

# Antimicrobial Coating System for Mitigation of Microbiologically Influenced Corrosion (MIC)

## Executive Summary

Royal Coatings has developed a proprietary **100% solids epoxy-based coating system** with integrated antimicrobial functionality, specifically engineered to mitigate **Microbiologically Influenced Corrosion (MIC)** in demanding industrial environments. The system has demonstrated robust antimicrobial efficacy against key MIC-associated bacterial classes—including sulfate-reducing, acid-producing, and slime-forming—through multiple independent third-party laboratory validations.

The coating system is:

- Fully applicable and curable under immersed (underwater/submerged) conditions
- Patent-pending (U.S. Patent Application No. 18/626,558)
- EPA-registered as an antimicrobial pesticide 10/3/2024
- Characterized by a very low non-ablative leach rate of **0.313  $\mu\text{g}\cdot\text{cm}^{-2}\cdot\text{d}^{-1}$**  (ISO 10890)

Durability testing to **NORSOK M-501** standards shows excellent adhesion retention after cyclic aging and long-term seawater immersion (pull-off values  $\geq 11.35$  MPa post-exposure). Microbiological testing confirms strong to complete inhibition of target organisms relevant to oil & gas, water/wastewater, power generation, and marine applications.

**Target Markets:** Oil & gas, water & wastewater infrastructure, power generation facilities, and marine.

## Current Development Stage & Objectives:

1. Comprehensive review of completed and in-progress test data to verify alignment with industry specifications and determine any additional qualification requirements.
2. Identification and onboarding of beta test sites for real-world field validation.
3. Progression toward full commercialization.

## Coating System Composition

- **Primer:** Prime 200-MF – High-PSI adhesion, surface-tolerant, 100% solids epoxy primer with excellent wetting and sealing properties.
- **Topcoat:** Flex 200-GFCU – Flexible, antimicrobial-modified, 100% solids epoxy finish coat providing sustained microbial inhibition.



Both components are solvent-free, high-build epoxy formulations designed for superior long-term performance in aggressive environments.

## Key Technical Specifications

- Application and full cure possible under fully immersed (underwater) conditions.
- Patent Pending: U.S. Application No. 18/626,558.
- EPA Registration: 10/3/2024
- Non-ablative antimicrobial leach rate (ISO 10890): **0.313  $\mu\text{g}\cdot\text{cm}^{-2}\cdot\text{d}^{-1}$** .

## Third-Party Performance & Durability Testing

**Testing Laboratory:** KTA-Tator, Project No. 410646-A1 **Standard:** NORSOK M-501

Test Description	Standard	Duration/Condition	Pull-Off Adhesion Result
Initial Adhesion	ISO 4624:2016	As-applied	11.91 MPa
Cyclic Aging (accelerated weathering)	ISO 20340:2009	4,200 hours	11.35 MPa
Continuous Seawater Immersion	ISO 2812-2:2007	4,200 hours	18.52 MPa

## Third-Party Microbiological Efficacy Testing

### Louisiana State University (Chen Lab)

- Method: CLSI M07
- Organism: *Staphylococcus aureus* (slime-forming bacteria)
- Result: Significant growth inhibition

### Element Materials Technology – Report No. N1001

- Method: Modified ASTM G22
- Organism: *Desulfovibrio piger* ATCC 29098 (sulfate-reducing, anaerobic)
- Result: Complete growth inhibition; **7.64 mm** zone of inhibition

### GTI Energy – Report No. 242749 (Bacteria harvested from failed oil pipeline isolates)

- Method: ASTM E2647-20 (qPCR-based)
- Organisms: *Clostridium* spp. and *Acetobacterium* spp. (acid-producing, anaerobic; pipeline failure isolates)
- Result: **93.75%** reduction in maximum bacterial population

### Element Materials Technology - 7 Day total kill

- Method: JIS Z 2801 (surface antimicrobial activity)
- Organisms (multi-class):
  - *Pseudomonas fluorescens* (aerobic, biofilm-forming)
  - *Acetobacter acetii* (acid-producing)
  - *Shewanella oneidensis* (metal-reducing)