

CORROSION TECHNOLOGY SERVICES



- *Reduce the high cost of corrosion*
- *Develop cost-effective corrosion control programs*
- *Devise remedial action plans for corrosion problems*

It's not just rust.

Corrosion—the degradation of materials that is caused by their environment—takes many forms affecting both metals and nonmetals, resulting in billions of dollars in mostly avoidable damages each year.

Our cause determinations and minimization services help clients reduce the high cost of corrosion.

From failure of process piping to the sudden catastrophic collapse of a 500,000-gallon acid storage tank, we facilitate selections that offer the best combination of cost, corrosion resistance, and mechanical and physical properties.

M&M Engineering contributes knowledge and experience to develop cost-effective corrosion control programs, consistent with the inherent risks of the particular process of environment. Our on-site inspections identify existing and

potential corrosion problems. We provide a firm basis for periodic inspection to detect developing problems, assign risk-based priorities, and define corrective measures, such as changes in materials or process.

We offer corrosion technical services in four areas.

Prediction — Analysis of potential corrosion problems on the basis of physiochemical data and corrosion history.

Diagnosis — Analysis of failures caused by corrosion or related cracking/materials degradation processes for metallic and nonmetallic materials or components.

Testing — Conventional and state-of-the-art electrochemical testing.

Remediation/Mitigation — Definition of corrective measures, including materials selection, environmental modification, coatings, linings, and inhibitors.



M&M Engineering analyzes information acquired from different sources at diverse plants and constructs profiles of corrosion problems. We then suggest operating or maintenance schemes, create test programs for selecting new materials or altering operating conditions, and devise remedial action plans for corrosion problems.

We provide these services for a broad range of applications, including various water and waste treatment processes, the energy, chemical process, pulp and paper, and vacuum/solid-state electronics industries, and biomedical implant manufacturers.

M&M Engineering also performs corrosion testing to address all anticipated modes of corrosion and adequately simulate operating conditions.

Conventional Corrosion Tests

Conventional corrosion tests involve exposing specimens—such as flat coupons, U-bends, and compact welded twist specimens—to the environment of concern under laboratory conditions. Corrosion is assessed through weight loss and microscopic examination. Scanning electron microscope (SEM) and metallographic examinations are used when needed.

M&M Engineering's Corrosion Test Facility has 12 ASTM standard laboratory immersion test cells suitable for use with most solutions at temperatures up to the solution boiling point. We also have high-pressure autoclaves dedicated to corrosion testing.

Electrochemical Testing

Electrochemical tests provide vital information about corrosion processes and are critical in the

evaluation of corrosion inhibitors. Using a potentiostat, M&M Engineering can perform DC electrochemical corrosion measurements, including linear polarization; Tafel curve generation; linear current scans; construction of corrosion behavior diagrams, as well as potential and current electrochemical noise spectroscopy.

Bench Scale Simulations

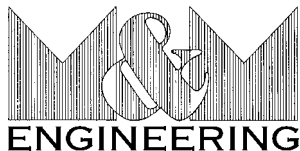
Corrosion testing of dynamic processes often requires bench-scale simulation to mimic the true corrosive environment. We designed and constructed a simulator of the unique corrosive conditions of compressed air energy storage. Some materials behaved differently than expected, so we averted a potentially catastrophic materials selection. Other examples include our bench-scale simulation of pulp and paper white water in an investigation of rotating corrosion fatigue of suction roll alloys, and dynamic simulation of the loads operating on human knees to test artificial joints.

Full-Scale and Field Tests

When only full-scale testing of materials will suffice, corrosion specimens are inserted into the process stream, then examined like the specimens of conventional laboratory corrosion tests.

M&M Engineering successfully designed such a test for sulfur vapor at high temperature and pressure in a situation where even the materials from which to construct the test rack were uncertain. We also conducted full-scale trials of steel and high-alloy production tubulars downhole in a very high temperature, hypersaline geothermal well. In this test, sections of the production tubulars themselves were the test specimens.

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