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NUCLEAR REGULATORY COMMISSION

WASHINGTON, D. C. 20555

WM DOCKET CONTROL CENTER  
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LPDR-  
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WM Project 16  
Docket No.

MEMORANDUM FOR: Kien Chang, WMEG, and John Voglewede, WMEG  
ABR 24 11:17

FROM: Michael McNeil, WMB/DE/RES

Distribution:

Chang

PDR ✓  
LPDR ✓

SUBJECT: BATTELLE COLUMBUS RESEARCH ON THE STRESS CORROSION CRACKING OF STEEL (Return to WM, 623-SS)

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"Some Effects of Surface Condition on the Stress Corrosion Cracking of Line Pipe Steel" by J.P. Beavers, T.K. Christman, and R.N. Parkins, was given at the "Corrosion '87" conference in San Francisco last March. While it is primarily directed at gas pipeline applications, there appear to be significant implications for the carbon steel overpacks planned for use in the basalt and salt environments.

The work reported on covered stress corrosion cracking in steels with a nominal carbon content around .2%, but often with decarburized surfaces. In general, the cracking agent in the groundwater is the carbonate/bicarbonate couple, possibly aggravated by chloride ions.

The following were the salient points:

1. Cracking is intergranular and branching. The intergranular fracture surfaces are normally covered with a film which contains both  $FeCO_3$  and  $Fe_3O_4$ .
2. There is a positive correlation between cracking and pitting; the more pits there are, the more cracks.
3. Samples with decarburized surfaces seem to show aggravated SCC in the laboratory; the data base does not permit one to draw definite conclusions concerning the applicability of this to field conditions.
4. Mill scale ( $Fe_3O_4$ ) appears to have a deleterious effect upon stress corrosion behavior.
5. Shot peening of pipe increases resistance to SCC; this may be partly due to removal of  $Fe_3O_4$  but is also due to imposition of compressive stresses in the surface.

I believe that Professor Wilde is encouraging DOE contractors to consider shot peening as a way of reducing vulnerability to SCC.

I think a particularly interesting point is the presence of  $FeCO_3$  (an unusual corrosion product) on the fracture faces. I shall discuss this with the successful bidders on D1667 and D1692.

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PDR WASTE PDR  
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Michael B. McNeil  
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