

February 28, 2002

Alex Marion  
Nuclear Energy Institute  
1776 I Street, Suite 400  
Washington, DC 20006-3708

SUBJECT: NRC STAFF QUESTION AND COMMENTS CONCERNING BWOG SHORT  
TERM RECOMMENDATIONS CONCERNING POTENTIAL FOR SEVERING  
PLUGGED TUBES

Dear Mr. Marion:

By letter dated February 14, 2002, the Nuclear Energy Institute (NEI) provided recommendations developed by the Babcock & Wilcox Owners Group (BWOG) for addressing the potential for plugged tubes to sever such as was recently observed at Three Mile Island Unit 1 (TMI-1). These recommendations apply to owners of once-through-steam-generators (OTSGs) that will be performing scheduled steam generator inspections prior to industry's completion of its longer term investigation of this issue.

The staff of the Materials and Chemical Engineering branch reviewed these recommendations and developed the enclosed questions and comments. Given that the BWOG recommendations apply to plants with OTSGs whose outages are occurring over the next few months, we request you provide a timely response. In the meantime, pending the industry's ongoing in-depth investigation, the staff concludes there is adequate justification to support continued operation.

If you have any questions or comments, please contact Emmett Murphy of my staff on (301) 415-2710.

Sincerely,

*/ra by KKarwoski f/*

William H. Bateman, Chief  
Materials and Chemical Engineering Branch  
Division of Engineering  
Office of Nuclear Reactor Regulation

Enclosure: As stated

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## BWOG SHORT TERM RECOMMENDATIONS FOR TMI PLUGGED TUBE SEVER EVENT

### Questions:

1. The BWOG short term recommendations state that the most susceptible tube populations are those included in the NEI letter dated December 21, 2001, and include in general any repaired locations that resulted in a change in the leak tightness of a mechanical joint. Clarify that repaired locations would include Alloy (Inconel) 600 (I600) and Alloy (Inconel) 690 (I690) plugs, ribbed plugs (Westinghouse (W) and Framatome (F)), rolled plugs (W, F, Combustion Engineering (CE)), roll sleeve plugs (F), explosive welded plugs (F), and TIG welded plugs (F, CE) that have been repaired or replaced. Clarify also whether the susceptible tubes would be limited to tubes passing through drilled holes in the uppermost support plate as is indicated in the December 21, 2001, letter.
2. Describe any improvements in process controls for expanding and sealing I690 rolled plugs compared to I600 rolled plugs which have leaked. This comparison should address the full range of process controls in place for I600 plugs over the years these plugs were used. Explain why the process controls for I690 plugs should significantly reduce the potential for leakage in these plugs relative to I600 plugs.
3. 471 Alloy 690 rolled plugs have reportedly been repaired or replaced. Provide a detailed description of why repair or replacement of these plugs was necessary.
4. Describe the ultrasonic test (UT) technique used for the detection and the determination of the water level in a plugged tube. Describe how it was qualified. Discuss whether its performance has been demonstrated in the field (i.e., compare field UT results to observed water level upon plug removal). How accurately does it determine water level?

### Comments:

1. It is not apparent that the BWOG recommendations serve to minimize the number of water filled, swelled, and severed tubes that may exist in the drilled hole, peripheral zone of the bundle. At TMI-1, 3 percent of tubes with original unrepaired I600 plugs were found to contain more than 50 percent water. There are several thousand (perhaps as many as four thousand) tubes among all once-through steam generators (OTSGs) containing such plugs. Assuming a 3 percent fill rate, over 100 of these tubes could be filled with water with some of these residing in the drilled hole zone of the bundle periphery. This population is not included among the populations described as most susceptible, yet it is likely to contain many more tubes filled with water than the 555 tubes with Framatome rolled I600 plugs (which were filled with water at the rate of 10 percent at TMI-1) which are considered by BWOG to be among the most susceptible tubes.
2. The TMI-1 experience indicates that tubes with originally installed, unrepaired I690 plugs are significantly less susceptible to water fill, swelling, and severance than tubes with I600 plugs. Zero of 87 tubes with I690 plugs were found to contain water. This suggests a susceptibility rate (for water fillage) which does not exceed 1 or 2 percent as an upper bound.

Enclosure

The actual susceptibility rate is between zero and 1 to 2 percent which is a relatively low susceptibility rate compared to tubes with various I600 plugs. However, there are 17500 tubes in OTSGs with originally installed, unrepaired I690 plugs. Thus, depending on the actual value of the susceptibility rate, the tube population with originally installed, unrepaired I690 plugs could be contributing a significant fraction of the total number of water filled, swelled, or severed tubes present in OTSGs.