Treatment for Hydrocarbon & MTBE Contaminated Water

BLUE SKY
Water Technologies, Inc.

Bill Whiteside
916-988-1182
blueskytechnologies.biz
bill@blueskytechnologies.biz

National Groundwater Association Press Release
http://www.ngwa.org/gwonline/MTBE.TXT

ACN	010270488
IND	JRL
ENT	010329
TI	UNUSUAL TREATMENT FOUND EFFECTIVE
SOU	GROUND WATER MONITORING & REMEDIATION; V21 N1; P6
ISSN	1069-3629
STAE	CA
CNTY	SHASTA
DATE	WI/2001
LAN	ENGLISH
LIB	NGWIC
CHEM	MTBE; HYDROCARBONS; METALS
DESC	ACID MINE DRAINAGE; WASTE WATER TREATMENT; MINE WASTES; INDUSTRIAL POLLUTION SOURCES
ABST	A NEW ELECTRO-OXIDATION PROCESS USES AN INTENSE MAGNETIC FIELD AND PROPRIETARY CHEMICALS TO REMOVE METAL CONTAMINANTS FROM ACID MINE DRAINAGE AND OTHER CONTAMINATED WASTE WATER. (BLUE SKY AND SUBSIDIARIES) HAVE A PILOT PLANT OPERATING AT MAMMOTH MINE. THE RESULTING EFFLUENT SURPASSED FEDERAL SURPASSED FEDERAL DRINKING WATER STANDARDS.

Overview

A highly effective treatment process available through Blue Sky Technologies produces exceptionally high removal rates for total hydrocarbons, diesel, oil, and volatile aromatics including MTBE. In demonstrated applications, the patent pending process easily treated contaminated water with an excess of 58,000 parts-per-million (PPM) total hydrocarbons and MTBE in excess of 460,000 parts-per-billion (PPB). Laboratory tests of the final effluent produced results exceeding those required of Federal Drinking Water Standards. No other treatment process has achieved such outstanding results.

The process has been duplicated at numerous industrial sites. In each application, tests of the final treated effluent revealed hydrocarbon and volatile aromatic removal near or below non-detectable parts-per-billion levels. On September 23, 1998, and again on the 25th, we demonstrated the process at Elmendorf AFB in Anchorage, Alaska. Without any prior lab bench testing the process was initiated by pumping wastewater from a large collection sump contaminated with aviation fuels, diesel, and gasoline. Following about 15 minutes of equipment calibration, the trailer-mounted system was producing drinking water-quality effluent.

Laboratory tests of the treated effluent revealed all hydrocarbons and volatile aromatics were removed to non-detectable levels. MTBE is not required in the state of Alaska and therefore was not present. The benzenes, toluene, and xylene isomers (volatile aromatics) were removed to non-detectable parts-per-billion levels.

In West Sacramento, California, wastewater generated from washing the insides of petroleum tank trucks produces a highly contaminated waste stream containing excessive amounts of gasoline, diesel and aviation fuel. An analysis of the raw influent revealed total hydrocarbons of almost 60,000 parts-per-million with MTBE levels of 460,000 parts-per-billion. The treatment process removed all of the hydrocarbons and volatile aromatics to non-detectable levels with the exception of MTBE which showed a residual of 60 PPB. Even at 60 PPB, this represents a 99.9998% reduction. Subsequent tests revealed that with some additional equipment calibration, all of the MTBE could have been removed.

Recently, we designed an MTBE removal process for groundwater and potable water treatment applications. The new process, specifically designed for lightly contaminated water, combines several new technologies to produce a cost effective means of removing MTBE to non-detectable levels.

Hydrocarbon & MTBE Removal Process

The process used for the treatment of hydrocarbon contaminated water relies upon recently developed technology that provides the means of altering the chemical and physical properties of organic contaminants within aqueous solutions. The following described process represents new innovative technology that has only recently been introduced to the treatment and remediation industry.

The flow diagram shown represents the process for hydrocarbon removal for moderately contaminated wastewater generated in industrial cleaning applications involving heavy degreasing of equipment. Other variations include contamination where organic and inorganic compounds are present, or where groundwater contamination levels are measured in a few parts-per-million or less.

Step 1

The treatment process is initiated when wastewater is pumped from a sump or storage tank to the above-ground Oil/Water Separator. The Oil/Water Separator (our exclusive, patented design) employs several innovative features unavailable in similar devices. As the influent stream enters the separator, air is injected in the manifold system causing free-floating oils to rapidly ascend to the surface of the first compartment. As the oils accumulate on the surface they are directed over a weir and to the oil containment tank. The water must flow downward through coalescent tribes to the second separation chamber where residual floating oils are again removed. This process is repeated in four separate chambers before the water exits the unit. The oil accumulation tank is equipped with an automatic water decanting device that removes any water from the separated oil thereby producing a concentrated hydrocarbon mixture ready for disposal.

Step 2

Following removal of the free-floating hydrocarbons, the remaining wastewater is injected with a proprietary water conditioning agent and directed to the Molecular Destruction Reactor. The reactor is the heart of the treatment process. The electrodes within the reactor are surrounded by exceptionally strong magnetic fields. As DC current is applied to the electrodes, the combined forces have the ability of destroying the organic compounds resulting in the destruction of the chemical bonds and altering the solubility characteristics of the contaminants. The destruction of the chemical bonds holding the contaminant materials in solution sets the stage for the clarification or second phase of the process. By destroying these bonds, the contaminants are separated from the molecules of water (become insoluble) and will readily respond to conventional precipitation chemistry.

Step 3

Prior to entering the clarifier, the waste stream is injected with a primary coagulant, a polymer flocculent and the pH is adjusted to between 7 and 8. These water treatment additives cause a rapid agglomeration (gathering together) of the contaminant particles. The clarifier, our design and manufacture , causes a rapid separation of the flocculated materials. The solids settle to the bottom where they are periodically evacuated. The clarified water flows up the clarification chamber and is discharged at the top.

Step 4

The clarified water produced at this point is of sufficient quality it can be safely used for industrial recycling applications. If the water is to be discharged off-site it is directed through a carbon filtration unit to ensure removal of any remaining residual hydrocarbons.

Step 5

The sludge produced by the process can be further treated via a Bio-Remediation Unit that utilizes aerobic bacteria to digest and degrade the organic materials or it can he dewatered in a filter press prior to disposal.

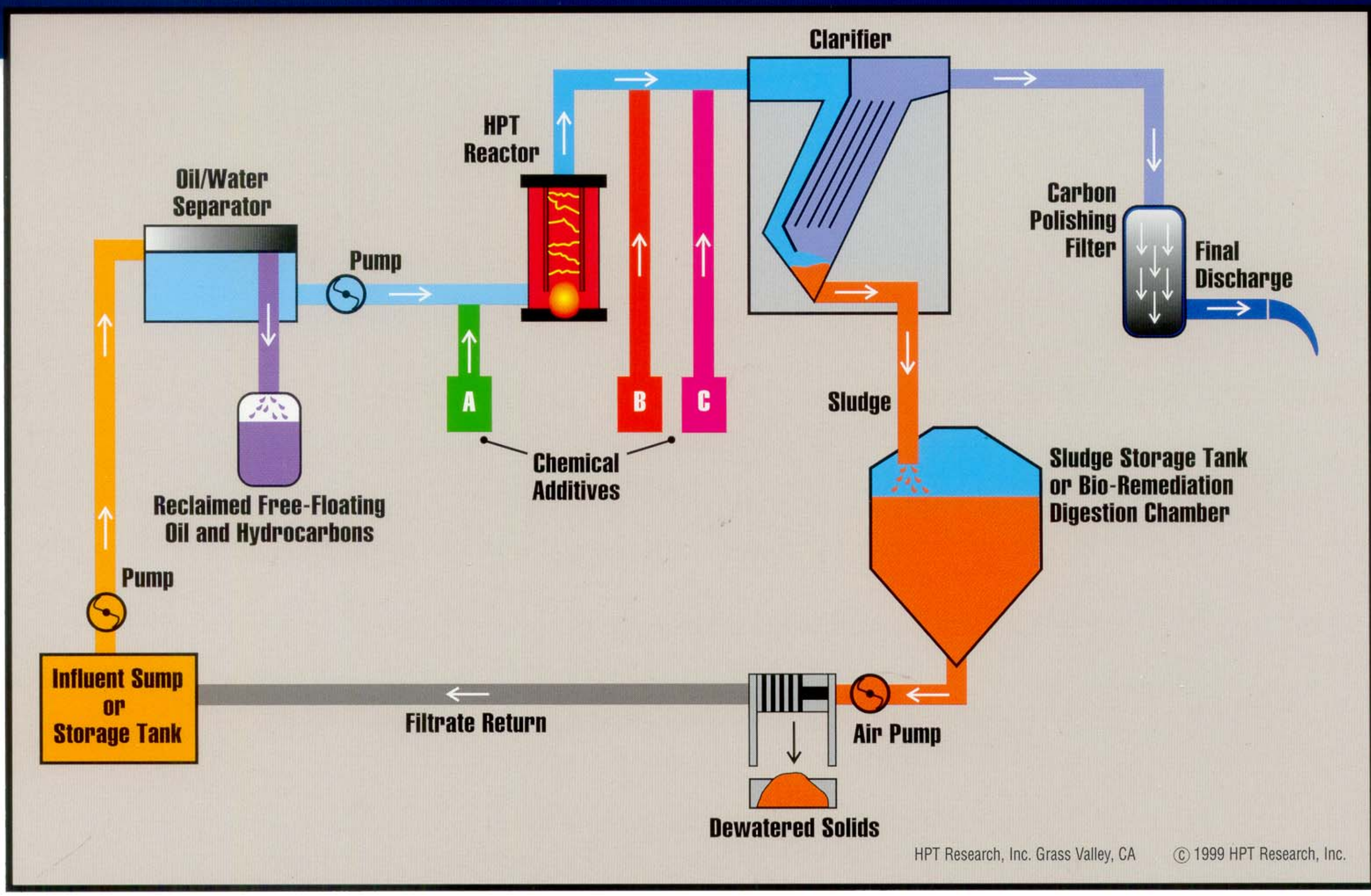
Additional Discussion

As previously mentioned, differing equipment configurations are utilized for the treatment of varying degrees of hydrocarbon contamination. For excessively contaminated waste streams involving mixtures of hydrocarbons and other compounds, it is often necessary to subject the wastewater to more than one Molecular Destruction Reactor In these applications, it is necessary to destroy and remove specific groups of compounds in the first reactor/ clarifier phase followed by a second treatment phase utilizing different voltage and magnetic values to remove the remaining contaminants.

The treatment of groundwater contaminated with relatively small amounts of hydrocarbons, specifically MTBE and other volatile aromatic compounds, presents some unique treatment problems. There isn’t enough of the contaminant material present to influence the conductivity of the water to sufficiently allow our reactor to destroy the compounds. Combining our hydrocarbon technology with a new type of filtration system developed by an associate firm, we can now effectively treat MBTE-contaminated groundwater.

The majority of the water in this latter process is treated and discharged directly from the filtration units. The side stream, containing the extracted contaminant material, is then treated using our reactor/ clarification process. In this manner, relatively large volumes of lightly contaminated water can be treated in a cost-effective manner.

Hydrocarbon and MTBE Treatment Flow Diagram



Features, Advantages and Benefits

Our Hydrocarbon Treatment System can be adapted to a wide range of applications involving highly contaminated waste streams or lightly contaminated groundwater:

- Process will produce clarified effluent that will meet or exceed discharge requirements.
- The treatment process can achieve non-detectable PPB levels of hydrocarbons in the final effluent.
- In addition to hydrocarbon removal, the process will also remove any heavy metals present in the waste stream,
- The system incorporates a cost-effective method of managing the product sludge.
- The treatment systems can be installed on trailers for portability and be scaled to accommodate large or small volumes of water.
- Standard systems can operate on 5 KW generator, 220 VAC and 115/120 VAC.

Hydrocarbon Treatment Test Results and Demonstration Description

On-site Treatment of Hydrocarbon Contaminated Waste Water

It is not uncommon for small amounts of liquid hydrocarbons (oils and fuels) to contaminate many thousands of gallons of surface or groundwater.

Many mechanical means (oil, water separators) have been employed over the years. Almost every conceivable type device has been built with varying success rates.

While floating and emulsified oils are serious environmental hazards, the dissolved hydrocarbons, especially the volatile aromatics can be toxic to plant and animal fife. Research has shown that contamination levels as low as 40 to 50 parts per billion of certain hydrocarbons can be harmful or hazardous. Selenium is often found associated with oil production water, and is considered hazardous to 5 parts per billion.

The latest research on MTBE in drinking water shows that some people are adversely affected by MTBE at levels of only 40 parts per billion.

These water soluble PAHs (MTBE) have resisted standard water treatment except for aeration, While the concept of volatilizing these hydrocarbons into the atmosphere is inexpensive, they can be again re-associated with airborne moisture particles and upon condensation enter the groundwater System.

Early containment of hydrocarbon spills can greatly reduce the area contaminated or number of gallons of water that is contaminated. After containment and/or storage, on-site treatment is limited to only a few crude treatment options... being trapped by absorbent materials (lots of volume for hazardous storage) or putting the contaminated water through some type of activated charcoal filter. While these charcoal filters are effective in removing some dissolved hydrocarbons, they can only absorb at best approximately 20% of its carbon weight in hydrocarbon contaminants and are not effective in MTBE removal.

The cost of treating these hydrocarbon contaminated waste waters can vary substantially depending upon the loading. Spills in very remote sites can be even more costly owing to access, transportation, etc.

An ideal system to treat hydrocarbon contaminated waste waters on site would: 1) reduce the number of gallons of hydrocarbon contaminated water to be shipped for hazardous waste storage or further treatment, 2) reduce the use of absorbent materials as a treatment (transportation and hazardous waste storage fees), and 3) actually treat the hydrocarbon contaminated waste waters and reduce the floating hydrocarbons (by oil/water separation and incineration) or to remove or destroy the dissolved hydrocarbons so as to make the treated wastewater meet surface discharge specification legal for on-site surface discharge.

We have been building recycle systems for a number of years and have had good success with the removal of dirt, oil, grease and fuels created by steam cleaning or high pressure washer applications. With the discovery of several new proprietary additives, the percentage removal of organics and hydrocarbons has been greatly enhanced.

At one particular site in California that tests and repairs fuel tankers, we have been able to consistently remove 99.9% of all the oils, greases, fuels and PAHs with a mechanical/chemical precipitation process.

Untreated Sump Water

Method:				
SM5520C	Total Oil & Grease	58,000	mg/l	(parts-per-million)
SM552OF	Hydrocarbon Oil & Grease	53,000	mg/l	(parts-per-million)
EPA 8015/DHS	Total Petroleum Hydrocarbons	2,200,000	ug/l	(parts-per-billion)
2 Volatile Aromatics				
		Result	***Units***	
	Benzene	5700	ug/l	(parts-per-billion)
	Chlorbenzene	ND	ug/l	(parts-per-billion)
	1,2-Dichlorobenzene (o-DCB)	ND	ug/l	(parts-per-billion)
	1,3-Dichlorobenzene (m-DCB)	ND	ug/l	(parts-per-billion)
	1,4-Dichlorobenzene (p-DCB)	ND	ug/l	(parts-per-billion)
	Ethylbenzene	14000	ug/l	(parts-per-billion)
	Toluene	52000	ug/l	(parts-per-billion)
	Total Xylene Isomers	88000	ug/l	(parts-per-billion)
	Methyl Tert-Butyl Ether (MTBE)	460000	ug/l	(parts-per-billion)

Test Results of Treated Sump Water

LUFT Analysis				
SM5520C	Total Oil & Grease	ND	mg/l	(parts-per-million)
SM552OF	Hydrocarbon Oil & Grease	ND	mg/l	(parts-per-million)
602 Volatile Aromatics				
	Benzene	ND	ug/l	(parts-per-billion)
	1,2 Dichlorobenzene (o-DCB)	ND	ug/l	(parts-per-billion)
	1,3 Dichlorobenzene (m-DCB)	ND	ug/l	(parts-per-billion)
	1,4 Dichlorobenzene (p-DCB)	ND	ug/l	(parts-per-billion)
	Ethylbenzene	ND	ug/l	(parts-per-billion)
	Toluene	ND	ug/l	(parts-per-billion)
	Total Xylene Isomers	ND	ug/l	(parts-per-billion)
	Methyl Tert-Butyl Ether	60	ug/l	(parts-per-billion)
610/8100 Polynuclear Aromatic Hydrocarbons				
	Acenaphthene	ND	ug/l	(parts-per-billion)
	Anthracebe	ND	ug/l	(parts-per-billion)
	Benzo(a)anthracene	ND	ug/l	(parts-per-billion)
	Benzo(a)pyrene	ND	ug/l	(parts-per-billion)
	Benzo(b)fluoranthene	ND	ug/l	(parts-per-billion)
	Benzo(ghi)perylene	ND	ug/l	(parts-per-billion)
	Benzo(k)fluoranthene	ND	ug/l	(parts-per-billion)
	Chrysene	ND	ug/l	(parts-per-billion)
	Dibenz(a,h)anthracene	ND	ug/l	(parts-per-billion)
	Fluoranthene	ND	ug/l	(parts-per-billion)
	Fluorene	ND	ug/l	(parts-per-billion)
	Inderio(1,2,3-cd)pyrene	ND	ug/l	(parts-per-billion)
	Naphthalene	6.0	ug/l	(parts-per-billion)
	Phenanthrene	ND	ug/l	(parts-per-billion)
	Pyrene	ND	ug/l	(parts-per-billion)
	Acenaphthylene	0	ug/l	(parts-per-billion)

8/99–2K