sought to verify licensee compliance with the current licensing basis for that facility, the NRC must prepare the reason or reasons for each information request prior to issuance to ensure that the burden to be imposed on respondents is justified in view of the potential safety significance of the issue to be addressed in the requested information." The request for information is being made to ensure that licensees are in compliance with their current licensing bases, consistent with 50.54(f).

Because the generic letter makes no attempt to impose new requirements or new interpretations of plant licensing and design bases, as discussed above, and because the information is being requested in accordance with 10 CFR 50.54(f), a backfitting analysis pursuant to 10 CFR 50.109 is not necessary. Therefore, the staff has not revised the generic letter to reflect this comment.

Generic Letter 97-XX  
August , 1997  
Page of 11