**From:** Deborah Jackson RES
**To:** Cayetano Santos; Robert Tregoning RES
**Date:** Friday, September 13, 2002 9:25AM
**Subject:** Re: Additional thoughts on D-B head crack testing

This is a resend for some. 10 is fine with me.

>>> Cayetano Santos 09/13/02 09:23AM >>>
That sounds like a good idea. Would you like to meet around 10? Debbie's/Ed's office again?

>>> Robert Tregoning 09/13/02 07:07AM >>>
Debbie:

I've digested all the various comments from Mark, Bill, and Gery. I think it would be a good idea to meet this morning in order to discuss revisions to include these comments. I'm free all morning.

Rob

>>> Deborah Jackson 09/12/02 06:03PM >>>
Gery,

Thanks for the comments. Jeff Hixon and Bill Cullen who were also on the conf call are on cc for this reply so they have your comments.

Debbie

>>> "Gery Wilkowski" <gwilkows@columbus.rr.com> 09/12/02 05:55PM >>>
Debby et al:

I talked a little more to the guys here and I think that your concern over the temperature gradient through the thickness is a very second (maybe third order) effect from an applied strain concern. When we did our initial evaluation (report attached), we were concerned that our analysis had the cladding in a stress free condition at 605F. SIA had the cladding at a stress free condition at room temperature. The actual stress free temperature may have been around 1100F, which would be the stress-relief temperature of the RPV head after cladding was put on. When we looked at the strains imposed with the 500F or so temperature differences, the thermal strains were less than 0.1%. This was far less than the strains from the pressure-induced bulging at "failure", and we therefore neglected the 500F thermal strain. Strains with a 300F gradient would be even less, so with some calculations I believe you can show that any testing need not have to have that temperature gradient. You should do some good fluid/heat-transfer calculations to see with the gradient is through the thickness, and perhaps use a mean temperature in the test. On the otherhand, you may need water in the test pipe to be at 605F to provide the driving force (temperature controls the saturation pressure for the water decompression behavior) to create the opening area. Put high temperature heater tapes on the test pipe.

Also, as I noted, some fluid/heat transfer calculations could be done to determine what the metal temperature on the surface of the cavity might be. The water could be at 212F, but there would be some vapor region that acts as an insulator and the metal surface temperature is probably much higher. Also the external fluid in the cavity is probably really more of a boric

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acid with a little H2O in it, which might have a boiling temperature higher than 212F. Was there lots of boric acid in the cavity when they first uncovered it?

Zhili confirmed for me that the 6-wire cladding procedure would have the 6 wires effectively in one weld pool. If the weld wires were not making one weld pool, then the solidified flux from one weld wire would make inclusions in the weld pool from the following weld wire. Hence you should be able to see one row of cladding overlapping the next row in an etched metallographic section.

I remember that for the Midland head at Framatome-Lynchburg, that the inside surface of that head was ground smooth, i.e., there were no weld bead ripples on the inside surface. Even better, the photos of the section removed from D-B showed the inside surface was smooth (see attached picture).

The test could be as simple as shown in my attached sketch. We'd need to brace the test fixture for thrust loads if the cladding rapidly ruptures.

Regards,

Gery

p.s. Not sure I got all that were in the conference call in my distribution list.

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**CC:** Jeffrey Hixon; Mark Kirk; Shah Malik; William Cullen