

CHEMICAL PROCESSING

Off-Shore Oil Major Extends Service Life of Seawater Intake Piping with Antimicrobial Corrosion-Resistant Rotational Lining



MIC-GUARD, a customized antimicrobial agent developed and manufactured by BTG Products, Canyon, TX, was incorporated into intake pipeline sections that were rotationally lined with monolithic HDPE by RMB Products, Fountain, CO.

Two types of corrosion cause the majority of problems in offshore or seawater applications; aqueous corrosion and microbially influenced corrosion (MIC). Aqueous corrosion stems from the alkalinity of the seawater itself where MIC degradation stems from microorganisms in the seawater that cause corrosion and stress cracking in materials. Rotational lining solutions can apply a thick, fully bonded, vacuum resistant, monolithic liner of high-density polyethylene (HDPE) to the inner diameter of piping systems. This coating system has been proven to provide long-term protection against aqueous corrosion in salt-water applications. To combat MIC, a recently developed combination of antimicrobial powder and high-density polyethylene powder was applied through rotational lining. Experiments were conducted to evaluate the biological and mechanical performance of material coatings. Results from microbiological testing showed that coatings enhanced with the material resisted and deactivated over 99% of bacteria. Additional results from mechanical testing show that the additive has no significant negative impact on the corrosion or abrasion resistance of the HDPE lining or on the adhesion of the lining to the substrate. These results are significant because the additive material eliminates the primary source of MIC while maintaining the mechanical and thermal properties of the existing HDPE coating system.

Challenge

Pipe failure is a main component of the operating and maintenance costs of gas industry pipelines. Oil and gas companies have limited options to prevent internal pipe corrosion.

At a Glance

Client: Oil Major

Industry: Chemical Processing—Oil & Gas

Manufacturing Solution: Rotational lining with custom-compounded antimicrobial polymer matrix

PROJECT GOALS

- Limit biofouling buildup during off-peak
- Decrease production turnaround time
- Maintain or improve component performance/life production
- Find an alternative to super duplex 2507 stainless steel components
- Meet or beat budget cost targets

REQUIREMENTS

- Provide exceptional resistance to seawater corrosion
- Address high mechanical-property demands
- Provide a turnkey solution
- Ensure uniform wall thickness in lining complex shapes
- Custom-compound polymer (HDPE) with antimicrobial additive

HIGHLIGHTS

- **Delivered product in less than 4 months vs. 50 weeks for super duplex stainless steel**
- **Tested and validated all materials to ensure design-life requirements met for maintenance-free performance**
- **Saved Customer \$5 million in manufacturing costs**
- **On track for improved service life, reducing future maintenance costs and capital expense**



Fresh water intake pipe joint lined with antimicrobial HDPE.

Many producers employ significant resources on materials that are resistant to microbial corrosion (super duplex 2507 stainless), but even these expensive materials are still susceptible to biofilm development. Therefore, many producers are currently flushing piping with various chemicals and biocides to kill off excessive microorganisms.

Replacing these materials and procedures with antimicrobial HDPE linings decrease operating costs and environmental impact without impacting life expectancy. In order to prevent corrosion, pipes and other structures are commonly lined with high-density polyethylene or HDPE that is resistant to aqueous corrosion in salt water or brine. Coatings and linings with this material have been used for many years with great success. Rotational lining solutions can apply a thick, fully bonded, vacuum resistant, monolithic liner of high-density polyethylene (HDPE) to the inner diameter of piping systems. This liner has proven to last over 20 years in brine water services providing long-term corrosion protection to aqueous corrosion in saltwater applications. Defects and microbial degradation of polymer coatings, however, can provide opportunities for localized biological attacks. Additionally, biofouling can gradually build up on top of the lining system and decrease efficiency and capacity of the fluid delivery system.

Solution

RMB Products and BTG Products have spent over 24 months developing a new product to protect fluid delivery systems from microbial and non microbial corrosion. The product development and fabrication phases consisted of:

- Design and engineering
 - Custom material formulation and compounding (high-density polyethylene—HDPE—with added antimicrobial agent)
- Testing and validation
 - Preparation of the host structure
 - Rotational lining with complex geometry
 - Finishing, painting and delivery for inspection and acceptance

RMB Products provided in-house services throughout all phases of the project and delivered product in about one-third of the time required for stainless steel components.

Results

All aspects of the project ran smoothly and all project requirements were successfully met.

Project turnaround. MIC-GUARD was sourced from BTG Products and mixed into the HDPE powder without any increase in project lead time.

Product performance. Several parts of the project required rounds of testing and validation to meet the customer's stringent design-life specifications for maintenance-free performance.

- RMB Products used standard and proprietary preparation processes to enhance the receiving surface of the host material and better condition it for a successful coating application.
- RMB Products and the customer collaborated to select high-density polyethylene (HDPE) for the lining material. The customer requested the addition of an antimicrobial element, requiring RMB Products to test modified batches of material from BTG Products to achieve the design requirements without affecting established mechanical properties.

Cost reduction. BTG Products and RMB Products satisfied the budget requirements. The rotational lining technology saved the customer \$5 million on the caisson portion of the offshore project. Relative to the overall project costs approximating \$1 billion, the cost-savings contribution was a modest amount. However, meeting or exceeding all other project requirements while generating significant savings was a winning combination for the customer. As the project moves ahead, the use of corrosion-resistant HDPE will increase operational life, reducing maintenance costs and long-term capital expense for the customer.

Customer satisfaction. The project progressed smoothly due to the ongoing successful collaboration of the customer, BTG Products, and RMB Products. The customer engineers were highly satisfied with the value provided to the project by the alternative manufacturing materials and technologies. Going forward, the customer has an additional arsenal of manufacturing options—with demonstrated advantages—that it can consider for future projects.

About RMB Products

RMB Products is a leading supplier of engineered polymer products for critical applications in the aerospace, chemical processing, semiconductor and biopharmaceutical industries. Our success is based on helping customers lower capital cost and operating expenses through innovative manufacturing processes and high-performance materials.

About BTG Products

BTG Products is a developer and manufacturer of safe, effective antimicrobial solutions to support the oil and gas, aviation, healthcare, and consumer markets. We specialize in producing customized antibacterial and mold inhibiting coatings and additives that decrease capital expenditures, increase lifespan, and reduce maintenance costs.



To learn more about how our innovative solutions help you add product features while lowering costs, visit our websites at btgproducts.com and rmbproducts.com.

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