

August 17, 2011

MEMORANDUM TO: Stewart N. Bailey, Chief  
Safety Issues Resolution Branch  
Division of Safety Systems  
Office of Nuclear Reactor Regulation

FROM: Blake A. Purnell, Project Manager */RA/*  
Generic Communications and Power Uprate Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF JULY 19, 2011, PHONE CALL WITH PERFORMANCE  
CONTRACTING, INC. TO DISCUSS ITS JET BREAKUP EXPERIMENTS

On July 19, 2011, U.S. Nuclear Regulatory Commission (NRC) staff held a teleconference with representatives of Performance Contracting, Incorporated (PCI) and Alden Research Laboratory to discuss jet breakup experiments that had been conducted at Alden. A debris interceptor, proposed by PCI to reduce debris bypass for emergency core cooling system (ECCS) strainers was also discussed. Client licensees of PCI also participated in the call. This teleconference was closed to the public due to the proprietary nature of the discussions.

The following PCI documents (enclosed) were discussed during the call:

- PCI Document No. PDT-2011.04.20, DRAFT 1, "Jet Breakup Experiments—Small Scale Results," prepared by Alden, dated April 2011 (proprietary)
- PCI Concept summary, "Sure-Trap Debris Trap for ECCS," Rev. 0, undated

The purpose of the jet breakup experiments is to determine how the energy from falling water impacting the containment pool will influence the potential for debris transport. The NRC staff questioned how the results of the jet breakup momentum experiments would be used to change the turbulence created in the plant computational fluid dynamics (CFD) models that provide the basis for the flume turbulence during strainer testing. In general, the NRC staff wanted to know if momentum was conserved, and if not, how the energy in the falling water was assumed to dissipate. Alden representatives stated that the CFD model would include the effects of the falling water if the momentum measured at a known distance under the water surface is used as an input into the model. The full energy of the falling water is considered to add to the turbulence in the pool.

The NRC staff requested that the treatment of spray drainage be explained, since the jet breakup paper concentrated on reactor coolant system (RCS) break flow. The Alden representatives stated that spray drainage will be evaluated using a methodology similar to that used for break flow. The paper was written to include water falling into the pool in general although only break flow was explicitly discussed.

NRC staff questioned the position in the paper that vertical pipe discharge into the pool could be neglected. The staff agreed that for some RCS designs that there are limited locations where a double-ended guillotine break (DEGB) would discharge directly downward into the pool. However, the staff was not convinced that vertical discharge into the pool could be neglected for several reasons. The reasons include the potential for pipe whip to reorient horizontal pipes in the downward direction, alternate piping design layouts, the potential for non-RCS loop breaks, and the potential for pipe breaks to open such that the discharge is vertical (non-DEGB type break). This issue will be reviewed by all parties as implementation of the jet breakup experiments progresses.

NRC staff noted that the jet breakup paper discussed non-RCS loop breaks that could provide break flow into the pool and that the coordinates and debris quantities associated with these locations would correspond to the actual break locations. The staff questioned whether several debris generation and transport cases (including flume tests) would need to be conducted for each plant to determine the limiting debris transport. The Alden representative stated that they were developing a paper that describes the methodology that will be used to validate that the limiting break locations will be evaluated and tested for each plant.

NRC staff requested that the derivation and purpose of some of the equations, dimensionless values, and coefficients used to evaluate the momentum tests be explained. Alden representatives provided the derivation of the equations. Additionally the staff questioned what the pitot-static tube mentioned in the paper was used for during the experiments. Alden representatives stated that the pitot-static tube was used to measure the velocity of fluid flow in the pipes, especially partially filled pipes. NRC staff also requested information on how more than one value for each flow rate and pipe size was collected. The Alden representative explained that the heights were varied for each flow condition resulting in several data points each.

This concluded the discussions on the jet breakup experiments. Staff agrees with the methods used in the small scale experiments. Larger scale experiments may yield the information necessary to provide a good model for break flow and spray drainage into the containment pool. The industry parties will determine whether they believe it is beneficial to continue with further experiments that would allow the results to be extrapolated and used for plant evaluations.

NRC staff also discussed the PCI Sure-Trap debris interceptor with the industry representatives. NRC staff noted that the debris interceptor should reduce the amount of debris reaching the strainer and also debris bypassing the strainer. The NRC staff also stated that the PCI paper included important phenomena that would have to be considered in the application of the interceptor. Importantly the interceptor would have to result in minimal flow induced pressure loss, or the loss would have to be considered on a plant specific basis, to ensure that net positive suction head margins and other strainer considerations are not adversely affected.

NRC staff noted that significant sensitivity testing would likely be required to determine how changing variables like flow rate, debris loads, debris arrival timing, debris concentration, and velocity ratios between the interceptor and strainer affect bypass. The staff was also concerned that it may be difficult to determine a point where bypass is no longer occurring or has reached a steady state value. The staff stated that the use of a debris interceptor similar to the one described could be beneficial to strainer head loss or strainer bypass. The staff agreed that the debris trap could be credited for trapping fiber "fines" if substantiated by the testing and development.

Enclosures:

1. List of Participants
2. PCI Document No. PDT-2011.04.20, DRAFT 1, "Jet Breakup Experiments—Small Scale Results," prepared by Alden, dated April 2011 (Proprietary)
3. PCI Concept summary, "Sure-Trap Debris Trap for ECCS," Rev. 0, undated

cc: James Bleigh/PCI

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**List of Participants for July 19, 2011,  
Phone Call with PCI, Alden, and Licensees**

<b>Name</b>	<b>Affiliation</b>
Ron Holloway	Wolf Creek Nuclear Operating Corp.
Matt Brandes	Callaway
Wes Schulz	South Texas Project
Ernie Kee	South Texas Project
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Tom Kendall	Point Beach
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Chris Kudla	PCI
Patrick Reyes	PCI
Kevin Koelsch	PCI
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Brian Dannaker	AREVA
Stu Cain	Alden Research Laboratory
Ludwig Haber	Alden Research Laboratory
Matt Horowitz	Alden Research Laboratory
Steve Smith	NRC
David Beaulieu	NRC
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