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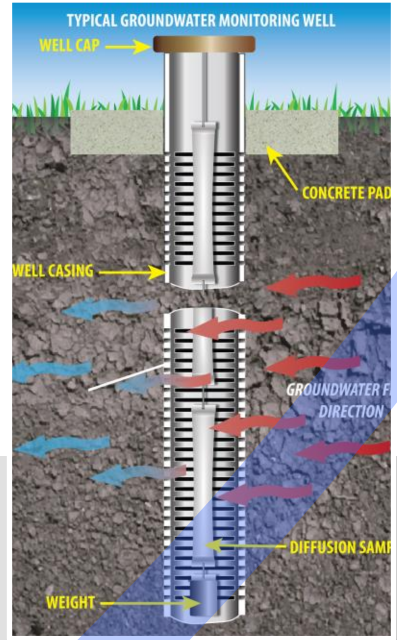
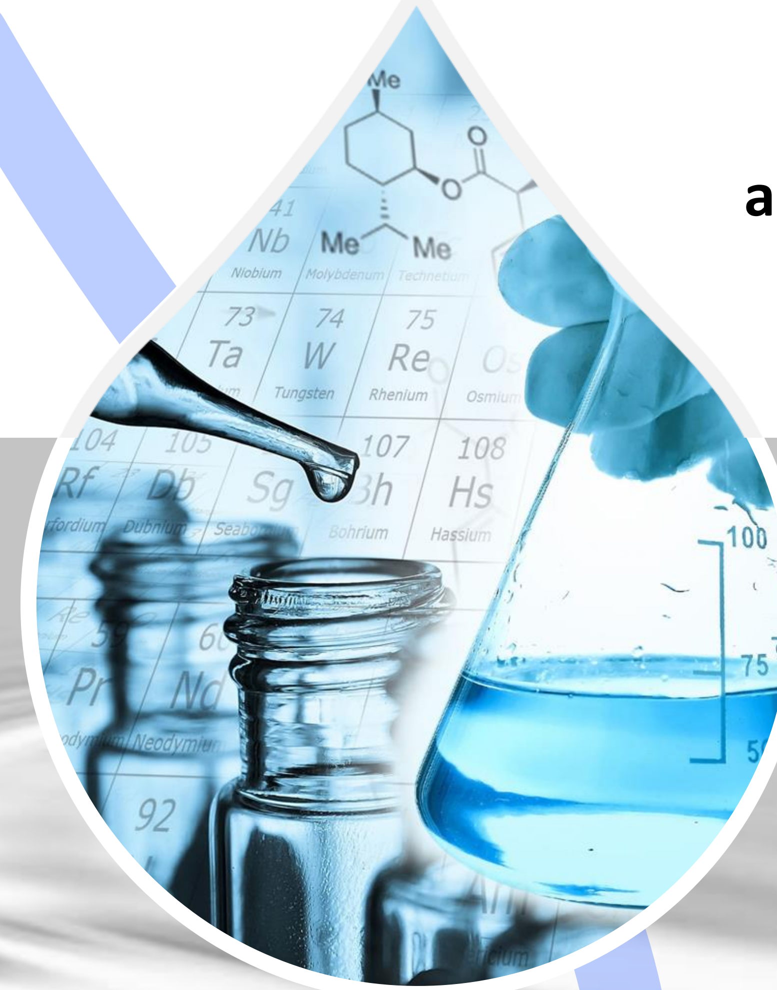
MTBE

and other fuel oxygenates





The MTBE Experts

Responsible Party Identification
GIS and Geomatics
Contaminant Hydrogeology
Fate and Transport Modeling
Risk Assessment
Remediation Feasibility Studies
Soil and Groundwater Remediation
Natural Resource Damage Assessment
Water Resources Assessment
Source Water Assessment and Protection
Drinking Water Treatment
Environmental Risk Management
Litigation Support/Expert Witness
Forensic Engineering
Stakeholder/Public Participation
Regulatory Strategy

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Fuel Oxygenate Properties

Compound	Vapor Pressure [20-25 °C] (mmHg)	Sorption (Log K_{oc}) (unitless)	Solubility [20-25 °C] (mg/L)	Henry's Law Constant (unitless)	Biodegradation Potential (relative)	Relative Mobility	Treatment Technology: Vadose Zone	Treatment Technology: Groundwater (in-situ)	Treatment Technology: Groundwater (ex-situ)	Toxicity (LD_{50}) (mg/kg)	Regulatory Levels: CA Primary/ Secondary (µg/L)	Regulatory Levels: USEPA (µg/L)
MTBE	249	1.15	48,000	0.024	poor	Increased ↑	SVE	Asp/MPE	AOP/AS/GAC/Bio	4,000	13/5	20-40 (advisory)
TBA	31.42	0.62	Miscible	0.003	moderate		Bio	Bio	AOP/Bio	3,500	12 (AL)	NS
MeOH	122	-0.74	Miscible	0.00019	excellent		Bio	Bio	Bio	6,000	NS	NS
EtOH	32.57	0.077	Miscible	0.00028	excellent		Bio	Bio	Bio	7,060	NS	NS
ETBE	89.96	1.57	5,031	0.10	poor		SVE	Asp/MPE	AOP/AS/GAC	1,215	NS	NS
DIPE	77.56	1.81	2,666	0.16	poor		SVE	Asp/MPE	AOP/AS/GAC	6	NS	NS
TAME	99.72	1.62	4,295	0.13	poor	↓	SVE	Asp/MPE	AOP/AS/GAC	1,000	NS	NS
Benzene	95	1.82	1,770	0.23	good	Decreased	SVE	Asp/MPE	AOP/AS/GAC/Bio	3,800	1/NS	5

Chemical properties from: http://www.gsi-net.com/en/publications/gsi-chemical-database.html
Koc = organic carbon partition coefficient
Mobility estimates from solubility, Log Koc and biodegradation

Treatment technologies are those in common use
Toxicity based on acute oral dosing studies of same animal species
LD50 = lethal dose to 50% of the population

MTBE = methyl tertiary butyl ether
MeOH = methanol
EtOH = ethanol
TBA = tertiary butyl alcohol

ETBE = ethyl tertiary butyl ether
DIPE = di-isopropyl ether
TAME = tertiary amyl methyl ether

SVE = soil vapor extraction
ASp = air sparging
MPE = multi-phase extraction
Bio = biological treatment

AS = air stripping
GAC = activated carbon
NS = no standard exists
AL = action level

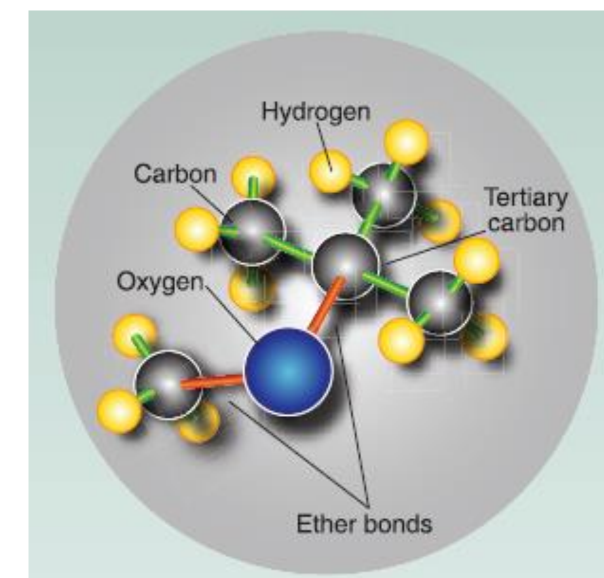
Strategies to Protect Water Supplies From MTBE and Other Fuel Oxygenates

Due to its widespread use, its presence in systems prone to leaks, and its fate and transport properties, MTBE has impacted water resources and potable water supplies across the nation. The restoration of these valuable resources will cost billions of dollars. Given the magnitude of the problem, MTBE contamination requires a pro-active rather than reactive approach to water resources protection. Therefore, to be prepared, water utilities and other impacted parties should consider the following:

1. Understand the hydrogeology of local groundwater basins.
2. Understand the chemical properties of the different fuel oxygenates being used in your area.
3. Locate the sources of fuel oxygenates in the vicinity of water supply wells
4. Develop source water assessment and protection plans.
5. Monitor and sample wells on a regular basis – for all fuel oxygenates
6. Identify the risks that release sites pose to your water resources.
7. Ensure that fuel releases are investigated and remediated effectively and expeditiously.
8. If the resource is impacted, work with regulators and the parties responsible for the problem.
9. Make sure that all work is conducted in a manner that is protective of the resource, and your interests.
10. Don't accept risks and liabilities that belong with the responsible parties
11. If necessary, take stronger actions to have the responsible parties restore the resources and to ensure that your interests are best served.
12. Keep the public informed, and never compromise the trust that exists between you and your customers.

Things to Keep in Mind

1. Fuel oxygenate releases can be managed – we have the tools, we just need the well, the resources (money), and the ability to use them.
2. All contaminant releases pose risk and liabilities – some can be tolerated, some managed, and some have to be mitigated. However, like beauty, risk is in the eye of the beholder
3. Fuel oxygenates other than MTBE may have been present in gasoline, particularly TBA.
4. Understand the chemical properties of the contaminants and the hdyrogeologic setting into which they are released – these are the keys to effective protection, investigation and remediation
5. Implement immediate and effective mitigation measures
6. Once in groundwater, MTBE will travel faster and further than other gasoline constituents.
7. MTBE does not biodegrade well, although it will attenuate due to dispersion and dilution (if mitigation is implemented).
8. No aquitard is impenetrable – given enough mass, space and time, MTBE will find its way to deeper aquifers.
9. Don't plume chase – develop a conceptual model of the hydrogeology and contaminant transport, collect data within the framework of such a model, and revise the model as necessary.
10. Treatment technologies can effectively remove MT BE and other fuel oxygenates from water – although they may be more costly to implement that for other contaminants.



Source: USGS

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