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OIL DRILLING SPECIALTY CHEMICALS

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|------------|-----------------------------------------------------------------------------|
| 1. NTP | Prevents H ₂ S malodor and corrosion induced by H ₂ S |
| 2. ATO SAN | Concentrated biocide that decomposes rapidly |
| 3. IWT 310 | A unique blend of sequestering agents for inorganic removal |
| 4. IC 16 | A corrosion inhibitor that inhibits hydrochloric acid |

I-DATA SHEET

NT PRODUCT ^{UNIQUE}

ELIMINATES H₂S

DESCRIPTION

NTP is an environmentally benign, non-toxic and non-biocidal liquid for odor control. Under anaerobic conditions, bacteria metabolize organic carbon compounds to produce malodorous and explosive chemicals. These chemicals, (which include volatile fatty acids (VFA's), hydrogen sulfide (H₂S) and mercaptans) create nuisance odors near the oil drilling. **NTP** effectively and economically prevents the production of H₂S and mercaptans, thereby stopping odors from forming thus creating a pleasant living environment.

DESCRIPTION

NTP is a powdered product that is applied at low concentrations depending upon the initial concentration of hydrogen sulfide gas (H₂S), sulfate and soluble sulfide. This product is generally applied in areas where H₂S are generated such as: water and wastewater treatment plants, pulp and paper mills, petroleum wells, municipality drains and septic systems, grease traps and wherever anaerobic activity is present.

A start-up concentration to prevent the formation of these malodors varies from 5 to 100 ppm.

Unlike other products, **NTP**:

- Is not a biocide
- Is environmentally-friendly and not toxic
- Prevents the initial formation of these malodors and does not only mask it.
- Oxidize existing H₂S and sulfide.
- Modifies the metabolism of anaerobic bacteria and does not kill these bacteria essential for anaerobic biodegradation, therefore BOD and COD are not affected.
- Prevents the corrosion induced by Sulfate-Reducing Bacteria (SRB).

- NTP works by inhibiting SRB (sulfate reducing Bacteria). These bacteria reduce sulfate SO_4^- to hydrogen sulfide gas (H_2S) and soluble sulfide S_2^- . To measure the efficiency of NTP product, we have to measure the concentration of soluble sulfide in water and H_2S gas. Usually the presence of NTP in a solution inhibits the formation of H_2S gas and soluble sulfide. Usually in a control sample (ABSENCE OF NTP): The concentration of sulfate decreases due to the activity of Sulfate reducing bacteria, the concentration of H_2S gas increases and the concentration of soluble sulfide increases. In a treated sample with NTP: the concentration of sulfate does not change, there is no formation of H_2S and no formation of soluble sulfide. Also there is the noticeable rotten egg odor reduction in samples treated with NTP.
- Soluble sulfides can be measured easily by a Hach or Lamotte method. H_2S gas can be measured by an H_2S meter or a Gastec Unit. Hydrogen sulfide H_2S gas can be measured with the GASTEC by piercing the tape through the hole. [H_2S meter: Type PhD 2 Atmospheric Monitor Model 101 (Biosystems Inc.)].
- Soluble sulfide, sulfate and volatile fatty acids were measured with a Hach spectrophotometer DR 2010. To assess sulfide, Sulfide method 813: (Hach; Methylene blue method; 5 to 800 $\mu\text{g}/\text{L}$) adapted from Standard Methods for the Examination of Water and Wastewater was used. Hydrogen sulfide and acid-soluble metal sulfides react with N,N-dimethyl-p-phenylenediamine sulfate to form methylene blue which was measured at 665 nm. A 25 mL of reactors was measured into a sample cell. Deionized water (25 mL) was measured into a second sample cell (the blank). Sulfide 1 Reagent (1.0 mL) was added to each cell and mixed. Sulfide 2 Reagent (1.0 mL) was added to each cell and mixed. The solution turned blue if sulfide was present. The cells were incubated at room temperature for 5 minutes and sulfide was measured at 665 nm.
- To assess VFAs, Method 8196 (Hach; Esterification Method; 27 to 2800 mg/), adapted from The Analyst, 87, 949 (1962) was used. To assess sulfate, Method 8051 (Hach; 2 to 70 mg/L) adapted from Standard Methods for the Examination of Water and Wastewater was used. Procedure is equivalent to USEPA method 375.4 for wastewater.

GC/FID method for determining VFAs concentration

Gas Chromatograph – Hewlett Packard model HP6890. Flame Ionisation Detector (FID). Integration program (HP ChemStations). Column model Supelco 24315, column 15459-01A, type SPB-1000, length 30 m and 0.32 mm internal diameter with a 0.25 μm thickness film.

GC program: constant flow of 2.5 ml/min of helium. Initial temperature is 120°C constant for 5 minutes, followed by an increase of 15°C/min until 170°C which is kept constant for 5 minutes. The total program consists of 13.33 minutes. Injector temperature: 190°C; detector temperature: 220°C; manual injection: 1µL.

Sample preparation: once centrifuged at 13000g for 15 minutes, an amount of 960 µL of the supernatant was added to 20 µL solution of 1000 ppm heptanoic acid and 20 µL solution of hydrochloric acid (37%). This solution was mixed and injected.

I- DATA SHEET

ATO SAN **REGISTRATION No. 29461** **PEST CONTROL PRODUCTS ACT**

GUARANTEE:

2,2,-dibromo-3-nitrilopropionamide20%

Controls bacteria, fungi and yeasts in petroleum industry, paper mills, metalworking fluids containing water, and enhanced oil recovery systems; controls bacteria and algae in industrial recirculating water cooling towers.

PETROLEUM INDUSTRY

ENHANCED OIL RECOVERY SYSTEMS

For controlling slime-forming bacteria, sulfide-producing bacteria, yeasts and fungi in oil field water, polymer or micellar floods, water-disposal systems, or other oil field water systems, add 1-80 ppm by wt. **ATO SAN** (2-60 mL **ATO SAN** /cubic meter of water) depending on the severity of contamination. Additions should be made with a metering pump either continuously or intermittently.

Continuous Feed Method: When the system is noticeably fouled, add 10-80 ppm by wt. **ATO SAN** (10-60 mL **ATO SAN** /cubic meter of water) continuously until the desired degree of control is achieved. Subsequently, treat with 1-15 ppm by wt. **ATO SAN** (2-10 mL **ATO SAN** /cubic meter of water) continuously, or as needed to maintain control.

Intermittent or Slug Method: When the system is noticeably fouled, or to maintain control of the system, add 10-80 ppm by wt (10-60 mL **ATO SAN** /cubic meter of water) intermittently for 4-8 hours per day, and from 1-4 times per week, or as needed depending on the severity of contamination. Addition of **ATO SAN** may be made at the free water knockouts, before or after the injection pumps and injection well headers.

NOTE: For control of bacteria, yeast and fungi in aqueous solutions of biopolymer used in flooding operations, add 15-80 ppm by wt. **ATO SAN** (10-60 mL **ATO SAN** /cubic meter of water). Additions of **ATO SAN** should be made with a metering pump immediately after preparation of the aqueous biopolymer solution to prevent loss of viscosity.

DIRECTIONS FOR USE

NOTE: Add **ATO SAN** separately to the system. Do not mix with other additives in order to avoid decomposition of **ATO SAN** due to the high pH of many additive formulations.

PAPER MILLS

For the control of bacterial, fungal and yeast growth in pulp, paper and paper-board mills, add **ATO SAN** at the rate of 60-210 mL/tonne of pulp or paper (dry basis). Addition may be continuous or intermittent, depending upon the type of system and the severity of contamination. It should be made with a metering pump at a location that will insure uniform distribution of **ATO SAN** in the mass of fiber and water such as the beaters, jordan inlet or discharge, broke chest, furnish chests, save-alls and white-water tanks. Heavily fouled systems should be boiled out, then treated with 60-140 mL **ATO SAN**/tonne of paper (dry basis), as necessary for control.

Moderately fouled systems should be treated continuously with 140-210 mL **ATO SAN**/tonne of paper (dry basis) until the slime accumulation is controlled. Addition rates can then be reduced to 60-140 mL **ATO SAN** /tonne of paper on a continuous or intermittent basis, as needed for control. Dislodged slime may cause breaks in the paper and a cleanup of the paper machine may be advisable.

Slightly fouled systems should be treated continuously with 60-140 mL **ATO SAN** /tonne of paper (dry basis) until the slime is controlled, then added on an intermittent basis to maintain control.

ATO SAN: Interacts with cytoplasmic membrane proteins. It interferes with transport of nutrients across the membrane. Conditions of application:

1. Use : alkaline/neutral wet end
2. Site Machine chest
3. Concentration: 0,5 to 4 ppm
4. Cycle: 1 hr on, 1 hr off

Advantages:

Efficient over a board range of pH values, it dissolves in water; it decomposes rapidly in aquatic environments.

INDUSTRIAL RECIRCULATING WATER COOLING TOWERS

This product is for recirculating water systems only add **ATO SAN** to the basin (or any other point of uniform mixing). Addition should be made with a metering pump. It may be continuous or intermittent, depending on the severity of the contamination when treatment is begun, and the retention time in the system. Optimum performance with this product is attained by continuous or intermittent treatment. If "shock" treatment is used, the blowdown should be discontinued for 24-48 hours.

FOR CONTROL OF BACTERIA

Add 1.0-10 mL **ATO SAN** /1000 L of water in the system, depending on the severity of contamination.

Intermittent or Slug Method – Initial Dose: When the system is noticeably fouled, add 5.0-10 mL **ATO SAN** /1000 L of water in the system. Repeat until control is achieved. Subsequent dose: When microbial control is evident, add 3.0-10 mL **ATO SAN** /1000 L of water in the system every 4 days or as needed to maintain control. Badly fouled systems must be cleaned before treatment is begun.

Continuous Feed Method – Initial Dose: When the system is noticeably fouled, add 5.0-10 mL **ATO SAN** /1000 L water to the system. Subsequently maintain this level by pumping a continuous feed of 0.5-5.0 mL **ATO SAN** /1000 L of water in the system per day. Badly fouled systems must be cleaned before treatment is begun.

FOR CONTROL OF ALGAE

Add 30-95 mL **ATO SAN** /1000 L of water in the system, depending on the severity of contamination.

Intermittent or Slug Method – Initial Dose: When the system is noticeably fouled, add 50-95 mL **ATO SAN** /1000 L of water in the system. Repeat until control is achieved.

Subsequent Dose: When algal control is evident, add 30-95 mL **ATO SAN** /1000 L of water in the system daily, or as needed to maintain control. Badly fouled systems must be cleaned before treatment is begun.

Continuous Feed Method – Initial Dose: When the system is noticeably fouled, add 50-95 mL **ATO SAN** /1000 L of water to the system.

Subsequent Dose: Maintain this treatment level by pumping a continuous feed of 30-95 mL **ATO SAN** /1000 L of water in the system per day.

Badly fouled systems must be cleaned before treatment is begun.

METALWORKING FLUIDS CONTAINING WATER

This product is effective in metalworking concentrates which have been diluted in water at ratios of 1:100 to 1:4.

For controlling (or inhibiting) growth of bacteria, fungi and yeast that may deteriorate metalworking fluids containing water, add **ATO SAN** to the fluid in the collection tank. Additions should be made with a metering pump. Initial or Slug Dose: When the system is just noticeably fouled, add 250 mL **ATO SAN** /1000 L of metalworking fluid to the system. Repeat until control is achieved.

Subsequent Dose: When microbial control is evident, add 100-200 mL of **ATO SAN** /1000 L of metalworking fluid per day or as needed to maintain control. Additions can be made continuously or intermittently. Slug the system as required.

I-DATA SHEET

IWT 310

CORROSION & SCALE INHIBITOR

DESCRIPTION

IWT 310 was developed by atomes. Main field of application are the treatment of boilers, cooling and process water as well as scale and corrosion prevention in water and wastewater treatment and petroleum.

IWT 310 is a highly effective scale and corrosion inhibitors. **IWT 310** is a unique blend of sequestering agents.

CHARACTERISTICS

Physical form: clear, colorless to yellowish, low-viscous, almost odorless liquid
pH (0.5% solution): ~ 7.00

SCALE INHIBITION

IWT 310 has proved highly effective as a threshold inhibitor. Very low additions (ppm range), i.e. in far less than sub-stoichiometric concentrations (calculated on the hardness of the water), prevent the formation of scale and incrustations, respectively. Even water which is highly over-saturated with hardness constituents such as calcium carbonate remain without scale when **IWT 310** is added. The outstanding effectiveness of **IWT 310** is proofed by a multitude of practically orientated trials, which can be discussed and are available.

CORROSION INHIBITION

Under the conditions found in cooling water, **IWT 310** is a good corrosion inhibitor for carbon steel. In the case of relatively soft water, it is common to combine **IWT 310** with synergistic substances (phosphates, zinc salts). In water of higher hardness or with sufficiently high alkalinity (approx. 300 mg/l or more, calculated as calcium carbonate), **IWT 310** and no inorganic components – known as all-organic formulations – are highly effective.

BENEFITS

- Easy to administer single product
- Prevents corrosion
- Concentrated formula
- Economical & Excellent for scale control
- Simple to test product
- Prevents scale deposition

DOSAGE

The dosage of **IWT 310** will vary depending on plant conditions. Specific recommendations, can be provided by your  **atomes** representative.

UNIQUENESS OF IWT 310

IWT 310 is composed of 4 chelating agents working together in synergy to chelate inorganic metal ions.

The first chelating agent is a multifunctional molecule offering combination properties of polyphosphates and amino-Carboxylate sequestering agent. It has excellent thermal hydrolytic stability compared to polyphosphates. It has low content of phosphoric, has structural features of both phosphoric acid and carboxylic acid group, which enable its excellent scale and corrosion inhibition properties. Its antiscaling property under high temperature is far better than that of organophosphines. It can improve zinc salt solubility, has good chlorine oxidation tolerance and good composite synergy.

Usage:

It is a high efficient agent as scale and corrosion inhibitor. It is the excellent stabilizer for zinc salt. It is widely used in circulating cool water system and **oilfield** refill water system as scale and corrosion inhibitor, suitable to composite with zinc salt and copolymer. It can be used in situations of high temperature, high hardness, high alkali and high concentration index. In lavation fields, it is used as chelating agent and metal detergent.

It is usually used together with zinc salt, copolymer, organophosphine, imidazole and other Water Treatment Chemicals.

The advantages include:

1. Threshold effect
2. Sequestration
3. Deflocculation effect
4. Corrosion control
5. Hydrolytic & chlorine stability
6. Low phosphorus content

Applications:

- Cooling/boiler water treatment
- Oil drilling field water treatment
- Sea water evaporators
- Cleaning formulations

The second agent is an organophosphoric acid corrosion inhibitor. It can chelate with Fe, Cu, and Zn ions to form stable chelating compounds. It can dissolve the oxidized materials on these metals' surfaces. It shows excellent scale and corrosion inhibition effects under temperature 250°C. It has good chemical

stability under high pH value, hard to be hydrolyzed, and hard to be decomposed under ordinary light and heat conditions. Its acid/alkali and chlorine oxidation tolerance are better than that of other organophosphoric acids (salt). It can react with metal ions in water system to form hexa-element chelating complex, with calcium ion in particular. Therefore, It has good antiscaling and visible threshold effects. When built together with other water treatment chemicals, it shows good synergistic effects. It is used as scale and corrosion inhibition in circulating cool water system, oil field and low-pressure boilers in fields such as electric power, chemical industry, metallurgy, fertilizer, etc. The dosage of 1-10mg/L is preferred as scale inhibitor, 10-50mg/L as corrosion inhibitor, and 1000-2000mg/L as detergent. Usually, It is used together with polycarboxylic acid.

The third agent is a polyamino carboxylic acid and is used as a chelating agent which forms coordination compounds with metal ions (chelates) such as Ca^{2+} , Cu^{2+} or Fe^{3+} .

The fourth agent is a polyamino carboxylic acid with the formula $[\text{CH}_2\text{N}(\text{CH}_2\text{CO}_2\text{H})_2]_2$. Its usefulness arises because of its role as a chelating agent, i.e. its ability to "sequester" metal ions such as Ca^{2+} and Fe^{3+} .

I-DATA SHEET

IC 16

DESCRIPTION

Solutions containing H₂SO₄, HCl, sulphamic and other acids are widely used in industry for cleaning, pickling and removing scale and rust from metal surfaces. **IC 16** is specially formulated to be added to these acidic systems to provide protection to the base metal without interfering with the with action of the acid in removing scale, rust and other oxidation products. **IC 16** is provides effective inhibition at low concentrations and under a wide range of conditions. Typical application rates are in the range of .02 to .06% depending upon the use conditions.

SPECIFICATIONS

APPEARANCE	White crystals
ACTIVES	100%
ODOUR	Minimal
pH (2%)	7 - 8
SOLUBILITY (in water)	10%
TOXICITY	Low
STORAGE STABILITY	2 years in sealed container

DIRECTIONS

Solution preparation: **IC 16** dissolves in water and acidic conditions, but depending on temperature and concentrations, dissolution speed may not be suitable for some applications. Since **IC 16** dissolves readily in alcohols, it is easy to prepare concentrates to add to the acid solutions at the desired dosage rates (IPA or ethanol recommended).

Typical dosage rates: Optimal **IC 16** dosage level for inhibition of 15% HCl at room temperature is in the 0.020 to 0.040 active % based on total solution weight. At higher temperatures dosage levels up to 0.06% may be required. Generally this gives a 90 – 95% reduction in corrosion rates on typical mild steel.

Addition of surfactants at a level of 10% of the **IC 16** dosage level can significantly increase the inhibitive performance.