

Removal of MTBE from Household Ground Water Supplies

Treating ground water supplies contaminated with MTBE is considerably more difficult than when gasoline alone is present.

Typically, granular activated carbon (GAC) is used as an interim measure to remove gasoline contamination from household ground water supplies (Hall and Mumford, 1987). But MTBE, with its relatively high solubility, is poorly adsorbed by GAC: thus breakthrough of MTBE comes early. Laboratory (APL, 1983; and Lowry, unpublished experiments) and field (DEP experience) data substantiate this point. In general the bedlife of GAC units is less than 25% of what it would be if no MTBE were present. Or, in practical terms, a typical 2 cubic foot GAC unit will last only a few weeks or months when MTBE is present (the length of time being dependant on concentrations of contaminants, rate of water use, and the brand and type of GAC employed). Because the cost of GAC treatment is primarily in the replacement of the carbon bed, this makes GAC uneconomic when MTBE is present above a few tens of parts per billion.

Aeration is an alternative method of treatment for the removal of MTBE from water supplies. Aeration does not have the problem of saturation of an adsorptive medium. But unfortunately, the relatively low volatility of MTBE makes it difficult to remove compared to the other components of gasoline. Here the Henry's Law Constant is the controlling variable: for MTBE it is estimated to be less than 0.05, whereas it is 0.20 and 0.23 for benzene and toluene respectively. However, the efficacy of aeration can be increased by lengthening the aeration time or increasing the air to water ratio.

Lowry Engineering has developed a unique batch aeration system with variable aeration time, which has treated individual domestic water supplies contaminated with more than 200,000 parts per billion total gasoline and MTBE, with the treated water having no detectable hydrocarbons. Several units are now being monitored in the field where they have been performing satisfactorily. We have found that the system is the most effective and secure against breakthrough when contamination of ground water exceeds a few parts per million total gasoline or fuel oil, or more than 50 ppb MTBE.

For further information on treatment see Lowry and Lowry (1985).

Conclusions

- 1) MTBE is a more soluble and more rapidly spreading ground water contaminant than other components of gasoline,
- 2) Its presence in spilled gasoline increases dissolved concentrations of gasoline in ground water in the immediate vicinity of the spill to about an order of magnitude above typical values for spills in which there is no MTBE, and
- 3) It is more difficult to remove from contaminated water than the other components of gasoline.

Discussion of Policy Options

As this work grew out of a regulatory background founded on the need to limit the damage caused by leaking underground storage tanks, it is natural for us to think in terms of what these findings should mean in terms of new policy decisions. The following are a sample. There may be other options, and we are not advocating one option over another. The object of this discussion is to stimulate the reader into thinking of what should be done.

Option 1: MTBE could be abandoned as an additive in gasoline stored underground. Replacement of MTBE by ethanol, methanol or TBA is not, however, likely to improve the

uation vis a vis ground water. All are more soluble than MTBE, and TBA is almost impossible to remove by carbon adsorption or air stripping (API, 1983).

But octane enhancement without additives is possible (DoE, 1985). It is achieved by "reforming" some of the components of the distillate during the refining process so that the refined gasoline already has sufficient octane. Some producers prefer this "reformat" method of obtaining the required octane, and it does not have the environmental disadvantages of MTBE or its alcoholic competitors.

Option 2: Because the increased mobility of plumes containing MTBE results in greatly increased volumes of contaminated ground water, gasolines in which MTBE is blended could perhaps be stored only in double-contained facilities, or those with sensitive and effective leak detection systems. (This policy option may also have to be applied to gasolines blended with any highly soluble additive.)

Option 3: Because of the rise in popularity of MTBE and other very soluble additives to replace lead as the octane enhancer, it is perhaps time to acknowledge that all underground storage must be as secure as possible.

One Final Point. The Human Side of MTBE Contamination.

Several colleagues have commented that MTBE may be useful as a contaminant tracer because it is apparently less toxic, and precedes and travels further than the BTX components. We beg to differ. That opinion forgets the human element of gasoline spills.

The North Berwick spill contaminated the wells of two homes to concentrations an order of magnitude higher than if there had been no MTBE. The young couple in one of those homes had to wait for us to invent a whole new method of water treatment for their household supply. The young family in the other decided that water treatment was not the way to go, and chose instead to truck in water, at considerable expense and nuisance. The fact that MTBE appears to be less toxic than benzene was no consolation to the parents of young children. The anguish these two families underwent cannot be put into words.

The six other homes in North Berwick with only MTBE in their water were worried about when they would get gasoline too. The trauma associated with the contamination of a home water supply is not proportional to the toxicity of the contaminant detected.

References

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