

1st Quarterly Report to the
Office of Pipeline Safety, US Dept. of Transportation
Interagency Agreement DTRS56-04-X-0025
April 30, 2004 as Modified August 4, 2004

Task Order #02
Fatigue Fracture and Crack Arrest in High-Strength Pipeline Steels
For the Quarter ending
July 31, 2004

1. Progress, Findings, and Activities:

- a) Task 1 Standards - Awaiting data on which to act
- b) Task 2 Fatigue - The main objective of the first quarter of this project was to locate appropriate materials and to design the test specimen and fixtures. We contacted various sources and got a firm commitment for pipe from PG&E and a general commitment from CanMet. We developed a reduced-section fatigue test specimen (with a gage length of 6 inches and an overall length near 18 inches), and received support for this design from a number of our collaborators. The width of the specimen is a minimum of 3 inches, within the tolerances of the loading capacity of one of our larger fatigues machines, yet wide enough to develop valid data, and allow the addition of stress risers (notches) and intentional deformation (to simulate third-party damage). The specimens will be oriented along the length of the pipe, and so will primarily assess crack-growth properties in the hoop direction. The fixtures will have a curved surface that matches the original curvature of the pipe, and so will not induce any bending stresses. We are also considering specimens oriented along the hoop direction, to develop data in the two main load directions.

Background information on the state-of-the-art in the testing of these materials and the types of data in existence was collected. In addition to general literature searches and discussions with experts, we reviewed a number of proposals (in response to formal calls for proposals by government agencies) which contained a nice summary of current and near-future materials and techniques. We also gained valuable information on the current status of various aspects of pipe technology by participating in (and helping to sponsor) an April 2004 Workshop on Coating Technology (held in Biloxi, Mississippi). After a few last manuscripts are received, we will publish and distribute the proceedings. In addition to these activities, NIST staff sought input from Keith Wooten, Chair of a Pipeline Research Council Corrosion Committee.

2. Activities Planned for the Next Reporting Period

- a) Task 2 - Fatigue - ongoing
NIST will gear up for fatigue testing using the PG&E pipe. Once the steel is received, we can machine the fatigue fixtures to the proper radii and check the

gripping capability. We expect to start the fatigue crack growth matrix near 60 % of the ultimate strength for the various pipe strengths.

- b) **Task 3 – Crack Arrest**
Once the fatigue testing is proceeding smoothly, we will start to develop the crack arrest task of our measurement plan.
- c) **Other Tasks 4 to 6**
These tasks will follow the initial fatigue testing.
- d) **Meetings and Committee Activities**
NIST will continue to support pipeline R&D community through participation in organization of meetings, standards committee activities, and through participation in the interagency PSIA coordinating committee. CANMET has asked us to visit for a more detailed discussion of potential collaborations, and we have been invited to attend the April 2005 Pipeline meeting in Banff.

3. Problems, Issues or Concerns

None at this time.

4. Anticipated Task Completion Dates

On schedule per the statement of work as listed in the August 4, 2004 modified agreement.

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