

THE FINEAMIN TECHNOLOGY

This technology offers a tenacious, hydrophobic corrosion resistant barrier protection between metal and water.

In modern steam boilers installations, often mixed metallurgies exist.

This reality makes the choice of water treatment regime critical to achieve efficient and reliable plant operations.

These practical demands are compounded by stricter environmental regulations and increased pressure to seek, evaluate, and apply non-toxic treatment alternatives for the steam and cooling water systems.

Conventional treatment programs have been applied with varying degrees of success for a long time and will no doubt continue for many years to come.

There exists however, an always increasing number of plant engineering managements, who when faced with the practical limitations associated with use of conventional water treatment chemistries and the very specific and direct negative consequences to longevity of capital plant, are now demanding improved treatment performance, and accept no risks to operator's health and safety, and reduced toxicity to our environment.

The **FINEAMIN** technology is a multi-component conditioning chemical for the complete boiler water-steam reticulation system. Each individual component of the polyamine surface active formulation synergistically assures unequalled levels of metal protection in all steam, condensate, and water sections.

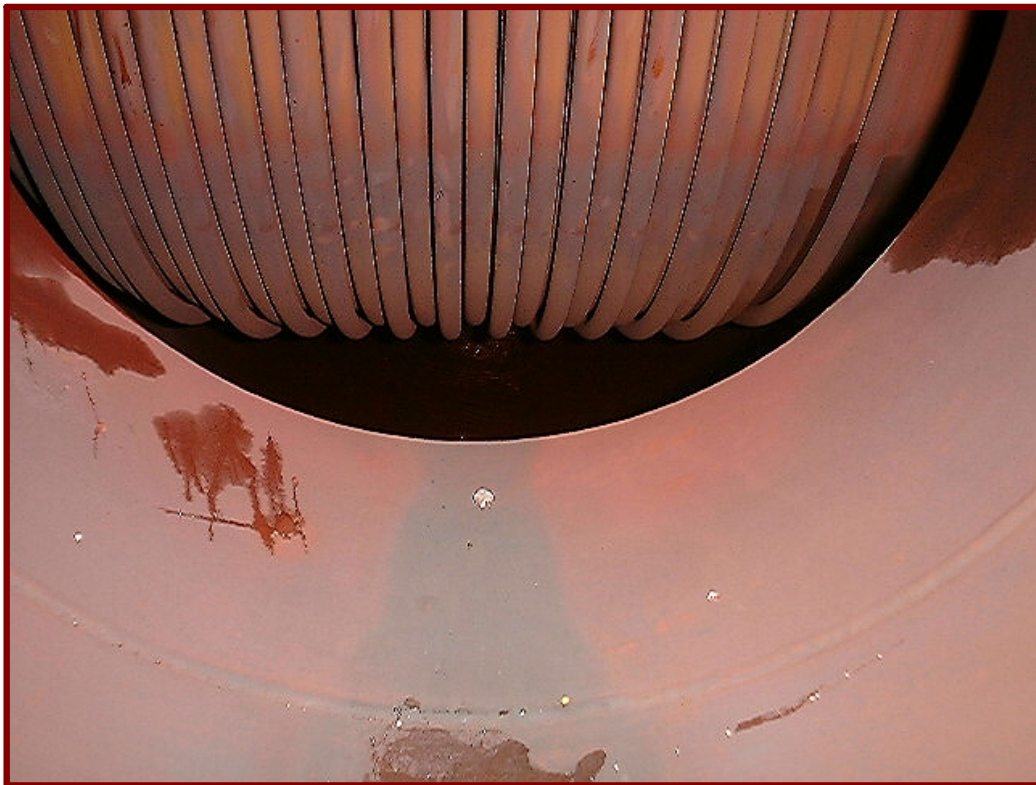
Corrosion inhibition and unmatched levels of metal passivation remains the cornerstone of the **FINEAMIN** technology.

The **FINEAMIN** technology offers superior treatment performance in all boiler pressure ranges and in all closed cooling circuits at all times meeting and often eliminating all the limitations know to affect commodity treatment regimes, whilst achieving favourable economics of steam production.

We can tailor the **FINEAMIN** technology for each individual customer by blending different formulations, and thereby ensure at all times that we meet and improve your capital plant treatment needs.

Low pressure Preheater heat exchanger

**The water drop shows and proves the existence of an hydrophobic protection
The heat transfer is improved.**



The **FINEAMIN** technology is a further technical advancement in metal passivation and scale/deposits dispersion technology.

The **FINEAMIN** technology was developed with the sole view of assuring industries demands, both now and well in to the future, for a performance and truly competitive alternative to the all existing water treatment systems.

The **FINEAMIN technology is the fruit of 30 years of technical and related practical experience**

The **FINEAMIN** technology offers the discerning engineers with ever increasing expectations for plant protection, reliability and safety and who demands additional metal protection and value added performance benefits, a truly viable, surface active, hydrophobic anodic protection of metal for all sections of the steam water cycle.

The **FINEAMIN** technology is a multi-component cationic, anodic surface active mixture of aliphatic protective polyamines and dispersants containing a blend of volatile alkalizing amines, the formulations components working in a synergistic way to ensure thermal stability and the performance passivation of metal in the entire steam water cycle.

The formulation is unique in its ability to passivate metal by the formation of a magnetite containing hydrophobic, non wettable protection

All the **FINEAMIN** product formulations are environmentally compatible and under typical industrial dosages are non toxic and possess on all steam, water side surfaces exposed to electrolyte, preventing corrosion mechanisms and the adherence of deposits.

The unequalled metal passivation properties remain the cornerstone of the **FINEAMIN** technology.No threat in handling and effluents sent to drain.

The **FINEAMIN** technology allows the formation of a surface active; thermally stable organic, magnetite containing barrier film, even on copper surfaces, thus ensuring successful protection of alloys.

Protection is ensured by separation of the metal from electrolyte and residual oxygen, thus terminating the anodic reaction.

This action has notable benefit in life extension of plant in these sections, in addition to significantly lowering the liberation of metals of different electrode potential that may potentially lead to deposition of multi-metallic scales and thus promote galvanic corrosion.

The **FINEAMIN** technology is non-stoichiometric in dosage and can thus accommodate many of the feed water upsets encountered in day-to-day operations without negative consequence or collateral damage to capital plant.

The testing of the residual of the chemical is not required, and is not a part of your Operator's routine duties. Dosages are not adjusted based on residual testing or contaminant levels, rather set for the specific flow rates associated with your particular facility.

The **FINEAMIN** technology is a viable performance alternative to commonly employed, conventional commodity treatments like hydrazine, ammonia, phosphates, chelants, all

oxygen scavengers, and volatile neutralizing amines and thereby avoids all of the limitations and the failures known to effect these commodity treatment.

The **FINEAMIN** technology meets the unique challenges and demands of successful boiler & cooling water treatment, namely:

Unequaled prevention of corrosion in all steam/water/condensate sections of plant.

Prevention of scale and/or deposits and improved efficiency of heat transfer.

Single pack, multi-component blended product, single injection point assures ease of application

Improved economics of the plant's water treatment program.

Technical support and service.

A few of the **FINEAMIN technologies' benefits to industry are:-**

Single pack, multi-component products ensures ease of dosing.

Unequaled passivation of entire steam water circuit.

****FINEAMIN** does not contribute to boiler solids, and therefore promotes reduced fuel, reduced water usage & lower effluent discharge.**

****FINEAMIN** is non-toxic and environmentally compatible.**

The accumulative and professional knowledge and experiences of the well respected regulatory and controlling authorities, like:

The German TÜV (boilers < 68 bar), the VGB (boilers > 68 bar)

The American Energy and Power Research Institute EPRI

The contaminant and management guidelines they offer to industry, should be embraced.

It is the responsibility of every professional engineer in any market or industry sector to respect and with dedicated effort, work toward achieving these contaminant guidelines.

Water and steam side corrosion is well known and mechanisms understood

"The origins, causes and mechanisms of corrosion and waterside fouling are all known and well understood, yet failures and reduced plant availability continues to be a problem and one that is increasing annually" - Dr. B Dooley - EPRI - USA.

Erratic and often elevated corrosion rates, deposition of contaminants in both the boiler and after boiler sections, decreased heat transfer efficiencies, unfavorable increased fuel to steam ratios, increased environmental discharge due to boiler blowdown and effluent from demineralization plant regeneration etc.

It is the responsibility of every chemist in industry to ensure the maintenance of a thin, competent, uniform and stable magnetite layer on all waterside and steam side surfaces.

Magnetite: how the FINEAMIN technology maintains and improves your magnetite oxide protection

Magnetite is an oxidized inorganic, crystalline corrosion product that shows signs and tendencies to build, to grow, to become thicker.

This action will impair the heat transfer. Under reducing conditions found on boiler water-side surfaces, a smooth, black, tenacious, dense magnetite layer will naturally grow.

Magnetite forms by direct reaction of water with the tube metal. Usually, coarse, particulate magnetite will not tenaciously adhere to surfaces unless intermixed with other potential scale forming deposits. Scraping small amounts of this material from surfaces and exposing these particles to a magnet usually indicates whether iron oxide as magnetite is present.

Hematite formation, on the other hand, is favored at somewhat lower temperatures and higher oxygen concentrations. Hematite is a binder species that tends to accumulate and hold other materials in the deposit. Hematite can be red if formed where oxygen concentrations are high.

It is important that the existing, fine and competent magnetite surface not be disturbed and that existing be maintained without build, this for fear of reduced heat transfer efficiency and the increased likelihood or need for eventual acid or chemical cleaning of the boilers.

The ability of the FINEAMIN technology to form a significantly improved, more dense and competent structured hydrophobic oxide at the metal surface is without question better than that produced by hydrazine

Boiler water carry-over, turbine fouling, erosion and corrosion

Deposits are able to form anywhere in the presence water or steam. Furnace wall and screen tubes are usually the most heavily fouled, roof and floor tubes will often also contain deposits.

Superheaters frequently contain deposits that are formed elsewhere and are carried into the system by boiler feed water used for attemperation. Though successful make-up water pre-treatment plants can be expected to produce high quality, low contaminated make-up waters to boilers, often naturally occurring humic acids and organic low weight molecular acids may prove problematic to steam and first formation of condensate due to their volatility and concentration in the early condensate formed. In installations operated on high quality make-

up water the predominant composition of deposits is due to corrosion and re-deposition of corrosion products and oxides of the same.

How FINEAMIN protects your whole plant

The FINEAMIN technology is un-equaled in its ability to passivate metal and thus lower significantly, the generation of corrosion products and subsequent deposit formation. Assuming good quality, low contaminated make-up and condensate water, deposits found in economizers are usually due to deposition of corrosion products that are formed in other pre-boiler, condensate and feed water tank areas. The initial cause of the deposits being due to corrosion, thus being in violation of the primary goal of successful boiler water treatment, the prevention of corrosion, & avoid wastage of metal and reduced availability of plant due to the same.

The FINEAMIN technology has a non-stoichiometric reaction with waterborne contaminants and water / electrolyte exposed heat transfer scale contaminants. The technology has the ability to accommodate in many of the practical instances, varying concentrations of feed water contaminants without negative consequence to capital plant. Existing deposits are slowly and progressively removed, dispersed and discharged by controlled boiler blowdown. The heat transfer surfaces are exposed to the cationic surface active, thermally stable organic, magnetite containing barrier film, that offers protection against additional corrosion mechanisms by stopping the anodic reaction and preventing the adhesion of additional deposits.

Deposits are usually heaviest on the hot side of steam-generating tubes. Because of steam channeling, DNB (departure From Nucleate Boiling) accumulations are often heavier on top portions of horizontal and slanted tubes. Because deposits tend to concentrate in the hottest regions of steam-generator tubes, those tubes near the bottom rear wall of boilers using chain-grate stokers, and screen tubes are susceptible to deposition. Coarse particulate matter is likely to be found in horizontal runs and where flow velocity is low.

Waterborne deposits usually enter the economizer from sources such as the returned condensate (normally not polished). Oxides formed as a result of elevated oxygen concentrations before or inside the economizer may be moved and deposited in the economizer.

In many installations, magnetic separators are installed in the feed water line to assist preventing suspended magnetite entering the feed water heater and economizer sections. The FINEAMIN technology achieves and maintains steam quality as per international guidelines by assisting with stability of boiler / steam interface evaporation and lowering considerably the concentration of corrosion products generated and transported through the steam water cycle.

With FINEAMIN your steam is PURE

Superheater deposits are caused by carryover of boiler water, sometimes associated with foaming or high water levels. Such deposits will usually be concentrated near the superheater inlet or in nearby pendant U-bends.

Contaminated attemperation water can also add deposits immediately downstream from the introduction point. When the introduction of boiler resident or thermally insoluble contaminants enter the steam (superheated sections) these contaminants are driven from solution and, often possessing considerable mass, have significant negative impact on turbine blades through erosion and corrosion. Chip scale and exfoliated oxide particles can also be blown through the superheater, accumulating in pendant U-bends, or even more seriously they can be carried into turbines resulting in erosion and deposition / fouling of the turbine blading.

In installations that enjoy high condensate ratios, the treatment effectiveness, both volatile and non-volatile is of paramount importance in achieving metal passivation, termination of corrosion, corrosion product generation and transport / re-deposition of the same in other sections. To assist with capture of this contaminant removal requirement, historically the challenges have been countered by the high installation and operational costs of condensate polishing plants, these designed to remove contaminants generated by process contamination and circuit corrosion

With the FINEAMIN treatment, you reduce the corrosion rate, improve the plant efficiency and save money for maintenance, energy and chemicals.

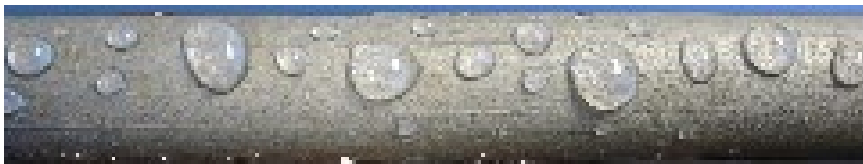
Our group experiences have shown installations operational on the FINEAMIN technology with significantly lower usage of condensate polishing plants, making their predominant purpose to act as security against process contamination. This philosophy is in keeping with our un-equalled, un-matched technological product performance ability to substantially reduce corrosion and maintain a clean heat transfer, thus embracing the desire to rather treat the cause (preventing corrosion) than to practice symptomatic treatments.

Boiler deposits come from four sources: water borne minerals, treatment chemicals, corrosion products (pre-boiler and boiler), and external contaminants. Deposits from these sources may interact to increase deposition rates, to produce a more tenacious layer, and to serve as nucleation sites for deposit formation. Such species include (but are not limited to) metal oxides, copper, phosphates, carbonates, silicates, sulfates, and contaminants, as well as a variety of organic and inorganic compounds.

The FINEAMIN technology ensures successful steam water alkalization throughout the entire steam water cycle. Due to the nature of the multi-component formulation, the dosing regime will typically contain thermally stable organic aliphatic polyamines, dispersants and volatile alkalizing amines, offering pH control and unequalled levels of metal passivation in all sections

With FINEAMIN, you solve the problem of copper alloys corrosion

Copper corrosion in brass or yellow metal areas like condenser tubes is believed to be the result of excessive ammonia, used as a volatile treatment for steam and condensate alkalization. Since ammonia is extremely volatile and will preferentially be absorbed in cooler water, its predominant concentration in the condenser waters is expected. Corrosion of brass or copper alloys is not normally of concern unless in the presence of residual oxygen, the latter required for oxidation of the brass thus allowing the ammonia to corrode and form the ammonia, copper cuprate complex. Typically corrosion of brass or copper condenser sections is a sign of the existence of un-scavenged oxygen and ammonia. Copper is deposited either by direct exchange with iron (cementation reaction) or by reduction of copper oxide by hydrogen evolved during corrosion. It is common to see large, reddish stains of elemental copper intermixed with corrosion products such as magnetite and hematite. The reddish color superficially resembles hematite. Elemental copper can be easily discriminated from other materials by a silver nitrate test. A single drop of silver nitrate will precipitate white silver crystals almost immediately if elemental copper is present. Copper oxide formed under boiler conditions is black and nonmagnetic. Galvanic corrosion associated with copper deposits (either elemental copper or oxide) is exceedingly rare in well passivated boilers.



The FINEAMIN technology allows formation of a cationic surface active, thermally stable organic, magnetite containing barrier film, even on copper surfaces, thus ensuring successful protection of alloys. Protection is ensured by separation of the metal from electrolyte and residual oxygen, thus terminating the anodic reaction. This action has notable benefit in life extension of plant in these sections, in addition to significantly lowering the liberation of metals of different electrode potential that may potentially lead to deposition of multi-metallic scales and thus promote galvanic corrosion.

With FINEAMIN, you keep the optimal conditions in the all plant

The volatile ratio and steam / water alkalization characteristics of the FINEAMIN technology is far superior to that of ammonia, being present in all vapor and condensing stages, compared to ammonia where it favors existence mainly in cooler water / condensate sections. Typical water sample collection systems force cool samples to < 30 oC and in so doing drive the

ammonia into the aqueous phase, offering false security of pH when in fact, reality would show first formation or early condensate pH's to be considerably lower..

All deposits are undesirable and ultimately result from poor water-chemistry. Correct water treatment can reduce and totally eliminate deposition. The general rules of proper water treatment are not so obvious. Water-chemistry upsets and operational changes should be minimized.

Deposition can be avoided by operating at or slightly below design loads and ensuring that all boiler components are functioning properly. The most important boiler operating characteristic influencing deposition is firing practice. Also, elimination of hot spots, correct monitoring of water levels and maintenance of a constant load are necessary to avoid deposition. In addition, correct burner position, well-considered fuel adjustments, and appropriate blowdown practices contribute to reduced deposition.

Deposits rarely contain only a single compound. Chemical scale analysis is often necessary to determine the amount and variety of each chemical species. Soluble species will be washed away when the boiler cools and steam generation ceases. Washing sometimes results in laboratory analysis that often do not accurately reflect in-service compositions. It is usually safe to assume that concentrations of highly soluble species are underreported in laboratory analysis. The presence of any highly soluble material is often sufficient to prove DNB – Departure From Nucleate Boiling. The amount, composition, and stratification of deposits are often altered near a rupture site. Escaping fluids may remove deposits near the rupture. Occasionally, fire-side combustion products may find their way onto internal surfaces near the rupture. Weight determinations for deposits near bulged or ruptured surfaces are usually underestimates of actual in-service values

With [FINEAMIN](#), you respect the international Guidelines

Every installation should strive toward meeting the stipulated International Guidelines, thus attaining the best possible protection of superheater, turbine and condensate sections. Under normal, stable operation, steam cation conductivity should ideally be maintained at $\pm 0,2$ $\mu\text{S/cm}$. Unfortunately, in many installations, the combined and accumulative effect of inherent organic foulants present in natural water sources susceptible to seasonal change, acid degradation products of many conventional chemical treatments and pollution of the condensate by process contaminants, in addition to the potential existence of corrosion mechanisms - all contribute to reduced steam and water quality management.

The [FINEAMIN](#) technology is typically an AVT (all volatile), fully organic program, sometimes installation specific formulations do not increase the salinity / conductivity of the boiler, typically encountered when using conventional inorganic phosphate, sulphite, alkali treatment regimes. Since the technology is able to lower the generation of suspended solids by improved corrosion protection of metal and does not contribute to boiler conductivity, substantial reductions in blowdown of boilers can be enjoyed, typically reductions exceeding 60 % can be achieved. These savings promote notable reductions in fuel, water and environmental discharge, the economic benefit of the same often exceeding the cost of the technology itself.

The technology is environmentally compatible and enjoys a > 80 % natural degradation in the environment. For more information on this or any other technical aspect of the technology, please contact us with your questions and or/comments.

The management of silica in boilers is often the predominant contaminant determining blowdown frequency and securing acceptable volatile silica concentrations in the steam to turbine. Typically, International Controlling Guidelines should be adhered to based upon the pressure and operational conditions of the boiler and as dictated by the relevant turbine manufacturer. Under normal conditions, where make-up water is used that contains residual silica, boiler silica concentrations should be carefully controlled in the sodium silicate form (achieved with phosphate or sodium hydroxide) to prevent silicic acid carry-over into the steam and condensate. Practical achievements & experiences have shown the [FINEAMIN](#) technology able to equal and sometimes offer improved control of silica management whilst still respecting accepted concentration limits for steam volatile silica.