



**5th QUARTERLY REPORT – PUBLIC PAGE
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"Full Scale Testing of Interactive Features for Improved Models"

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1.0 Results and Conclusions

Task 2: Material Selection, Acquisition, and Characterization

GDF SUEZ is continuing their characterization work for Tasks 5a, 5c and 6.

BMT has acquired another pipe (Pipe E), approximately 150 feet in length that has been removed from service, for full scale fatigue testing. The pipe is 20 inch diameter, 0.25 inch wall thickness, Grade X-52, 1971 vintage. The pipe (Pipe E) has several corrosion features as identified by in line inspection (ILI).

Task 3: Baseline Existing Features

In-line inspection has identified several corrosion features in sections of Pipe E that have been acquired by BMT for carrying out the dent interaction with corrosion features fatigue tests. A table was created that lists the corrosion features as identified by ILI. The corrosion features range from 5% - 28% in depth. Visual and non-destructive inspections will be carried out to identify and confirm the size of corrosion features as listed.

Task 4: Full Scale Testing of Complex Dents

A dent was created on a spare pipe using 4 inch hemispherical end cap and subjected to cyclic pressure loading. The pipe was instrumented with strain gauges and data captured during dent formation and pressure cycle loading. The indenter size and shape was selected as was carried out on previous full scale test program. The test data was compared with finite element (FE) model predictions. The FE models for the particular dent shape and size have been validated with the previous full scale test program. The trial test was carried out to ensure that the full scale test control system, instrumentation and data acquisition system were all working to produce quality test results. Comparisons were made between experimental and FEA results for indenter force versus displacement during dent creation. Comparison were made between experimental and FEA results for strain data at two different locations. The comparison between the experimental and FE model indicates that the experimental results correlate very well with the validated FE models indicating that the control system and the sensors are working as desired.

Task 5a: Dent and Gouge Severity

For Task 5a, GDF SUEZ performed a fatigue test on defect 5.4.3. by cycling it between 29 bars and 49 bars at a frequency of 3.10^{-2} Hz. The defect of 5.4.3 failed after 13421 cycles as a leak.

The last pressure cycles versus time shows that only two cycles were affected by the leak, meaning that the uncertainty on the number of cycles for determining the fatigue life is small, compared to the 13421 cycles of the fatigue lifetime.

Task 5b: Interaction between Defects

There is no work to report during this reporting period on Task 5b.

Task 5c: Dent and Gouge Defects Removed from Service

There is no work to report during this reporting period on Task 5c.

Task 6: SCC Colonies and SDO Modeling Coordination

The SCC crack sizing equipment from Jentek Sensors was used for crack mapping and crack depth estimation.

SCC colonies on SCC-1 pipe were characterized in both length and in depth. Magnetic particle inspection (MPI) was also performed on the different SCC colonies of the SCC-1 vessel. Deepest cracks are shown in the different MPI views. A table was created to show the main characteristics in terms of colony length, maximum crack depth and crack length of the deepest crack according to the sizing as measured by MWM FA214 Jentek Sensor.

C-scans of the colonies characterized with the Jentek MWM sensor were created with specific indications concerning the average and maximum crack depth, noted crack depth (CD) on the figures. While the MPI photos provide a good local view of the defects, with indication of the deepest zones, the C-scans allow for a good representation of where the colonies lie on the pipe surface, their different shapes and distances from one another.

Task 8: Dissemination of Results

The project team held monthly internal meetings with the Technical Advisory Committee (TAC).

Task 9: Project Management and Reporting

The project team held regular teleconference meetings to track performance, schedule and budget. The project team completed and submitted the required monthly and quarterly report. The project team met with PHMSA Technical Advisors to discuss the program.

2.2 Problems, Technical Issues or Major Developments

Task 3a, Baseline existing features and Task 4, Full Scale testing of Complex dents are behind schedule. The delay in part has been due to the delay in acquiring pipe samples. There have also been delays in getting the full scale fatigue testing system fully operational. The above mentioned issues has resulted in a 6 month delay in the existing schedule. The team is discussion options to address the issue.

2.0 Plans for Future Activity

Task 2: Material Selection, Acquisition, and Characterization

Pipe 6 has been identified. Its main characteristics are: OD 323 mm, Thickness 6 mm, Grade L360 MB. Calculations are ongoing to evaluate its suitability for the scheduled complex loading test, i.e. internal pressure fatigue tests combined with axial loading, before purchasing the pipe.

BMT Fleet will also carry out material characterization work on Pipe E with corrosion features.

Task 3: Baseline Existing Features

Baseline measurements of the corrosion features as identified by ILI will be carried out.

Task 4: Full Scale Testing of Complex Dents

BMT will fabricate round bar indenters for full scale fatigue testing.

Task 5a: Dent and Gouge Severity

Detailed investigation, including destructive, of Defects 5.4.1, 5.4.2 and 5.4.3 will be performed. GDF SUEZ will create defects 5.5.1 and 5.5.2 to be less severe than defects 5.5.1 to 5.5.3, especially not showing sharp angles at the sides of the gouge.

Task 5b: Interaction between Defects

There is no future work to report during this reporting period on Task 5b.

Task 5c: Dent and Gouge Defects Removed from Service

GDF SUEZ is searching for another existing dent + gouge feature removed from operations (pipe 8).

Task 6: SCC Colonies and SDO Modeling Coordination

The experimental plan will be drafted and circulated for approval by the project team.