

## **ETI Cleaning & Gas Freeing Solution™**

Our proprietary ETI Cleaning & Gas Freeing Solution™ utilizes a strong buffer system in combination with appropriate chelants and surfactant in order to: neutralize polythionic acids on contact, dissolve all scales found in nearly any refinery process unit, and emulsify any hydrocarbon residue contained in a system. The mixture also renders pyrophoric substances inactive and has proven excellent for polymer removal. Additionally, Benzene and other regulated air contaminants have been absent from the vapor spaces of vessels opened after these cleanings.

ETI Cleaning & Gas Freeing Solution™ is effective, non-toxic, non-flammable, non-hazardous, and non-corrosive. It does **not** make **stable** emulsions. Any emulsified hydrocarbons can be recovered in the refinery's API separator and in most locations the solution can be drained directly to the plant sewer with no ill effect on the wastewater treatment plant. Thus, ETI Cleaning & Gas Freeing Solution™ not only saves valuable time, but also virtually eliminates waste disposal costs.

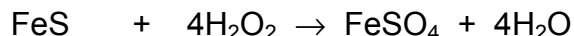
## **ETI Oxidizer #1™**

In addition to our flagship product, we now offer a novel oxidation technology which includes all of the advantages of Hydrogen Peroxide with none of the hazards. We have recently applied it in conjunction with ETI Cleaning & Gas Freeing Solution™ to clean and deodorize several Mercaptan storage vessels, and quickly and effectively remove iron sulfide scale from refinery process equipment.

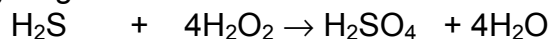
While ETI Cleaning & Gas Freeing Solution™ has proven excellent for the cleaning & decontamination of many types of refinery process equipment, it does not destroy sulfide but rather puts it into solution. As a result, the removal of iron sulfide scale is relatively slow with ETI Cleaning & Gas Freeing Solution™ alone. However, the introduction of an oxidant (such as Hydrogen Peroxide) would speed up the dissolution of iron sulfide by oxidizing the sulfide in the solution to sulfate. Unfortunately, as the following reactions will demonstrate, the safety of introducing Hydrogen Peroxide into hydrocarbon-containing process equipment is questionable at best.

Reactions of Hydrogen Peroxide with ferrous sulfide and hydrogen sulfide follow:

ferrous sulfide

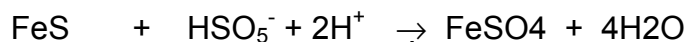


hydrogen sulfide



While the hydrogen peroxide accomplishes the desired result, it can decompose, releasing free oxygen and creating explosive conditions. The hydrogen peroxide can also accumulate and suddenly react when the proper conditions are reached. For these reasons, the addition of hydrogen peroxide must be carefully controlled and temperature and ORP carefully monitored. In many cases, these measures do not satisfy the safety concerns of oil refinery clients.

ETI Oxidizer #1™ is a binary salt which supplies the Monopersulfate ion ( $\text{HSO}_5^-$ ) as the oxidizing agent in solution. The similar oxidations are:



The above equation illustrates how ETI Oxidizer #1™ accomplishes the desired results. The advantage of ETI Oxidizer #1™ is that the decomposition of the Monopersulfate ion will release sulfate ions rather than free Oxygen. Furthermore the oxidizing reaction of ETI Oxidizer #1™ has a much lower heat of formation than that of hydrogen peroxide. Thus, ETI Oxidizer #1™ can **safely** and effectively remove sulfides from refinery process equipment.

## **ETI-916™ Universal Acid Inhibitor™**

Our exclusive acid reaction inhibitor protects metals (including carbon steel and aluminum) from corrosion during cleanings with nitric acid. This allows for the quick removal of the most difficult deposits (including Calcium Sulfate) at ambient temperatures. This proprietary inhibitor also protects metals of construction from ferric ion corrosion in any mineral acid solution.

This product was recently used with nitric acid at a Northern California Refinery for the chemical cleaning of cooling water exchangers representing a variety of metallurgies, including carbon and stainless steels. As this was a pilot study by the refinery, the heads on five exchangers were pulled and the exchangers were examined before and after the cleaning. In addition, an in line corrosion monitor was used to monitor how well the inhibitor protected carbon steel from the nitric acid. A brief summary of the results follows.

- The first pair of exchangers cleaned were the least fouled. Approximately 99% of the deposits were successfully removed.
- The third exchanger was 80% plugged. The flow through this particular exchanger had been reduced to less than 20 gallons per minute. When the cleaning was complete 95% of the deposits had been removed and only 15 tubes were left with reduced flow.
- The fourth and fifth exchangers were 10% plugged and heavily fouled with a hard deposit containing significant levels of silica. The initial flow rate was minimal. However, the cleaning removed 98% of the deposits and renewed the exchangers to near maximum efficiency.
- Furthermore, at no point during the cleaning was a corrosion rate reading exceeding 1.87 mpy observed.

The benefits of this type of cleaning include:

- Increased availability of equipment as the inhibited nitric acid is effective in a short contact time. Thus drastically reducing the out of service time associated with mechanical cleaning.
- Significant cost savings (approximately ¼ the cost of normal mechanical options)
- Extended equipment service life due to the effectiveness of the inhibitor and the fact that the scale removal decreases or eliminates the “pitting” associated with under-deposit corrosion.

Upon completion of this pilot study our client discovered that by employing this type of cleaning on a regular basis to routinely remove waterside deposits rather than waiting until a severe loss of efficiency is observed it is possible to enhance refinery productivity.

## Stabilization & Contaminant Fixation Products

**EN-1™** bonds soil into a hard (rock-like) material, which will pass TCLP for hydrocarbons and metals. This has been used to treat the area inside a refinery tank firewall after a large spill of vacuum resid.

**Urrichem™** is a cementation promoter, which has been used successfully to treat mercury, arsenic, chromium and vanadium contaminated soils and sludges so that the resulting solids pass TCLP for non-hazardous disposal. Urrichem has been used for many diverse purposes: from treatment of filter press cake to pass TCLP for non-hazardous disposal to repair of a leaking clay pond bottom without emptying the pond.

## Other Unique Products

We can provide procedures, supervision and products for the use of accelerated, enzyme-enhanced biodegradation technologies to treat various refinery sludges, as well as a wide range of hydrocarbon and pesticide-contaminated soils and water. This often can offer major reductions in treatment, time, and cost (versus other methods).

Our **zeolite material**, a synthetic absorbent that is selective for Benzene, Toluene, Ethylbenzene and Xylene (BTEX compounds) will hold benzene equivalent to 14% of its weight, and can be used in flow-through systems similar to those used for activated carbon. Thermal regeneration is possible for up to four cycles, and (unlike activated carbon) the regenerated material has the same capacity as virgin material. This material makes possible the treatment of large volumes of liquid to low BTEX concentrations without removing less regulated hydrocarbons to the same low concentrations.

This same synthetic absorbent is also effective (and selective) in removing BTEX compounds from air (or other gases) in the same type of apparatus in which activated carbon is used for this function.

Other synthetic **zeolites** are available for removal of benzene from hydrocarbon mixtures, for removal of PCB from hydrocarbon mixtures and for removal of various elements (such as: selenium, cadmium, chromium, mercury, lead, nickel and zinc) from water.

## Consulting, Supervision & Oversight

We also offer consulting and project oversight services in cleaning of tanks (and other types of liquid receptacles), and in treating of the waste generated for easier (and more economical) disposal (or recycling). A program to optimize tank cleaning practices, as well as waste treatment and disposal practices includes:

1. A review of past practices for cost-effectiveness and environmental hazards.
2. Evaluation of the environmental safety of the prior tank cleanings.
3. Collecting data about tanks to be cleaned in the near future.
4. Selecting the optimum methods for cleaning of each tank to be cleaned in the near future, (and for treatment and disposal of the wastes generated).
5. Assistance with contractor selection and project oversight.

Our personnel can provide expertise and unique technologies to resolve emulsions in product or waste tanks, with emphasis on removing solids from the tank (in the oil or water phase) rather than depositing them on the tank bottom.

## Your First Choice

We offer many other services, including process unit startup and shutdown assistance, operator training, process troubleshooting, assistance with emulsion problems, on-stream (or semi on-stream) chemical cleaning procedures and unique, non-corrosive water side cleaning procedures.

References are available upon request.

Of course, all inquiries and evaluations are performed in strict confidence, and the entire information obtained and results produced are presented to the customer's representative. ***Please contact us for your free evaluation and estimate.***

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