



RAE Engineering and Inspection Ltd.

13 May 2016

Warren Environmental Inc  
P.O. Box 1206, Carver, Ma. 02330, USA

**Attention:** Jane Warren

**Reference:** SWAT test of Warren Environmental coating

To whom it may concern,

In 2010, RAE Engineering and Inspection Ltd. (RAE Engineering) was requested to perform a laboratory SWAT (Severe Waste Water Accelerated Test) exposure for Warren Environmental coating.

The SWAT conditions were: cyclic dipping (3 dips per day) into 10% sulphuric acid with 4000 ppm NaCl, a gas atmosphere of air with 500 ppm H<sub>2</sub>S and a test temperature of 65°C. Originally, the test duration selected was 28 days; however the SWAT duration was extended to 145 days as requested.

At the conclusion of the test exposure, the two panels labeled with Warren Environmental Panel #011 and Panel #012 were evaluated by blistering analysis, adhesion analysis, foam analysis, color change, Dry Film Thickness (DFT), and Electrochemical Impedance Spectroscopy (EIS) analysis. **The Warren Environmental coating showed the best performance compared to other coatings tested in the same batch, having small blisters and excellent impedance.**

*Test results obtained from Warren Environmental Panel #011 and Panel #012: (RAE 0923-LS-00.004.302 SWAT Test Final Report)*

- a. After 145 days of exposure, the Warren Environmental coating had several tiny (<1 mm in diameter) blisters of ASTM D714 blister rating #8MD on

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both test panels. The blisters were wet inside but did not appear to penetrate to the substrate.

b. Adhesion Analysis

The Warren Environmental coating showed NACE TM0185 adhesion ratings of C and D on the two test panels after 145 days of exposure to the test conditions. Several 4 mm to 10 mm sized coating chips were removed adhesively on each test panel after the prying action. Small amounts of coating remained in the profile. The unexposed control panel showed excellent adhesion, having a rating of A.

c. Foam Analysis

The Warren Environmental coating showed foam ratings of S/MD on the control panel and test panels.

d. Color Change

At the beginning of the test, the Warren Environmental coating was white in color. Slight yellowing of the coating was observed after 10 days in test. By test end, the coating showed moderate color change, appearing dark yellow throughout the surface.

e. Dry Film Thickness (DFT)

The Warren Environmental panels had initial DFT measurements of 106 mils and 88 mils at the beginning of the test. The coating did not show a significant change in thickness throughout the test duration.

f. EIS

Pre-test impedance of the Warren Environmental coating was excellent with a Log Z value of 11.8. The coating impedance ranged between 9.7 and 10.9 throughout the duration of the test. Overall the coating impedance remained very high after exposure to the test conditions.



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Regards,  
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