API-AGA JOINT COMMITTEE ON OIL AND GAS PIPELINE WELDING PRACTICES

Fracture Mechanics Subcommittee

January 25-26, 2012

Chaired by Yong-Yi Wang, Ph.D. (CRES)

Minutes

1 MEETING TIME AND ATTENDANCE

The fracture mechanics subcommittee met three times in the morning and afternoon of January 25 and in the morning of January 26 for a total duration of approximately 9 hours. The meeting in the morning of 25th was a semi-formal gathering set up in a short notice. Approximately 10-14 individuals participated the meetings. The attendance lists are attended.

2 DESCRIPTION OF SUB-COMMITTEE MEETINGS

The subcommittee reviewed approximately 40 items related to Appendix A of API 1104 from the list of summary comments provided by the editorial committee. The resolution of those items is given in a revised list of comments which has been provided to the full committee.

Doug Fairchild mentioned that the work on strain-based ECA will continue.

3 NOTES ON A FEW IMPORTANT ISSUES

1. The requirements of cross-weld tensile tests, Sort Key Nos. 2 and 236, received the greatest amount of subcommittee’s time, approximately 3.5 hours. There were many sound arguments on various options of the requirements. Draft language of those options were written and discussed. The subcommittee eventually voted on two options and the recommended language is

"If the specimen breaks at a strength equal to or greater than the specified minimum tensile strength of the pipe, and the result is acceptable and no further testing is required. Although tensile specimen failure in the weld is acceptable, provided the strength requirement is met, gross weld strength undermatching should be avoided."

2. At least two ballot items that had passed the committee votes previously were not incorporated in the draft 1104 document. These items were noted in the list of summary comments.

3. There was one comment related to the machining tolerance cross-weld tensile specimens. The subcommittee agreed to seek guidance from the full committee.
on whether the machining tolerance should be included in the sketches of test specimens.

4. The possibility and implication of girth weld failure due to strain concentration at the welds resulted from weld strength undermatching (against actual pipe properties) was discussed in the context of ground movement hazards. The subcommittee agreed that the full resolution of this issue requires the involvement of at least three entities: (1) pipeline design, (2) linepipe specifications, i.e., API 5L, and (3) API 1104. There were different views as to whether 1104 should narrowly focus on welding procedure qualification issues or the broader issue of girth integrity over the service life of a pipeline. Guidance from full committee would be helpful.

5. Percent shear area of Charpy test specimens was taken out from the Charpy requirement in the draft document. Although the current impact energy value requirements have proven successful in other standards to achieve ductile behavior of welds fabricated with cellulosic electrodes, there may be situations where the Charpy requirements alone are too low to guarantee adequate fracture resistance. Lateral expansion was suggested as a possible indicator of ductility; however, there is no known data demonstrating lateral expansion as a useful criteria specifically for pipeline welds. Test data linking the lateral expansion and transition temperature should help to determine the validity of a lateral expansion criterion. Such test data may exist at Chevron, BP, Lincoln Electric or other companies. It was also suggested that PRCI may fund a project to generate necessary test data.

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14 The company is cautioned to consider weld undermatching issues as it relates to pipeline bending or other longitudinal tensile loads. An example of assessing weld strength undermatching is given in Wang, Y.-Y., Liu, M., Horsley, D., and Bauman G., "A Tiered Approach to Girth Weld Defect Acceptance Criteria for Stress-Based Design of Pipelines," 6th International Pipeline Conference, Paper No. IPC2006-10491, September 25-29, 2006, Calgary, Alberta, Canada."
4 ATTENDANCE RECORDS