July 29, 2010

Mr. Alexander Marion, Vice President
Nuclear Operations
Nuclear Energy Institute
1776 I Street NW, Suite 400
Washington, DC 20006-3708

Dear Mr. Marion:

By letter dated December 6, 2004 (Agencywide Documents and Access Management System (ADAMS) No. ML043280631), the U.S. Nuclear Regulatory Commission (NRC) staff provided its safety evaluation (SE) on Nuclear Energy Institute (NEI) 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology." The purpose of the NEI 04-07 guidance report and the associated NRC staff SE was to provide pressurized-water reactor (PWR) licensees an acceptable methodology to perform the evaluations requested in Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors."

In the course of a recent NRC staff review of industry debris generation testing intended to justify zone-of-influence (ZOI) values smaller than those accepted in Table 3-2 of the staff's SE on NEI 04-07, the staff determined that some ZOI values in the SE should be corrected. This letter transmits a draft SE revision that affects SE-accepted ZOI values for "Sure-Hold" banded insulations and adds a separate ZOI for Transco reflective-metallic insulation (RMI) to address the potential impacts of aluminum RMI on chemical effects. An additional draft revision is being made to Table 3-3 of the SE to specify a debris size distribution for jacketed Nukon with "Sure-Hold" bands that is consistent with the analysis in Appendix II to the SE. Revised draft SE pages are enclosed (Enclosure 1). These pages would replace pages 30 and 38 from the December 6, 2004 SE. The staff's basis for these revisions is detailed below.

The NRC staff recently recognized that both NEI 04-07 and the associated NRC staff SE had omitted a scaling equation that should be applied to certain jacketed insulation configurations. Specifically, this scaling equation accounts for increased stresses on the banding or latches used to secure jacketed insulation installed on pipes that are larger than the diameter of the target pipe in the tested configuration from which the reference destruction pressure was determined. The scaling equation had originally been developed by the Boiling Water Reactors Owners' Group and was included in its Utility Resolution Guidance document (Tab 7 of ADAMS Accession No. ML092530482) as well as the corresponding NRC staff SE (Tab 1 of ADAMS Accession No. ML092530482). Most of the ZOI values referenced in NEI 04-07 and its corresponding SE were derived from the Utility Resolution Guidance document; however, the scaling equation that applies to certain ZOI values was inadvertently omitted.

The NRC staff reviewed the test data that provided the bases for each of the potentially affected ZOI values accepted in Table 3-2 of the SE of NEI 04-07 to determine whether the ZOI values should be revised. This included a review of debris damage mechanisms, ZOI model considerations, and actual sizes and quantities of debris (i.e., debris characteristics) generated during the tests used as the basis for the ZOI values. Based on this review, the NRC staff determined that a revision was only necessary for ZOI values associated with “Sure-Hold” banded insulations and Transco RMI with aluminum foils.

The staff’s basis for not applying the scaling equation to all the recommended insulations in the BWROG Utility Resolution Guidance is as follows:

(1) For Transco stainless steel RMI and Darchem DARMET RMI, the staff determined the existing ZOI value is sufficient without additional scaling because stainless steel RMI is not a significant contributor to strainer head loss.

(2) For calcium silicate with aluminum jacketing and stainless steel bands, the staff determined the existing ZOI value is sufficient without additional scaling because the ZOI value is based on a different test using a two-phase jet for which the damage mechanism observed during testing was related to tearing of the jacketing rather than failure of the jacketing bands. Therefore, the scaling equation does not apply to calcium silicate with aluminum jacketing and stainless steel bands.

(3) For Koolphen-K and Mirror RMI, the staff determined the existing ZOI values proposed by industry are sufficiently conservative without additional scaling. This conclusion is based primarily on the following reasons: First, the large existing ZOI values for these materials would already encompass most or all of many plant containment compartments for the largest pipe rupture sizes. Second, as stated in the staff’s SE on NEI 04-07, the industry-proposed jet model in the ANSI/ANS 58.2-1988 standard tends to conservatively overpredict the volumes of low-pressure isobars that are associated with these large ZOIs. Third, there is an uncredited but likely potential for reflections and deflections to have removed energy from the jet at significant distances from the break.

The NRC staff determined that sufficient conservatism did not exist in the ZOI values for “Sure-Hold” banded insulations to allow the NRC staff to disregard applying the scaling equation to these insulations. The quantity of damaged fiberglass that could be generated when a scaled up ZOI is considered is potentially greater than fibrous debris quantity computed using the existing ZOI. For example, after accounting for this scaling, the quantity of small fines generated during the "Sure-Hold"-banded air jet tests of jacketed Nukon would potentially result in more small fine debris than assuming 60 percent small fines per the baseline assumption in NEI 04-07 for the existing ZOI. In addition, given the observations of fibrous insulation testing without “Sure-Hold” bands as referenced in Appendix II of the SE, the staff determined that failure of the bands at some point as the target moves closer to the jet would likely result in the fibrous insulation being fragmented into predominantly fine debris. Lastly, due to the 8-ft length of the jacketed Nukon targets secured with "Sure-Hold" bands relative to the nozzle diameter of 3 inches, at the distances tested, the outer regions of the target would not have been exposed to the full jet centerline pressure. This may have resulted in an underestimation of the potential for debris generation when using “Sure-Hold” bands.

In addition to identifying the omitted scaling equation during the NRC staff review of industry debris generation testing, the NRC staff also identified that the ZOI value for Transco RMI with aluminum foils was not adequate for evaluating the potential impacts of the material related to chemical effects. In particular, the SE-accepted ZOI value for Transco RMI is based on the generation of transportable debris that could result in strainer blockage. However, NRC staff recognizes that aluminum RMI can have a significant impact on strainer performance through the generation of aluminum precipitates without transporting to the strainer. For this reason, a separate ZOI of four pipe diameters (4D) is being proposed for Transco RMI with aluminum foils. This ZOI is expected to predict a similar amount of small aluminum foils using the 75 percent assumption as the realistic assessment of RMI air-jet testing documented in Appendix II of the SE on NEI 04-07. Additionally, as described in Appendix II of the SE, cassettes were shown during air jet testing to be removed from the target over a range of destruction pressures from 4 to 600 psig. While large quantities of transportable foil debris were not generated during these tests, cassettes that were removed from the pipes were observed to have significant damage to the outer sheaths at destruction pressures equal to or greater than 10 psig, which corresponds to 6 psig (17D) based on the staff 40 percent reduction in destruction pressures for two-phase jets documented in the SE. This damage to the outer sheath could result in exposure of the internal foils to sump fluid if submerged or directly sprayed upon. For the case of Transco RMI with aluminum internal foils, the removal of cassettes from piping or components can result in a significant quantity of additional aluminum debris. The existing ZOI for Transco RMI did not consider chemical effects and as such, could greatly under predict the potential for chemical precipitate formation where the RMI contains aluminum.

The NRC staff has considered the impacts of the revised ZOI values in Table 3-2 on the sump strainer performance analyses that PWR licensees are conducting in response to Generic Letter 2004-02. Based on a review of information submitted in response to this generic letter, the staff has determined that the revision to the SE on NEI 04-07 would not necessitate generic changes to PWR licensees' existing analyses. The staff's determination is based primarily on the following reasons: (1) according to information available to the NRC staff, "Sure-Hold" bands are not currently installed at PWRs to secure insulation; and (2) because partially damaged RMI cartridges are not expected to be transportable and stainless steel does not have an impact on chemical effects, the staff does not consider it necessary for PWR licensees to revise their debris generation analyses for stainless steel Transco RMI. The NRC staff will consider on a plant-specific basis whether additional actions are necessary to address the impact of the revised SE ZOI values on a handful of PWRs with aluminum RMI that may have the potential to generate additional quantities of aluminum-bearing chemical precipitates.

The NRC staff plans to make an additional revision to Table 3-2 of the SE on NEI 04-07 for the purpose of clarification. Based on reviews of PWR licensees' supplemental responses to Generic Letter 2004-02, the NRC staff observed several instances in which licensees had applied a ZOI value from the SE on NEI 04-07 to a plant insulation configuration that was less robust than the configuration that had been tested. To raise awareness of the need to ensure that plant installations are at least as robust as the tested configuration, the staff has now included in Table 3-2 a reference to the source document that describes the testing from which each ZOI value was derived, along with one paragraph of associated clarifying text.

The NRC staff also intends to update Table 3-2 for protective coatings which previously indicated that future testing was needed to justify ZOIs for qualified epoxy and untopcoated inorganic zinc coatings. Testing of these materials has been performed and the staff documented its initial evaluation of these materials in a letter dated March 28, 2008 (ADAMS Accession No. ML080230462). However, in light of new information, the NRC staff re-evaluated the testing and documented its new conclusions in a letter dated April 6, 2010 (ADAMS Accession No. ML100960495). As documented in that letter, the NRC staff considers 4D, with reference to acceptable testing reports, to be an acceptable ZOI for epoxy coatings and 10D to be an acceptable ZOI for untopcoated inorganic zinc coatings. As 10D is the default ZOI for qualified coatings in the SE, the staff intends to delete the reference to untopcoated inorganic zinc from Table 3-2.

The NRC staff further plans to revise Table 3-3 of the SE to specify a debris size distribution for jacketed Nukon with "Sure-Hold" bands that is consistent with the analysis presented in Appendix II to the SE. Appendix II documents that the staff's acceptance of the baseline size distribution of 60% small pieces and 40% large pieces for Nukon fiber blankets was based on a ZOI size of 17D. As demonstrated in Figure II-2 from this appendix, the degree of insulation fragmentation is not constant with jet pressure, but increases as the jet pressure impacting the target is increased, approaching 100% fragmentation into small fines at impingement pressures of approximately 20 psig. Although jacketing secured with "Sure-Hold" bands would provide the underlying Nukon fiberglass greater protection than was afforded the targets in the tests shown in Figure II-2, much larger impingement pressures ranging from greater than 20 psig potentially up to the reactor coolant system pressure for targets near the break opening would be experienced. Air jet testing of jacketed Nukon secured with "Sure-Hold" bands did not result in the failure of the jacketing system; however, based on the dimensional scaling of the jet nozzle to the target, the target would not have been fully impacted by the peak jet centerline pressure. Furthermore, the jet centerline pressures tested were intended to establish the threshold of destruction and are not sufficient to characterize the resulting debris size distribution within the ZOI. Therefore, the NRC staff is planning to revise Table 3-3 of the SE to indicate that jacketed Nukon with "Sure-Hold" bands destroyed within a ZOI should be considered to be 100% small fines.

Finally, in response to some licensees' interest in installing “Sure-Hold” bands to justify reduced destruction of thermal insulation, the staff has enclosed draft guidance (Enclosure 2) to ensure that licensees' insulation installations involving “Sure-Hold” bands are sufficiently robust to justify the ZOI values in the SE. This draft guidance is beyond the level of detail necessary for inclusion in the SE but is provided as a reference to licensees that intend to credit reduced ZOIs using “Sure-Hold” bands to ensure licensees install them in a manner consistent with the SE expectation that plant installations be at least as robust as the tested configuration.

The NRC staff is soliciting public comments on the draft SE revision in Enclosure 1 and on the draft guidance for installing "Sure-Hold" bands in Enclosure 2 for a period of 60 days from the date of this letter. The staff is planning to hold a public meeting following the expiration of this period to provide responses to public comments we receive.

Sincerely,

/for RA Sher Bahadur/

William H. Ruland, Director
Division of Safety Systems
Office of Nuclear Reactor Regulation

Enclosures:
1. Revised Draft SE Pages
2. NRC Staff Draft Guidance For Installation

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William H. Ruland, Director
Division of Safety Systems
Office of Nuclear Reactor Regulation

Enclosures:
1. Revised Draft SE Pages
2. NRC Staff Draft Guidance For Installation

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Table 3-2 Revised Damage Pressures and Corresponding Volume-Equivalent Spherical ZOI Radii

Target Material	Destruction Pressure (psig)	ZOI Radius/ Break Diameter	Reference for Test Description
Protective Coatings (epoxy and epoxy-phenolic paints)	150	4D	See note (1)
Darchem DARMET RMI Transco RMI with stainless steel foils	114	2.0	BWR Utility Resolution Guidance, Vol. 3 [27]
Transco RMI with aluminum foils	40[(2)]	See note (2)	BWR Utility Resolution Guidance, Vol. 3 [27]
Jacketed Nukon with "Sure-Hold" bands Mirror RMI with "Sure-Hold" bands	90[(3)]	See note (3)	BWR Utility Resolution Guidance, Vol. 3 [27]
K-wool	24	5.4	BWR Utility Resolution Guidance, Vol. 3 [27]
Calcium Silicate (Al. cladding, SS bands)	24	5.45	Ontario Power Generation [64]
Temp-Mat with stainless steel wire retainer	10.2	11.7	BWR Utility Resolution Guidance, Vol. 3 [27]
Unjacketed Nukon, Jacketed Nukon with standard bands Knaupf ET Panel	6	17.0	BWR Utility Resolution Guidance, Vol. 3 [27]
Koolphen-K	3.6	22.9	BWR Utility Resolution Guidance, Vol. 3 [27]
Min-K Mirror RMI with standard bands	2.4	28.6	BWR Utility Resolution Guidance, Vol. 3 [27]

(1) The testing is described in guidance sent to NEI on March 28, 2010 (ML080230462). The testing was re-evaluated by NRC staff in a letter to NEI dated April 6, 2010 (ML100970149) and a 4D ZOI was determined to be adequate.

(2) The reference value of destruction pressure provided here is appropriate for determining transportable foils using the baseline size distribution for RMI in Table 3-3. In addition, aluminum RMI should be treated as partially damaged cassettes between 4D (40 psig) and 17D (6 psig). Aluminum internal foils of partially damaged cassettes within this range should be considered for contribution to chemical precipitate generation if the cassettes are evaluated to transport to the sump or are directly exposed to sump fluid.

(3) The reference value of destruction pressure provided here is appropriate for target material installed on pipe sizes of 12-inch nominal diameter (or smaller). For target material installed on pipes of diameter D, where D exceeds a 12-inch nominal diameter, the destruction pressure is to be determined from the following equation:

$$P_{dest}(D) = P_{dest}(12") \times \frac{R(12")}{R(D)}$$

Where:

$P_{dest}(D)$ = Destruction pressure for target material installed on a pipe of diameter D

$P_{dest}(12")$ = Destruction pressure for target material installed on a pipe of 12-inch nominal diameter

R(12")	=	Outer radius for target material installed on a pipe of 12-inch nominal diameter
R(D)	=	Outer radius for target material installed on a pipe of diameter D

The ZOI radius corresponding to $P_{dest}(D)$ can then be determined according to the jet model in the ANSI/ANS 58.2-1988 standard. The purpose of this scaling equation is to account for increased stress on insulation banding as the target pipe size is increased beyond the 12-inch nominal diameter pipe on which banded target materials were installed during the testing that determined the reference destruction pressure value.

Formal debris generation studies have confirmed that insulation products having outer casings, jackets, or other similar mechanical barriers resistant to jet impingement yield smaller quantities of debris than do less robust materials. Various studies have also demonstrated dependence between the orientation of the jacketing seam relative to the jet and the amount of debris generation. This suggests that the integrity of the jacket during impingement is an important feature for minimizing debris generation. Russell reports, for example, that double jacketing an insulation product with a second overcladding of stainless steel having a rotated, opposing seam was very effective at minimizing the distance from the jet to the onset of damage
(OPG, 2001). As mentioned in Appendix I to this SE, any improvement in the mechanical resistance of the insulation product will help to avoid inflated ZOI volumes predicted by the ANSI jet model for very low damage pressures.

In applying the ZOI and destruction pressure values from Table 3-2, care should be taken to ensure that plant insulation installations to which these values are applied are at least as robust as the configuration that was tested. This guidance applies not only to the physical properties of the insulation or other target material (e.g., base material, jacketing, bands, latches, etc.), but also to the particular means of installation and attachment of jacketed insulations (e.g., ensuring band and jacket stresses for the installed configuration are bounded by testing, ensuring that more-limiting failure modes would not occur due to configuration or orientation differences, etc.). Scaling from the test condition to the plant condition should be applied where appropriate and justified. Specifically, as noted in Table 3-2 for certain types of insulation where excess band or latch stress was observed to be the failure mode, the reference destruction pressure should be scaled according to pipe diameter for insulation installed on larger plant pipe sizes. A reference that describes the testing that supports each of the values in Table 3-2 is provided in the final column of the table.

As noted above, the ANSI/ANS jet model has been proposed in the GR and found acceptable by the staff for the purpose of estimating potential damage volumes associated with empirically measured damage pressures. Various attributes and interpretations of the ANSI jet model are presented in Appendix I to this SE. Among those observations is the explanation of potentially exaggerated conservatism for very

Table 3-3 NEI Recommended Debris Size Distributions

Material	Percentage Small Fines	Percentage Large Pieces
Fibrous Materials in a ZOI		
NUKON™ Fiber Blankets	60	40
Transco™ Fiber Blankets	60	40
Knaupf	60	40
Temp-Mat	60	40
K-Wool	60	40
Min-K	100	0
Generic Low-Density Fiberglass	100	0
Generic High-Density Fiberglass	100	0
Generic Mineral Wool	100	0
Jacketed NUKON™ with Sure-Hold Bands	100	0
Reflective Metallic Insulation in a ZOI		
All Types	75	25
Other Material in a ZOI		
Calcium Silicate	100	0
Microtherm	100	0
Koolphen	100	0
Fire Barrier	100	0
Lead Wool	100	0
Coatings	100	0
Material Outside a ZOI		
Covered Undamaged Insulation	0	0
Fire Barrier (Covered)	0	0
Fire Barrier (Uncovered)	100	0
Lead Wool (Covered)	0	0
Unjacketed Insulation	100	0
“Qualified” Coatings	0	0
“Unqualified” Coatings	100	0

Staff Evaluation of GR Section 3.4.3.3: The baseline recommendations can be grouped as follows:

- Materials for which adequate debris generation data exists to evaluate the debris size distribution, i.e., NUKON™ fiberglass and DPSC Mirror™ RMI insulations.
- Materials deemed to have a size distribution no finer than the materials for which debris generation data is available.

NRC STAFF DRAFT GUIDANCE FOR INSTALLATION OF “SURE-HOLD” BANDS

Purpose

The intent of this document is to provide Nuclear Regulatory Commission (NRC) staff guidance regarding the installation of "Sure-Hold" bands so that licensees installing these bands to secure plant insulation will achieve a robust configuration commensurate with the applicable destruction pressures provided in the staff’s safety evaluation (SE) on the Nuclear Energy Institute (NEI) 04-07 guidance report.

The guidance herein describes methods acceptable to the staff for installing "Sure-Hold" bands. These methods are ultimately based on insights derived from destruction testing of insulation secured with these bands. Alternate installation methods may also be found acceptable by the staff provided that they are adequately justified. For example, adequate justification for alternate methods could include analysis and insights using existing data obtained from previous destruction testing of insulation secured with "Sure-Hold" bands or the performance of additional destruction testing of "Sure-Hold" banded insulation.

Background

A number of licensees have expressed interest in using "Sure-Hold" bands to secure problematic insulations currently installed in their containments as an alternative to insulation replacement. Although replacement or removal of the materials from containment is the most reliable way to prevent problematic insulation debris from being generated during a postulated loss-of-coolant accident (LOCA), testing has demonstrated that the installation of "Sure-Hold" bands to secure certain jacketed insulation materials would result in a configuration with significantly improved resistance to damage from LOCA-jet impingement. Depending on plant-specific strainer designs, debris types and quantities, as well as other factors, some licensees may consider installation of "Sure-Hold" bands to be an effective means to reduce quantities of post-LOCA debris that would potentially be generated and subsequently be available for transport and accumulation on the recirculation sump strainer.

"Sure-Hold" Band Design

As used in the NRC staff’s SE on NEI 04-07, the term "Sure-Hold" band refers to a specific band and latched fastener design that was tested for resistance to jet impingement by the Boiling Water Reactors Owners’ Group (BWROG) as part of its air jet impact test program. This testing is described further in Volume 3 of the BWROG’s Utility Resolution Guidance (URG) document (ADAMS Accession No. ML092530505), which also includes a description of the "Sure-Hold" banding system that was used. Key attributes of the "Sure-Hold" banding system are summarized below:

Table 1: Attributes of the “Sure-Hold” Banding System Tested by the BWROG	
Band Material	Stainless Steel
Band Width	2 inch
Band Thickness	0.062 inch (16 gauge)
Latch-and-Strike Fastener	CamLoc Series 18L with Modified Strike

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The modifications performed to the latch-and-strike fasteners that were used for the successful "Sure-Hold" band tests are described in Volume 3 of the URG. A photograph showing the modified latch-and-strike design is also provided therein. Essentially, weld beads were placed at each end of the strike's "J" hook to prevent the latch from sliding off of the strike. As discussed below, air jet testing performed by the BWROG clearly demonstrated the importance of this modification with respect to the damage resistance of the target material.

Debris Generation Tests Involving "Sure-Hold" Bands

In all, Volume 3 of the BWROG Utility Resolution Guidance describes six air jet impact tests that involved "Sure-Hold" bands, four of which used Nukon fiberglass insulation, and two of which used Mirror reflective-metallic insulation. The staff reviewed these test results in the process of developing guidance for the installation of "Sure-Hold" bands. A summary of applicable test parameters is tabulated on the following page, while some important observations regarding these tests are stated below:

- The effectiveness of the modification to prevent release of the latch-and-strike fasteners used to secure the "Sure-Hold" bands was demonstrated by the testing.
- Some degree of material destruction occurred in all of the tests involving jacketed Nukon secured with "Sure-Hold" bands.
- Considering tests of Nukon involving the modified "Sure-Hold" bands, the maximum damage observed, which was less than 10 percent small fines, appeared to be the result of jacket separation at axial seams and insulation extrusion through these seams, rather than the result of "Sure-Hold" band failures. This is apparent from post-test photographs in Volume 3 of the BWROG's Utility Resolution Guidance.
- The tests involving jacketed Nukon secured with "Sure-Hold" bands used longer targets (i.e., approximately 8 ft) than were typically used during the BWROG air jet impact test program (e.g., 2-3 ft). Therefore, a significant length of the target may not have been exposed to the full jet centerline pressure. As a result, the staff expects that the degree of damage indicated for the "Sure-Hold" band tests involving Nukon may have been nonconservative.
- Although the entire length of the jacketed Nukon targets secured with "Sure-Hold" bands would not have been exposed to the full jet centerline pressure, the staff expects that the "Sure-Hold" bands nearest the target centerline would have been exposed to representative stresses and these bands did not fail. Therefore, the staff believes the banding and spacing is adequate.
- The tests involving jacketed Nukon secured with "Sure-Hold" bands did not consider limiting orientations for the jacket seam or band latching.
- Although not fully relevant in that a different insulating material was involved, the two tests of Mirror reflective-metallic insulation secured with "Sure-Hold" bands provide a limited indication of the effectiveness of the "Sure-Hold" banding system for jacketing seam and band latching orientations that are more limiting than tested for jacketed Nukon secured with "Sure-Hold" bands.

Table 2: "Sure-Hold" Band Tests Involving Nukon Fiberglass										
Test	L/D (Linear)	Target Pressure (psig)	Jacket	Orientation of Jacket Seam(s)[1]	Jacket Axial Overlap[2] (in)	Modified/ Unmodified Fasteners?	Approx. Band Spacing[3] (in)	Orientation of Band Latching[1]	Degree of Damage (Small Fines)	Notes
31-1	7	160	2-piece	12-o'clock / 6-'clock	2	Unmodified	10	9-o'clock	~ 22%	7 of 9 (unmodified) "Sure-Hold" bands removed
31-2	11	110	1- piece	9-o'clock	2	Modified	10	9-o'clock	~ 3%	All 9 "Sure-Hold" bands remained in place
31-3	5	190	1- piece	9-o'clock	2	Modified	10	9-o'clock	~ 5%	1 of 9 "Sure-Hold" bands removed
31-4	5.3	190	2- piece	12-o'clock / 6-'clock	2	Modified	10	9-o'clock	~10%	1 of 9 "Sure-Hold" bands removed

[1] Jet impacts target at 3-o'clock.
[2] The tests summarized in Table 2 were performed with 3 axial lengths of jacketing, for a total target length of approximately 8 ft.
[3] Bands were not uniformly spaced and indicated value represents an approximate average.

Table 3: "Sure-Hold" Band Tests Involving Mirror Reflective Metallic Insulation										
Test	L/D (Linear)	Target Pressure (psig)	Jacket	Orientation of Jacket Seam(s)[1]	Jacket Axial Overlap[2] (in)	Modified/ Unmodified Fasteners?	Approx. Band Spacing (in)	Orientation of Band Latching[1]	Degree of Damage	Notes
29-1	20	20	2-piece	3-o'clock / 9-'clock	N/A	Modified	14	3-o'clock	None	All 3 "Sure-Hold" bands remained in place
29-2	8.5	105	2-piece	3-o'clock / 9-'clock	N/A	Modified	14	3-o'clock	None	All 3 "Sure-Hold" bands remained in place

[1] Jet impacts target at 3-o'clock.
[2] The tests summarized in Table 3 were performed with a single length of jacketing, for a total target length of approximately 3 ft.

Guidance for Installation of "Sure-Hold" Bands for Nukon Fiberglass

In applying the destruction pressure values accepted in the NRC staff's SE on NEI 04-07 for jacketed Nukon secured with "Sure-Hold" bands, the staff considers it appropriate for licensees to ensure that their installed configurations are consistent with the guidelines provided below. These guidelines were developed in consideration of the test observations described above. Dimension provided below for overlaps and spacing between bands are representative of the tests performed of "Sure-Hold" bands for Nukon fiberglass.

- "Sure-Hold" bands installed by licensees should be of a design that is equivalent to or more robust than the bands used for the BWROG air jet impact tests as described herein and in Volume 3 of the BWROG's Utility Resolution Guidance.
- Fasteners used to secure "Sure-Hold" bands should be of a design that is equivalent to or more robust than the modified latch-and-strike design used for the BWROG air jet impact tests as described herein and in Volume 3 of the BWROG's Utility Resolution Guidance.
- The center-to-center spacing for "Sure-Hold" bands should not exceed 10 inches.
- An axial overlap of at least 2 inches should be maintained between adjacent segments of jacketing. A "Sure-Hold" band should be centered on the overlap between adjacent segments of jacketing.
- A circumferential overlap of at least 2 inches should be maintained along radial seams of the jacketing.
- Adjustable latch-and-strike fasteners should be installed with sufficient tension to ensure a secure insulation.
- "Sure-Hold" bands, fasteners, and associated components should be installed in a manner that is consistent with their design specifications. For example, some fastener designs may not be compatible with small-diameter piping.
- "Sure-Hold" bands, fasteners, and associated components were designed and tested to support installation on piping insulation. The staff would not consider it acceptable for licensees to apply destruction pressure values approved for "Sure-Hold" bands on piping to insulation installed on non-piping components such as steam generators, pressurizers, reactor coolant pumps, etc.
- The staff would not consider it acceptable for licensees to apply the approved destruction pressure values associated with "Sure-Hold" bands at locations on piping where local conditions would prevent installation of "Sure-Hold" bands consistent with these guidelines or manufacturers' design specifications. Such conditions may exist due to valves, piping tees, interferences, etc.
- In other respects not specifically addressed in this guidance (e.g., jacketing material, jacketing thickness, cloth cover, standard jacketing latches, etc.), licensees' installations involving "Sure-Hold" bands should be at least as robust as the conditions tested.
- Licensees seeking to install "Sure-Hold" bands to secure insulations that are physically different than Nukon fiberglass and Mirror reflective metallic insulation should perform material-specific testing to determine an appropriate destruction pressure. Testing would not be necessary in cases where an acceptable evaluation determines that a given material is sufficiently similar to either Nukon fiberglass or Mirror reflective metallic insulation to support application of the same or a similar (e.g., including margin to account for uncertainties associated with physical differences) destruction pressure.