REQUEST FOR ADDITIONAL INFORMATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING LICENSEE DEBRIS GENERATION

ASSUMPTIONS FOR GSI-191 RELATED TO INFORMATION CONTAINED IN

TECHNICAL REPORTS WCAP-16710 AND WCAP-16851

PRESSURIZED WATER REACTOR OWNERS GROUP

PROJECT NO. 694

ISSUE 1: The testing conditions did not adequately account for shock waves.

a. Shock waves behave spherically (not like a jet). The staff is concerned that equivalent zones of influence (ZOIs) calculated by jet volumes during insulation testing is non-conservative for shock damage and may underestimate spherical ZOI diameter by more than a factor of 2.

b. Testing was performed at cold leg temperatures while hot leg and pressurizer temperatures are above the superheat limit of 577°F for water. The staff is concerned that vapor explosions are possible above 577°F which could yield a large shock wave.

c. The water temperature at the nozzle at test initiation was significantly lower than the water in the tank and resulted in a lower corresponding initial saturation pressure at the nozzle. The staff is concerned that the lower initial temperature minimized shock wave formation potential, which likely resulted in less insulation damage.

d. Rupture disks, like those used during testing, have a finite opening time which impacts shock wave formation. The staff is concerned that acceptance that the test results included shock wave damage requires inherent acceptance by the staff of a finite break opening time for large break loss of coolant accidents (LBLOCAs), which are normally considered instantaneous.

e. No method for scaling the shock wave from a test nozzle to a plant LBLOCA pipe size has been provided. The staff is concerned that small nozzles used during testing underestimate the shock wave potential during a LBLOCA.

ISSUE 2: An adequate basis for applying test results to plant jacketing systems has not been submitted.

a. Larger pipe sizes in the plant as compared to the test configuration may result in different failure mechanisms.

b. The target size was too large/too close to the test jet which resulted in less force on the target edges than in the center as evidenced by center focused damage in test photos.

c. Pipe jacketing failures are not the same as large component jacketing failures because of differences in the distance between band latches, the number of latches, installation, band length, panel area under jet force, and the potential for damage propagation by the jet getting under large steam generator (SG) panels.

d. Jacket tears due to lip lifting by the jet may not be the failure mode on large pipes. In addition, most plants use stainless steel jacketing which is stronger than the tested aluminum. Therefore, lift forces may damage the banding and latches resulting in greater loss of jacketing.

e. The staff currently considers an open latch to be the same as a disengaged latch due to the random uncertainty in achieving this configuration. A basis has not been provided for predicting repeatability for when a latch will open and disengage versus when a latch will open and remain engaged.

f. The potential for damage propagation outside the tested ZOI exists on large components (i.e. getting under large SG panels).

g. Axial jet impingement on insulation may be worse than perpendicular impingement; especially for damage propagation along the pipe

ISSUE 3: The NRC Staff does not accept the statement that unjacketed NUKON was not damaged at a spherical damage zone equivalent to five pipe diameters (5D ZOI) because this insulation was jacketed at the beginning of the test.

ISSUE 4: Large uncertainties exist using the American National Standard Institute/American Nuclear Society (ANSI/ANS) 58.2-1988 model to calculate insulation loads. The NRC staff is concerned that the use of the ANSI/ANS-58.2-1988 model may have yielded non-conservative results.

a. Describe the procedure used to calculate isobar volumes used in determining equivalent spherical ZOI radii using the ANSI/ANS-58.2-1988 standard.

b. Explain why the technical report WCAP-16710 analysis was based on 530°F rather than the initial test temperature of 550°F. Include an explanation of how the initial temperature differences between rupture disk water and tank water were incorporated into the jet sub cooling analysis.

c. Explain assumptions on how mass flow rate was determined considering potential for two-phase flow and temperature dependant water and vapor densities.

ISSUE 5: Provide a detailed description of the test apparatus specifically including the piping from the pressurized test tank to the exit nozzle including the rupture disk system. The NRC staff is concerned that differences in the test apparatus and analysis conditions may not have been accounted for in calculation of jet volumes. Test stagnation pressures during the test may have been significantly lower than calculations predicted.

ISSUE 6: The NRC staff does not accept the position that damage observed during testing is not likely in the plant.

ISSUE 7: The NRC staff does not accept the position that jet-ejected insulation panels during a LBLOCA would not be damaged due to subsequent collisions in the plant. The NRC staff position is that containment conditions are significantly more crowded than the test conditions. Therefore more damage would occur to ejected insulation in the plant than the minor damage observed during the technical report WCAP-16710 testing.