United States Environmental Protection Agency | Office of Water (4606) | EPA 916-F-01-022 July 2001

Source Water Protection Practices Bulletin

Managing Above Ground Storage Tanks to Prevent Contamination of Drinking Water

Above ground storage tanks (ASTs) are tanks or other containers that are above ground, partially buried, bunkered, or in a subterranean vault. These can include floating fuel systems. This fact sheet focuses on the management of facilities with ASTs to prevent contamination of drinking water sources (ground water and surface water used as public drinking water supplies).

ABOVE GROUND STORAGE TANK USE

The majority of storage tanks contain petroleum products (e.g., motor fuels, petroleum solvents, heating oil, lubricants, used oil). Oil storage facilities with ASTs are typically found in marketing terminals, refineries, and fuel distribution centers. Storage tanks may also be found in airports, school bus barns, hospitals, automotive repair shops, military bases, farms, and industrial plants. Discharges of chemicals, petroleum, or non-petroleum oils from storage tanks can contaminate source water. Product spilled, leaked, or lost from storage tanks may accumulate in soils or be carried away in storm runoff.

Some of the causes for storage tank releases are holes from corrosion, failure of piping systems, and spills and overfills, as well as equipment failure and human operational error. The Spill Prevention Control and Countermeasures (SPCC) regulations require owners or operators of certain above ground oil storage facilities to prepare and comply with written, site-specific, spill prevention plans (see 40 CFR Part 112):

- Facilities with a total above ground oil storage capacity of more than 1,320 gallons;
- Single above ground tanks with an oil storage capacity of more than 660 gallons; and
- Facilities with a combined underground oil storage capacity greater than 42,000 gallons.

Above ground storage tanks

Please note, however, that State AST regulations may be more stringent or differ in other ways from the Federal requirements. You must check with local regulatory authorities to make sure which ASTs are subject to what requirements. All AST facility owners or operators exempt from these regulations should still consider implementing the prevention measures described in this fact sheet to preclude future storage tank problems.

WHY IS IT IMPORTANT TO MANAGE ABOVE GROUND STORAGE TANKS NEAR THE SOURCES OF YOUR DRINKING WATER?

Storage tank releases can contaminate soil and drinking water supplies. Petroleum products are composed of volatile organic compounds (VOCs). Any oil spill can pose a serious threat to human health and the environment, requires remediation that extends beyond your facility's boundary, and results in substantial cleanup costs. Even a small spill can have a serious impact. A single pint of oil released into the water can cover one acre of water surface area and can seriously damage an aquatic habitat. A spill of only one gallon of oil can contaminate a million gallons of water. It may take years for an ecosystem to recover from the damage caused by an oil spill. The location of the facility must be considered in relation to drinking water wells, streams, ponds and ditches (perennial or intermittent), storm or sanitary sewers, wetlands, mudflats, sandflats, farm drain tiles, or other navigable waters. Factors such as the distance to drinking water wells and surface water, volume of material stored, worse case weather conditions, drainage patterns, land contours, and soil conditions must also be taken into account.

AVAILABLE PREVENTION MEASURES TO ADDRESS ABOVE GROUND STORAGE TANKS

The following list of prevention measures is not all-encompassing; others can be found in the references provided at the end of the document. Furthermore, detailed explanations of each device mentioned below are found in the supporting documents. Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source water, the public's acceptance of the measures, and the community's desired degree of risk reduction.

Federal AST Requirements under 40 CFR Part 112

Follow standard tank filling practices when filling tanks to prevent spills and overfills. Furthermore, all ASTs should have a ***secondary containment*** area that contains spills and allows leaks to be more easily detected. The containment area surrounding the tank should hold 110 percent of the contents of the largest tank plus freeboard for precipitation. Secondary containment for ASTs must be impermeable to the materials being stored. Methods include berms, dikes, liners, vaults, and double-walled tanks. A manually controlled sump pump should be used to collect rain water that may accumulate in the secondary containment area. Any discharge should be inspected for petroleum or chemicals prior to being dispensed.

Routinely monitor ASTs to ensure they are not leaking. An audit of a newly installed tank system by a professional engineer can identify and correct problems such as loose fittings, poor welding, and poorly fit gaskets. After installation, inspect the tank system periodically to ensure it is in good condition. Depending on the permeability of the secondary containment area, more frequent containment area checks may be necessary. Areas to inspect include tank foundations, connections, coatings, tank walls, and the piping system. Integrity testing should be done periodically by a qualified professional and in accordance to applicable standards.

If an AST has remained out of service for more a year or more, many States require owners to maintain and monitor the tank, declare the tank inactive, or remove it. If the tank is declared inactive, remove all substances from the AST system (including pipes) and completely clean the inside. Secure tanks by bolting and locking all valves, as well as capping all gauge openings and fill lines. Clearly label tanks with the date and the words "Out of Service." Samples may be required when removing tanks to determine if any contamination has occurred. Most States require out-of-service tanks to be inspected and meet leak detection requirements before they are put back into service.

Additional AST Prevention Measures

The following prevention measures go beyond the Federal regulations under 40 CFR Part 112, but are highly recommended:

The location of the facility must be considered in relation to drinking water wells, streams, ponds and ditches (perennial or intermittent), storm or sanitary sewers, wetlands, mudflats, sandflats, farm drain tiles, or other navigable waters. The distance to drinking water wells and surface water, volume of material stored, worse case weather conditions, drainage patterns, land contours, and soil conditions must also be taken into account.

ASTs should have ***corrosion protection*** for the tank. Options include elevating tanks, resting tanks on continuous concrete slabs, installing double-walled tanks, cathodically protecting the tanks, internally lining tanks, inspecting tanks according to American Petroleum Institute standard, or a combination of the options listed above. All underground piping to the tank should be double-walled or located above ground or cathodically protected so you can inspect it when it fails.

To maximize system safety, seal the floors, containment area, and sump pump pit with an appropriate coating (e.g., petroleum resistant coating). Any accumulated water should be inspected for petroleum or chemicals prior to discharge

Accumulated minor spillage, over time, may result in a film or sheen on collected rain water, making it unsuitable for discharge to the soil or drains. ***Periodic cleanup*** of the containment areas (e.g., sweeping with a broom and using limited absorbent) can prevent unnecessary dirt and contaminant buildup.

While not a preventative measure for source water protection, ***preventing evaporation*** has economic and air quality benefits. To keep out rain and reduce evaporation losses and moisture condensation, paint tanks a reflective color, install them in an east-west direction, install a low-pressure valve on top of the tank, and cover the structure. A roof structure covering a 10,000 gallon tank will conserve 600 to 1,000 gallons of gasoline per year, which would have escaped by evaporation without the shade cover.

Local jurisdictions may want to implement ***registration programs*** for exempt tanks, in order to exercise some oversight of their construction and operation. Furthermore, most States also require inspections for ASTs by fire marshals. Inspection programs can be expanded to cover water contamination issues.

Covered AST with secondary containment

FOR ADDITIONAL INFORMATION

The following documents contain more detailed information on ASTs and are available for free on the Internet. You can contact your EPA Regional SPCC or Oil Coordinator for more information, as well. There are also State and local authorities that are often located in Oil, Environmental, or Pollution Control Divisions who can provide you with local regulations for ASTs.

Contact local government authorities in your area to see if there are ordinances in place to manage ASTs. Numerous examples of local source water protection-related ordinances for various potential contaminant sources can be found at:
http://www.epa.gov/r5water/ordcom/
http://www.epa.gov/owow/nps/ordinance/
http://www.epa.gov/owow/nps/ordinance/links.htm

The following documents provide additional information on AST prevention measures and regulations:

Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.. *Above-Ground Fuel Storage Systems* (EES-61). (1992, October). Retrieved February 9, 2001 from the World Wide Web:
http://www.cdc.gov/niosh/nasd/docs2/as04300.html

Minnesota Pollution Control Agency. *Above-Ground Storage Tank Systems*. (2000, October 18). Retrieved February 9, 2001 from the World Wide Web:
http://www.pca.state.mn.us/cleanup/ast.html

Minnesota Pollution Control Agency. *Out-of-Service Tank Systems*. (1998, November). Retrieved February 9, 2001 from the World Wide Web:
http://www.pca.state.mn.us/cleanup/ast.html

Purdue University Extension Service. *Petroleum Product Storage Practices on the Farm*. (1991). Retrieved February 12, 2001 from the World Wide Web:
http://pasture.ecn.purdue.edu/~epados/farmstead/fuel/src/title.htm

South Dakota Department of Environment and Natural Resources, Ground Water Quality Program.. *Frequently Asked Questions about UST and AST Systems*. (n.d.). Retrieved February 19, 2001 from the World Wide Web:
http://www.state.sd.us/denr/DES/Ground/tanks/FAQTANK.htm

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. *SPCC Requirements and Pollution Prevention Practices for Bulk Storage Facilities.* (n.d.). Retrieved February 9, 2001 from the World Wide Web:
http://www.epa.gov/oilspill/spcc/index.htm

U.S. Environmental Protection Agency, Office of Water. *Storm Water Management for Industrial Activities – Developing Pollution Prevention Plans and Best Management Practices*. Section 3.6 – Liquid Storage in Above-Ground Storage Tanks (EPA 832/R-92-006). (1992, September). Retrieved February 9, 2001 from the World Wide Web:
http://www.epa.gov/owm/sw/indguide/index.htm

U.S. Environmental Protection Agency, Oil Spill Program. *Introduction and Background to the Oil Pollution Prevention Regulation*. (n.d.). Retrieved May 1, 2001 from the World Wide Web: http://www.epa.gov/oilspill/spcc/index.html

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Source Water Protection Practices Bulletin

Managing Agricultural Fertilizer Application to Prevent Contamination of Drinking Water

If improperly managed, elements of fertilizer can move into surface water through field runoff or leach into ground water. The two main components of fertilizer that are of greatest concern to source water quality (ground water and surface water used as public drinking water supplies) are nitrogen (N) and phosphorus (P). This fact sheet focuses on the management of agricultural fertilizer applications; see the fact sheets on managing agricultural pesticide use, animal waste, and storm water runoff for other prevention measures that relate to agriculture.

FERTILIZER USE IN AGRICULTURE

Fertilizer application is required to replace crop land nutrients that have been consumed by previous plant growth. It is essential for economic yields. However, excess fertilizer use and poor application methods can cause fertilizer movement into ground and surface waters. While fertilizer efficiency has increased, Colorado State University estimated that about 25 percent of all preplant nitrogen applied to corn is lost through leaching (entering ground water as nitrate) or denitrification (entering the atmosphere as nitrogen gas).

Fertilizer spreading

WHY IS IT IMPORTANT TO MANAGE FERTILIZER USE NEAR THE SOURCES OF YOUR DRINKING WATER?

Improper or excessive use of fertilizer can lead to nitrate pollution of ground or surface water. Nitrogen fertilizer, whether organic or inorganic, is biologically transformed to nitrate that is highly soluble in water. In this soluble form, nitrate can readily be absorbed and used by plants. On the other hand, soluble nitrate is highly mobile and can move with percolating water out of the soil, thus making it unavailable for plant uptakes. Crop producers, therefore, need to match nitrogen applications to crop uptake to minimize nitrate leaching and maximize efficiency.

Use of nitrogen-containing fertilizers can contribute to nitrates in drinking water. Consumption of nitrates can cause methemoglobinemia (blue baby syndrome) in infants, which reduces the ability of the blood to carry oxygen. If left untreated, methemoglobinemia can be fatal for affected infants. Due to this health risk, EPA set a drinking water maximum contaminant level (MCL) of 10 milligrams per liter (mg/l) or parts per million (ppm) for nitrate measured as nitrogen.

Another major component of fertilizer is phosphorus. Under certain conditions phosphorus can be readily transported with the soil. In fact, 60 to 90 percent of phosphorus moves with the soil. Phosphorus is the major source of water quality impairments in lakes nationwide. Even though regulations that affect the taste and odor of water are not Federally enforceable under the Safe Drinking Water Act, municipalities often must treat their drinking water supplies for these aesthetic reasons.


Organic fertilizer application

The use of organic nutrient sources, such as manure, can supply all or part of the nitrogen, phosphorus, and potassium needs for crop production. However, organic fertilizers can also cause excessive nutrient loads if improperly applied.

AVAILABLE PREVENTION MEASURES TO ADDRESS AGRICULTURAL APPLICATIONS OF FERTILIZER

This section discusses some of the most often used prevention measures, but is not an exhaustive list of all known measures. For information on additional prevention measures, see the documents referenced in the last section of this fact sheet. Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source water, the public's acceptance of the measures, and the community's desired degree of risk reduction.

The goal of these prevention measures is to minimize nutrient losses from agricultural lands occurring by edge-of-field runoff and by leaching from the root zone. Effective nutrient management abates nutrient movement by minimizing the quantity of nutrients available for loss. This is achieved by developing a comprehensive nutrient management plan and using only the types and amounts of nutrients necessary to produce the crop, applying nutrients at the proper times and with proper methods, implementing additional farming practices to reduce nutrient losses, and following proper procedures for fertilizer storage and handling.

Application Rates and Fertilizer Types


Fertilizer spreader

One component of a comprehensive nutrient management plan is to determine proper fertilizer application rates. The goal is to limit fertilizer to an amount necessary to achieve a realistic yield goal for the crop. Soil sampling and crediting other sources are also parts of the concept.

Yearly ***soil sampling*** is necessary for determining plant nutrient needs and to make accurate fertilizer recommendations. Many factors must be considered when determining sampling methods and frequency.

Calculating the optimal rate of application also includes ***crediting other sources*** that contribute nitrogen and phosphorous to the soil. Previous legume crops, irrigation water, manure, and organic matter all contribute nitrogen to the soil, while organic matter and manure contribute phosphorus.

Along with soil samples and fertilizer credits from other sources, nitrogen fertilizer recommendations are based on ***yield goals*** established by the crop producers. Yield expectations are established for each crop and field based on soil properties, available moisture, yield history, and management level.

Applying the ***appropriate form of nitrogen fertilizer*** can reduce leaching. Nitrate forms of nitrogen fertilizer are readily available to crops, but are subject to leaching losses. Nitrate fertilizer use should be limited when the leaching potential is moderate to high. In these situations, ammonium nitrogen fertilizers should be used because they are not subject to immediate leaching. However, ammonium nitrogen transforms rapidly into nitrate when soils are warm and moist. More slowly available nitrogen fertilizers should be used in these conditions. Nitrification inhibitors can also delay the conversion of ammonium to nitrate under certain conditions.

Phosphorus fertilizer is less subject to leaching, but loss through surface runoff is more common. To minimize losses of phosphorus fertilizer, applications should only be made when needed (determined through soil testings) and at recommended rates.

Fertilizer Application Timing

Nitrogen fertilizer ***applications should be timed*** to coincide as closely as possible to the period of maximum crop uptake. Fertilizer applied in the fall has been shown to cause ground water degradation. Partial application of fertilizer in the spring, followed by small additional applications as needed, can improve nitrogen uptake and reduce leaching. Reasons to alter nitrogen amounts include abnormal weather or crop quality.

Fertilizer Application Methods

Fertilizer application equipment should be inspected at least once annually. Application equipment must also be ***properly calibrated*** to insure that the recommended amount of fertilizer is spread.

Correct fertilizer placement in the root zone can greatly enhance plant nutrient uptake and minimize losses. Subsurface applied or incorporated fertilizer should be used instead of a surface broadcast fertilizer. The most efficient application method for many crops, especially in erosive soils, is to place dry fertilizer into the ground in bands. Band or drilled row fertilizers are applied closer to the seed and can be recovered by the crop more efficiently. All surface-applied fertilizers should be mechanically incorporated into the soil to reduce losses through surface runoff and volatilization. Fertilizer should never be applied to frozen ground, and also should be limited on slopes and areas with high runoff or overland flow.

Irrigation water should be managed to maximize efficiency and minimize runoff or leaching. Irrigated crop production has the greatest potential for source water contamination because of the large amount of water applied. Both nitrogen and phosphorus can leach into ground water or run off into surface water when excess water is applied to fields. Irrigation systems, such as sprinklers, low-energy precision applications, surges, and drips, allow producers to apply water uniformly and with great efficiency. Efficiency can also be improved by using delivery systems such as lined ditches and gated pipe, as well as reuse systems such as field drainage recovery ponds that efficiently capture sediment and nutrients. Gravity-controlled irrigation or furrow runs should be shortened to prevent over-watering at the top of the furrow before the lower end is adequately watered.

Runoff

Additional Farming Practices

A complete system is needed to reduce fertilizer loss. Components of this system often include farming practices that are not strictly related to fertilizer, such as conservation tillage and buffers.

Conservation tillage is another field management method used to reduce runoff. In conservation tillage, crops are grown with minimal cultivation of the soil. When the amount of tillage is reduced, the plant residues are not completely incorporated and most or all remain on top of the soil. This practice is critical to reducing phosphorus losses because the residue provides cover and thereby reduces nutrient runoff and erosion by water.

Conservation tillage

Creating ***buffer strips or filter strips*** can impede runoff and help filter nitrogen and phosphorus from runoff. Buffer strips and filter strips are created by planting dense vegetation near surface water bodies. The root systems of these plants hold soil in place, thereby decreasing the velocity of runoff and preventing erosion. The vegetation and soils strain and filter sediments and chemicals. For more information on buffer strips and filter strips see the fact sheet on storm water runoff.

Wheat-corn-fallow rotation

Crop rotation can often yield crop improvement and economic benefits by minimizing fertilizer and pesticide needs. Planting legumes as part of a crop rotation plan provides nitrogen for subsequent crops. Deep-rooted crops can be used to scavenge nitrogen left in the soil by shallow-rooted crops. ***Cover crops*** stop wind and water erosion, and can use residual nitrogen in the soil.

A high-tech way to level or grade a field is to use ***laser-controlled land leveling*** equipment. Field leveling helps to control water advance and improve uniformity of soil saturation in gravity-flow irrigation systems. This improves irrigation efficiency and reduces the potential for nutrient pollution through runoff.

Fertilizer Storage and Handling

Follow label directions for storing and mixing fertilizer and for disposing empty containers. Lock or secure storage container valves when the container is not in use.

Protect permanent fertilizer storage and mixing sites from spills, leaks, or storm water infiltration. Storage buildings should have impermeable floors and be securely locked. Impermeable secondary containment dikes can also be used to contain liquid spills or leaks. Do not store fertilizer in underground containers or pits.

To prevent accidental contamination of water supplies, mix, handle, and store fertilizer away from wellheads and surface water bodies. Installing anti-backflow devices on equipment can also prevent spillage. Ideally, mix and load fertilizers at the application spot.

Immediately recover and reuse or properly dispose of spills. Granular absorbent material can be used at the mixing site to clean up small liquid spills.

FOR ADDITIONAL INFORMATION

These references have information on agricultural fertilizer use and best management practices. All of the following documents are available for free on the internet. You should also contact the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Conservation District, and Agricultural Extension Service representatives in your area for more information on nutrient management and cost-share programs, such as the Environmental Quality Incentives Program (EQIP), the Conservation Reserve Program (CRP), and the Conservation Reserve Enhancement Program (CREP), to assist in financing source water protection measures.

Contact local government authorities in your area to see if there are ordinances in place to manage fertilizer use. Numerous examples of local source water protection-related ordinances for various potential contaminant sources can be found at:
http://www.epa.gov/r5water/ordcom/
http://www.epa.gov/owow/nps/ordinance/
http://www.epa.gov/owow/nps/ordinance/links.htm

The following documents provide more detailed information on prevention measures for fertilizer use on the farm.

Colorado State University Cooperative Extension. *Best Management Practices for Nitrogen Fertilization* (XCM-172). (1994, August). Retrieved February 9, 2001 from the World Wide Web: http://www.ext.colostate.edu/PUBS/CROPS/pubcrop.html#soil

Colorado State University Cooperative Extension. *Best Management Practices for Pesticide and Fertilizer Storage and Handling* (XCM-178). (1994, August). Retrieved February 9, 2001 from the World Wide Web: http://www.ext.colostate.edu/PUBS/CROPS/pubcrop.html#soil

Colorado State University Cooperative Extension. *Best Management Practices for Phosphorus Fertilization* (XCM-175). (1994, August). Retrieved February 9, 2001 from the World Wide Web: http://www.ext.colostate.edu/PUBS/CROPS/pubcrop.html#soil

Farm*A*Syst - University of Wiscocsin. Retrieved May 22, 2001 from the World Wide Web: http://www.uwex.edu/farmasyst/

Kansas State University Cooperative Extension Service. *Best Management Practices for Nitrogen*. (1996, March). Retrieved February 9, 2001 from the World Wide Web: http://www.oznet.ksu.edu/library/ageng2/#WaterQuality

Kansas State University Cooperative Extension Service. *Best Management Practices for Phosphorus*. (1998, February). Retrieved February 9, 2001 from the World Wide Web: http://www.oznet.ksu.edu/library/ageng2/#WaterQuality

North Carolina State University. *Sustainable Practices for Vegetable Production in the South – Conservation Tillage*. (1997, July 9). Retrieved March 14, 2001 from the World Wide Web: http://www.cals.ncsu.edu/sustainable/peet/tillage/c03tilla.html

Purdue University Extension Service. *Fertilizer Storage and Handling on the Farm*. (1999). Retrieved February 12, 2001 from the World Wide Web: http://pasture.ecn.purdue.edu/~epados/farmstead/fert/src/title.htm

Texas Agricultural Extension Service. *Reducing the Risk of Ground Water Contamination by Improving Fertilizer Storage and Handling* (B-6026). (n.d.). Retrieved February 9, 2001 from the World Wide Web: http://agpublications.tamu.edu/catalog/index.html

University of Maryland – Cooperative Extension. *Agricultural Nutrient Management*. Retrieved May 22, 2001 from the World Wide Web: http://www.agnr.umd.edu/users/agron/nutrient/

University of Saskatchewan, Department of Agriculture. *Fertilizer: The Basics*. (n.d.). Retrieved February 16, 2001 from the World Wide Web: http://www.ag.usask.ca/cofa/departments/hort/hortinfo/misc/fertiliz.html

U.S. Department of Agriculture. *Irrigation Systems and Land Treatment Practices*. (2001, February 6). Retrieved March 14, 2001 from the World Wide Web: http://151.121.66.126/Briefing/wateruse/Questions/glossary.htm

U.S. Department of Agriculture, Natural Resources Conservation Service. *Comprehensive Nutrient Management Planning – Technical Guidance*. (2000, December). Retrieved April 30, 2001 from the World Wide Web: http://www.nhq.nrcs.usda.gov/PROGRAMS/ahcwpd/ahCNMP.html

U.S. Department of Agriculture, Natural Resources Conservation Service. *Conservation Practices Training Guide*. (1999, August). Retrieved April 30, 2001 from the World Wide Web: http://www.ftw.nrcs.usda.gov/tech_ref.html

Virginia Cooperative Extension. *Fertilizer Storage, Handling, and Management* (442-906). (1996, June). Retrieved February 9, 2001 from the World Wide Web: http://www.ext.vt.edu/pubs/farmasyst/442-906/442-906.html

WELLHEAD PROTECTION PROGRAM PLAN

What to know about Agricultural Fertilizer Application

Hoke County depends on groundwater to provide public water supplies. Help us preserve our water quality for our current and future needs (more information on reverse). For more information, please contact the Hoke County Regional Water at 910-848-0385 .

MANAGING FERTILIZER USE NEAR DRINKING WATER SUPPLIES

If improperly managed, elements of fertilizer can move into surface water through field runoff or leach into ground water. The two main components of fertilizer that are of greatest concern to public drinking water supplies are nitrogen (N) and phosphorus (P). Crop producers need to match nitrogen applications to crop uptake to minimize nitrate leaching and maximize efficiency. Due to health risk, the EPA set a drinking water maximum contaminant level (MCL) of 10 milligrams per liter (mg/l) for nitrate measured as nitrogen. The goal of the prevention measures, as described below, are to minimize nutrient losses from agricultural land occurring by edge-of-field runoff and by leaching from the root zone. This can be achieved by developing a comprehensive nutrient management plan and using only the types and amounts of nutrients necessary to produce the crop, applying nutrients at the proper times and with proper methods, implementing additional farming practices to reduce nutrient losses, and following proper procedures for fertilizer storage and handling.

APPLICATION RATES AND FERTILIZER TYPES

- Limit fertilizer to an amount necessary to achieve a realistic goal
- Perform yearly soil sampling to determine nutrient needs
- When calculating rate of application, credit other sources to include nitrogen and phosphorous contributions from previous legume crops, irrigation water, manure, and organic matter
- Understand and follow fertilizer yield goals based on soil properties, available moisture, yield history, and management level
- Apply the appropriate form of nitrogen fertilizer based on soil and weather conditions.

APPLICATION PRACTICES
Apply product during maximum crop uptake periods
Inspect and calibrate equipment annually to ensure accurate application amounts
Correctly place fertilizer in the root zone to enhance plant nutrient uptake which minimalizes loss
Manage irrigation water due to the large amount of water applied. Sprinklers, precision applicators, surges and drips can apply water uniformly.

EPA NC RWA TRAINING SUPPORT

Aqueous Film-Forming Foam (AFFF)

1 Introduction

Aqueous film-forming foam (AFFF) is a highly effective firefighting product intended for fighting high-hazard flammable liquid fires. AFFF products are synthesized by combining hydrocarbon foaming agents with fluorinated surfactants to achieve a product that has been used at military installations, civilian airports, petroleum refineries, bulk storage facilities, and chemical manufacturing plants (Hu et al. 2016; CONCAWE 2016).

This fact sheet is targeted to local, state, and federal regulators and tribes in environmental, health and safety roles as well as AFFF users at municipalities, airports, and industrial facilities. This fact sheet is not intended to replace manufacturer specifications or industry guidance for AFFF use, or to discuss alternatives in detail. It is only intended to educate users on AFFF use to reduce and eliminate potential harm to human health and the environment. Additional information is available in the Guidance Document.

ITRC has developed a series of fact sheets that summarize recent science and emerging technologies regarding PFAS. The information in this and other PFAS fact sheets is more fully described in the ***ITRC PFAS Technical and Regulatory Guidance Document (Guidance Document)*** (*https://pfas-1.itrcweb.org/*).

This fact sheet outlines methods to properly identify, handle, store, capture, collect, manage, and dispose of AFFF to limit potential environmental impacts, and includes:

- Definition of AFFF
- Best Management Practices for AFFF use
- Regulations Affecting Sale and Use
- Foam Research and Development

2 What is AFFF?

Class B firefighting foams are commercial surfactant solutions that are designed and used to combat Class B flammable fuel fires. All Class B foams are not the same. Although not usually categorized this way from a fire protection viewpoint, they can be divided into two broad categories from a per- and polyfluoroalkyl substances (PFAS) perspective: fluorinated foams that contain PFAS and fluorine-free foams (F3) that do not contain PFAS.

There are six groups of Class B foams that contain PFAS and four groups of Class B foams that do not contain PFAS. Figure 1 illustrates all categories of Class B foams. This fact sheet focuses on AFFF only as these are the primary foams that contain fluorosurfactants.

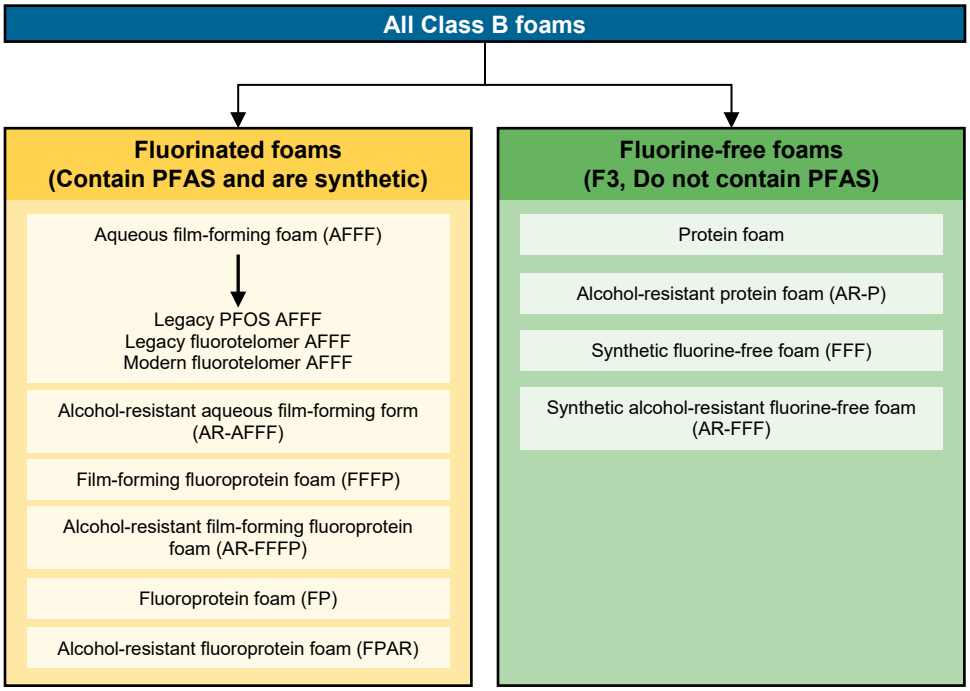

Figure 1. Types of Class B foams.
Source: S. Thomas, Wood, PLC. Used with permission.

Aqueous Film-Forming Foam (AFFF) *continued*

AFFF is considered a fluorinated foam and when mixed with water, the resulting solution achieves the interfacial tension characteristics needed to produce an aqueous film that spreads across the surface of a hydrocarbon fuel (petroleum greases, tars, oils and gasoline; and solvents and alcohols) to extinguish the fire and to form a vapor barrier between the fuel and atmospheric oxygen to prevent re-ignition. This film formation is the defining feature of AFFF.

AFFF has been used at chemical plants, flammable liquid storage and processing facilities, merchant operations (oil tankers, offshore platforms), municipal services (fire departments, firefighting training centers), oil refineries, terminals, and bulk fuel storage farms, aviation operations (aircraft rescue and firefighting, hangars), in some industrial fire extinguishers, and military facilities.

There are three possible types of AFFF, each is presented in Figure 1:

- legacy PFOS AFFF (manufactured in the US from the late1960s through 2002)
- legacy fluorotelomer AFFF (contain some long-chain PFAS) (manufactured in the US from the 1970s until 2016)
- modern fluorotelomer AFFF (short-chain PFAS became the predominant fluorochemicals used in manufacturing in response to USEPA 2010/2015 voluntary PFOA Stewardship Program)

Most foam manufacturers now produce Class B F3s. Performance of these foams should be evaluated carefully as future purchasing decisions are made. Organizations should determine whether a Class B F3 can achieve the required performance specifications for their specific flammable liquid hazards as part of pre-planning for replacement materials (FFFC 2016). As of publication, F3s do not meet the performance requirements of the Mil-Spec and therefore are not used at federal- and FAA-regulated facilities (FAA 2020). A mandate within the FAA Reauthorization Act of 2018 (enacted October 5, 2018) directs the FAA to stop requiring the use of fluorinated foam no later than 3 years from the date of enactment (October 4, 2021), so F3 use is anticipated at FAA-regulated facilities in the near future. The National Defense Authorization Act of fiscal Year 2020 (signed into law Dec 20, 2019) requires the DOD to phase out its use of AFFF at all military installations by Oct. 1, 2024, with limited exceptions, and immediately stop military training exercises with AFFF. The secretary of the Navy must publish specifications for PFAS-free firefighting foam at all military installations and ensure that the foam is available for use by Oct. 1, 2023.

3 Best Management Practices (BMPs) for Class B AFFF Use

Firefighting foams are an important tool to protect human health and property from flammable liquid fire threats. Proper management and usage strategies combined with the ongoing refinement of environmental regulations will allow an informed selection of the viable options to sustainably use firefighting foams. BMPs should be established for the use of any firefighting foam to prevent possible releases to the environment that can lead to soil, groundwater, surface water, and potentially drinking water contamination. The discharge of firefighting foams to the environment is of concern because of the potential negative impact they can have on ecosystems and biota. AFFF, due to the presence of PFAS, poses a unique challenge to protecting the environment when it is released. Specifically, for AFFF, the amount of PFAS from foam that may enter groundwater depends on the type and amount of foam used, the degree of containment, when and where the foam was used, the type of soil and the depth to groundwater. AFFF is typically discharged on land but can run off into surface water or stormwater or infiltrate to groundwater. A conceptual site model (CSM) is presented in Figure 2.

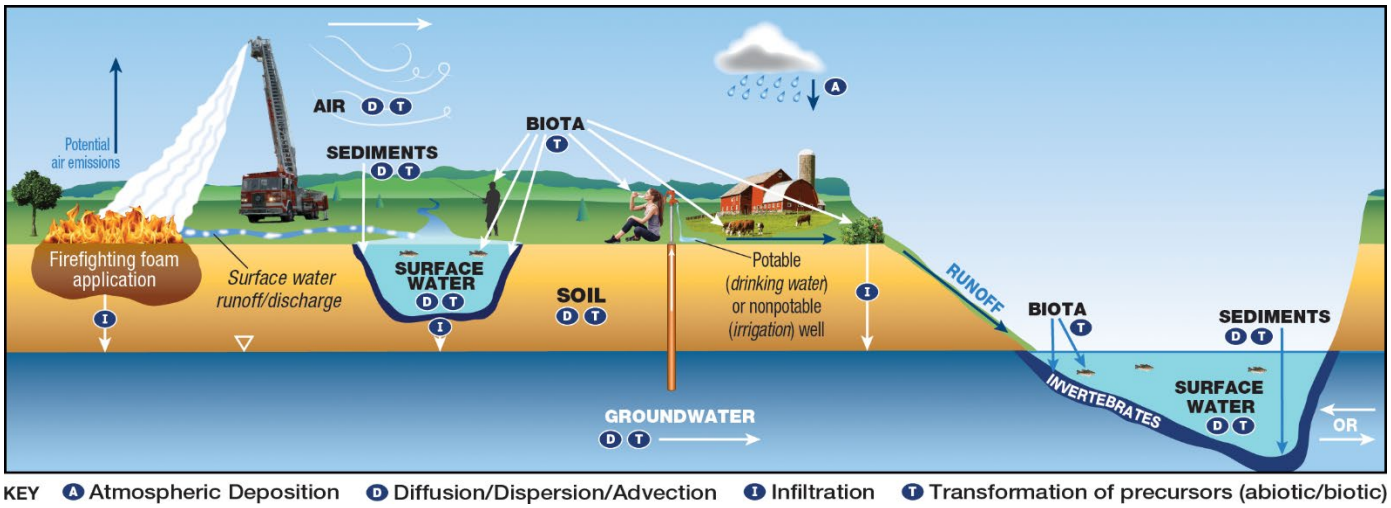

Figure 2. CSM for fire training areas.

Source: Adapted from figure by L. Trozzolo, TRC. Used with permission.

BMPs should consider the entire life cycle for AFFF, including procurement and inventory, foam systems and operations, emergency firefighting operations, immediate investigative and clean-up actions, treatment and disposal and system replacement.

The procurement and inventory of foam should be carefully considered. Foams should be selected that meet the performance specification requirements governing the use. Foams procured should be documented, labelled clearly and adequately contained. Foam use and disposal should be carefully tracked and recorded.

When evaluating foam systems and operations, from fixed-system testing, mobile firefighting equipment testing and appropriate training exercises, engineering and administrative controls as well as personal protective equipment (PPE) should be carefully evaluated. During emergency firefighting operations following a release of firefighting foam, PPE should be used correctly, maintained, and decontaminated routinely. Immediate investigative and clean-up actions include initial mitigation efforts such as source control, containment tactics, and recovery tactics.

BMPs start with pre-planning and deciding which foam to keep in stock. The team should consider key factors such as these:

- Whether F3 alternatives can meet site-specific performance requirements
- Site-specific evaluation of likely fire hazards and potential risks for life, public safety, and property
- Potential environmental, human health, and financial liabilities associated with AFFF releases
- Site constraints, including existing equipment retrofit requirements to adapt to alternate foams

The treatment and disposal of AFFF products and environmental media impacted with PFAS can be complex, time consuming, and costly. Practitioners should be aware of approved and available disposal options prior to the generation of PFAS-impacted waste or the start of an AFFF replacement project to avoid potentially lengthy waste storage timeframes. Currently, available disposal options for AFFF and PFAS-impacted materials are limited and each option has its advantages and disadvantages. More information is included in the Guidance Document.

Firefighting foam replacement is complex and could require a complete system review and, potentially, redesign and modification of system components to meet the new objectives or material and performance requirements. Foam replacement should include an evaluation of specific hazards and application objectives, a review of applicable performance standards, an understanding of engineering requirements for foam product storage and application, and a check to ensure that the foam product is approved for use for the specific hazards being mitigated.

4 Regulations Affecting the Sale and Use of AFFF

There are many State, Federal, and International regulations and guidance documents governing the procurement, use, and disposal of AFFF. Activities range from AFFF take-back programs and prohibition of manufacture, sale, use, and import of AFFF through to restrictions and requirements for disposal. Refer to the Guidance Document for further information.

Figure 3. Life cycle considerations for AFFF.
Source: S. Thomas, Wood, PLC. Used with permission.

5 Foam Research and Development

A substantial amount of research related to AFFF alternatives and replacement chemistries has recently been completed and/or is being considered at the time of publication. For more information related to this topic, please refer to the Guidance Document. Several organizations globally have made investments in research and development around AFFF from the assessment of their use, environmental impacts, as well as socioeconomic impacts of transiton to and performance specifications of F3 alternatives.

6 References and Acronyms

The references cited in this fact sheet and further references can be found at https://pfas-1.itrcweb.org/references/.
The acronyms used in this fact sheet and in the Guidance Document can be found at https://pfas-1.itrcweb.org/acronyms/.

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Source Water Protection Practices Bulletin

Managing Small Quantity Chemical Use to Prevent Contamination of Drinking Water

Many small businesses, government agencies, and academic institutions use chemicals to carry out their business functions. Although varying greatly in purpose, these small quantity chemical users share in their ability to potentially contribute to the pollution of drinking water. Many small businesses understand their day-to-day business operations but may lack familiarity with procedures for proper use and management of chemicals. This fact sheet provides an overview of prevention measures and demonstrates how precaution must be taken in all areas regarding chemical use. Businesses that generate hazardous waste, as it is defined under the Resource Conservation and Recovery Act, should consult with their State hazardous waste agency regarding proper handling and disposal.

PLACES WHERE SMALL QUANTITY CHEMICAL USE OCCURS

Small quantity chemical users include dry cleaners, beauty shops, photo finishers, vehicle repair shops, printers, laboratories, water supply facilities, academic institutions, nursing homes, medical facilities, and many others. It is the daily practices of these businesses that use chemicals and produce chemical waste. Degreasing, cleaning, polishing, paint preparation, rust removal, and photo processing are just a fraction of the activities in which small businesses are engaged.

Improper disposal of chemicals from these users can reach ground or surface water through a number of pathways. If substances from these businesses are accidentally or intentionally discharged into sewers, contamination of ground and surface waters can occur. Improper disposal into sewers can also endanger the ability of publicly-owned treatment works (POTWs) to properly treat wastewater. Chemicals poured into septic systems or dry wells can leach into ground water or contribute to treatment system failure. Chemical users should always ensure that haulers they hire to carry their waste off-site are properly licensed and that they deliver the waste to appropriate disposal sites.

WHY IS IT IMPORTANT TO MANAGE SMALL QUANTITY CHEMICAL USE NEAR THE SOURCES OF YOUR DRINKING WATER?

Many ordinary businesses use chemicals and produce chemical waste that can be harmful to humans if ingested. Types of chemicals used by these businesses include solvents, corrosives, dry cleaning agents, heavy metals and inorganics, inks and paint, lead-acid batteries, plating chemicals, cyanide, and wood preserving agents. Each set of contaminants has its own environmental and health hazards. For example, a dry cleaning filtration residue, perchloroethylene, causes kidney and liver damage in both humans and animals. It is among the most common contaminants in ground water and a very small amount can contaminate many thousands of gallons of water. Used cyanide, a common waste product of metal finishing, is considered an acutely hazardous waste and can be toxic in very small doses. Chemical manufacturers can supply Material Safety Data Sheets (MSDS) which list these kinds of dangers and help to categorize products and their waste.

AVAILABLE PREVENTION MEASURES TO ADDRESS SMALL QUANTITY CHEMICAL USE

Due to the large number and variety of businesses that use chemicals, there are a vast number of prevention measures, many of which are specific to the facility of interest. This fact sheet discusses some prevention measures that are common to most chemical using facilities. Before a facility can implement any pollution prevention practice, it must first assess what kinds of chemicals are used and how they are used. Monitoring chemical use can help operators decide which option will be the most beneficial. Businesses should start with easy and inexpensive practices before considering more costly measures such as equipment and process modifications. Some of the easiest and least expensive practices can produce the most effective pollution prevention results.

Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source waters, the public's acceptance of the measures, and the community's desired degree of risk reduction.

Ways to Avoid Excess Chemical Use

Good waste reduction and management strategies can significantly reduce the threat of hazardous materials to drinking water sources. Make sure employees carefully follow the manufacturer's directions when mixing or using chemicals to prevent producing large quantities of useless material that must be disposed of as waste. The toxicity of waste can be reduced by using the least hazardous or least concentrated products available to accomplish their processes. Such substitutions include the use of water based paints, or high solids solvent based paints when water based paints are not available. Cleaning products and solvents, which can contain highly toxic or harsh chemicals, can be replaced with less hazardous counterparts. Printing businesses can use nontoxic inks that are free of heavy metal pigments.

Responsible purchasing can also drastically decrease the amount of waste for disposal. This includes ordering materials on an as-needed basis and returning unused portions back to vendors. A facility may unwittingly create excess harmful materials by mixing hazardous with

nonhazardous waste. Avoiding this practice can significantly reduce the toxicity of waste disposed and increase the possibility of recycling materials. Another method of waste reduction is trading waste with other businesses. ***Waste exchanges*** reduce disposal costs and quantities, reduce the demand for natural resources, and increase the value of waste.

Proper Use and Handling of Chemicals

Reading the label on chemical containers is one of the simplest and most important prevention measures. The label provides information on proper use, storage, and disposal and may provide emergency information in the event the product is accidentally spilled or ingested. In cases where the chemical is highly dangerous, the label will contain special warnings or use restrictions.

Employee training is critical in preventing source water pollution by chemical using facilities. While many preventive measures seem simple and straightforward, if they are not followed or employees are unaware of them, significant consequences can result. All staff should be trained to store materials properly and be aware of spill control and response protocols. Employees can be encouraged to learn and retain proper procedures through periodic drills, pollution prevention training workshops, and company incentive or reward programs.

Proper Storage and Disposal of Chemicals

Chemical audits are a good starting point. It is important to understand chemical needs for the facility and compare these to the chemical supply on hand. Where appropriate, excess chemicals should be removed (and properly disposed), or future purchasing adjusted to reduce stored inventories. A ***chemical management plan*** that includes a list of chemicals used, the method of disposal such as reclamation or contract hauling, and procedures for assuring that toxic chemicals are not discharged into source water should be implemented.

Proper on-site storage of hazardous substances helps to prevent accidental leaks and applies to both storage areas and containers. Designated storage areas should have paved or impervious surfaces, a protective cover, and secondary containment around all containers to catch spills. Containers should have clear and visible labels which include purchase date and all information presented on the distributer's original label. Dating materials allows facilities to use older materials first. When not in use, storage containers must be sealed to prevent spills and evaporation. Storage areas and containers should be thoroughly inspected on a weekly basis and secured against unauthorized entry. Care should be taken that chemical storage and handling areas do not allow for contamination of storm water flows. EPA has developed extensive guidance providing BMPs for storm water management in industrial settings.

Hazardous waste should never be discharged into floor drains, storm drains, toilets, sinks, other improper disposal areas, or other routes leading to public sewers, septic systems, or dry wells. Chemical waste should be disposed of according to the manufacturer's directions and State and local requirements. Many local communities sponsor household hazardous waste events to collect and properly dispose of small quantities of chemicals.

A useful tool for making disposal decisions is the ***Material Safety Data Sheet*** (MSDS). These sheets provide important information regarding contents of commercial products and enable a facility to determine whether materials will produce hazardous waste. MSDS data (i.e., chemical name, ingredients, possible carcinogens, and other known hazards) are also important for chemical use, storage and spill control. MSDS documents can be obtained from manufacturers and should be kept readily accessible.

When hazardous substances are unintentionally released, the event is considered a spill and must be treated appropriately. ***Spill prevention and control*** includes spill response plans which serve as guidance for employees in the event of a large spill. A good plan minimizes environmental impact and reduces liability for clean-up costs and possible bodily injuries. It should be kept where it can be easily viewed by employees near mixing and storage areas. Besides detailed instructions for staff, a spill response plan includes a diagram showing the location of all chemicals, floor drains, exits, fire extinguishers, and spill response supplies. Spill response supplies (e.g., mop, pail, sponges, absorbent materials) should also be listed. Someone trained in these procedures must be on site or easily reachable during hours of operation.

Other practices to control spills include the use of funnels when transferring harmful substances and drip pans placed under spigots, valves, and pumps to catch accidental leakage. Sloped floors allow leaks to run into collection areas. Catch basins in loading dock areas, where nearly one third of all accidental spills occur, can help recapture harmful chemicals. All practices should be performed in a way that allows the reuse or recycling of the spilled substance.

FOR ADDITIONAL INFORMATION

These sources contain information on small quantity chemical use pollution prevention practices. All of the documents listed are available free of charge on the Internet.

Assistance is available to communities wishing to enact ordinances to protect water supplies from contamination due to small quantity chemical use or to small businesses seeking to improve their operations with management measures. Local fire departments or departments of health have the authority to pass ordinances or regulations covering chemical use and safety. Contact local government authorities in your area to see if there are ordinances in place to manage small quantity chemical use. Numerous examples of local source water protection-related ordinances for various potential contaminant sources can be found at http://www.epa.gov/r5water/ordcom/, http://www.epa.gov/owow/nps/ordinance/, and http://www.epa.gov/owow/nps/ordinance/links.htm. The Small Business Environmental Home Page (http://www.smallbiz-enviroweb.org/fundstat.html) provides links to financial assistance programs and other available assistance in all 50 States.

The following resources provide information on selection and design of specific management measures:

Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Drinking Water Program. (1996, June). *Tips for Protecting Your Drinking Water Supply*. Retrieved February 26, 2001, from the World Wide Web: http://www.state.ma.us/dep/brp/dws/files/donts.htm

Minnesota Pollution Control Agency. (1999, July). *Disposal of Industrial Wastewater and Alternatives*. UICP/8-02/July 1999. Retrieved February 21, 2001, from the World Wide Web: http://www.pca.state.mn.us/water/pubs/8-02.pdf

New Hampshire Department of Environmental Services. (1999, February). *Best Management Practices (BMPs) for Groundwater Protection*. WD-WSEB-22-4. Retrieved February 26, 2001, from the World Wide Web: http://www.des.state.nh.us/factsheets/ws/ws-22-4.htm

New York State Department of Environmental Conservation, Pollution Prevention Unit. (1998, March). *Environmental Compliance and Pollution Prevention Guide for Small Quantity Generators*. Retrieved January 2001, from the World Wide Web: http://www.dec.state.ny.us/website/ppu/ecppsqg.pdf

Ohio Environmental Protection Agency, Division of Hazardous Waste Management. (1997, August). *Your Business and Hazardous Materials Management*. Retrieved February 21, 2001, from the World Wide Web: http://www.epa.state.oh.us/dhwm/dwatt/brochure.htm

U.S. EPA, Envirosense. (1993, February). *Case Study: Preventing Ground Water Contamination.* #1903. Retrieved February 21, 2001, from the World Wide Web: http://es.epa.gov/techinfo/case/michigan/michcs15.html

U.S. EPA, New England. (2000, April). *What Role Does Your Business Have in Protecting Drinking Water Sources*. EPA-901-F-00-001. Retrieved February 21, 2001, from the World Wide Web: http://www.epa.gov/region01/eco/drinkwater/sourcewater.pdf

U.S. EPA, Office of Solid Waste. (1996, April). *Understanding the Hazardous Waste Rules*. EPA530-K-95-001. Retrieved May 1, 2001, from the World Wide Web: http://www.epa.gov/epaoswer/hazwaste/sqg/handbook/sqg_pdf.pdf

U.S. EPA, Office of Wastewater Management. (1992, September). *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and BMPs*. Retrieved May 1, 2001, from the World Wide Web: http://www.epa.gov/owm/sw/indguide/index.htm

The following sites provide information on preventive measures for small quantity chemical use:

downthedrain.org is a site dedicated to reducing the threat of hazardous materials to our drinking water supply. http://www.downthedrain.org

The Miami-Dade Department of Environmental Resource Management provides several best management practices fact sheets for various types of facilities. http://www.co.miami-dade.fl.us/derm/

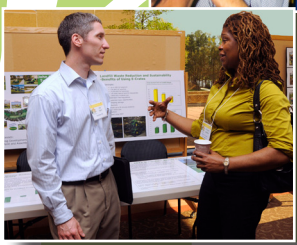
The Small Business Environmental Home Page (http://www.smallbiz-enviroweb.org) helps small business access environmental compliance and pollution prevention information. Its publication section provides documents and web sites for various small quantity chemical users.

The U.S. EPA's Office of Enforcement and Compliance Assistance (http://es.epa.gov/oeca/main/compasst/index.html) provides documents and links related to small quantity chemical users.

Information on waste exchange can be found on U.S. EPA's Envirosense web site for Materials/Waste Exchange. http://es.epa.gov/program/iniative/waste/waste.html.

N.C. DIVISION OF ENVIRONMENTAL ASSISTANCE AND CUSTOMER SERVICE

Customer service through technical, compliance and financial assistance



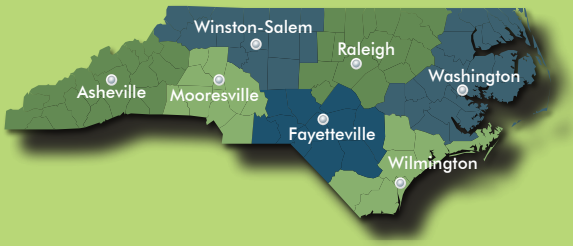
NCDENR

N.C. DIVISION OF ENVIRONMENTAL ASSISTANCE AND CUSTOMER SERVICE

The **N.C. Division of Environmental Assistance and Customer Service (DEACS)** assists citizens, businesses, local governments and communities statewide on a diverse range of environmental issues.

DEACS technical services:

- **Toll-free hotline** with experienced staff to answer your environmental questions
- **On-site assessments** and training for waste, water and energy management
- **Compliance** information and tips
- Environmental **recognition** programs
- **Grants** for recycling businesses and local governments
- **Recycling** infrastructure support
- Statewide points of contact for **permit information** and **environmental assistance**



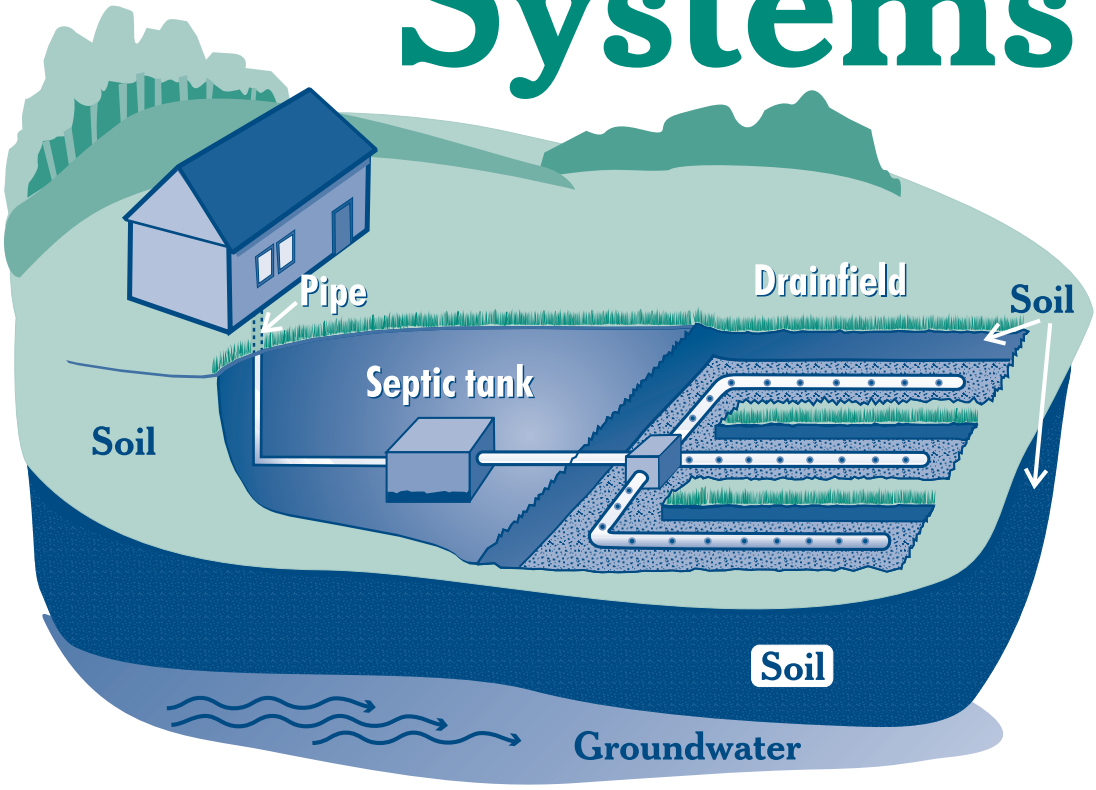
Within the N.C. Department of Environment and Natural Resources, DEACS works to protect and improve North Carolina's environment while supporting a strong economy.

Environmental Assistance Hotline
1-877-623-6748 (toll-free)
eac@ncdenr.gov
ncenvironmentalassistance.org

2000 copies of this public document were printed on 100% recycled content and FSC certified paper at a cost of $713.79 or $0.24 each.

EPA
United States
Environmental Protection
Agency

A Homeowner's Guide to Septic Systems



What's Inside

Your Septic System is your responsibility!

Did you know that as a homeowner you're responsible for maintaining your septic system? Did you know that maintaining your septic system protects your investment in your home? Did you know that you should periodically inspect your system and pump out your septic tank?

If properly designed, constructed and maintained, your septic system can provide long-term, effective treatment of household wastewater. If your septic system isn't maintained, you might need to replace it, costing you thousands of dollars. A malfunctioning system can contaminate groundwater that might be a source of drinking water. And if you sell your home, your septic system must be in good working order.

Top Four Things You Can Do to Protect Your Septic System

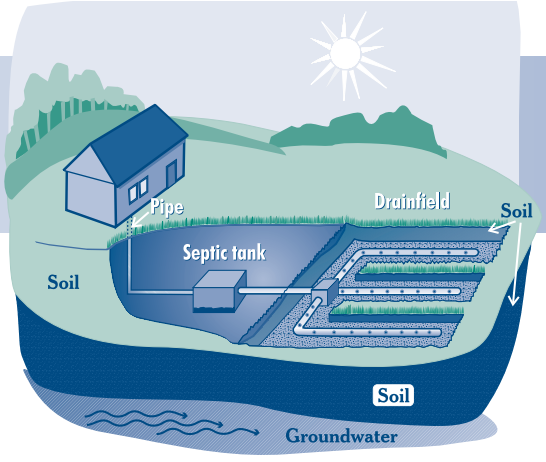
1. **Inspect your system (every 3 years) and pump your tank as necessary (generally every 3 to 5 years).**
2. **Use water efficiently.**
3. **Don't dispose of household hazardous wastes in sinks or toilets.**
4. **Care for your drainfield.**

This guide will help you care for your septic system. It will help you understand how your system works and what steps you can take as a homeowner to ensure your system will work properly. To help you learn more, consult the resources listed at the back of this booklet. A helpful checklist is also included at the end of the booklet to help you keep track of your septic system maintenance.

How does it work?

Components

A typical septic system has four main components: a pipe from the home, a septic tank, a drainfield, and the soil. Microbes in the soil digest or remove most contaminants from wastewater before it eventually reaches groundwater.



Typical onsite wastewater treatment system

Septic system aliases:

- **On-lot system**
- **Onsite system**
- **Individual sewage disposal system**
- **Onsite sewage disposal system**
- **Onsite wastewater treatment system**

Pipe from the home

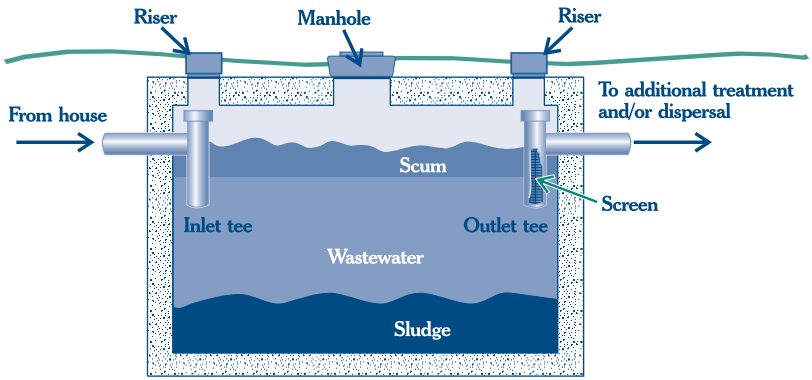
All of your household wastewater exits your home through a pipe to the septic tank.

Septic tank

The septic tank is a buried, watertight container typically made of concrete, fiberglass, or polyethylene. It holds the wastewater long enough to allow solids to settle out (forming sludge) and oil and grease to float to the surface (as scum). It also allows partial decomposition of the solid materials. Compartments and a T-shaped outlet in the septic tank prevent the sludge and scum from leaving the tank and traveling into the drainfield area. Screens are also recommended to keep solids from entering the drainfield.

Newer tanks generally have risers with lids at the ground surface to allow easy location, inspection, and pumping of the tank.

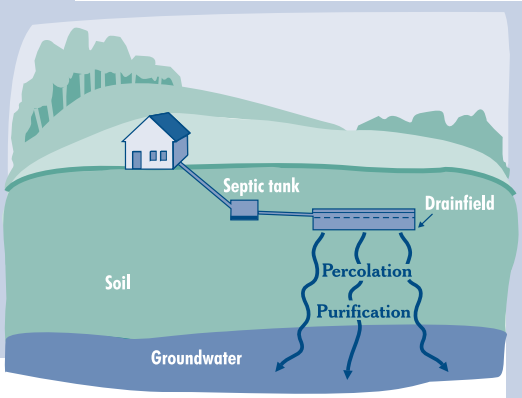
Typical single-compartment septic tank with ground-level inspection risers and screen



Tip **To prevent buildup, sludge and floating scum need to be removed through periodic pumping of the septic tank. Regular inspections and pumping as necessary (generally every 3 to 5 years) are the best and cheapest way to keep your septic system in good working order.**

Finding Your System

Your septic tank, drainfield, and reserve drainfield should be clearly designated on the "as-built" drawing for your home. (An "as-built" drawing is a line drawing that accurately portrays the buildings on your property and is usually filed in your local land records.) You might also see lids or manhole covers for your septic tank. Older tanks are often hard to find because there are no visible parts. An inspector/pumper can help you locate your septic system if your septic tank has no risers.



Drainfield

The wastewater exits the septic tank and is discharged into the drainfield for further treatment by the soil. The partially treated wastewater is pushed along into the drainfield for further treatment every time new wastewater enters the tank.

If the drainfield is overloaded with too much liquid, it will flood, causing sewage to flow to the ground surface or create backups in plumbing fixtures and prevent treatment of all wastewater.

A reserve drainfield, required by many states, is an area on your property suitable for a new drainfield system if your current drainfield fails. Treat this area with the same care as your septic system.

Soil

Septic tank wastewater flows to the drainfield, where it percolates into the soil, which provides final treatment by removing harmful bacteria, viruses, and nutrients. Suitable soil is necessary for successful wastewater treatment.

Alternative systems

Because many areas don't have soils suitable for typical septic systems, you might have or need an alternative system. You might also have or need an alternative system if there are too many typical septic systems in one area or the systems are too close to groundwater or surface waters. Alternative septic

systems use new technology to improve treatment processes and might need special care and maintenance. Some alternative systems use sand, peat, or plastic media instead of soil to promote wastewater treatment. Other systems might use wetlands, lagoons, aerators, or disinfection devices. Float switches, pumps, and other electrical or mechanical components are often used in alternative systems. Alternative systems should be inspected annually. Check with your local health department or installer for more information on operation and maintenance needs if you have or need an alternative system.

Why should I maintain my septic system?

When septic systems are properly designed, constructed, and maintained, they effectively reduce or eliminate most human health or environmental threats posed by pollutants in household wastewater. However, they require regular maintenance or they can fail. Septic systems need to be monitored to ensure that they work properly throughout their service lives.

Saving money

A key reason to maintain your septic system is to save money! Failing septic systems are expensive to repair or replace, and poor maintenance is often the culprit. Having your septic system inspected regularly (at least every 3 years) is a bargain when you consider the cost of replacing the entire system. Your system will need pumping (generally every 3 to 5 years), depending on how many people live in the house and the size of the system. An unusable septic system or one in disrepair will lower your property value and could pose a legal liability.

Protecting health and the environment

Other good reasons for safe treatment of sewage include preventing the spread of infection and disease and protecting water resources. Typical pollutants in household wastewater are nitrogen, phosphorus, and disease-

causing bacteria and viruses. If a septic system is working properly, it will effectively remove most of these pollutants.

With one-fourth of U.S. homes using septic systems, more than 4 billion gallons of wastewater per day is dispersed below the ground's surface. Inadequately treated sewage from septic systems can be a cause of groundwater contamination. It poses a significant threat to drinking water and human health because it can contaminate drinking water wells and cause diseases and infections in people and animals. Improperly treated sewage that contaminates nearby surface waters also increases the chance of swimmers contracting a variety of infectious diseases. These range from eye and ear infections to acute gastrointestinal illness and diseases like hepatitis.

How do I maintain my septic system?

Inspect and pump frequently

You should have your septic system inspected at least every 3 years by a professional and your tank pumped as recommended by the inspector (generally every 3 to 5 years). Systems with electrical float switches, pumps, or mechanical components need to be inspected more often. Your service provider should inspect for leaks and look at the scum and sludge layers in your septic tank. If the bottom of the scum layer is within 6 inches of the bottom of the outlet tee or the top of the sludge layer is within 12 inches of the outlet tee, your tank needs to be pumped. Remember to note the sludge and scum levels determined by your service provider in your operation and maintenance records. This information will help you decide how often pumping is necessary. (See the checklist included at the end of the booklet.)

What Does an Inspection Include?

- Locating the system.
- Uncovering access holes.
- Flushing the toilets.
- Checking for signs of backup.
- Measuring scum and sludge layers.
- Identifying any leaks.
- Inspecting mechanical components.
- Pumping the tank if necessary.

Four major factors influence the frequency of pumping: the number of people in your household, the amount of wastewater generated (based on the number of people in the household and the amount of water used), the volume of solids in the wastewater (for example, using a garbage disposal increases the amount of solids), and septic tank size.

Some makers of septic tank additives claim that their products break down the sludge in septic tanks so the tanks never need to be pumped. Not everyone agrees on the effectiveness of additives. In fact, septic tanks already contain the microbes they need for effective treatment. Periodic pumping is a much better way to ensure that septic systems work properly and provide many years of service. Regardless, every septic tank requires periodic pumping.

In the service report, the pumper should note any repairs completed and whether the tank is in good condition. If the pumper recommends additional repairs he or she can't perform, hire someone to make the repairs as soon as possible.

Use water efficiently

Average indoor water use in the typical single-family home is almost 70 gallons per person per day. Leaky toilets can waste as much as 200 gallons each day. The more water a household conserves, the less water enters the septic system. Efficient water use can improve the operation of the septic system and reduce the risk of failure.

High-efficiency toilets

Toilet use accounts for 25 to 30 percent of household water use. Do you know how many gallons of water your toilet uses to empty the bowl? Most older homes have toilets with 3.5- to 5-gallon reservoirs, while newer high-efficiency toilets use 1.6 gallons of water or less per flush. If you have problems with your septic system being flooded with household water, consider reducing the volume of water in the toilet tank if you don't have a high-efficiency model. Plastic containers (such as ½-gallon plastic milk jugs) can be filled with small rocks and placed in a toilet tank to reduce the

amount of water used per flush. (Be sure that the plastic containers do not interfere with the flushing mechanisms or the flow of water.) You'll save about ½ gallon of water per flush! You might also consider replacing your existing toilet with a high-efficiency model to achieve even more water savings.

Faucet aerators and high-efficiency showerheads

Faucet aerators help reduce water use and the volume of water entering your septic system. High-efficiency showerheads or shower flow restrictors also reduce water use.

Water fixtures

Check to make sure your toilet's reservoir isn't leaking into the bowl. Add five drops of liquid food coloring to the reservoir before bed. If the dye is in the bowl the next morning, the reservoir is leaking and repairs are needed.

A small drip from a faucet adds many gallons of unnecessary water to your system every day. To see how much a leak adds to your water usage, place a cup under the drip for 10 minutes. Multiply the amount of water in the cup by 144 (the number of minutes in 24 hours, divided by 10). This is the total amount of clean water traveling to your septic system each day from that little leak.

Use Water Efficiently!

- **Install high-efficiency showerheads**
- **Fill the bathtub with only as much water as you need**
- **Turn off faucets while shaving or brushing your teeth**
- **Run the dishwasher and clothes washer only when they're full**
- **Use toilets to flush sanitary waste only (not kitty litter, diapers, or other trash)**
- **Make sure all faucets are completely turned off when not in use**
- **Maintain your plumbing to eliminate leaks**
- **Install aerators in the faucets in your kitchen and bathroom**
- **Replace old dishwashers, toilets, and clothes washers with new, high-efficiency models.**

For more information on water conservation, please visit www.epa.gov/owm/water-efficiency/index.htm

Watch your drains

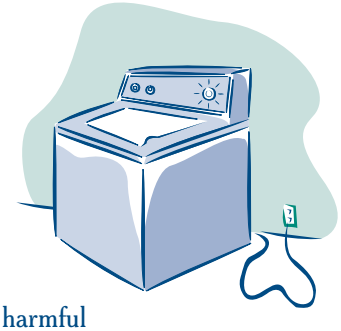
What goes down the drain can have a major impact on how well your septic system works.

Waste disposal

What shouldn't you flush down your toilet? Dental floss, feminine hygiene products, condoms, diapers, cotton swabs, cigarette butts, coffee grounds, cat litter, paper towels, and other kitchen and bathroom items that can clog and potentially damage septic system components if they become trapped. Flushing household chemicals, gasoline, oil, pesticides, antifreeze, and paint can stress or destroy the biological treatment taking place in the system or might contaminate surface waters and groundwater. If your septic tank pumper is concerned about quickly accumulating scum layers, reduce the flow of floatable materials like fats, oils, and grease into your tank or be prepared to pay for more frequent inspections and pumping.

Washing machines

By selecting the proper load size, you'll reduce water waste. Washing small loads of laundry on the large-load cycle wastes precious water and energy. If you can't select load size, run only full loads of laundry.



Doing all the household laundry in one day might seem like a time-saver, but it could be harmful to your septic system. Doing load after load does not allow your septic tank time to adequately treat wastes. You could be flooding your drainfield without allowing sufficient recovery time. Try to spread water usage throughout the week. A new Energy Star clothes washer uses 35 percent less energy and 50 percent less water than a standard model.

Care for your drainfield

Your drainfield is an important part of your septic system. Here are a few things you should do to maintain it:

- Plant only grass over and near your septic system. Roots from nearby trees or shrubs might clog and damage the drainfield.
- Don't drive or park vehicles on any part of your septic system. Doing so can compact the soil in your drainfield or damage the pipes, tank, or other septic system components.
- Keep roof drains, basement sump pump drains, and other rainwater or surface water drainage systems away from the drainfield. Flooding the drainfield with excessive water slows down or stops treatment processes and can cause plumbing fixtures to back up.

What can make my system fail?

If the amount of wastewater entering the system is more than the system can handle, the wastewater backs up into the house or yard and creates a health hazard.

You can suspect a system failure not only when a foul odor is emitted but also when partially treated wastewater flows up to the ground surface. By the time you can smell or see a problem, however, the damage might already be done.

By limiting your water use, you can reduce the amount of wastewater your system must treat. When you have your system inspected and pumped as needed, you reduce the chance of system failure.

A system installed in unsuitable soils can also fail. Other failure risks include tanks that are inaccessible for maintenance, drainfields that are paved or parked on, and tree roots or defective components that interfere with the treatment process.

Failure symptoms

The most obvious septic system failures are easy to spot. Check for pooling water or muddy soil around your septic system or in your basement. Notice whether your toilet or sink backs up when you flush or do laundry. You might also notice strips of bright green grass over the drainfield. Septic systems also fail when partially treated wastewater comes into contact with groundwater. This type of failure is not easy to detect, but it can result in the pollution of wells, nearby streams, or other bodies of water. Check with a septic system professional and the local health department if you suspect such a failure, and remember to have your septic system inspected by a professional at least every 3 years.

Stop, look, and smell!

Failure causes

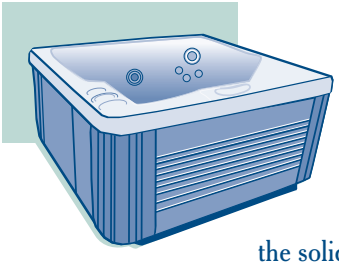
Household toxics

Does someone in your house use the utility sink to clean out paint rollers or flush toxic cleaners? Oil-based paints, solvents, and large volumes of toxic cleaners should not enter your septic system. Even latex paint cleanup waste should be minimized. Squeeze all excess paint and stain from brushes and rollers on several layers of newspaper before rinsing. Leftover paints and wood stains should be taken to your local household hazardous waste collection center. Remember that your septic system contains a living collection of organisms that digest and treat waste.

Household cleaners

For the most part, your septic system's bacteria should recover quickly after small amounts of household cleaning products have entered the system. Of course, some cleaning products are less toxic to your system than others. Labels can help key you into the potential toxicity of various products. The word "Danger" or "Poison" on a label indicates that the product is highly hazardous. "Warning" tells you the product is moderately hazardous. "Caution" means the product is slightly hazardous. ("Nontoxic" and "Septic Safe"

are terms created by advertisers to sell products.) Regardless of the type of product, use it only in the amounts shown on the label instructions and minimize the amount discharged into your septic system.



Hot tubs

Hot tubs are a great way to relax. Unfortunately, your septic system was not designed to handle large quantities of water from your hot tub. Emptying hot tub water into your septic system stirs the solids in the tank and pushes them out into the drainfield, causing it to clog and fail. Draining your hot tub into a septic system or over the drainfield can overload the system. Instead, drain cooled hot tub water onto turf or landscaped areas well away from the septic tank and drainfield, and in accordance with local regulations. Use the same caution when draining your swimming pool.

Water Purification Systems

Some freshwater purification systems, including water softeners, unnecessarily pump water into the septic system. This can contribute hundreds of gallons of water to the septic tank, causing agitation of solids and excess flow to the drainfield. Check with your licensed plumbing professional about alternative routing for such freshwater treatment systems.

Garbage disposals

Eliminating the use of a garbage disposal can reduce the amount of grease and solids entering the septic tank and possibly clogging the drainfield. A garbage disposal grinds up kitchen scraps, suspends them in water, and sends the mixture to the septic tank. Once in the septic tank, some of the materials are broken down by bacterial action, but most of the grindings have to be pumped out of the tank. Using a garbage disposal frequently can significantly increase the accumulation of sludge and scum in your septic tank, resulting in the need for more frequent pumping.

Improper design or installation

Some soils provide excellent wastewater treatment; others don't. For this reason, the design of the drainfield of a septic system is based on the results of soil analysis. Homeowners and system designers sometimes underestimate the significance of good soils or believe soils can handle any volume of wastewater applied to them. Many failures can be attributed to having an undersized drainfield or high seasonal groundwater table. Undersized septic tanks—another design failure—allow solids to clog the drainfield and result in system failure.

If a septic tank isn't watertight, water can leak into and out of the system. Usually, water from the environment leaking into the system causes hydraulic overloading, taxing the system beyond its capabilities and causing inadequate treatment and sometimes sewage to flow up to the ground surface. Water leaking out of the septic tank is a significant health hazard because the leaking wastewater has not yet been treated.

Even when systems are properly designed, failures due to poor installation practices can occur. If the drainfield is not properly leveled, wastewater can overload the system. Heavy equipment can damage the drainfield during installation which can lead to soil compaction and reduce the wastewater infiltration rate. And if surface drainage isn't diverted away from the field, it can flow into and saturate the drainfield.

For more information

Local Health Department

Name

Agency

Address

Address1

Phone and e-mail

EPA Onsite/Decentralized Management Homepage

www.epa.gov/owm/onsite

EPA developed this Web site to provide tools for communities investigating and implementing onsite/decentralized management programs. The Web site contains fact sheets, program summaries, case studies, links to design and other manuals, and a list of state health department contacts that can put you in touch with your local health department.

National Small Flows Clearinghouse

www.nesc.wvu.edu

Funded by grants from EPA, the NSFC helps America's small communities and individuals solve their wastewater problems. Its activities include a Web site, online discussion groups, a toll-free assistance line (800-624-8301), informative publications, and a free quarterly newsletter and magazine.

Rural Community Assistance Program

www.rcap.org

RCAP is a resource for community leaders and others looking for technical assistance services and training related to rural drinking water supply and wastewater treatment needs, rural solid waste programs, housing, economic development, comprehensive community assessment and planning, and environmental regulations.

National Onsite Wastewater Recycling Association, Inc.

www.nowra.org

NOWRA is a national professional organization to advance and promote the onsite wastewater industry. The association promotes the need for regular service and educates the public on the need for properly designed and maintained septic systems.

Septic Yellow Pages

www.septicyellowpages.com

The Septic Yellow Pages provides listings by state for professional septic pumpers, installers, inspectors, and tank manufacturers throughout the United States. This Web site is designed to answer simple septic system questions and put homeowners in contact with local septic system professionals.

National Association of Wastewater Transporters

www.nawt.org

NAWT offers a forum for the wastewater industry to exchange ideas and concerns. The NAWT Web site lists state associations and local inspectors and pumpers.

EPA-832-B-02-005
December 2002

Additional copies can be obtained from:
U.S. EPA Publications Clearinghouse
P.O. Box 42419
Cincinnati, OH 45241
Telephone: 800-490-9198 • Fax: 513-489-8695
Office of Water
U.S. Environmental Protection Agency

Notice

Septic System Dos and Don'ts

(adapted from National Small Flows Clearinghouse)

Dos

- Check with the local regulatory agency or inspector/pumper if you have a garbage disposal unit to make sure that your septic system can handle this additional waste.
- Check with your local health department before using additives. Commercial septic tank additives do not eliminate the need for periodic pumping and can be harmful to the system.
- Use water efficiently to avoid overloading the septic system. Be sure to repair leaky faucets or toilets. Use high-efficiency fixtures.
- Use commercial bathroom cleaners and laundry detergents in moderation. Many people prefer to clean their toilets, sinks, showers, and tubs with a mild detergent or baking soda.
- Check with your local regulatory agency or inspector/pumper before allowing water softener backwash to enter your septic tank.
- Keep records of repairs, pumpings, inspections, permits issued, and other system maintenance activities.
- Learn the location of your septic system. Keep a sketch of it with your maintenance record for service visits.
- Have your septic system inspected at least every 3 years and pumped periodically (generally every 3 to 5 years) by a licensed inspector/contractor.
- Plant only grass over and near your septic system. Roots from nearby trees or shrubs might clog and damage the drainfield.

Don'ts

- Your septic system is not a trash can. Don't put dental floss, feminine hygiene products, condoms, diapers, cotton swabs, cigarette butts, coffee grounds, cat litter, paper towels, latex paint, pesticides, or other hazardous chemicals into your system.
- Don't use caustic drain openers for a clogged drain. Instead, use boiling water or a drain snake to open clogs.
- Don't drive or park vehicles on any part of your septic system. Doing so can compact the soil in your drainfield or damage the pipes, tank, or other septic system components.

Homeowner Septic System Checklist

Septic System Description

Contact your local authority if you don't have this information.

Date system installed _____

Installer _____

Phone _____

Tank size _____ **gallons**

Capacity _____ **bedrooms**

Type ☐ **conventional**

☐ **alternative (type)** _____

For more information about septic systems, contact:

Clean Water starts at Home

Name

Agency

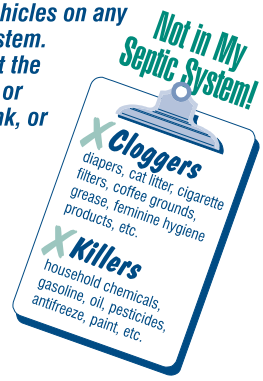
Phone and e-mail

U.S. Environmental Protection Agency

www.epa.gov/owm/onsite/

Things to keep in mind:

- ✓ *Inspect your system (every 1 to 3 years) and pump your tank (as necessary, generally every 3 to 5 years).*
- ✓ *Use water efficiently.*
- ✓ *Don't dispose of household hazardous wastes in sinks and toilets.*
- ✓ *Plant only grass over and near your septic system. Roots from nearby trees or shrubs might clog and damage the drainfield.*
- ✓ *Don't drive or park vehicles on any part of your septic system. Doing so can compact the soil in your drainfield or damage the pipes, tank, or other septic system components.*



Septic System Maintenance Record

Next Service	Scheduled Activity	Pumping Co./ Phone	Activities Completed	Comments
Jan. 2003	inspection	Joe Pumper 555-1234	inspection	sludge layer okay-may need pumping next year

Place on electrical box (fuse box) or other convenient location.

EPA-832-B-02-005
December 2002

United States Environmental Protection Agency
Office of Water (4606)
EPA 816-F-01-023
July 2001

Source Water Protection Practices Bulletin

Managing Underground Storage Tanks to Prevent Contamination of Drinking Water

This fact sheet focuses on the management of underground storage tanks (USTs) to prevent contamination of drinking water sources (ground water and surface water used as public drinking water supplies). USTs are tanks and any connected underground piping that have at least ten percent of their combined volume underground. USTs contain either petroleum or hazardous substances identified by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), except those substances listed as hazardous wastes. Over 95 percent of USTs contain petroleum.

UNDERGROUND STORAGE TANK USE

You are likely to find many USTs in the vicinity of the water sources you want to protect. Currently, the U.S. EPA regulates about 714,000 active USTs located at about 269,000 sites nationwide. Many USTs are located at filling stations that fuel vehicles. In addition to thousands of roadside filling stations, USTs can be found at airports, school bus barns, hospitals, automotive repair shops, military bases, industrial plants, residential areas and other facilities.

Some USTs, like the following, do not need to meet the Federal requirements:

- USTs not storing either petroleum or certain hazardous substances;
- Farm and residential tanks of 1,100 gallons or less capacity holding motor fuel used for noncommercial purposes;
- Tanks storing heating oil used on the premises where it is stored;
- Tanks on or above the floor of underground areas, such as basements; and
- Septic tanks and systems for collecting storm water and wastewater.

Please note, however, that State UST regulations may be more stringent or differ in other ways from the Federal requirements. You must check with local regulatory authorities to make sure which USTs are subject to what requirements. For example, some States regulate heating oil tanks and farm and residential tanks. Even if your UST does not need to meet Federal, State, or local requirements, you should strongly consider implementing some of the prevention measures mentioned in this fact sheet to preclude future releases.

WHY IS IT IMPORTANT TO MANAGE UNDERGROUND STORAGE TANKS NEAR THE SOURCES OF YOUR DRINKING WATER?

Most UST releases result from the corrosion of parts, improper installation, failure of piping systems, poorly conducted fuel deliveries (spills and overfills), and improper operation and maintenance of the UST system.

UST releases can contaminate soil and drinking water supplies. As of September 2000, almost 412,000 UST releases had been confirmed. Once in the soil, these releases can move rapidly and threaten drinking water supplies. EPA estimates that about half of UST releases reach ground water.

Leaking pipe from UST

Petroleum includes carcinogenic compounds such as benzene. Even at very low levels, fuel contaminants in water may not be detected by smell or taste, yet they can affect human health. Petroleum can also contain the additive methyl tertiary butyl ether (MTBE), which can make water smell and taste bad enough to be undrinkable. And it does not take much pollution to create a drinking water problem. For example, an unrestricted gasoline leak of one drop per second releases about 400 gallons per year. Even a few quarts of gasoline in the ground water can pollute a drinking water well. Also, cleaning up contaminated soil and ground water involves expensive operations. Average cleanup costs at leaking UST sites are about $125,000, and ground water cleanup at some sites exceeds $1 million.

AVAILABLE PREVENTION MEASURES TO ADDRESS UNDERGROUND STORAGE TANKS

Federal UST regulations were promulgated in 1988 to prevent and detect UST releases (see 40 CFR Part 280). The following paragraphs briefly identify some basic UST requirements. Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source water, the public's acceptance of the measures, and the community's desired degree of risk reduction.

Federal UST Requirements

Proper installation. USTs must be installed according to industry standards with great care to maintain the integrity and the corrosion protection of the tank.

Tanks must also be ***properly sited*** away from wells, reservoirs, and floodplains. Ideally, all types of USTs should be located outside of source water protection areas.

Excavated USTs

Corrosion protection. UST systems must be made of noncorrodible material, such as fiberglass, or have corrosion protection provided in other ways, such as by being made of externally coated and cathodically protected metal, having double-walls, metal having a thick corrosion resistant cladding or jacket, or having an internal tank lining.

Spill protection. USTs must have catchment basins that can catch spills that may occur when the delivery hose is disconnected from the fill pipe. A catchment basin is basically a bucket sealed around the fill pipe.

Overfill protection. When an UST is overfilled, large volumes can be released at the fill pipe and through loose fittings on the top of the tank or a loose vent pipe. USTs must have overfill protection devices, such as automatic shutoff devices, overfill alarms, and ball float valves. In addition, proper filling procedures during fuel delivery must be followed to reduce the chance of spills or overfills.

Leak detection. Leak detection options include automatic tank gauging, interstitial monitoring, statistical inventory reconciliation, vapor monitoring, and ground water monitoring. All leaks must be detected in a timely manner, before they become big cleanup and liability problems.

Proper closure. The regulatory authority needs to be notified 30 days before UST closure, and a determination must be made if any contamination of the environment has occurred. The tank must be emptied and cleaned, after which it may be left underground or removed. Standard safety practices should always be followed when emptying, cleaning, or removing tanks.

Additionally, some large capacity UST owners — those who have more than 42,000 gallons of oil storage capacity at one site — may need to comply with Federal Spill Prevention Control and Countermeasures (SPCC) regulations. Refer to the above ground storage tank fact sheet or 40 CFR Part 112 for information.

Additional Prevention Measures

Local jurisdictions may want to implement ***registration programs*** for exempt tanks, in order to exercise some oversight of their construction and operation.

Local governments can use ***land use controls*** to address some of the potential risks from USTs. For example, zoning can restrict these activities to specific geographic areas that are away from drinking water sources. Prohibition of gas stations (which use USTs) or residential

heating oil tanks in source water protection areas can reduce the risk that harmful contaminants may enter source water. Local governments may also require permits that impose additional requirements such as setbacks, open spaces, buffers, walls and fences; street paving and control of site access points; and regulation of hours and methods of operation.

Work with your State and local UST regulatory authorities to ensure that ***adequate inspection*** of UST sites takes place regularly — inspections that verify whether USTs are properly equipped, operated, and maintained so they will not pose a threat to your water source. State UST program contacts are among the many resources found at the Web site described below.

FOR ADDITIONAL INFORMATION

Information and publications on UST regulations and best management practices can be obtained at no cost on the Internet at the following Web site address maintained by EPA's Office of Underground Storage Tanks: http://www.epa.gov/OUST/. You can also call an EPA Hotline at 1-800-424-9346 for assistance and to order helpful publications about USTs. The most useful general publication is called "Musts For USTs," a basic plain language description of UST types and Federal requirements. Also, see EPA's Drinking Water Academy Web site at http://www.epa.gov/safewater/dwa.html for a listing of documents on management measures.

Contact local government authorities in your area to see if there are ordinances in place to manage USTs. Numerous examples of local source water protection-related ordinances for various potential contaminant sources can be found at:
http://www.epa.gov/r5water/ordcom/
http://www.epa.gov/owow/nps/ordinance/
http://www.epa.gov/owow/nps/ordinance/links.htm

The following documents provide additional information on UST prevention measures and regulations:

American Petroleum Institute. *Preventing Spills in Storage Tanks.* (1999, February 16). Retrieved February 9, 2001 from the World Wide Web: http://www.api.org/oilspills/tanks.htm

Iowa Department of Natural Resources. *Groundwater Protection Fact Sheet – Underground Storage Tanks.* (1996, August). Retrieved February 9, 2001 from the World Wide Web: www.state.ia.us/dnr/organiza/wmad/lqbureau/ust/genust1.htm

Iowa Department of Natural Resources, Waste Management Assistance Division. *Underground Storage Tanks – Frequently Asked Questions*. (2001, January 15). Retrieved February 9, 2001 from the World Wide Web:
http://www.state.ia.us/dnr/organiza/wmad/lqbureau/ust/index.htm

Minnesota Pollution Control Agency. *Underground Storage Tank (UST) Systems*. (2000, December 27). Retrieved February 9, 2001 from the World Wide Web:
http://www.pca.state.mn.us/cleanup/ust.html

Purdue University Extension Service. *Petroleum Product Storage Practices on the Farm*. (1991). Retrieved February 12, 2001 from the World Wide Web:
http://pasture.ecn.purdue.edu/~epados/farmstead/fuel/src/title.htm

South Dakota Department of Environment and Natural Resources, Ground Water Quality Program. *Don't Wait Until 98*. (n.d.). Retrieved February 9, 2001 from the World Wide Web: http://www.state.sd.us/denr/DES/Ground/tanks/dont-2.htm

South Dakota Department of Environment and Natural Resources, Ground Water Quality Program. *Frequently Asked Questions about UST and AST Systems.* (n.d.). Retrieved February 19, 2001 from the World Wide Web: http://www.state.sd.us/denr/DES/Ground/tanks/FAQTANK.htm

U. S. Environmental Protection Agency, Region 7. *Region 7 Underground Storage Tank Fact Sheet – Understanding the 1998 Requirements.* (1998/1999, winter). Retrieved February 9, 2001 from the World Wide Web: http://www.epa.gov/region7/programs/artd/ustbx/index2.htm

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. *Musts for USTs – A Summary of Federal Regulations for Underground Storage Tank Systems* (EPA 510/K-95-002). (1995, July). Retrieved January 31, 2001 from the World Wide Web: http://www.epa.gov/swerust1/pubs/

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. *Straight Talk on Tanks – Leak Detection Methods for Petroleum Underground Storage Tanks and Piping* (EPA 510/B-97-007). (1997, September). Retrieved January 31, 2001 from the World Wide Web: http://www.epa.gov/swerust1/pubs/

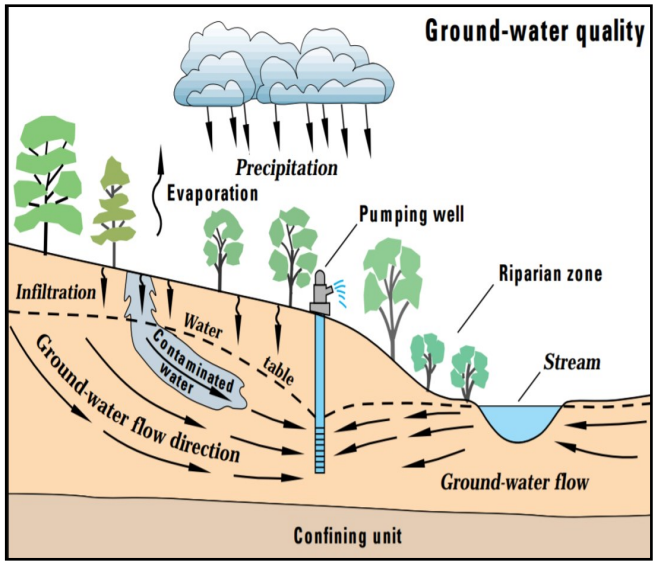
U.S. Environmental Protection Agency, Office of Underground Storage Tanks. *Upgrading UST Systems.* (1998, May 27). Retrieved January 31, 2001 from the World Wide Web: http://www.epa.gov/swerust1/ustsystm/upgrade.htm

U.S. Environmental Protection Agency, Office of Underground Storage Tanks. *What Do You Need to Know about Underground Storage Tanks?* (1999, June 7). Retrieved January 31, 2001 from the World Wide Web: http://www.epa.gov/swerust1/cmplastc/knowneed.htm

Pollution Prevention

Groundwater can be contaminated when hazardous materials are not properly managed. You can help:

- Safely store, handle and use chemicals / fuels,
- Monitor underground fuel tanks and chemical tanks. If possible, replace with above ground tanks (leaks are then visible),
- Reduce or substitute the use of chemicals,
- Keep chemicals protected from rain and prevent runoff,
- Participate in Hazardous Waste Collections.



Reduce, Reuse and Recycle

You can help your community, and the environment by saving money, energy and natural resources by reducing, reusing and recycling. The Hoke County Solid Waste accepts various types of waste, contact 910-875-3111 for more information.

Hoke County Regional Water
663 E. Palmer Road
Raeford, NC 28376
PH: 910-848-0385

Protect our Source Water

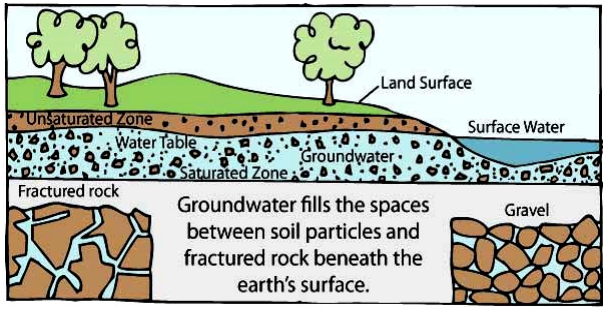
How Can You Help?

Hoke County

Wellhead Protection

WHAT IS GROUNDWATER?

Groundwater is the water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers. The Hoke County water system uses groundwater it pumps from the ground using twenty-six (26) wells located in our service area.



THE WELLHEAD PROTECTION PROGRAM

The Hoke County Regional Water System is developing a Local Wellhead Protection Program to protect its water supply from contamination. As a part of the program, we have identified the vulnerable area around our well sites called the "Wellhead Protection Area". Chemicals and other pollutants spilled or dumped in this area can be drawn into the well, possibly contaminating our community's drinking water supply. Residents and businesses in this area must be very careful with chemicals and other pollutants. Help us to preserve our water quality for our current and future needs.

POLLUTION SOURCES

Many of our daily activities can pollute our surface water and groundwater. Sources of groundwater pollution include:

- **Used oil, paint thinner, gasoline and other chemicals poured on the ground.**
- **Leaking fuel storage tanks (aboveground and underground).**
- **Overuse of pesticides and fertilizers on lawns, golf courses and agriculture fields.**
- **Chemical spills at businesses, farms and along highways.**
- **Illegal dumps and poorly managed landfills.**
- **Failing septic tanks.**
- **Leaking sewer lines.**
- **Improperly abandoned wells.**
- **Unlined waste pits, ponds and lagoons.**
- **Farm machinery repair shops/ Automobile repair shops**
- **Cemeteries/Funeral Homes**
- **Golf Courses**
- **Animal Feedlot / Animal Waste Storage**

HOW CAN YOU HELP?

Water is our most valuable natural resource and we are responsible for protecting it! You can help by doing your part to protect our supply by supporting this program. Here are some tips:

- Never pour used oil, paint thinner or other hazardous chemicals on the ground or down the drain. Take them to the Hoke Co. Convenience Site or to a Hazardous Waste Collection Event.
- Check for and fix leaks in storage tanks (i.e. home heating oil/kerosene) at your home or business.
- Inspect and pump your septic tank as needed.
- Have any unused wells on your property properly abandoned.
- Minimize your use of pesticides and fertilizers, storing them properly.
- Clean up junk and debris on your property.
- Report all chemical spills immediately.
- Encourage community leaders and businesses to do everything possible to protect our drinking water supply.

NC RWA
TRAINING SUPPORT