SAFETY GUIDE 1

NET POSITIVE SUCTION HEAD FOR EMERGENCY CORE COOLING AND CONTAINMENT HEAT REMOVAL SYSTEM PUMPS

A. Introduction

Proposed General Design Criterion 41 requires that the emergency cooling and containment heat removal systems be capable of accomplishing their required safety functions assuming partial loss of installed capacity. In current designs 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. This guide describes a suitable relationship between increases in containment pressure caused by postulated loss of coolant accidents and the net positive suction head (NPSH) of emergency core cooling and containment heat removal system pumps which may be used to implement General Design Criterion 41.

B. Discussion

A significant consideration related to emergency core cooling and containment heat removal systems is the potential for degraded pump performance which could be caused by a number of factors, including inadequate NPSH. If the NPSH available to a pump is not sufficient, cavitation of the pumped fluid can occur. This cavitation may reduce significantly the capability of the system to accomplish its safety functions.

It is important that the proper performance of emergency core cooling and containment heat removal systems be independent of calculated increases in containment pressure caused by postulated loss of coolant accidents in order to assure reliable operation under a variety of possible accident conditions. For example, if proper operation of the emergency core cooling system depends upon maintaining the containment pressure above a specified minimum amount, then too low an internal pressure (resulting from impaired containment integrity or operation of the containment heat removal systems at too high a rate) could significantly affect the ability of this system to accomplish its safety functions by causing pump cavitation. In addition, the deliberate continuation of a high containment pressure to maintain an adequate pump NPSH would result in greater leakage of fission products from the containment and higher potential offsite doses under accident conditions than would otherwise result.

Changes in NPSH for emergency core cooling and containment heat removal system pumps caused by increases in temperature of the pumped fluid under loss of coolant accident conditions can be accommodated without reliance on the calculated increase in containment pressure. Adequate NPSH can be assured by locating pumps at suitable elevations with respect to the storage volumes connected to their suction sides, by using multistage or booster pumps, by a combination of these methods, or by other techniques.

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.