

Oil & Gas Operations

ADVANCED SOLUTIONS FOR MICROBIAL CONTROL & H₂S SCAVENGING



TROY

The Gold Standard for Performance

2021
USA & Canada

TROY

Solutions for
Oil & Gas Operations



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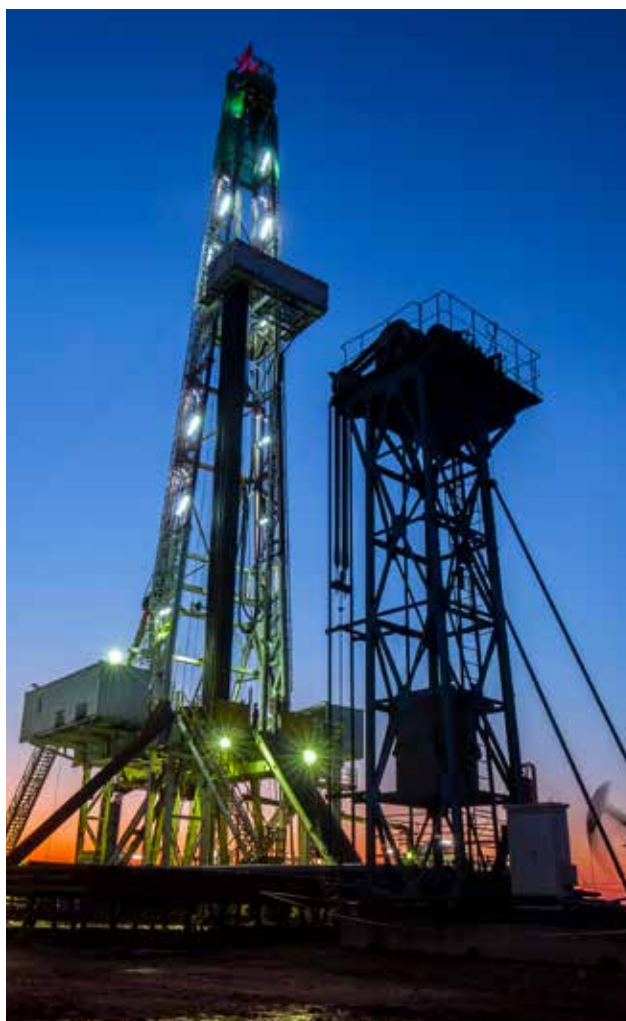
Introduction

Troy is a global leader in the development and manufacture of biocides and performance additives for numerous industries. Known as The Gold Standard for Performance, Troy offers customers advanced, innovative materials developed for optimum efficacy, cost-efficiency, and safe, environmentally responsible use. Troy has been serving industry for over 70 years, and is renowned for its world-class technical service capabilities. Troy offers its full portfolio of Aquamate™ biocide technologies to the energy sector, including oil & gas operations, to ensure contamination-free processes that benefit your bottom line. Troy also offers Oilmate™ hydrogen sulfide (H₂S) scavengers as well as additional multifunctional products.

Partnering with Troy

A partnership with Troy offers oil & gas operators numerous benefits, including the following:

- Microbial control expertise
- A broad platform of the leading active chemistries & H₂S scavengers
- A full suite of technical services & testing
- Global regulatory expertise
- Modern manufacturing facilities on 3 continents
- Worldwide logistics & distribution to ensure reliable supply



Advanced Aquamate™ Biocides



The presence of water in any manufacturing or industrial environment is all that bacteria need in order to survive and grow exponentially. The oil & gas extraction process is particularly susceptible to microbial contamination due to the vast volumes of water involved, especially in hydraulic fracturing and EOR (enhanced oil recovery). Troy Aquamate™ biocides control the microorganisms that contaminate oilfield environments and associated processes, such as cooling systems, process chemicals, and pipework. What's more, bacteria that release sulfur-containing compounds can also proliferate in certain environments, which is damaging as well as a health risk. Left unchecked, microbial growth will have expensive ramifications, including extended machinery downtime for cleaning or replacement; pipeline corrosion; reservoir souring; contaminated tanks; wasted product; and lost revenue.

Microbial Control

Microbial contamination is a threat throughout the oil extraction process, from initial drilling to waste systems and throughout transport and storage. A sound microbial control program incorporating high-performance Aquamate™ biocides is the most cost-effective way to ensure contamination-free oil & gas production, with minimized operating costs over the long term. Troy offers a full range of performance biocides ideally suited to the oil & gas industries, which you will find on the following pages.



To learn how Troy
can assist you to
achieve your objectives,
speak with your Troy
representative today,
or visit us online at
troycorp.com.



The Troy Portfolio of Solutions for Oil & Gas

Troy has a long history of manufacturing high-performance specialty chemicals that offer optimum efficacy and compatibility, with environmental responsibility and regulatory compliance. Troy can provide customized solutions worldwide, and is experienced in assisting customers with the implementation of complete contamination prevention programs.

The numerous stages along the hydrocarbon value chain have different requirements for protection against microbial contamination, as well as hydrogen sulfide scavenging. These requirements include speed and duration of control; system temperature and pressure; and compatibility with different actives. The chart below illustrates the stages of the extraction process, varying system requirements, and the Aquamate™ & Oilmate™ technologies best suited for each stage.

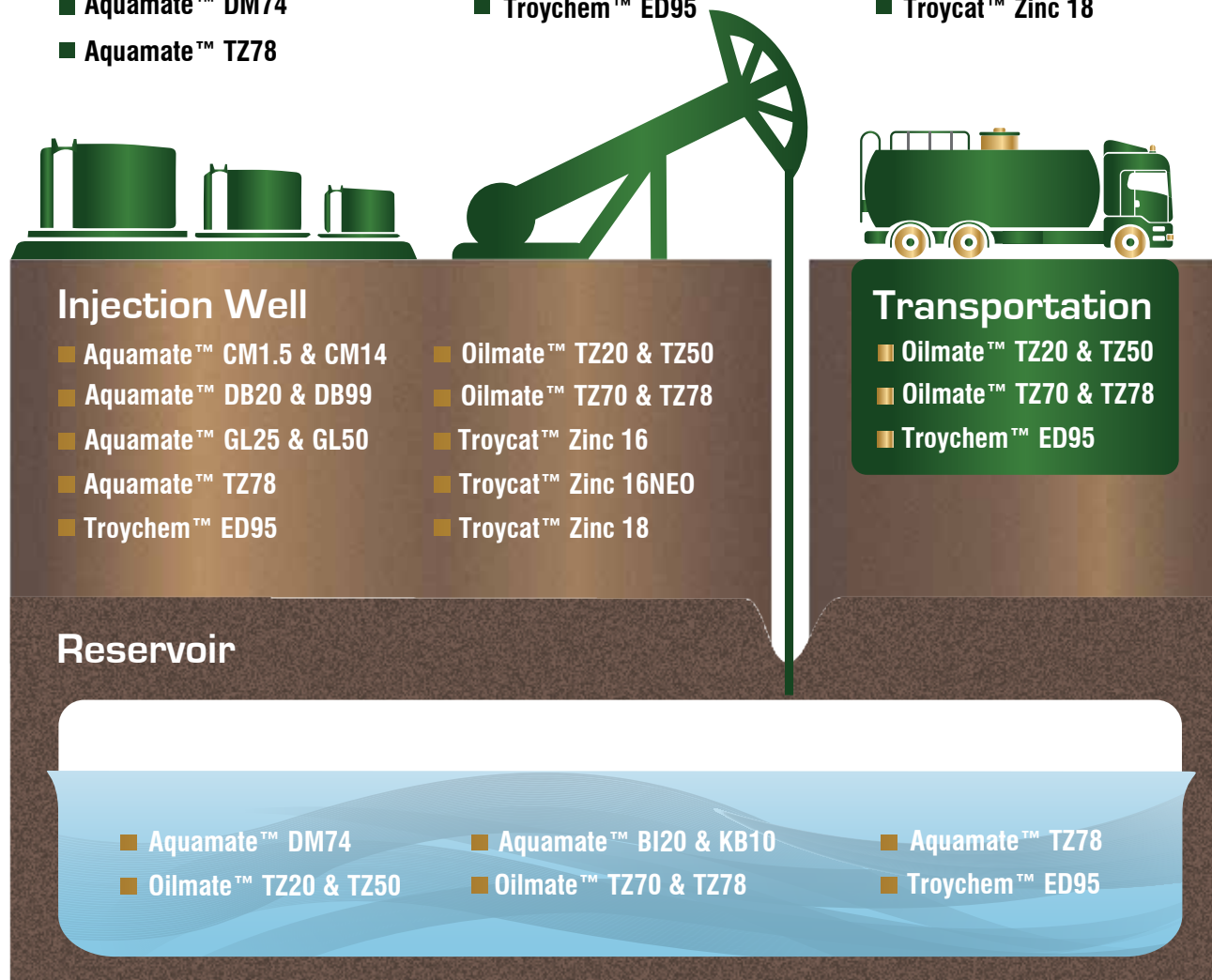
Selecting the Best Product

Topside

- Aquamate™ CM1.5 & CM14
- Aquamate™ DB20 & DB99
- Aquamate™ DM74
- Aquamate™ TZ78

- Oilmate™ TZ20 & TZ50
- Oilmate™ TZ70 & TZ78
- Troychem™ ED95

- Troycat™ Zinc 16
- Troycat™ Zinc 16NEO
- Troycat™ Zinc 18



Product	Function			% Active Ingredients	Physical Form	Efficacy		
	Bactericide	Fungicide	Algaecide			Speed of Kill	Duration of Protection	Efficacy on Oilfield Organisms (SRBs, APBs)*
Aquamate™ Biocides								
Aquamate™ DB20	●	●	●	20% DBNPA	Liquid	●	○	Excellent
Aquamate™ DB99	●	●	●	99% DBNPA	Powder	●	○	Excellent
Aquamate™ GL25**	●	●		25% Glutaraldehyde	Liquid	●	◐	Excellent
Aquamate™ GL50**	●	●		50% Glutaraldehyde	Liquid	●	◐	Excellent
Aquamate™ CM14	●			14% CMIT/MIT	Liquid	●	◐	Excellent
Aquamate™ CM1.5	●			1.5% CMIT/MIT	Liquid	●	◐	Excellent
Aquamate™ DM74**	●			73.7% DMO	Liquid	◐	●	Excellent
Aquamate™ TZ78	●			78% HHT	Liquid	◐	●	Excellent
Aquamate™ KB10	●	●		9.5% BIT	Liquid	○	●	Excellent
Aquamate™ BI20	●	●		19.2% BIT	Liquid	○	●	Excellent

* Sulfate-reducing bacteria (SRB) and Acid-producing bacteria. (APB)

Speed of Kill

● Minutes to about an hour ◐ Hours to about a day ○ Multiple days

** Not available in Canada. Please contact your Troy sales representative.

Duration of Protection

● Lasts weeks to months ◐ Lasts a few weeks ○ Lasts for a few hours to few days

Solutions for Oil & Gas

Compatibility†							Environmental Profile†				Product
Friction Reducers/ Anionic Additives	Proppant and Formation	Low Foaming	Non-Corrosive at Use Levels	Sour Systems (Sulfide)	Performance at High Temperature (>50°C)	pH Range of Use	Bio-degradeable	Low Aquatic Toxicity	No AOX Formation	Abiotic Degradation	
●	●	●	●	○	○	≤8.5	◐	○	●	●	Aquamate™ DB20
●	●	●	●	○	○	≤8.5	◐	○	●	●	Aquamate™ DB99
●	●	●	●	●	◐	≤9.5	●	◐	●	◐	Aquamate™ GL25**
●	●	●	●	●	◐	≤9.5	●	◐	●	◐	Aquamate™ GL50**
●	●	●	○	●	○	≤8.5	○	○	●	●	Aquamate™ CM14
●	●	●	○	●	○	≤8.5	○	○	●	●	Aquamate™ CM1.5
●	●	●	●	◐	●	≤11	●	●	●	●	Aquamate™ DM74**
●	●	●	●	◐	●	>7-11	●	●	●	○	Aquamate™ TZ78
●	●	●	○	●	○	≤11	○	○	●	●	Aquamate™ KB10
●	●	●	○	●	○	≤11	○	○	●	●	Aquamate™ BI20

† Characterization based on laboratory studies of active ingredients.

Compatibility Key

● Excellent ◐ Good ○ Fair

Environmental Profile

● Excellent ◐ Good ○ Fair

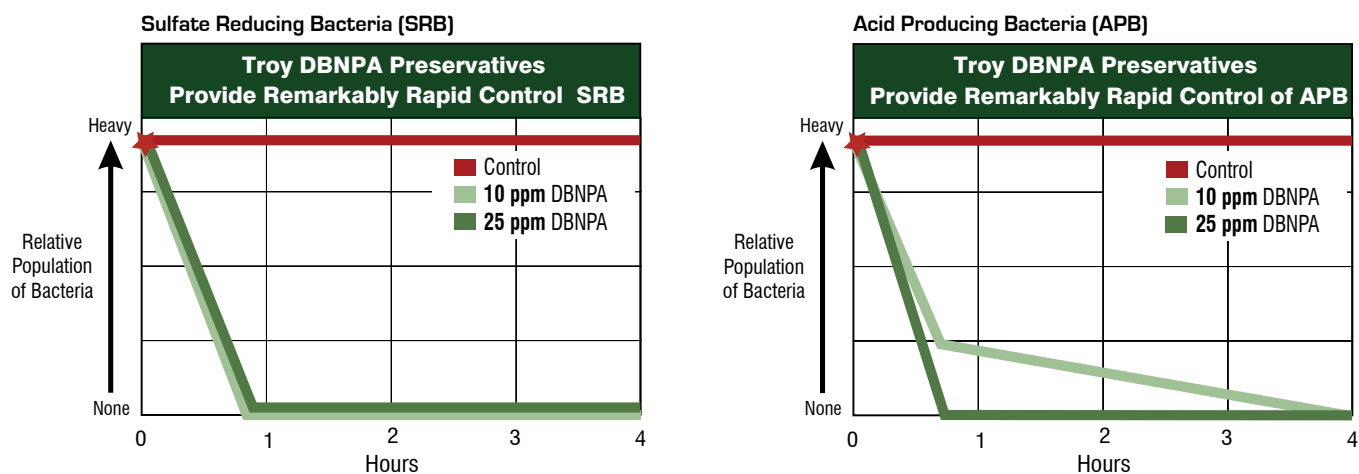
Performance Evaluations: Topside

Water preparation in the early stages of extraction is vital in order to prevent or limit the introduction of bacteria into assets. Untreated topside water can lead to corrosion and souring, as well as compromise later stages in the extraction process. Additionally, ineffective preparation can lead to higher treatment costs in later stages.

Evaluations were performed to gauge the efficacy of the Aquamate™ biocides best-suited for topside water

preparation. Water samples from oil & gas operations were inoculated with two different types of bacteria: sulfate-reducing and acid-producing. Samples were treated with different levels of DBNPA, and the relative population of bacteria was measured at three time intervals in order to observe speed-of-kill. As the results show in Exhibit 1, the Aquamate™ DBNPA biocides offered highly effective, rapid control of bacteria at extremely low use levels.

Exhibit 1



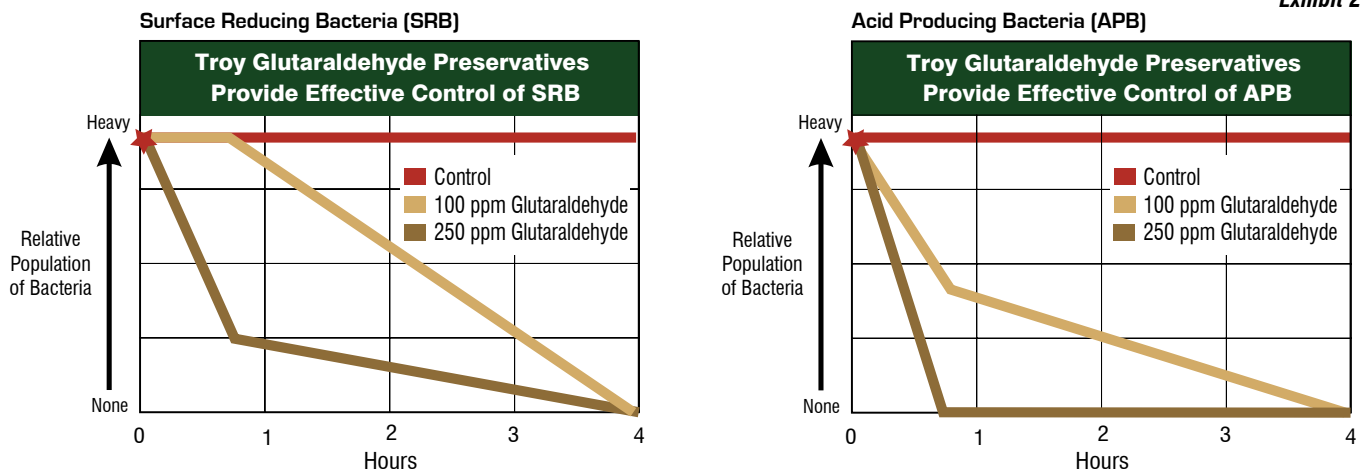
Performance Evaluations: Injection Well

Water injection into the well not only introduces bacteria populations, but also creates a subsurface, or downhole, environment ideal for continued bacterial growth. This is also a major concern for hydraulic fracturing operations. Biocides are essential in the water injection process in order to reduce the population of bacteria introduced, as well as to provide initial control in the subsurface environment.

Evaluations were performed on downhole water samples collected from oil & gas operations to gauge the efficacy of

Troy biocides best suited for protection during this stage of extraction. In Exhibit 2, water samples were inoculated with two different types of bacteria: sulfate-reducing and acid-producing. Samples were treated with different levels of biocide, and the relative population of bacteria was measured at three time intervals in order to observe speed-of-kill. As the results show, Aquamate™ Glutaraldehyde biocides offered effective initial control of bacteria.

Exhibit 2

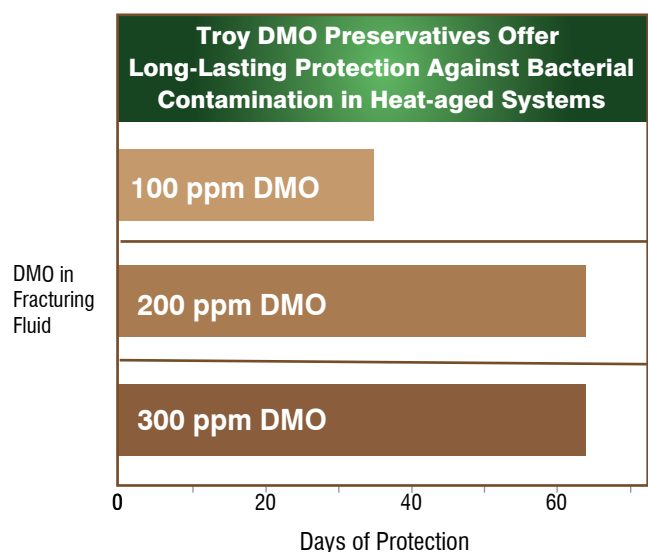


Performance Evaluations: Reservoir

Just as in other industries in which storage tanks pose contamination risks, the reservoir environment in oil & gas extraction is particularly prone to bacterial growth. Corrosion, souring, and bio-film formation are just some of the potential ramifications of inadequately treated reservoirs. The Troy biocide actives best-suited for protection of reservoirs are those that provide long-term efficacy, as well as the durability to withstand higher temperatures and pressure. While some biocides are engineered for quick-kill, such as those recommended for topside and well use, these biocides are intended to remain effective over a period of months.

Evaluations were performed on water samples collected from oil & gas reservoirs to gauge the efficacy of the Aquamate™ biocides best suited for protection during this stage of extraction. Water samples were inoculated, then treated with three different levels of biocide. The relative population of bacteria was measured at three time intervals in order to observe duration of protection. As the results show in Exhibit 3, the Aquamate™ DMO biocides offered more than 60 days of protection, depending on use levels tested.

Exhibit 3



Oilmate™ Hydrogen Sulfide Scavengers

With more stringent regulations reducing allowable emissions of hydrogen sulfide (H₂S), the use of effective H₂S scavengers is becoming increasingly important. Troy offers its advanced Oilmate™ portfolio of catalysts used for H₂S scavenging in oil & gas extraction and processing, as well as in natural gas extraction. From drilling fluids to the separation, treatment, and shipping and handling of crude oil, minimizing exposure to H₂S is essential.

Downstream

H₂S levels in untreated asphalt can be much higher than in crude oil, and without proper management, the risk of exposure to this toxic gas can be dangerously high. Because of its high viscosity, asphalt is often stored and processed at high temperatures (350°F/175°C), which further promote H₂S formation.

Natural Gas

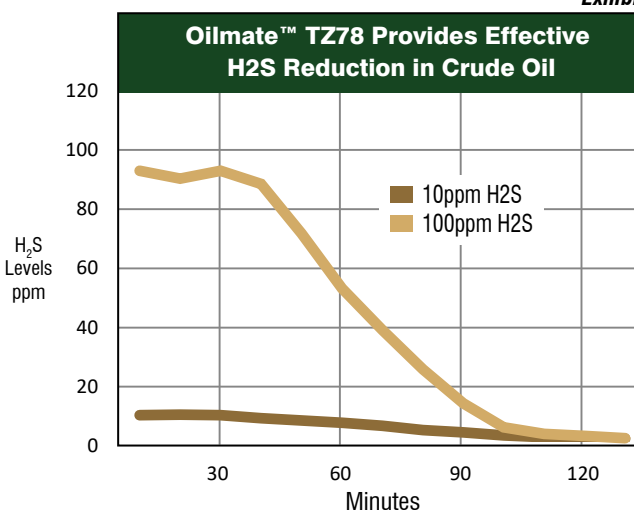
H₂S must be removed during the 'sweetening' process of natural gas for health, safety, and environmental reasons, as well as to prevent impurities in the energy source.



Oilmate™ Performance Evaluations

The chart in Exhibit 4 shows the efficacy of Oilmate™ TZ78 in the reduction of high and low levels of H₂S in 'sour' crude oil. Readings were taken every ten minutes to measure the levels of H₂S gas coming out of the crude sample in the vapor outlet line, once the Oilmate™ scavenger was introduced. As the results show, Oilmate™ TZ78 provided excellent and rapid reduction of H₂S levels in the crude oil samples, with eventual readings of near-zero at two hours.

Exhibit 4



Hydrogen Sulfide Scavengers

Products	Topside/Injection Well	Reservoir	Transportation	Typical Dose Efficacy (%)	Comments
Oilmate™ TZ78	•	•	•	0.01 - 0.03	Excellent compatibility with oil & natural gas systems
Oilmate™ TZ70	•	•	•	0.015 - 0.035	Excellent compatibility with oil & natural gas systems
Oilmate™ TZ50	•	•	•	0.02 - 0.06	Excellent compatibility with oil & natural gas systems. Suitable for low temperature environments
Oilmate™ TZ20	•	•	•	0.04 - 0.12	Excellent compatibility with oil & natural gas systems. Suitable for low temperature environments

Multifunctional Technology

Products	Topside/Injection Well	Reservoir	Transportation	Typical Dose Efficacy (%)	Comments
Troychem™ ED95	•	•	•	0.01 - 0.03	Non solid-forming
Troycat™ Zinc 16	•			0.01 - 0.03	Multi-purpose, with excellent compatibility & fast-acting performance
Troycat™ Zinc 16NEO	•			0.01 - 0.03	Low water-leaching, with easy incorporation
Troycat™ Zinc 18	•			0.01 - 0.03	High capacity, high viscosity





The Gold Standard for Performance

Services

As a Performance Partner, Troy offers a variety of services to support our product line of preservatives and additives to meet customer needs and provide market solutions.

Troy invites you to take advantage of the Troy services that can help you achieve your market objectives.

- Technical Service representatives can provide formulation assistance, product evaluation, and microbiological, analytical, and field testing to assist you in developing an optimum formulation that meets your product objective.
- Regulatory support is offered globally with regional and national expertise to meet your needs.
- R&D scientists work to anticipate future industry needs and develop innovative technology. Contact your Troy representative to discuss your unique requirement that may not be met by materials currently on the market. In fact, Troy may have just what you need already under development and if not, may be able to work with you to achieve your objective.
- A global supply network is in place to ensure product availability and fast delivery. Contact your local representative to ensure the product you need is available when you need it.

Contact your nearest Troy representative for immediate assistance or visit us online at www.troycorp.com. When visiting the website, become a registered user to obtain access to a wide range of resources.

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