GE Nuclear Energy

ABWR 52-001

11H3

Date 10/2/92

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Subject Internal Missiles - fans

Message Butch/Chet -

I propose to modify subsection 3.5.1.1.1.4 per the attached.

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3.5.1.1 Internally Generated Missiles (Outside Containment)

These missiles are considered to be those missiles resulting internally from plant equipment failures within the ABWR Standard Plant but outside containment.

3.5.1.1.1 Rotating Equipment

3.5.1.1.1.1. Missile Characterization

Equipment within the general categories of pumps, fans, blowers, diesel generators, compressors, and turbines and, in particular, components in systems normally functioning during power reactor operation, has been examined for any possible source of credible and significant missiles.

3.5.1.1.1.2 RCIC Steam Turbine

The RCIC steam turbine driving the pump is not a credible source of missiles. It is provided with mechanical overspeed protection as well as automatic governing; very extensive industrial and nuclear experience with this model of turbine has never resulted in a missile which penetrated the turbine casing.

3.5.1.1.1.3 Main Steam Turbine

Acceptance criteria 1 of SRP Section 3.5.1.3 considers a plant with a favorable turbine generator placement and orientation and adherence to the guidelines of Regulatory Guide 1.115 adequately protected against turbine missile hazards. Further, this criterion specifies that exclusions of safety-related structures, systems or components from low trajectory turbine missile strike zones constitutes adequate protection against low trajectory turbine missiles. The turbine generator placement and orientation of the ABWR Standard Plant meets the guidelines of Regulatory Guide 1.115 as illustrated in Figure 3.5-2.

In addition, the applicant referencing the ABWR design shall;

(1) Submit for NRC approval, within three years of obtaining an operating license, a turbine system maintenance program including probability calculations of turbine missile generation based on the NRC approved methodology (such as Reference 10), or

(2) Volumetrically inspect all low pressure turbine rotors at the second refueling outage and every other (alternate) refueling outage thereafter until a maintenance program is approved by the staff.

(3) Meet the minimum requirement for the probability of turbine missile generation given in Table 3.5-1.

3.5.1.1.1.4 Other Missile Analysis

No remaining credible missiles meet the significance criteria of having a probability (P_4) greater than 10^{-7} per year for rotating or pressurized equipment, because either:

(1) The equipment design and manufacturing criteria mentioned previously result in (P_1) being less than 10^{-7} per year; or

(2) Sufficient physical separation (barriers and/or distance) of safety-related and redundant equipment exists that the combined probability ($P_{\quad}$) is less than 10^{-7} per year.

These conclusions are arrived at by noting that pumps, fans, and the like are AC powered. Their speed is governed by the frequency of the AC power supply. Since the AC power supply frequency variation is limited to a narrow range, it is not likely they will attain an overspeed condition. At rated speed, if a piece such as a fan blade breaks off, it will not penetrate the casing. ~~As an example, a containment high purge exhaust fan has been analyzed for a thrown blade at rated speed conditions using an analytical expression from Reference 1. It is determined, based on maximum thickness this blade could penetrate, that the blade would not escape the fan casing and~~ consequently, (P_1) is less than 10^{-7} per year.

For example, ASME AG-1 requires that fans be designed to prevent any internally generated missiles from penetrating the fan housing unless other protection is provided.

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