FOLMAR
A Corrosion Protection solution for drinking water distribution piping systems
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Protection of the drinking water distribution piping system

Drinking water quality is affected by many factors related to the condition of the distribution piping system. Both the water quality and the health of the infrastructure are affected by corrosion reactions, which can also cause rusty water.

The water usually travels far from source to tap. While the purpose of all water treatment processes is to remove and reduce contaminants originating in the source water, new contamination can be introduced during this transport.

The distribution system is susceptible to considerable corrosion by aggressive source water, chlorine and chloramines. By using Folmar™ technology, corrosion is inhibited throughout the system, improving water quality and infrastructure lifespan.

The Folmar™ technology forms a closed; waterproof layer on top of the corrosion and prevents further reaction by separating the surface from aggressive water, carbonic acids, chlorine and chloramines. This corrosion inhibition technology prevents further changes to the thickness of the pipe wall.
1. Deposits form on pipe walls.

2. Deposits corrode the pipe material.

3. Bulky layers form on pipe walls.

4. Corrosion process turns the water brown.

5. FOLMAR™ forms a closed, waterproof layer on top of the corrosion products and prevents further reactions between the water and the deposits. Changes in the pipe wall thickness are prevented.
Technology

Silicates have a wide range of uses. In this particular application, water-soluble alkali silicates are used and react specifically with different metal surfaces. Our technology was developed to take advantage of these chemical reactions. Folmar™ uses negatively charged and sterically hindered monomer and polymer silicates, which are introduced to the drinking water distribution system using special dosing pumps. This method uses a very small amount of product; only about one ounce per 1000 gallons.

The product reacts chemically with the surfaces of the pipe metal and gets absorbed in the anode area, where it forms a thin monomolecular film and stops the formation of ferrous hydroxide. This film protects the metal against further corrosion. Instead of forming iron and rust deposits, a corrosion barrier film is formed on the inside of the walls of the piping system.

Microscopic and x-ray analysis show 2 layers on the interior surfaces on the drinking water piping system. Silicates form the outside layer on top of a layer of corrosion. As soon as the hydro-metallic oxide layer is covered with the silicate film, no further deposits are able to form.

The silicate layer does not continuously develop; once the thin layer has completely formed, the growth stops and a significantly reduced dosage can be used to maintain it. The film is an electrical insulator and stops the electrochemical reactions that cause corrosion. Because the layer is and remains extremely thin, it will never cause reductions in water flow. Folmar™ also contains small amounts of polyphosphates, which protect the cathode areas as well. These ingredients are tuned of optimal synergy and provide the best protection for all surfaces against corrosion and deposits.

Folmar™ dosing station with supply tanks. System services 20,000 inhabitants.
**Information**

Mixing with water: Under any conditions

Contamination: Even highly diluted Folmar™ prevents the growth of biofilm

Quality: ISO 9001 certified

Dosing: 5-10 ppm with water quality monitoring before and after

Dosage Control: Water flow quantity-based dosing pump. The maximum doing should not exceed 50ml per cubic meter of water.

Storage: In sealed plastic containers between 4 - 40 °C (40 – 104 °F)

Delivery: Jugs or totes ranging from 1 to 250 gallons.

Analytics: SiO₂ and PO₄³⁻ content in drinking water.

**Timeline of Investment, Water Quality, Corrosion, Microorganisms**
Figure 1
Postulated electrochemical reactions of iron in water, with and without added silica

Figure 2 and 3
Silicate corrosion inhibitor
Protection of Metals

FOLMAR™ treatment is used for corrosion control in any type of metal pipes found in the drinking water distribution system.

The best results have been observed for the following metal pipes and fixtures:

1. Iron and ferrous metals
2. Steel
3. Stainless Steel
4. Galvanized Steel
5. Red Brass
6. Yellow Brass
7. Copper
8. Lead
9. Bronze
10. Nickel Alloys

Protection of Cement and and Similar Materials

Dosing of FOLMAR™ to water systems can protect cement and similar materials from long term deterioration. The silicate reacts with available calcium and forms insoluble calcium-silicate compounds.

FOLMAR™ dosing can reduce the breakdown of asbestos-cement surfaces, both prolonging the lifetime of the material and minimizing the release of asbestos fibers.

Safety

FOLMAR is not explosive or flammable and not classified as hazardous material. Due to the moderate alkalinity, care should be taken to prevent contact with eyes and skin.

Wet FOLMAR spills are slippery and will dehydrate to form glass-like films. It is therefore recommended to immediately rinse minor spills with water.
Why it makes sense to use FOLMAR™:

- Avoid corrosion and red water
- Prevent Biofilm growth
- Minimize water main breaks
- Extend infrastructure lifetime
- Reduce ongoing maintenance costs
- Postpone capital investments
- Buy time to optimize expenditures for pipeline maintenance
- Reduce chlorine demand and DPB production
- Safeguard high water quality standard
- Improve taste and odor
- Protect customer’s investments in hot water heaters
- More satisfied customers
- Improve public relations

Folmar™ dosing point into the pipe system
Used pipes with and without FOLMAR™:

FOLMAR™ Stations:
How does Folmar™ work in corroded pipelines?

It is well established that silicic acids and their sodium compounds have outstanding corrosion inhibiting properties.

Silicates contain silicic acids in ionized or colloid form and can be polysilicates, metasilicates or sodium silicates.

The formulas and molecular structures are the result of years of research and experimentation following the highest of German Engineering Standards.

Folmar™ guarantees outstanding results in protecting drinking water systems from corrosion.

The special silicate compounds in Folmar™ react with the materials in the water that contribute to water hardness and form hard, crystalline silicate protective layers.

Simultaneously, Folmar™ reacts with dissolved carbon dioxide (carbonic acid) and other compounds and forms, relative to the hard crystalline layers, softer, elastic, gelatinous and very homogenous protective layers.

The first reaction progresses according to an established mechanism and forms the crystalline silicate protective layer. Orthosilicic acid, making up only a small portion of Folmar™, gradually condenses into higher molecular weight compounds by reacting with dissolved oxygen and forming orthodisilicic acid.

The reaction continues in flowing water through several developmental steps, so to speak. Metasilicic acid chains are formed with ring, chain and ribbon structures and result in the leaf structure of polysilicic acid. The reaction ends in the formation of highly polymerized lattice structure of silicon dioxide.

This silicon dioxide is completely insoluble in water because of the atomic bonding in the lattice structure. Several metal ions, as well as water are incorporated into the leaf structure during the intermediate phases of reaction, for example magnesium, sodium, potassium, calcium, aluminum, iron and possibly also manganese.

This material exchange continues to build throughout the formation of the lattice structure. As the leaf structures grow, water eventually ceases to be incorporated and is instead expelled as the lattice structure takes shape.

The endpoint of the reaction yields a lattice structure of silicon dioxide that is essentially nonreactive and will practically only be vulnerable to hydrofluoric acid.
As stated, the reaction mechanism between the silicates and the carbonic acid in the water will simultaneously form a homogenous gel structure on the walls.

It should be noted that proper dosing of FOLMAR™ in conjunction with adequate flow rates are important for the ensured formation of the gel structure.

The development of FOLMAR™ yielded unique silica bonds that are not structurally altered by the additional bonding of phosphate. The experiments that were conducted show that phosphates with the longest possible chain linkages give the best results.

Through the special bonding of silica and phosphate found only in FOLMAR™, optimal corrosion inhibition is achieved even in situations with unfavorable water quality.

**FOLMAR™ is effective in corrosive water environments**

During primary corrosion steps in aggressive water, metal hydroxides are formed and are the carriers of positive charge. The positively charged metal hydroxides absorb the negatively charged silicic acids with the help of other components. A gelatinous and homogeneous protective film is formed with the inclusion of water hardness contributors. The formation of the protective film is to be understood as an absorptive precursor and is dependent on the presence of metal oxides and hydroxides.

The protective gel film hampers electrochemical corrosion by perturbing the flow of current at both the anodic and cathodic half reaction sites. Through the action as an electrical insulator, the electrical current responsible for corrosion is interrupted and the formation of soluble metal ions is halted. The corrosion is practically completely stopped, aside from a small amount that is not avoidable with the technology and materials of today. FOLMAR™ is a liquid, highly active and highly concentrated multicomponent product based on unique silicate technology, manufactured to food quality standards.

There are additional advantages to using FOLMAR™:

The formation of cathodic regions on metal surfaces is stopped by the marked and uniform increase in the surface alkalinity.

Localized corrosion cells are eliminated by the doing of FOLMAR™. Lime and mineral deposits are counteracted during longer periods of stagnation.

The intensive formation of a protective film with FOLMAR™ is dependent on the formation of positively charged metal hydroxides, which inevitably occur in oxygen-containing drinking water systems.
The naturally occurring metal hydroxides on pipeline and storage facility walls absorb the negatively charged silicic acids in FOLMAR™. A tightly sealed, homogenous metal-gel protective film is formed under the limited influence of water hardness contributors.

This gelatinous film is 0.08 – 0.16 mil thick and counteracts the electrical corrosion currents that are responsible for the conversion of useful infrastructure metal into soluble metal ions – the products of corrosion.

This technology has been successfully used in German drinking water systems since 1984. There have been no problematic changes in the water.

The determining factors for the successful implementation of FOLMAR™ dosing is the use of precise and proper dosing technique with regular monitoring and avoidance of stagnation.

Folmar™ is approved and certified in many countries all over the world.
Για την βελτίωση της ποιότητας του νερού σε πισίνες και spa.

Επεξεργασία νερού CettaOxyd & CettaClean.

Καινοτόμος επεξεργασία νερού για κολυμβητικές
dεξαμενές και spa. Μειωμένο κόστος λειτουργίας από 20% εως 50%,
με κρυστάλλινη ποιότητα νερού και άριστη υγιεινή.

Οι κολυμβητές αισθάνονται, βλέπουν, μυρίζουν και
αναγνωρίζουν την καλύτερη ποιότητα νερού.

FilterActiveClean

Καινοτόμος τεχνολογία για τον καθαρισμό του
περιέκτη και του μέσου διήθησης που αφαιρεί τις
επικαθήσεις, το βιοφίλι και αναζωογονεί τα φίλτρα
προσφέροντας σημαντικό οικονομικό όφελος.

TankActiveClean

Καινοδομος τεχνολογία για τον καθαρισμό της
κολυμβητικής δεξαμενής. Πλήρης αφαίρεση
ανόργανων και οργανικών επικαθήσεων.

Ποιοτικό νερό
σημαίνει
Ποιοτική Ζωή
Τεχνολογία, Προϊόντα και Υπηρεσίες για την βελτίωση και διατήρηση της άριστης ποιότητας του πόσιμου νερού.

**TankActiveClean**
Εξελιγμένη τεχνολογία για τον καθαρισμό δεξαμενών πόσιμου νερού, αφαιρώντας πλήρως το σύνολο των επικαθήσεων, μικροοργανισμών και του βιοφίλμ.

**FilterActiveClean**
Καινοτόμος τεχνολογία για τον καθαρισμό του περιέκτη και του μέσου διήθεσης που αφαιρεί τις επικαθήσεις, το βιοφίλμ και αναζωγονεί τα φίλτρα προσφέροντας σημαντικό οικονομικό όφελος.

**PipeActiveClean - Desinfection**
Νέα τεχνολογία, διεθνώς κατοχυρωμένη στον Παγκόσμιο Οργανισμό Πυκνωτικής Ιδιοκτοσίας, για τον καθαρισμό δικτύων πόσιμου νερού.

**Mösslein Superior Purification**
Πλήρως αυτοματοποιημένο σύστημα παραγωγής υψηλής ποιότητας πόσιμου νερού.

**CettaClear for flocculation**
Bioflocculant
An alternative in replacing polyacrylamide
Certified Partner for Greece:

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