

Onion Paper

An Onion Enterprise Newsletter

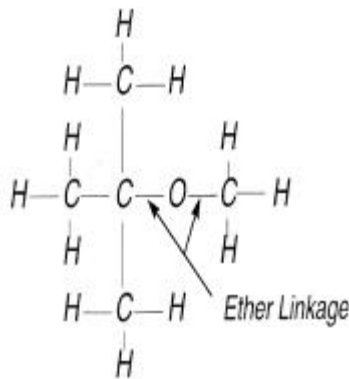
September, 1998

Volume 2, Issue 1

OE provides solutions to your treatment needs. At OE

MTBE: IS IT A GOOD THING?

MTBE-Methyl tert-Butyl Ether is added to gasoline to improve air quality. Since 1970, MTBE was added to gas throughout the U.S. as an octane booster. Since 1992, MTBE has been added to gasoline year round in states like California to comply with the Federal Clean Air Act. MTBE is estimated to reduce carbon monoxide emissions 15-20 percent. MTBE is being used in many states including: CA, OR, TX, WI, IL, IN, WV, VA, PA, NY, NJ, MA, VT, CT, DE, DC, MD, RI, NH. These states represent approximately 75% of the US population. Debate over exposure in air is non-



MTBE'S OXYGENATED STRUCTURE

we THINK about the problem before we suggest a technology. Unlike many remediation companies that have only one technology to offer, OE offers the technology that best fits your problem. Our staff is composed of former engineering

conclusive. The literature review indicates that exposure to humans in air seems minor. MTBE has a relatively short half life because of its rapid reaction with hydroxyl radicals forming TBF and Formaldehyde.

Where is the Problem?

Surface Water and Ground Water

MTBE it is believed to be getting into the **surface water** from the use of motorized water vehicles such as boats and jet skies. Concentrations in California reservoirs were recorded to have levels as high as 11 ppb. Finding MTBE in drinking reservoirs has triggered the call for banning at a minimum, the use of water craft with two cycle engines, and the eventual ban of all motor vehicles on the drinking water reservoirs.

MTBE is getting into **groundwater** from leaking underground tanks and petroleum pipelines. The health risks of MTBE in ground water are unknown at this time.

EPA has labeled MTBE as a Possible Human carcinogen

There are four direct and two associated treatment technologies that are summarized *continued on page 2*

MTBE: TECHNOLOGY TREATMENT CRITERIA

The following is a summary of criteria for treatment technologies used to treat MTBE as discussed in a White paper from the proceedings at a MTBE Workshop held on September 30 - October 1, 1997.

- **Cost Effective** at various influent concentrations which is meant to keep cost within normal treatment ranges.
- **Reliability** a process that operates under normal conditions and not upset regular/or severe upset conditions.
- **Robustness** vulnerability to operator error, mode and timing of failure and factor of safety.
- **Regulatory Approval** process must >

be permitted by various regulatory and public agencies. Existing technology having a proven track record.

- **Simplicity** the ease of which operators can maintain and operate the units.
- **Size or footprint** is meant to reflect the need to consider the overall size of the treatment units.

The following pages contain information on treatment systems that are to be used To treat MTBE in water



MTBE: TREATMENT TECHNOLOGIES SUMMARY

within this text. The discussion below highlights the applicability of these technologies and their effectiveness, advantages and disadvantages, in treating MTBE in water. The technologies include: **Air Stripping** (tower, tray, Venturi), **Carbon, Advanced Oxidation, and Biological Treatment**

Air Stripping

There are three types of air strippers that will be summarized in this text: tower, tray and Venturi. All three methods use a basic technology where water is forced into contact with air where the volatiles, through mass transfer and dispersion are "stripped" out of the water. The rate of removal from water is controlled by temperature of the water, solubility of the chemical constituent, the chemical Henry's constant (volatility). In many locations off gas treatment is required.

MTBE is highly soluble and has a low Henry's constant which requires a higher air: water ratio, up to five times higher than other compounds such as benzene. Having high air to water ratios can quickly drive up the cost of remediation because the higher cost of off gas treatment

The **Packed Tower** (Structured and Random) remove contaminants by physical removal. First the water that is being treated

MTBE: IS IT A GOOD ? *continued form page 1*

EPA has issued a drinking water advisory of 20 to 40 parts per billion MTBE. California has established an interim action level of 35 parts per billion in drinking water. Other states such as Nevada, New Jersey and Massachusetts have action levels that range from 75-200 ppb. You can taste it at 39-134 ppb and smell it from 15-95 ppb. MTBE is highly soluble and very mobile in groundwater. Because of its high solubility, MTBE migrates much quicker in ground water than other gasoline components such as benzene, toluene, xylene. In some reports, it is estimated that the MTBE

of a vertical tower. Air is forced drafted up the tower counter current to the water flow. The water is sprayed onto packing which thins the water air boundary, increases the flow path length generating a large mass transfer area where the contaminants are volatilized. A structured pack tower has advantages over a random pack when dealing with MTBE. Structured pack offers larger surface area, up to **nine** times more, so that the water /air boundary layer is very thin and aids in the mass transfer process. The structure packing also offers a 50 % reduction in pressure residence over a random pack. This is important with MTBE removal because the air to water ratios are up to five times greater to treat MTBE. The advantages of a packed tower is that it can be built to handle almost any size flow. The input of air and the size can be varied to achieve significant removal of MTBE. The disadvantage is that if the off gas has to be treated there is significant flow to treat.

Tray Strippers use forced draft, counter-current through horizontal trays. Contaminated water is sprayed with a nozzle into the upper tray. The water flows along the aeration tray and down to the next tray. Clean air is blown up through holes in the trays forming bubbles and generating a large mass transfer surface area where contaminants are volatilized. The

moves through the aquifer at the same rate of the groundwater flow. The US Geological Survey has reported that 51 public potable groundwater well systems in five states have reported MTBE contamination. The city of Santa Monica currently has approximately 50% of the city's water supply wells shut down do to the presence of MTBE. The presence of MTBE may be on the increase as older fiberglass tanks begin to leak due to their age and the effects that MTBE and other alcohol additives are having on the fiberglass resins. The resins are soluble to alcohol. Owing -Corning on March 9th 1995 issued an advisory on tanks that were purchased prior to April 1990, not to be used where Ethanol content is over 10%. and methanol 5%.

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MTBE : is it a good? It depends



MTBE: TREATMENT TECHNOLOGIES SUMMARY

Continued from page 2

are the ease of maintenance and the cost effectiveness of the system in low flow situations. The disadvantages : because of the high air to water ratios needed to treat MTBE, the rate maximum flow rates these system can handle are from 40-100 gpm depending on the initial concentrations and the removal efficiency required.

A Venturi stripper is the heart of an engineered air stripping design to take advantage of advances in fluid dynamics. The stripper uses highly turbulent jets of water to shear and accelerate fluid films within an open bore. The microturbulence achieved within the bore reduces the fluid film boundary layer and creates the large surface area normally produced by packing or trays used in a traditional air stripper. The jet action that takes place aspirates the air, eliminating the need for noisy blowers. Off-gas volume is reduced through the counter-current air flow by recirculating the air from the previous module. The key to cost containment in using air strippers is reducing the air flow and concentrating the volatiles. ***In the case of MTBE it has the potential of reducing the air flow by a factor of five(5).***

The advantage of this system is its capability of handling large flow rates, ease of maintenance, low noise and relatively low flow for off gas treatment.

The disadvantage to this system is the higher initial capital cost. The higher initial capital cost will more then offset when off gas treatment is needed.

Carbon

Granular activated carbon(GAC) treatment of water is achieved by having the contaminated water flow through an activated carbon bed where the carbon adsorbs the organic contaminants removing them from the water. Typically, the carbon beds are in series and in higher flow situations in parallel. The removal efficiency of the GAC beds are effected by the mass transfer zone, the contact time the carbon has with the water and the loading rate of the chemical constituent.

MTBE when compared to Benzene needs twice the transfer zone, 30 to 50% longer contact time and up to eight times less loading capabilities(pound for pound up to eight times more carbon is needed.

The advantages of using carbon is that it is simple to use and is readily available. The disadvantages are that it is expensive to use and it has to typically be regenerated off site off site.

continued on page 4

Partial lists of products for sale and rent

Vapor Phase

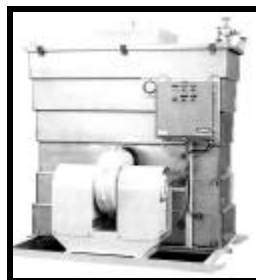
Treatment

Thermal Oxidizers
chlorinated and non
Catalytic Oxidizers
chlorinated and non
Regenerative
CatOx
Carbon Vessels
Concentrators
Blowers
Liquid Ring
Pumps
Moisture
Separators
Dual Phase
Extraction

Fluid

Treatment

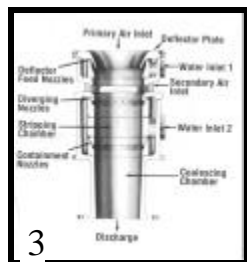
Air Strippers
Oil-water
separators
Pumps
UV Oxidation,
Cav-OX
Carbon Vessels
Tanks
Flow Indicators
Transfer Pumps



1

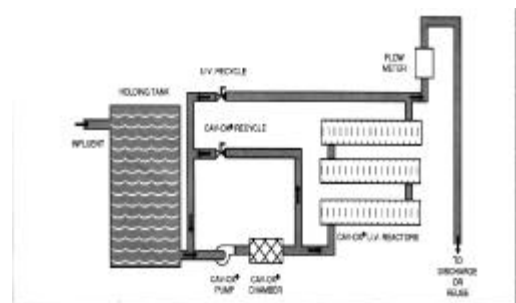


2



3

- 1) Tray Stripper
- 2) Tower stripper
- 3) Venturi Stripper



Advanced Oxidation

MTBE: TREATMENT TECHNOLOGIES SUMMARY

Continued from page 3

An additional use of GAC may be treating the off gas from an air stripper. Carbon loading capabilities of vapor phase carbon may be as much as doubled that of liquid.

Advanced Oxidation Process(AOP)

AOP oxidizes organic contaminants using a combination of cavitation, Hydrogen peroxide(H₂O₂) and ultraviolet light. When water first enters the AOP system it is cavitated. The cavitation process causes the water molecule to split forming hydroxyl radicals(OH). The release of the hydroxyl radicals react very quickly to oxidize much of the organic contaminants. The water is further treated by the use of hydrogen peroxide and then it is exposed to UV light to activate the peroxide and produce additional hydroxyl radicals which completes the treatment process. AOP works very well with MTBE and can achieve removal rates up to 99 percent.

An advantage of AOP is that the organic contaminants are completely destroyed and not transferred to another medium. There is no off gas treatment when using this method. Disadvantages are

potentially higher capital equipment costs. Operational advantages and disadvantages will vary depending on if off gas treatment needed in the area of treatment.

Biological Treatment(BT)

Biological treatment may be the most cost effective method in treating MTBE in both water and air. There are several new studies

Bio Treatment is the most cost effective treatment technology in treating both Vapor and water contaminated with MTBE

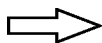
out on the effectiveness of Bireactor systems coming from the UC-Davis, LLNL, and NJIT. One of the newest technologies is the BIOX system as described on the following page.



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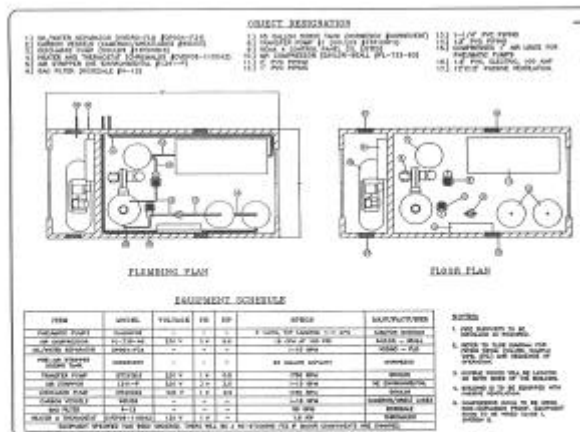
Pre-Packaged Remediation Systems

All systems are designed to your site specific requirements. Each system is pre-wired, plumbed and tested prior to delivery to your site. These systems can either be **skid or trailer** mounted. Explosion proof designs are also available. **Simple example**



Telecommunications and Controls

Let OE's design engineers bring your control panel into the 21st century with its advanced communication system. The control panels are assembled using UL listed part and bringing you the latest in control technologies

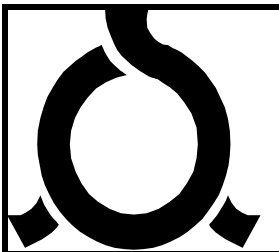


- ACCEPTED AS IS
- REVISE AND SUBMIT
- ACCEPTED AS CORRECTED
- NOT ACCEPTED

Conditions or comments addressed under headings REVISE AND SUBMIT, or NOT ACCEPTED done and certificate that these items are fixed. All overruns, or changes will be made and a follow up set of plans will be submitted for acceptance.

Client

Call 877-566-7007 for more information



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OE provides solutions to your treatment needs. At OE we THINK about the problem before we suggest a technology. Unlike many remediation companies that

BioRemediation of MTBE, Chlorinated and

OE is introducing several new Technologies at this conference.

OE BIOREACTORS are used to treat Chlorinated & Non Chlorinated Hydrocarbons, and MTBE in both water and air. We have over eighteen years of experience in providing Bioreactors.

Our **Proprietary Technology** in biotechnology and biocatalysts are the strength behind our

BioOX

The Next Generation of Remediation Products

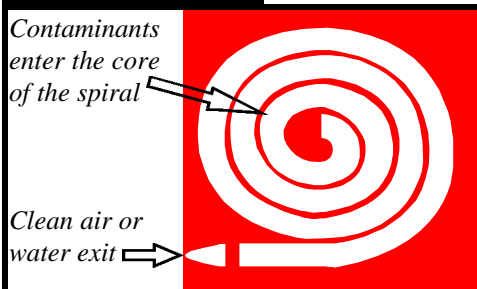
Biotechnology for Environmental Cleanup

The Bioreactors can be used to consume and destroy pollution.

An over view of the products are as follows:

- BioStack: The first portable, turn key, indoor air cleaning plant for complete destruction of air pollution
- BioOX: a general product for oxidative destruction of organic compounds or materials in the air and water.
- BioSorb: A cartridge-based biosorbent for the removal of heavy metals from the water and air.
- Solv-Ex: a solvent extraction system to recover clean oils, water and solids wet solids and sludge

OE can provide bench scale test of your waste stream at a very competitive price. OE will can also provide rental systems which allows you to experience the ease and stability of our reactors.



Contaminants enter the core of the spiral
Clean air or water exit
Contaminated air or water flows into a spirally-wrapped bed through the center of the cartridge. Flow spirals along (not through) the bio-support, keeping pressure drops low. Bacteria is attached to both sides of the flow channel

products.. The technology involves the immobilization of biologically active material such as enzymes, organelles and cells. The power behind the biocatalyst is demonstrated by its:

- exceptional resistance to contamination
- incredible long life
- ability to flourish in high densities

The technology consists of **cartridges** of spirally-wound Microporous plastic

sheets on which pre-acclimated bacteria are uniformly immobilized. These plastic sheets make up the core of the bio-reactors. The spirally-wound configuration allows large surface area for biodegradation in a small space. These cartridges are manufactured in sizes ranging from 50 ft² to 500 ft² per pass for immobilization of quantities of bacteria ranging from 500 grams to 5000 grams per cartridge. Yet they only measure from 8 to 37 inches in diameter and are from 18 to 47 inches tall.

have only one technology to offer, OE offers the technology that best fits your problem. Our staff is composed of former engineering consultants & scientists.

Contact OE at: **PHONE 877-566-7007**
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