Bases for withdrawal of Regulatory Guide 1.1,
"NET POSITIVE SUCTION HEAD FOR EMERGENCY CORE COOLING AND CONTAINMENT HEAT REMOVAL SYSTEM PUMPS"

(1) What regulation(s) did the Regulatory Guide support?

RG 1.1, Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Systems," was used to address 10 CFR Part 50, Appendix A, General Design Criterion 35 and 38. General Design Criterion 35 and 38 requires that the emergency cooling and containment heat removal systems be capable of accomplishing their required safety functions assuming loss of offsite power and a single failure. The ability to accomplish these safety functions reliably depends in part on the proper performance of system pumps which, in turn, depends on the conditions under which the pumps must operate. One of these conditions is suction pressure.

(2) What was the purpose of the Regulatory Guide?

RG 1.1 provided guidance to licensees and their vendors regarding calculation of the performance of emergency core cooling and containment heat removal systems. This was issued as one of the original safety guides developed to support the early licensing of commercial nuclear power plants.

(3) How was the Regulatory Guide used?

RG 1.1 provided a brief regulatory position found verbatim in the response to question 4 below. RG 1.1 was used in the past to review extended power uprates (EPUs). The guidance was written to be independent of calculated increases in containment accident pressure (CAP) caused by postulated loss of coolant accidents, in order to assure reliable operation under a variety of possible accident conditions. However, certain BWRs needed to use CAP to be able to qualify for the EPUs, notably Brown's Ferry. For example, in these EPU applications, proper operation of the emergency core cooling system could have depended upon maintaining the containment pressure above a specified minimum amount. In this case, too low an internal pressure (resulting from impaired containment integrity or operation of the containment heat removal systems at too high a rate) could have significantly affected the ability of this system to accomplish its safety functions by causing pump cavitation. Thus the guidance was insufficient to grant an EPU, and additional basis was needed to accept the use of CAP and its impact on suction pressure.

(4) Why is the Regulatory Guide no longer needed?

Staff published RG 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," in June 1974. That guidance identified early concerns with the effects of debris on the operation of the ECCS pumps and sumps and provided guidance for the physical configuration needed to meet the design criteria while considering debris effects. This RG was also used in the past to review extended power uprates (EPUs). Certain BWRs needed to use containment accident pressure (CAP) to be able to qualify for the EPUs, notably Brown's Ferry. With each revision of RG 1.82, further detail and guidance was incorporated. RG 1.82, Revision 3, Section 1.3.1 (titled NPSH) incorporated the staff position in RG 1.1, with more specific detail developed during extensive reviews of ECCS systems, particularly those associated with Generic Issue 191, "Assessment of Debris Accumulation on PWR Sump Performance,"

incorporated in revision 4. The relevant staff positions from RG 1.1 and RG 1.82 are shown below.

RG 1.1, Section C Regulatory Position:

> Emergency core cooling and containment heat removal systems should be designed so that adequate net positive suction head (NPSH) is provided to system pumps assuming maximum expected temperatures of pumped fluids and no increase in containment pressure from that present prior to postulated loss of coolant accidents.

RG 1.82, (R4) Section C. Regulatory Position 1.3.1 Net Positive Suction Head of the Emergency Core Cooling System (ECCS) and Containment Heat Removal Pumps

> Regulatory Position 1.3.1.1:
>
> The design of the emergency core cooling and containment heat removal systems should ensure that sufficient available NPSH is provided to the system pumps, assuming the maximum expected temperature of the pumped fluid and no increase in containment pressure from that present before the postulated LOCA.
>
> a. It is conservative to assume that the containment pressure equals the vapor pressure of the pool water. This ensures that credit is not taken for containment pressurization during the transient.
>
> b. For PWR sub atmospheric containments, this guidance should apply after termination of the injection phase. For these sub atmospheric containments, before termination of the injection phase, NPSH analyses should include conservative predictions of the containment atmospheric pressure and sump water temperature as a function of time.
>
> Regulatory Position 1.3.1.2:
>
> For certain operating reactors in which it is not practicable to alter the design, conformance with Section C 1.3.1.1 may not be possible. In these cases, the determination of available NPSH should not include containment pressure above that which is necessary to preclude pump cavitation. The calculation of available containment pressure and sump/pool water temperature as a function of time should underestimate the expected containment pressures and overestimate the sump/pool water temperatures when determining available NPSH for this situation.

The information in RG 1.82 has been updated from extensive reviews of the ECCS recirculation systems which have reduced the uncertainties contained in modeling studies of these systems. The staff has determined that the RG 1.82 guidance is more thorough and provides the needed detail to allow consideration of nuances in design which were not contemplated when RG 1.1 was written in 1970.

(5) What guidance is available once the Regulatory Guide is withdrawn?

As discussed in question 4, RG 1.82 includes the regulatory position of RG 1.1 as a basic consideration of design for NPSH and provides further information on the effects of the containment environment. It should be noted that the staff plans to revise RG 1.82 to include

additional guidance related to the use of CAP in NPSH calculations. Specifically, the staff plans to incorporate information in “Draft Guidance For The Use Of Containment Accident Pressure In Determining The Net Positive Suction Head Margin For Emergency Core Colling System And Containment Heat Removal Pumps And Containment Heat Removal Pumps In Boiling Water And Pressurized Water Reactors” (ADAMS ML13015A437). This document provides a detailed explanation of the considerations required to determine the acceptability of a proposed design or amendment.

(6) Is the Regulatory Guide referenced in other documents and what are the “ripple effects” on these documents if it is withdrawn?

This RG is mentioned in in NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” section 6.3, *“The design of the ECCS should conform to the recommendations of Regulatory Guide 1.1.”* The reviewer will now have RG 1.82 to use in its place. RG 1.82 is currently referenced in NUREG-0800 in section 6.2.2. The SRP will need to correct the reference in section 6.3.

(7) What is the basis for believing that no guidance similar to that in the Regulatory Guide will ever be needed?

The guidance remains valid and has been incorporated into RG 1.82.

(8) Will generic guidance still be needed?

The guidance is still needed and has been incorporated into RG 1.82. It should be noted that the staff plans to revise RG 1.82 to include further guidance on the use of containment accident pressure for calculating available NPSH. Specifically the staff plans to incorporate draft guidance discussed in the response to question #5 above.

(9) What is the rationale for withdrawing this Regulatory Guide instead of revising it?

RG 1.1 guidance was incorporated into RG 1.82.

(10) Do other agencies rely upon the Regulatory Guide, e.g., the Agreement States, National Aeronautical and Space Administration, Department of Energy?

The staff is unaware of any other agency that uses or relies on the guidance in RG 1.1.