December 9, 2005

Professor L. E. Hochreiter
Pennsylvania State University
233 Reber Building
University Park, PA 16802

Dear Professor Hochreiter,

In your letter to Dr. Brian W. Sheron, received on April 30, 2005, you submitted several reports prepared by your graduate students containing pipe failure data for stainless steel and carbon steel piping. You indicated that you had the students normalize the data in a manner that would facilitate comparison with the loss-of-coolant accident (LOCA) frequency estimates developed by the Office of Nuclear Regulatory Research (RES). This work, Draft NUREG-1829, entitled, "Estimating Loss-of-Coolant Accident (LOCA) Frequencies Through the Elicitation Process," was made available to the public in June 2005. The report is available under ADAMS Accession Number ML051520574 and on the NRC website at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1829/. A notice was published in the *Federal Register* on October 4, 2005, announcing the availability of this report (70 FR 57901) for public comment until November 30, 2005. Comments received after November 30, 2005, will be considered if time permits. In addition, on November 9, 2005, the NRC staff conducted a public workshop to facilitate the comment process. In the workshop, the staff provided an overview of the report and addressed clarification of items identified by the public.

As you know, members of my staff in the Division of Engineering Technology in RES reviewed the reports you submitted and developed a series of comments on the differences in the approaches and data used which prevent a meaningful comparison between Draft NUREG-1829 and your results. These comments are delineated in the enclosure.

We appreciate your interest in this topic. If you have any additional comments on Draft NUREG-1829 please submit them as soon as possible. We will address any additional comments you have, if time permits, as the public comment period has ended.

Sincerely,

/RA/

Jennifer L. Uhle, Chief
Materials Engineering Branch
Division of Engineering Technology
Office of Nuclear Regulatory Research

Enclosure:
As stated

December 9, 2005

Professor L. E. Hochreiter
Pennsylvania State University
233 Reber Building
University Park, PA 16802

Dear Professor Hochreiter,

In your letter to Dr. Brian W. Sheron, received on April 30, 2005, you submitted several reports prepared by your graduate students containing pipe failure data for stainless steel and carbon steel piping. You indicated that you had the students normalize the data in a manner that would facilitate comparison with the loss-of-coolant accident (LOCA) frequency estimates developed by the Office of Nuclear Regulatory Research (RES). This work, Draft NUREG-1829, entitled, "Estimating Loss-of-Coolant Accident (LOCA) Frequencies Through the Elicitation Process," was made available to the public in June 2005. The report is available under ADAMS Accession Number ML051520574 and on the NRC website at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1829/. A notice was published in the *Federal Register* on October 4, 2005, announcing the availability of this report (70 FR 57901) for public comment until November 30, 2005. Comments received after November 30, 2005, will be considered if time permits. In addition, on November 9, 2005, the NRC staff conducted a public workshop to facilitate the comment process. In the workshop, the staff provided an overview of the report and addressed clarification of items identified by the public.

As you know, members of my staff in the Division of Engineering Technology in RES reviewed the reports you submitted and developed a series of comments on the differences in the approaches and data used which prevent a meaningful comparison between Draft NUREG-1829 and your results. These comments are delineated in the enclosure.

We appreciate your interest in this topic. If you have any additional comments on Draft NUREG-1829 please submit them as soon as possible. We will address any additional comments you have, if time permits, as the public comment period has ended.

Sincerely,

/RA/

Jennifer L. Uhle, Chief
Materials Engineering Branch
Division of Engineering Technology
Office of Nuclear Regulatory Research

Enclosure:
As stated

DISTRIBUTION: DET r/f MEB r/f B. Sheron M. Mayfield C. Griimes

OAR in ADAMS? (Y or N) Y ADAMS ACCESSION NO: **ML053410452** TEMPLATE NO.:____
Publicly Available? (Y or N) Y DATE OF RELEASE TO PUBLIC: ____ SENSITIVE? _____
To receive a copy of this document, indicate in the box: "**C**" = Copy without attachment/enclosure "**E**" = Copy with attachment/enclosure "**N**" = No copy

OFFICE	DET/MEB		SISP REVIEW	
NAME	J. Uhle		Originator - J. Uhle	
DATE	12/9/05		12/9/05	

OFFICIAL RECORD COPY

NRC Comments on Pennsylvania State University Study of Pipe Failure Data

1. The Penn State report actually represents a "frequency of degradation" analysis for each pipe size, which is not comparable to the frequency of complete pipe failure from the expert elicitation. Specifically, the failure criterion used in the Penn State report treats all indications of degradation as if they represent a "failure" of the piping; therefore, a pin-hole leak in a 10-inch pipe is equated to a completely failed 10-inch pipe in the expert elicitation. The fact that the Penn State data depict a uniform trend of "degradation" frequency with pipe size is not surprising, since degradation is expected to be relatively uniform with pipe size.

2. Since the leak rates from a pin-hole leak and that from a complete failure of the same size pipe are generally different by orders of magnitude, the Penn State results and those from the RES expert elicitation are not comparable. Although the expert elicitation results are represented using failure frequency as a function of pipe size, the results were actually developed as a function of flow rate. The results as a function of flow rate were converted to the equivalent diameter for the complete severance of the pipe of that equivalent diameter. Therefore, the RES results reflect the flow rate from a complete severance of the respective pipe diameter, and the Penn State data generally represent minor leaks within the make-up capability of plants. This difference represents a large overestimate in the LOCA frequency for larger pipe sizes by the Penn State analysis, and would likely restrict the Penn State data to an equivalent pipe size less than 1 inch in diameter, rather than the range of greater than 10 inches depicted in the reports.

3. The RES expert elicitation estimated break frequencies within the reactor coolant system (RCS) [i.e., Class 1 in the parlance of the American Society of Mechanical Engineers (ASME)] and not within other plant systems. The database utilized within the Penn State study considered degradation in piping throughout the entire plant. ASME Class 1 piping is expected to have superior operating characteristics due to more stringent standards for the fabrication and inspection of ASME Class 1 piping, and the tightly controlled water chemistry for RCS piping. Combining these characteristics with the thinner pipe wall for much of the non-Class 1 piping, the overall reliability for RCS piping is expected to greatly exceed that for other piping systems in nuclear power plants and for other industries. Hence, degradation rates in the Penn State study are expected to be higher than those for ASME Class 1 piping.

4. The methods of computing the “failure frequencies” in the Penn State report had several inconsistencies within the report itself and between the report and the RES expert elicitation. First, the Penn State “events” data were normalized in a manner that is not consistent with that used for the RES expert elicitation. Second, the data related to operating experience for boiling water reactors and pressurized water reactors by the Penn State report should consider only that operating time for the specific reactor type and not the aggregated operational time for all plants. In addition, some of the events identified in the Penn State data as failures came from non-nuclear service, but no adjustment was made to account for the service time for these non-nuclear components.

Enclosure