**Staff Comments – Tornado Missiles Draft Paper**

Page 2, Section II, item 1: Review needs to address the potential for damage to HCVS by wind-generated missiles those portions of the HCVS below 30 feet.

Page 3, Section III: Guidance in NEI 12-06 as endorsed by JLD-ISG-12-001 is for protection of FLEX equipment storage. Flex equipment storage structures are either designed for required wind and wind-generated missile loads or have a separation such that a single tornado will not damage all sets of FLEX equipment. This is to help assure at least one set of FLEX equipment is available in the event of a beyond design basis external event. The NEI 12-06 guidance helps determine structural requirements and/or separation criteria for FLEX storage structures. This guidance was not understood to be used to predict the risk of an actual wind-generated missile strike on any specific system, structure, or component used or relied upon to support FLEX.

Page 4, Section IV, 1. Purpose: The same comment as above for Section III.

Page 6, first paragraph: Existing HCVS components contained within an existing structure is not always considered to be missile protected. A seismic building with sheetmetal siding is not considered to provide wind-generated missile protection. In addition, missile protection for HCVS piping and components external to any building needs to be considered for all elevations. Massive high-kinetic-energy missiles that deform on impact (a.k.a. automobile missile) need to be considered only up to 30-feet above grade. "Grade" made be considered to be the highest point relatively near the plant (e.g. a parking lot on a hill 300 yards from the structure would be considered to be grade level for the purposes of this evaluation (reference Regulatory Guide 1.76, rev. 1)).

Page 7 through page 9: It appears that average information is being used to estimate the risk of tornado-generated missiles which may strike the HCVS piping and components external to a building. Plants using this information should demonstrate that their facility is enveloped by these data.

Page 9, paragraph following Table 3.2: The document indicates that HCVS piping is generally using heavy duty piping. Please clarify the pipe schedule being used. It is our assumption that heavy duty piping is the same as extra strong or Schedule 40 for a 16-inch diameter pipe.

Page 10, Item 3.3: Please provide additional justification that a "[t]ornado-generated Schedule 40 piping missile" cannot fail the HCVS piping. If possible, make a calculation available for staff review that justifies this statement.

Page 10, Item 3.3, third paragraph: Staff agrees that surrounding buildings may generate missiles. However, buildings not constructed to withstand a tornado may generate additional missiles other than sheetmetal siding. NEI should address additional potential missiles which may be found on or in the constructions of surrounding structures. Such potential missiles may

include piping associated with rooftop HVAC systems, rooftop HVAC equipment, roof pavers used as access paths for rooftop equipment, building structural elements, etc. In addition, these wind-generated missiles may strike the HCVS piping and components located outside a protecting building anywhere it is exposed between grade level and termination above the roof. It is not limited to above 30 feet.

Page 12, Item 4: Staff is not convinced that the analysis adequately demonstrates that the HCVS is unlikely to be damaged by wind-generated missiles. Staff concurs that there may be a low probability that a given wind event will cause a loss-of-offsite-power, and a loss of all on site emergency and station-blackout generators, and a low of the HCVS. However, the analysis as is does not provide sufficient detail to justify that position. In addition, staff disagrees that wind-generated missiles only have to be considered for that portion of the HCVS 30-feet above ground.

Page 1, Section 1: Staff does not agree that HCVS system and components are not required to be wind-generated missile protected. In addition, missile protection should be considered below 30 feet above the ground in addition to 30-feet above ground.

Based on RIS 2015-06 and its associated documents (Enforcement Guidance Memorandum 15-002 and Bounding Generic Risk Assessment for Selected Plant Systems, Portions of Which Are Not Protected From Tornado-generated Missiles), a risk informed approach may be justifiable. The five principles in Section C of Regulatory Guide 1.174 should be addressed. In particular that the proposed approach is consistent with a defense-in-depth philosophy, the proposed approach maintains sufficient safety margin, and if the proposed approach results in an increase in core damage frequency or risk, the increase should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.

A risk informed approach may be either site specific or if generic should envelop all sites in the United States. This may consider worst case tornado frequencies along worse case missile source. If it is shown that a certain class of missiles does not have sufficient kinetic energy to damage the exposed HVCS system or components then they may be excluded from the analysis. The hazard of concern is those missiles which can cause sufficient damage to the HCVS system or components such that sufficient flow cannot be obtained to permit required decay heat removal or for Order EA-13-109, protect the containment from exceeding design limits. This could be from crushing the stack pipe or buckling of the pipe.

The evaluation should also address RIS 2006-23. If TORMIS is used, RIS 2008-14 should be addressed. Newer versions of TORMIS should be reconciled to the TORMIS version addressed in the NRC Safety Evaluation Report of September 26, 1983.

Other wind-generated hazard the licensees should consider is the actual wind load on the stack and it associated supports. With the concern over wind-generated missiles, this could be overlooked.

Site FSGs may want to include a contingency to restore venting capability in the occurrence flow from the stack becomes blocked due to damage.  This may be as simple as using a gas powered cutoff saw to cut the stack before the HCVS is required.