

Know Your Nitrogen

A Guide to Reducing Nitrogen Pollution at Home

Inside:
Nitrogen Worksheet

Alliance for the Chesapeake Bay

Nitrogen. It comprises 80 percent of the air we breathe. Without it, plants could not grow. It's an element so common to living things that it is hard to call this simple element dangerous.

But nitrogen in our water -- in the form of nitrate nitrogen -- can be lethal to life in our waterways. Unnaturally high doses of nitrogen in our streams, lakes and bays can trigger an imbalance in the ecosystem with drastic consequences (see page 2).

Most of the nitrogen overloads come from big-time sources, namely agriculture, sewage treatment plants, and electric power plants. But it also comes from the average home, from inside your bathroom to the cars parked in your driveway.

In addition to explaining where nitrogen is generated around a typical home, this fact sheet includes a worksheet on page 3 that actually quantifies your annual nitrogen output. The last page is a sampler of changes you can make to turn this number around. We can all do our part to help solve a big problem.

FERTILIZERS

Complete fertilizers contain nitrogen, phosphorus and potassium, represented by the three digit code on every fertilizer bag, such as 10-10-10 or 16-4-8. All fertilizers vary in their nutrient analysis, availability to plants, and reactions with the soil.

blue-grass and fine fescue, can actually harm lawns by promoting more leaf growth than root growth; 2) *messy spreading*: carelessly applying fertilizer near streets or other paved surfaces, allowing rain to wash the nutrients into storm sewers, which eventually empty into a nearby stream and river;

and lawn fertilizers. It gives an immediate green-up in both tomatoes and turf. But watch out if your soils are sandy and likely to drain the nitrate nitrogen into underground water supplies.

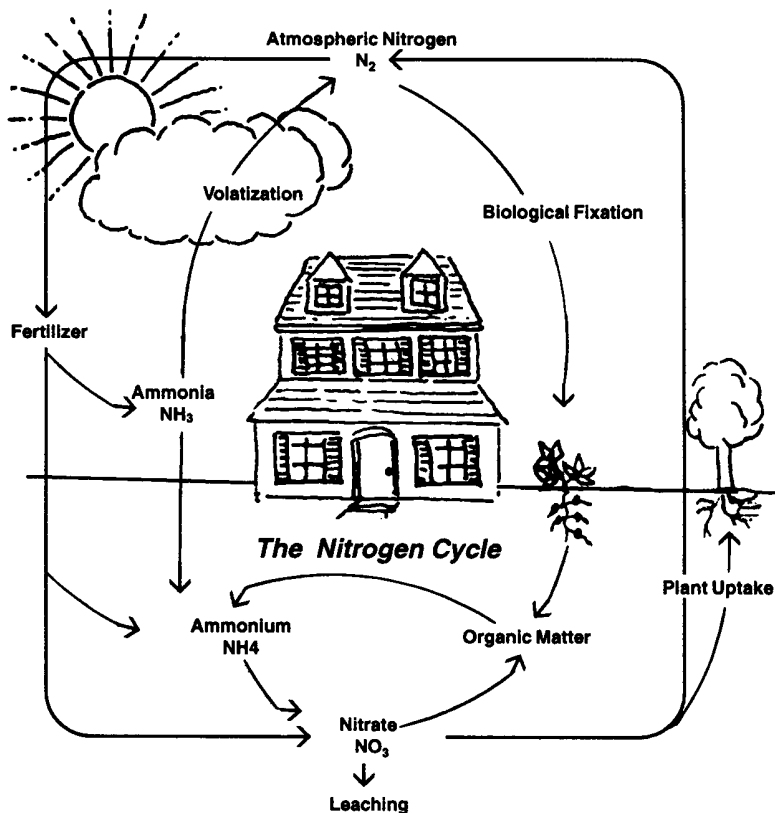
SEWAGE TREATMENT

Most rural and some suburban homeowners use on-lot septic systems to treat their human waste (black water) and waste water from household fixtures such as baths, sinks, and washing machines (grey water). These waste waters are piped to an underground tank which traps the solids and disperses the liquids throughout an absorption field. Here, the soil neutralizes the waste.

Once in the soil, nitrogen is removed primarily through denitrification (conversion to nitrogen gas). Rates of denitrification vary widely, depending on such factors as type of soil and amount of water added to the ground.

The problem is that even properly working septic systems do little to remove nitrogen. Most of the nitrogen leaves the sewage disposal system absorption area, potentially to enter ground and surface water.

Municipal sewage treatment plants are not required by state law to remove nitrogen from sewage effluent. Pennsylvania is, however, studying the feasibility of removing nitrogen at 16 major municipal sewage treatment plants (called biological nitrogen removal).



Before you reach for the nearest bag of weed 'n feed, consider what poor fertilizer choices can mean for your lawn or the environment:

1) *bad timing*: applying fertilizer at the wrong time of the year. Spring applications to common cool-season grasses, such as Kentucky

3) *feeding plants now not later*: using a form of nitrogen that is water-soluble and thus immediately available to the plant. This can be a poor choice if the soil drains easily, allowing nitrogen to leach into the ground water. Water-soluble ammonium nitrate is one of the cheapest sources of nitrogen in bulk-blend garden

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HOUSEHOLD CLEANERS

Household cleaners for glass, ovens, and vinyl siding often contain ammonia, a form of nitrogen. Some containers use spray or pump nozzles that unavoidably send nitrogen particles into the air never reaching their target. Simply rinsing buckets, rags and old containers can send nitrogen-laden residue to your local sewage treatment plant (which does not treat toxics like household cleaners), to a local stream via stormwater pipes, or into the ground water through the septic system. If household cleaners are harmful to humans, imagine what such products can do to the tiniest of aquatic life.

AIRBORNE NITROGEN

The latest scientific evidence estimates that roughly 30 percent of the nitrogen that enters the Chesapeake Bay comes from the air. Automobiles and other motor vehicles account for 36 percent of these airborne deposits, while electric utilities account for 40 percent. Everyone who drives a car or uses electricity that is generated by fossil fuels is partly responsible for this part of the nitrogen pollution problem.

Both cars and fossil fuel-burning power plants emit nitrogen oxides. Some of the nitrogen oxides are transformed into nitric acid in the atmosphere. This acid then falls to the earth in the form of acid precipitation, which has been proven to reduce crop and forest yields, kill fish and other aquatic life, and accelerate the decay of limestone statues, paint and metal finishes. If strong enough, acid precipitation can burn human skin, damage lungs, and irritate eyes and breathing functions.

Today's passenger cars emit about 70 percent less nitrogen oxides over their lifetimes than their uncontrolled counterparts of the 1960's. The number of cars and miles

driven, however, has nearly doubled over the past 20 years. The net result is only a modest reduction in each automotive pollutant, except for lead which has dropped by more than 95 percent.

Even your lowly lawn mower and other small gas powered engines (chain saws, leaf blowers, weed whackers) emit nitrogen oxides and other smog-producing gases. According to the EPA, about 5 percent of air pollution comes from the nation's 89 million lawn mowers, garden tractors, and other gas-powered garden equipment. (For a leaf blower, one hour is the equivalent of 34 hours of driving.) Only recently has EPA begun to regulate this type of equipment, setting exhaust emission standards for all new small spark-emission engines.

As for power plants that burn fossil fuels (mostly coal), requirements under the federal Clean Air Act have led to a 25 percent reduction in acid rain levels in Pennsylvania between 1990 and 1995. The reductions resulted from targeted reductions in the emissions of sulfur dioxide, another major contributor to acid rain, and nitrogen oxides.

PET WASTE

Dumping pet waste in the street or storm sewer or leaving it to decay near the street will add to water pollution if the next rain or melting snowfall washes it into storm sewers, which drain directly into our streams, lakes and bays. When pet waste is washed into lakes or streams, the waste decays, using up oxygen and sometimes releasing ammonia. Low oxygen levels and ammonia combined with warm temperatures can kill fish. Pet waste also contains nutrients that encourage weed and algae growth. Perhaps most importantly, pet waste carries disease which make water unsafe for swimming or drinking.

The Trouble with Nitrogen

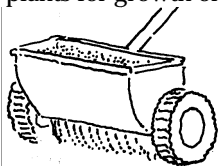
Whatever its source around the home, nitrogen in the water soluble form (nitrate nitrogen) can be washed into a nearby stream, river or lake through stormwater runoff. In Pennsylvania's freshwater lakes and streams, nitrogen does not usually cause water quality problems. But, where it flows into the shallow, saltier Chesapeake Bay via the Susquehanna and Potomac Rivers, nitrogen feeds algae like a fertilizer feeds a corn crop. When high amounts of nutrients are present, algae rapidly multiplies into huge masses called blooms. These floating algae blooms fill the water, blocking sunlight needed by bay grasses which provide food and habitat for many species. As the algae die, they sink and bacteria decomposes the algae in a process that removes oxygen from the water. Without enough oxygen, some species must leave the area. Those that can't leave die.

It is Pennsylvania's underground supplies of water most directly impacted by nitrate pollution. Because of its complete solubility, nitrate nitrogen can easily drain downward through some soils and contaminate ground water supplies, an issue of particular concern in Pennsylvania since about 50 percent of the state's population relies on ground water for public and domestic supplies. The contamination is especially acute in areas with limestone or carbonate bedrock (southcentral and southeastern Pennsylvania).

The federal Environmental Protection Agency has set a limit of 10 milligrams of nitrate per liter of groundwater as a safe threshold for drinking water. Higher levels of nitrate can create health problems for humans and animals. The most common problem is methemoglobinemia, or blue-baby syndrome, in which too much nitrogen in the blood can lead to suffocation if not detected in time. The health of young livestock animals can also be affected by high nitrate nitrogen levels in drinking water.

"Know Your Nitrogen" Worksheet

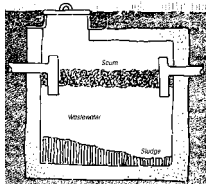
This worksheet examines activities around your home which generate nitrogen. It focuses on those activities or facilities over which you have at least some control -- areas in which choices can be made to reduce nitrogen outputs. It does not reflect how much nitrogen becomes pollution since some nitrogen is consumed by plants for growth or bound in the soil.



Lawn Fertilizers

- Step 1:** On the back of the fertilizer bag, note the parts of nitrogen, phosphorus, and potassium per bag. Nitrogen is the first number in the 3-digit formula. A 12-4-8 fertilizer, for instance, would contain 12 percent nitrogen on a weight basis.
- Step 2:** Determine the size of your lawn in square feet. (1 acre = 43,560 square feet). Commercial fertilizers give recommendations for pounds of fertilizer per 1000 square feet. Divide the size of your lawn (in square feet) by 1000 square feet.
- Step 3:** Determine how many pounds of fertilizer is recommended per 1000 square feet. (A typical recommendation would be 1.5 lbs. per 1000 sq. ft.) Multiply this number by the factor arrived at in step 2.
- Step 4:** Take Step 1's nitrogen figure (the first number in the N-P-K formula) and multiply by the total pounds of fertilizer arrived at in step 3. This is the total pounds of nitrogen you're applying in one application.
- Step 5:** Multiply the total pounds of nitrogen arrived at in step 4 by the number of times a year you fertilize you lawn with this formula.

Total pounds of nitrogen: _____



On-Lot Septic Systems

The average amount of nitrogen produced by a person in septic system effluent over one year is estimated to be 9.9 pounds.

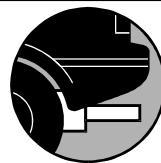
- STEP 1:** If you have an on-lot septic system, total the number of people living in your household,
- STEP 2:** Multiply the number of people in your household by 9.9 pounds for a total annual amount.

Total pounds of nitrogen: _____



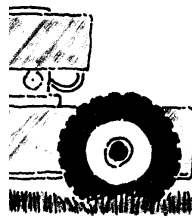
Household Cleaners

- STEP 1:** Check which cleaners you routinely use that contain ammonia. We will use six ounces as an average per use amount for the typical household.
- STEP 2:** Multiply six ounces by the number of times you use each of these cleaners in one year.
- STEP 3:** Divide the total by 16 to calculate the number of pounds of each cleaner used in one year.
- STEP 4:** Sum the total pounds of ammonia-containing cleaners routinely used over one year.
- Total pounds of nitrogen-containing cleaners:** _____



Automobiles

- STEP 1:** Estimate the number of miles driven per week for each of your family's cars and total the miles driven per week.
- STEP 2:** Multiply this mileage by .004 (an approximate average of the pounds of nitrogen oxides emitted by 1996 model cars over one mile).
- STEP 3:** Multiply this number (lbs. N emitted/one week) by 52 weeks/year for an annual amount.
- Total pounds of nitrogen oxides:** _____



Lawn Tools

Nitrogen Oxide Emission Rates:
 lawn mowers - .0053 lb./hour
 rear engine riding mowers - .0163 lb./hour
 lawn/garden tractor - .026 lb./hour
 leaf blower/vacuum - .0022 lb./hour
 snow blower - .0066 lb./hour

- STEP 1:** For each type of equipment noted above, determine how many weeks a year you typically use the equipment.
- STEP 2:** For each season, determine how many hours a week each tool is typically used.
- STEP 3:** For each equipment piece, multiply number of hours/week by the total weeks used in one year.
- STEP 4:** Sum the totals for each small gas-powered engine.
- Total pounds of nitrogen oxides:** _____



Electricity

Electric generation plants powered by coal (fossil fuel) emit .0024 pounds of nitrogen oxides per kilowatt hour of electricity produced.

- STEP 1:** Over the course of a year, record the kilowatt hours of electricity used by your household, which is noted on your monthly electric bill.
- STEP 2:** Total the year's kilowatt hours and multiply by .0025 for an annual amount of nitrogen oxide emissions contributable to your household.
- Total pounds of nitrogen oxides:** _____

ADD ALL OF THE ABOVE FIGURES: _____

This number is an estimate of how many pounds of nitrogen-containing compounds your household generates on a yearly basis.

Read on and you can learn how to reduce that number by some simple changes in your lifestyle. And here's an extra challenge. After reading the "What's a Homeowner to Do?" section, decide how your family can help reduce the nitrogen pollution problem. For one year, try out some new conservation practices and then re-work the calculations to see what kind of difference you can make.

WHAT'S A HOMEOWNER TO DO?...

Lawn Care

Did you know...

- A lawn fertilization program should begin in early October, not early May?
- By leaving grass clippings on the lawn, nitrogen applications can be reduced by 30 - 40 percent?
- Healthy trees and shrubs do not require annual fertilizer applications?
- Chemical fertilizers can add salt to the soil and can harm soil structure. High salt concentrations can kill soil-building microorganisms and promote soil compaction. Grass clippings and compost are better answers, returning needed bacteria and enzymes to the soil along with nutrients.



Simple and practical tips like these are easily accessible. Call your Cooperative Extension Service or check your local library for guidance.

The key is to know your soil and know your fertilizer if, in fact, you need additional nutrients. Take the time to learn some simple landscaping techniques that can produce a healthy, green lawn and garden without polluting ground water or surface water.

Sewage Management

On-lot sewage system users: Pump your septic tank regularly or the build-up of solids will inhibit the ability of a septic system to do its job right. A rule-of-thumb is to pump your tank every three years for a four-person household and a 2500 gallon tank. Also, support efforts by your municipality to adopt a sewage treatment program, which may require periodic septic tank pumping. Such programs are preventive maintenance -- if on-lot septic systems are left unmanaged, malfunctioning systems may force the extension of costly sewer lines for greater distances.

Municipal sewage plant users: Support efforts to upgrade sewage systems that remove nitrogen at the treatment plant. In Maryland, nearly all of the state's 61 major sewage treatment plants will remove nitrogen from treated waste by the year 2000.

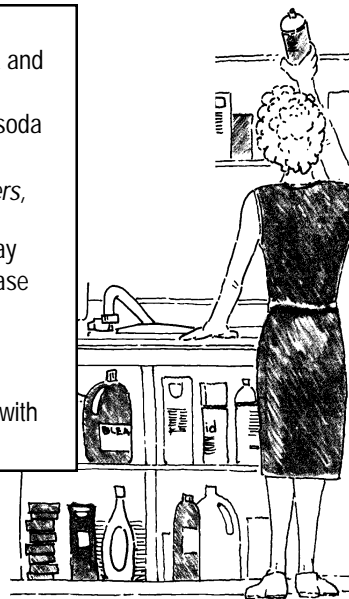
Household Cleaners

Some time-honored agents like borax, baking soda and lemon juice can match the cleaning power of most commercial cleaning products.

Instead of oven cleaner, try:
2 Tbs. castile soap, 2 tbs. borax and 2 C. water, set in oven for 20 minutes. OR scrub with baking soda and salt

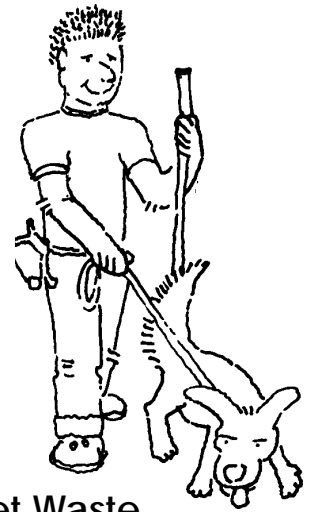
Instead of ammonia based cleaners, try:
undiluted white vinegar in a spray bottle; herbs can be added to ease the vinegar smell

Instead of abrasive cleaners or powders, try:
baking soda or borax; rub area with 1/2 lemon dipped in borax



Airborne Nitrogen

- **Conserve electricity.** Most electric power comes from coal-burning power plants. If we use less energy, the power plants will burn less coal. And that, in turn, will help reduce nitrogen oxides in the atmosphere.
- **Use public transportation or car pool to get to work.** The reduced mileage will save parking costs for some people and wear and tear on your vehicle.
- **Keep your car tuned-up.** Regular tune-ups reduce the amount of hydrocarbons, nitrous oxides and other pollutants coming from the exhaust pipe.
- **Drive less and walk more.** For short distances, riding a bike or walking is a smart option that will help keep you fit.



Pet Waste Management

When walking a dog, remember to carry a plastic bag and take the waste back home for proper disposal. At home, there are a few options for disposal:

- **Flush wastes down the toilet** (on-lot systems can remove some of the nitrogen; municipal sewage treatment plants will not remove the nitrogen but will remove dangerous pathogens). Be careful not to flush stones, sticks or cat litter (the cat feces may be scooped from the litter and flushed).
- **Bury the waste in your yard.** Dig a hole approximately five inches deep, away from vegetable gardens, wells or any body of water. Microorganisms in the top layer of soil will break down the waste and release nutrients to fertilize nearby plants. Don't add pet waste to your compost pile. The compost does not get hot enough to kill the disease causing organisms in pet waste.
- **Put waste in the trash.** This may be easy, but it is not the best solution, since waste taken to a landfill can still cause pollution in older, unlined pits. Incinerated waste can also emit air pollutants.
- **Install an underground pet waste digester.** It works like a small septic tank and can be purchased at pet stores. Check local laws that may restrict their use, design or location.

For more household tips, call Chesapeake Regional Information Service at 1-800-662-CRIS or the Internet at CRIS@igc.apc.org or DEP's Web Site www.dep.state.pa.us (choose information by subject/water management).