# 7th QUARTERLY REPORT – PUBLIC PAGE
# DTPH56-14-H-00002
# "Full Scale Testing of Interactive Features for Improved Models"

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## 1.0 Results and Conclusions

### Task 3: Baseline Existing Features

BMT completed the baseline measurements of the dimensions of the corrosion features last quarter for Task 4. Table 1 is reproduced here to show the listing of corrosion features identified in Pipe E.

**Table 1: Listing of Corrosion Features Identified in Pipe E**

| Pipe Segment | Feature ID | % Depth |
|---|---|---|
| 1 | 1-2 | 17% |
| 1 | 1-8 | 6% |
| 2 | 2-3 | 12% |
| 2 | 2-6 | 14% |
| 3 | 3-1 | 13% |
| 4 | 4-3 | 8% |
| 4 | 4-6 | 5% |

### Task 4: Full Scale Testing of Complex Dents

BMT completed the trial test on restrained dent fatigue test. BMT fabricated five pressure vessels from Pipe D (24 inch diameter, 0.375 inch wall thickness, Grade X-70, 1998 vintage pipe) for full scale dent fatigue testing.

### Task 5a: Dent and Gouge Severity

GDF SUEZ created and geometrically characterized the different dent and gouge reference defects 5.5.1, 5.5.2 and 5.5.3, in terms of circumferential and longitudinal profiles passing by the deepest point.

GDF SUEZ also created and geometrically characterized dent and gouge defect 5.5.3cp and, in terms of circumferential and longitudinal profiles passing by the deepest point.

Defect 5.5.3cp will be submitted to CP overprotection, and will be cycled in parallel with defect 5.5.3, which is not submitted to CP overprotection, therefore providing a direct comparison.

GDF SUEZ instrumented the two vessels and prepared the fatigue cycling on defects 5.5.3 and 5.5.3cp, the latter one with the addition of a box installed above the dent and gouge defect, and circulating a solution representing the environment, that is controlled by a specific system, as well as imposing a cathodic protection potential.

### Task 5b: Interaction between Defects

GDF SUEZ also created and geometrically characterized the different interacting dent and gouge defects and 5.5.3i1 A/B, in terms of circumferential and longitudinal profiles passing by the deepest point.

These defects are the reference case for interacting defects in terms of being spaced one from another by 600 mm i.e. about one pipe diameter, see **Error! Reference source not found.** through **Error! Reference source not found.**. They are referenced as 5.5.3i1A and 5.5.3i1B.

**Task 6: SCC Colonies and SDO Modeling Coordination**

Work started in 2014 aimed to identify near neutral stress corrosion cracking from the field and sized them in order to select the most appropriates ones. To do so a specific SCC crack sizing equipment was delivered to GDF SUEZ CRIGEN in December 2014. It is a Grid Station D8000beta equipment by Jentek with two sensors: a FA28 MWM sensor for crack mapping and a FA214 MWM sensor for crack depth estimation. Unfortunately after several weeks of characterization in 2014, available stress corrosion cracking features were shown to be shallow ones (1 mm deep max for most of them). Some were cut out and observed through optical microscope which confirm the low extend in depth of the individual cracks and that they were blunted by corrosion. The unknown timescale and loading conditions to reinitiate them in an acceptable way led a modification of the initial plans for SCC tests. Finally, due to some effects of cracks' sizes and crack spacing on crack interaction, it could be possible that due to some shielding effects from crack in interactions, propagation will be slowed down, increasing the risk of not reaching the objectives of the initial project. Therefore initial settings were re-scoped to focus on the following objectives.

- Investigate the combined effect of load interactions on the near neutral-pH stress corrosion crack growth rates (CGR) for two specific conditions:
  - One fitting with oil transmission load spectra (R –Ratio = 0.5);
  - The other fitting with gas transmission pipeline load spectra ( R –Ratio = 0.85);
- Address the effect of pressure fluctuations on initiation and growth rate of near-neutral pH SCC;
- Look at coalescence of individual cracks inside real stress corrosion cracking from the field.

**Task 8: Dissemination of Results**

The team has completed the following in the dissemination of the results.

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

**Task 9: Project Management and Reporting**

The team has completed the following project management and reporting sub-tasks:

- The project team held regular teleconference meetings to track performance, schedule and budget.
- The project team completed and submitted the required monthly and quarterly reports.

## 1.1 Problems, Technical Issues or Major Developments

There are no problems or technical issues to report this quarter.

## 2.0 Plans for Future Activity

Over the next 30-60 days, the following activities will be conducted:

**Task 2: Material Selection, Acquisition, and Characterization**
No direct work will be done on this task.

**Task 3: Baseline Existing Features**
No direct work will be done on this task.

**Task 4: Full Scale Testing of Complex Dents**
Full scale dent fatigue tests based on the test matrix identified in **Error! Reference source not found.** will be started.

**Task 5a: Dent and Gouge Severity**
Defects 5.4.1 and 5.5.1 will be destructively characterized. GDF SUEZ will start fatigue cycling of dent and gouge defects 5.5.3 and 5.5.3cp. Defect 5.5.3cp implements also cathodic protection (CP), so the loading rate is small enough to accommodate for CP overprotection phenomena to take place. Therefore, test duration is scheduled to be around 3 months.

**Task 5b: Interaction between Defects**
Instrumentation of interacting defects 5.5.3i will be finalized, and fatigue cycling will start.

**Task 5c: Dent and Gouge Defects Removed from Service**
In January, the sample repository of defects removed from service in France and will be reviewed to identify potential candidates for defect 8.ext2.3cp. It will also be submitted for fatigue cycling with the addition of cathodic protection.

**Task 6: SCC Colonies and SDO Modeling Coordination**
The next step will be to machine EDM notches and prepare the four pressure vessels. The team will also confirm the experimental protocol with the Technical Advisory Board and PHMSA.