Handling and Underground Storage of Fuels
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HANDLING AND UNDERGROUND STORAGE OF FUELS

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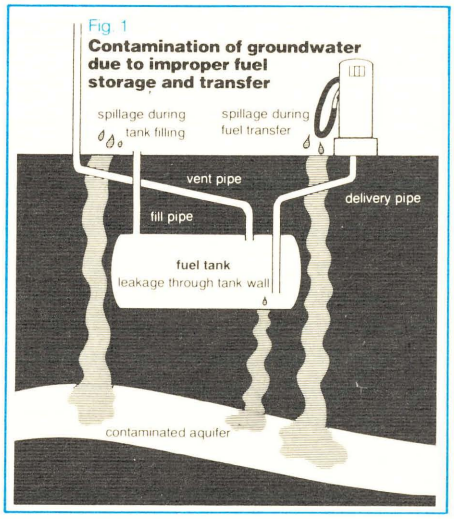
Fuel Leaks and Groundwater

The dangers of combustion or explosion associated with underground storage of gasoline, gasohol and diesel fuel have long been recognized. However, these substances can threaten humans in another way—as toxic contaminants of drinking water. Surveys in a number of states, including Michigan, have shown that fuel leaks and spills are significant contributors to groundwater contamination. Since groundwater is used as drinking water for about 50 percent of the population, and almost 100 percent of the farm and rural population, this type of contamination is a widespread problem.

Underground fuel tanks are a major source of this contamination. Most of these tanks are located at service stations; however, privately owned tanks (e.g., on homes and farms), can also significantly contaminate local groundwater supplies. Thus, individual tank owners play an important role in protecting the drinking water supply.

Underground storage tanks have a life of 15 to 25 years, and the probability that they will begin to leak increases with age. When leaks occur, fuel seeps through the soil to the groundwater. A leakage rate of just two drops per second can result in the loss of almost 500 gallons of fuel in one year and can contaminate nearly half a billion gallons of water to the point where odor and taste make it unacceptable for drinking.

The time it takes leaking fuel to reach the groundwater depends on soil composition, geological and hydrological factors and the distance between the tank and the aquifer. Once it reaches the groundwater, fuel tends to accumulate because: (1) it cannot evaporate, as it does on the surface; (2) it is not easily broken down by microorganisms; and (3) ground water moves very slowly. These factors lead to accumulation and persistence of these contaminants in the water (Fig. 1).



Health Effects of Fuel Components

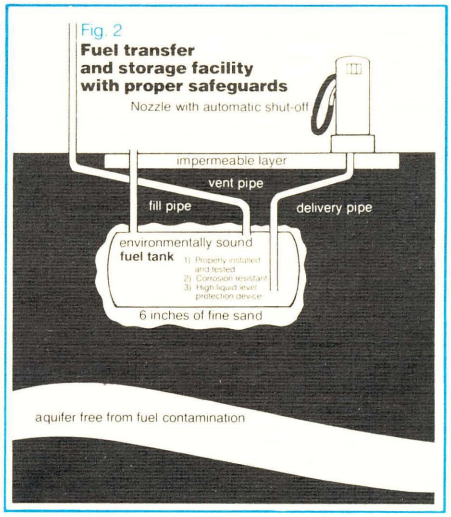
Petroleum fuels contain a number of potentially toxic compounds, including common solvents such as benzene, toluene and xylene, and additives such as ethylene dibromide and organic lead compounds. Some of the substances found in fuel have not been extensively studied and their effects, if any, are not known. When fed over a lifetime, ethylene dibromide has been found to cause cancer in laboratory animals. On the basis of inhalation studies, benzene is considered a human carcinogen. Using data from these studies, scientists have concluded that lifetime exposure to these substances in extremely small amounts (parts per billion—ppb) may lead to cancer rates in the range of 1 out of 100,000 or 1 out of 1,000,000 individuals. At these very low levels, fuel contaminants cannot be detected by smell or taste. Seemingly pure water may be contaminated with fuel components to the point of adversely affecting human health.

Dealing with Contaminated Groundwater

Once groundwater is contaminated, it is very difficult, time consuming and expensive to clean up. Decontamination usually requires aeration or filtration of large volumes of water. The time and cost of clean-up depends on the extent of contamination—even a small amount of contamination can be costly to clean up. If this groundwater is used for drinking and is contaminated, there are two alternatives: (a) import bottled water or (b) establish a new local source by drilling new wells or installing a system to treat and distribute river or lake water. Both of these remedies are expensive. It is best to prevent groundwater contamination from occurring. This bulletin describes how tank owners can help prevent contamination by properly using and storing fuels.

Preventing Spills and Leaks During Fuel Transfer

Fuel spills are usually due to carelessness during fuel transfer—overfilling the tank or spilling residual fuel from the hose at the beginning or end of the fueling process. Although small amounts are involved each time, repeated spills in the same area can lead to significant contamination. To prevent overfilling, equip underground storage tanks with a high liquid level protection device and carefully monitor



other tanks during fuel transfer. Be sure to empty fuel completely from the hose at the end of each fuel transfer. Minimize the number of fuel transfers and allow only trained workers to perform this task. To reduce the effects of spills, protect the ground under and around the transfer site with an impervious covering, such as a concrete apron or a layer of imbiber polymer (Fig. 2).

Leak Detection

Steps can be taken to prevent or minimize fuel leakage during tank installation and use. Systematically check for leaks during use by: (1) keeping an accurate inventory of tank fluid levels; (2) installing groundwater observation wells; or (3) using a leak detector. The leak detector is a sophisticated instrument which is not practical for routine use by the private tank owner. Using the inventory record method, leakage is apparent when there is any decrease in level over time, without any withdrawal of fuel. If the observation method is used, pipes are placed into the ground around and extending below the tank. Gasoline odor at the top of the pipe alerts the owner to possible leaks.

Once a leak is detected, take immediate steps to limit the flow of fuel into the ground. The tank should be emptied as soon as possible. Once the tank is empty, it can be repaired if it is otherwise sound, or replaced. Any repair and recoating should be done by qualified service personnel using registered repair products. (Information about registered products and qualified individuals is available from the Michigan Fire Marshal, Department of State Police.)

Corrosion Protection

The most important consideration when installing a new or used underground tank is to prevent or minimize corrosion. Corrosion can be minimized in a number of ways. If the tank is steel, be sure the tank is coated with corrosion-resistant material or is equipped with a pre-engineered or locally installed corrosion protection system. Also, be sure the composition of the soil layer surrounding the tank does not contribute to corrosion. A 6-inch layer of fine sand will accomplish this and will also cushion the tank and prevent possible puncture by sharp rocks. An alternative is to use a fiberglass rather than a steel tank. However, there is some question about using such tanks for alcohol-blend fuels. In addition, these tanks are more susceptible to dip-stick punctures unless a steel plate is installed below the fill hole.

Other Important Practices

Here are other ways to minimize the possibility of leakage. Be sure that:

—tank and connections (piping, valves, etc.) are not damaged during installation. Test for tightness after the tank is in place. This should be performed by qualified personnel as part of the installation process.

—backfilling is done carefully with allowance for settling so the tank will not shift in the ground and put stress on the connections.

—layer(s) covering the top of the tank are solid enough to withstand stress from vehicles driving over the site.

(For more details, see Agricultural Engineering Information Series No. 499.)

Out-of-Use Tanks

The above steps apply to installing as well as monitoring tanks currently in service. Tanks no longer in service must also be handled properly. If a tank is to be out of use for nine months or longer, empty and remove it from the ground, when feasible. If the tank is to be disposed of, perforate it in a number of places to rid it of flammable vapors and to make it unfit for further use before releasing for scrap.

State and Federal Action

The Michigan Fire Safety Board issued new regulations for the storage of flammable and combustible liquids in July of 1983. These are incorporated in this bulletin. The Fire Safety Board, however, tends to focus on fire or explosion rather than groundwater contamination.

Recently, both the U.S. Congress and the Michigan legislature enacted laws governing the use of underground storage tanks. These laws require that underground fuel storage tanks are registered and information provided as to ownership, age, size, construction and contents of each tank. The regulations, however, do not apply to private gasoline and diesel fuel tanks of less than 1,100 gallons and fuel oil tanks used for heating. Because these regulations do not apply to most farm and home fuel tanks, citizen self-regulation and community cooperation is needed to help protect groundwater supplies.

For More Information:

General Information and Referrals:

Center for Environmental Toxicology
Michigan State University
East Lansing, MI 48824
(517) 353-6469

For questions regarding current rules and proper procedures:

Michigan State Police
Fire Marshal Division
(517) 322-1924

Or

Michigan Department of
Natural Resources
Groundwater Quality Division
(517) 373-1947

For questions about health effects of groundwater contaminants:

Your Local Health Department

Or

Michigan Department of Public Health
Center for Environmental
Health Sciences
(517) 373-8050

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