HOMEOWNER'S MAINTENANCE GUIDE

Compliments of
Up Close Home Inspections

10 Steps to Save Energy in Your House

Sealing and **insulating** your home is one of the most cost-effective ways to make a home more comfortable and energy efficient—and you can do it yourself.

In this chapter, you will learn how to find and seal hidden attic and basement air leaks; determine if your attic insulation is adequate and learn how to add more; make sure your improvements are done safely; and reduce energy bills and help protect the environment.

You will notice your home's air leaks in the winter more than any other time of year. Most people call these air leaks "drafts." You may feel these drafts around windows and doors and think these leaks are your major source of wasted energy. In most homes, however, the most significant air leaks are hidden in the attic and basement. These are the leaks that significantly raise your energy bill and make your house uncomfortable.

In cold weather, warm air rises in your house, just like it does in a chimney. This air, which you have paid to heat, is just wasted as it rises up into your attic and sucks cold air in all around your home—around windows, doors, and through holes into the basement. Locating these leaks can be difficult because they are often hidden under your insulation. This chapter will help you find these leaks and seal them with appropriate materials.

STEP #1 Getting started

Sealing attic air leaks will enhance the performance of your insulation and make for a much more comfortable home.

Attic air sealing and adding insulation are do-it-yourself projects if your attic is accessible and not too difficult to move around in. The projects in this chapter can usually be completed in two days and will provide rewards for years to come.

If you find any major problems in the attic space such as roof leaks, mold, unsafe working conditions, inadequate flooring, inadequate ventilation, knob-and-tube wiring, recessed “can” lights, we recommend hiring a contractor to help you and/or correct these problems before proceeding.

Look around your house for any dropped-ceiling areas, dropped soffits over kitchen cabinets, slanted ceilings over stairways, and where walls (interior and exterior) meet the ceiling. These areas may have open spaces that could be huge sources of air leaks.

STEP #2 Working in the Attic

Be sure to use a work light to make sure that your work area is lit adequately.

Use personal protective equipment. To work in an attic, you need kneepads, coveralls, gloves and a hat to keep itchy and irritating insulation off your skin. Use an OSHA-approved particulate respirator or a high-quality dust mask.

Be safe. Do not work in the attic area if you feel that it is dangerous in any way. It's not worth risking life or property. Simply hire a qualified contractor to perform the work you need to get done. If you work in a hot attic, drink plenty of water.

Watch your step. Walk on joists or truss chords. Watch your head - there will be sharp nails and things sticking out above you and all around your head.

STEP #3 What You Will Need

- Reflective foil insulation or other blocking material such as drywall or pieces of rigid foam insulation to cover soffits, open walls, and larger holes
- Unfaced fiberglass insulation and large garbage bags
- Silicone or acrylic latex caulk for sealing small holes (1/4 inch or less)
- Expanding spray foam insulation for filling larger gaps (1/4 inch to 3 inches)
- Special high-temperature (heat-resistant) caulk to seal around flues and chimneys
- Roll of aluminum flashing to keep insulation away from the flue pipe
- Tape measure
- Utility knife and sheet metal scissors
- Staple gun (or hammer and nails) to hold covering materials in place
- Plastic garbage bag

STEP #4 Plug the Large Holes

The biggest savings will come from sealing the large holes. Locate the areas from the attic where leakage is likely to be greatest: where walls (interior and exterior) meet the attic floor; dropped soffits (dropped-ceiling areas) and; behind or under attic knee walls. **Look for dirty insulation**. Dirty insulation (black/brown stains on the underside of the insulation) indicates that air is moving through it. Push back the insulation or pull it out of the soffits. You will place this insulation back over the soffit once the stud cavities have been plugged and the soffits covered.

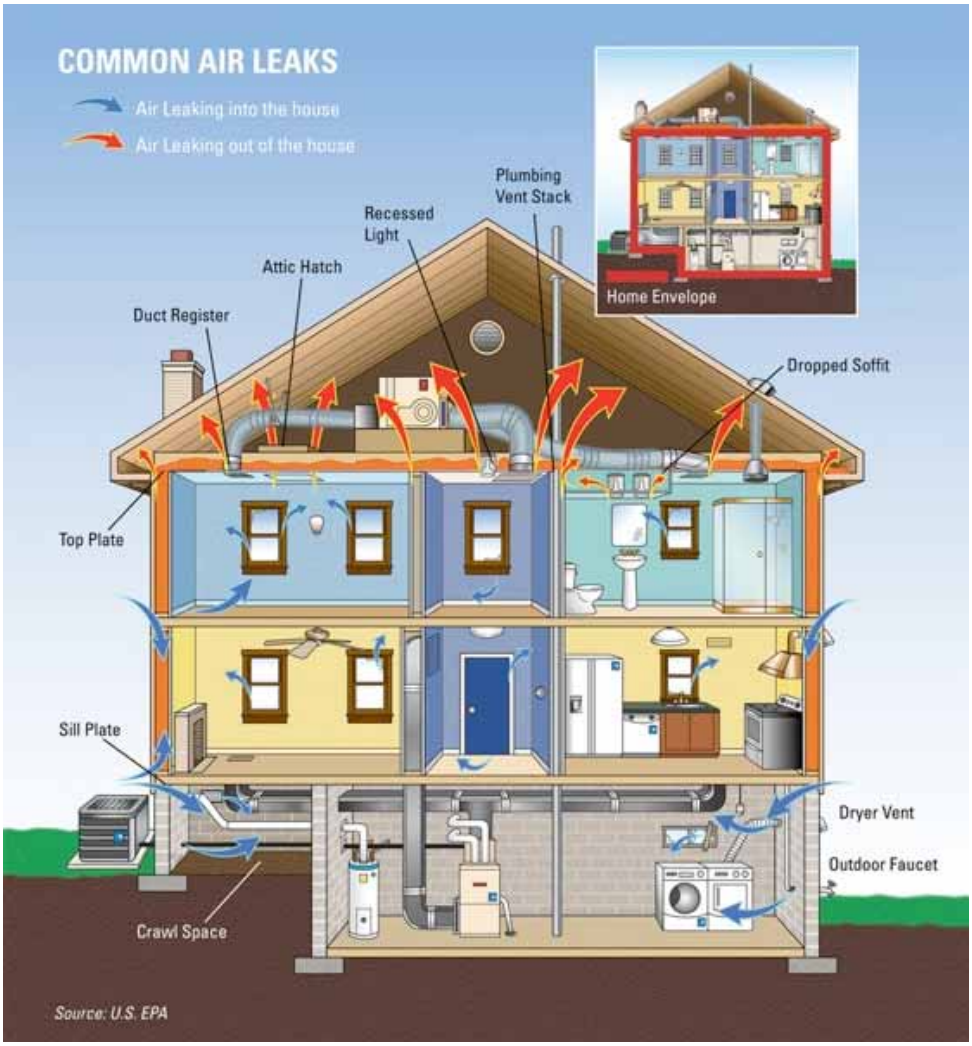
Dropped soffit. After removing insulation from a dropped soffit, cut a length of reflective foil or other blocking material (rigid foam board works well). Apply a bead of caulk or adhesive around the opening. Seal the foil to the frame with the caulk/adhesive and staple or nail it in place, if needed.

Under a wall. Cut a 24-inch long piece from a batt of fiberglass insulation and place it at the bottom of a 13-gallon plastic garbage bag. Fold the bag over and stuff it into the

open joist spaces under the wall (a piece of rigid foam board sealed with spray foam also works well for covering open joist cavities). Cover with insulation when you're done.

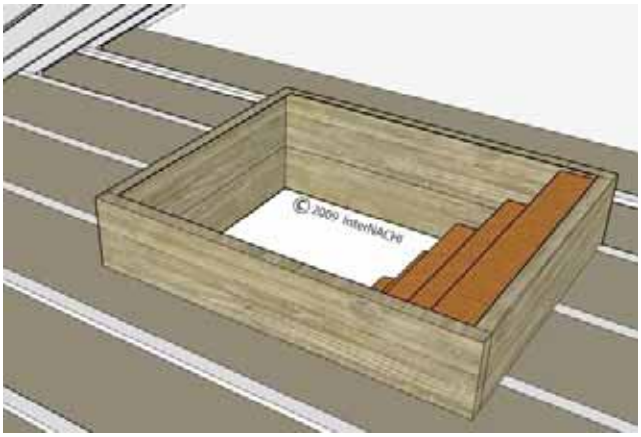
Finished rooms built into attics often have open cavities in the floor framing under the sidewalls or knee walls. Even though insulation may be piled against or stuffed into these spaces, they can still leak air. Again, look for signs of dirty insulation to indicate air is moving through. You need to plug these cavities in order to stop air from traveling under the floor of the finished space.

Flue. The opening around the flue or chimney of a furnace or water heater can be a major source of warm air moving in the attic. Because the pipe gets hot, building codes usually require 1-inch of clearance from metal flues (2 inches from masonry chimneys) to any combustible material, including insulation. This gap can be sealed with lightweight aluminum flashing and special high-temperature (heat-resistant) caulk. Before you push the insulation back into place, build a barrier out of the metal aluminum to keep the insulation away from the pipe.



STEP #5 Seal the Small Holes

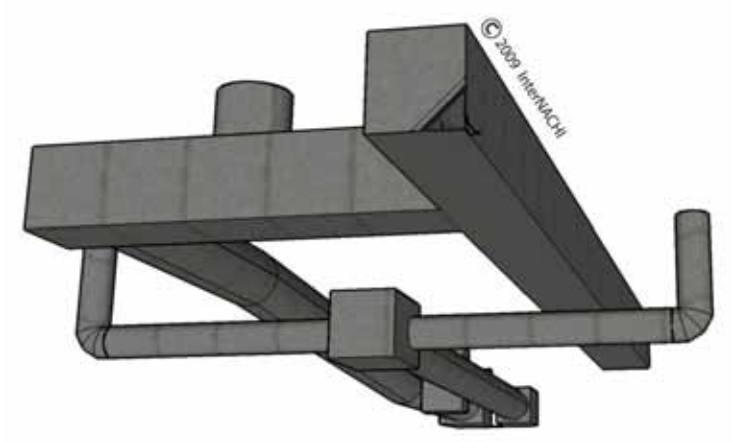
Look for areas where the insulation is darkened. This is the result of dusty air coming from the house interior, and moving into and being filtered by the insulation. In cold weather, you may also see frosty areas in the insulation caused by warm, moist air condensing and then freezing as it hits the cold attic air. In warmer weather, you'll find water staining in these same areas. Use expanding foam or caulk to seal the **openings around plumbing vent pipes and electrical wires**. When the foam or caulk is dry, cover the area again with insulation. After sealing the areas, just push the insulation back into place. If you have blown insulation, a small hand tool can be helpful to level it back into place.



STEP #6 Attic Access

Seal up the attic access panel with weather stripping. Cut a piece of fiberglass or rigid foam board insulation the same size as the attic hatch and glue it to the back of the attic access panel.

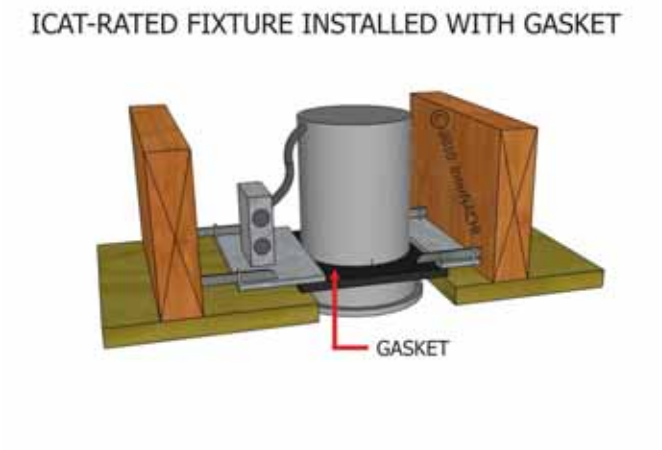
If you have pull-down attic stairs or an attic door, these should be sealed in a similar manner using weather stripping and insulating the back of the door. Treat the attic door like an exterior door to the outside.



STEP #7 Ducts

Sealing and insulating your ducts can increase the efficiency of your HVAC system. Leaky ducts waste an incredible amount of energy. Check the duct connections for leaks - seal the joints with mastic or foil tape (household duct tape should not be used). Pay special attention to all the duct penetrations going through the attic floor. Seal these with foam.

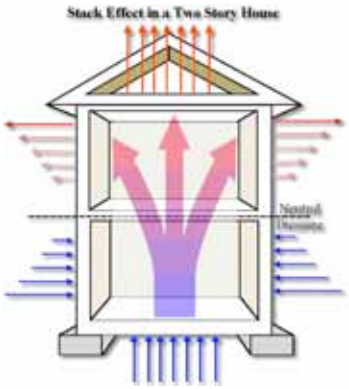
HVAC ducts should also be insulated—if your ducts are uninsulated or poorly insulated, seal them first, then add insulation. Use duct insulation material rated at least R-6. Duct sealant, also known as duct mastic, is a paste, which is more durable than foil duct tape. It is available at home improvement centers.



STEP #8 “Can” Lights

Recessed “can” lights (also called high-hats or recessed lights) can make your home less energy-efficient. These recessed lights can create open holes that allow unwanted airflow from conditioned spaces to unconditioned spaces. In cold climates, the heat from the airflow can melt snow on the roof and cause the development of ice dams. Recessed “can” lights in bathrooms also cause problems when warm, moist air leaks into the attic and causes moisture damage.

Warning: You can create a fire hazard if the “can” light is not insulated or sealed properly. It may be best to consult a professional before sealing “can” lights or coming in contact with any electrical components.



STEP #9 Stack Effect

Like a chimney. Outside air drawn in through open holes and gaps in the basement is drawn in by a chimney stack effect created by air leaks in the attic. As hot air generated by the furnace rises up through the house and into the attic through open holes, cold outside air gets drawn in through open holes in the basement to replace the displaced air. This makes a home feel drafty and contributes to higher energy bills. After sealing attic air leaks, complete the job by sealing basement leaks, to stop the stack effect.

Basement air leaks. Along the top of the basement wall where floor system meets the top of the foundation wall is a good area to look for open holes and gaps. Since the top of the wall is above ground, outside air can be drawn in through cracks and gaps where the house framing sits on top of the foundation.

Sealant or caulk is best for sealing gaps or cracks that are 1/4 inch or less. Use spray foam to fill gaps from 1/4 inch to about 3 inches. We also recommend you seal penetrations that go through the basement ceiling to the floor above. These are holes for wires, water supply pipes, water drainpipes, the plumbing vent stack, and the furnace flue.

Attic and basement air sealing will go a long way to improve your comfort because your house will no longer act **like an open chimney**.

STEP #10 Attic Insulation Thickness

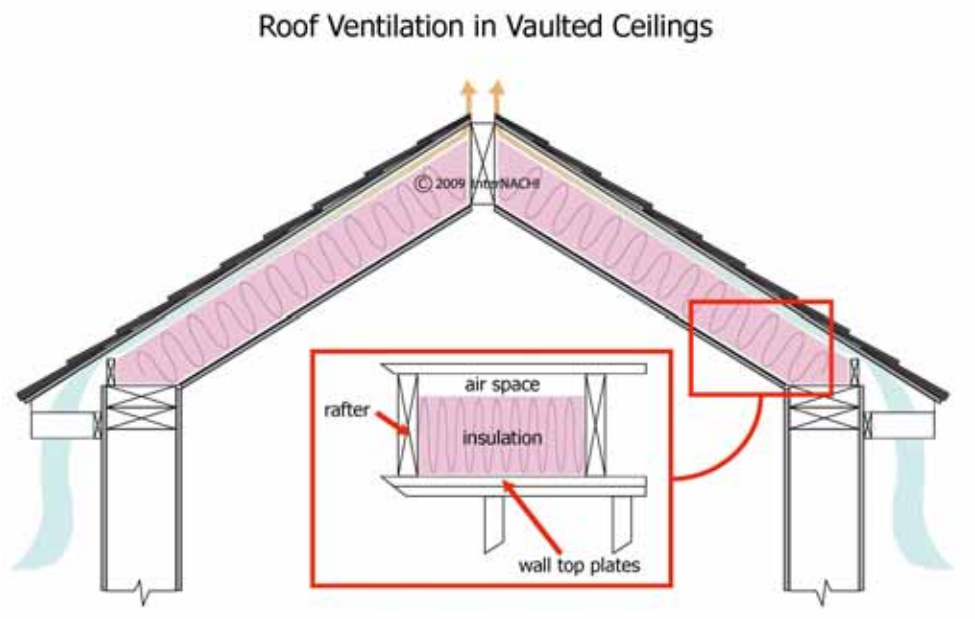
Look. One quick way to determine if you need more insulation on the floor of your attic is to simply look across the floor of your attic. If the insulation is level with or below your floor joists, more insulation is needed. If the insulation is well above the joists, you may have enough. There should be no low spots.

R-Value. Insulation levels are specified by R-Value. R-Value is a measure of insulation's ability to resist heat flow. The higher the R-Value, the better the thermal performance of the insulation. The recommended level for most attic floors is R-38 or about 10 to 14 inches (depending on the type of insulation and your climate).

When adding insulation, you do not have to use the same type of insulation that currently exists in your attic. You can add loose fill on top of fiberglass batts or blankets, and vice-versa. If you use fiberglass over loose fill, make sure the fiberglass batt has no paper or foil vapor barrier. The insulation needs to be "unfaced."

Laying out or spreading fiberglass rolls is easy. If you have any type of insulation between the rafters, install the second layer over and perpendicular to the first. This will help cover the tops of the joists and reduce heat loss or gain through the frame.

NEVER! Never lay insulation over recessed light fixtures or soffit vents. Keep all insulation at least 3 inches away from "can" lights, unless they are rated IC (Insulated Ceiling). If you are using loose fill insulation, use sheet metal to create barriers around the openings. If using fiberglass, wire mesh can be used to create a barrier.



Rafter vent trays. To completely cover your attic floor with insulation out to the eaves you need to install rafter vents or trays (also called insulation baffles). Rafter vents

ensure the soffit vents are clear and there is a clear opening for outside air to move into the attic at the soffits and out through the gable or ridge vent for proper ventilation.

Additional Information

For additional information on Indoor Air Quality (IAQ) issues related to homes such as combustion safety, indoor air contaminants, and proper ventilation, visit: http://www.epa.gov/iaq/homes/hip-front.html.

ENERGY STAR is a government-backed program helping businesses and individuals protect the environment through superior energy efficiency. To learn more about the wide variety of energy-efficient ENERGY STAR products and processes visit http://www.energystar.gov.

Checklists for the Seasons

These are checklists that you can use and incorporate into your routine home maintenance plan for your house. They are broken up into seasons.

Annually:
Hire a home inspector to perform a home maintenance inspection at part of your routine home maintenance plan.

In the Spring:
- Check for damage to your roof
- Check all the fascia and trim for deterioration
- Have a professional air conditioning contractor inspect and maintain your system as recommended by the manufacturer
- Check your water heater
- Replace all extension cords that have become brittle, worn or damaged
- Check your fire extinguishers
- Clean the kitchen exhaust hood and air filter
- Review your fire escape plan with your family
- Repair all cracked, broken or uneven driveways and walks to help provide a level walking surface
- Check the shutoff valve at each plumbing fixture to make sure they function
- Clean clothes dryer exhaust duct, damper, and space under the dryer
- Inspect and clean dust from the covers of your smoke and carbon monoxide alarms

In the Summer:
- Check kids playing equipment
- Check your wood deck or concrete patio for deterioration
- Check the nightlights at the top and bottom of all stairs
- Check exterior siding
- Check all window and door locks
- Check your home for water leaks
- Check the water hoses on the clothes washer, refrigerator icemaker and dishwasher for cracks and bubbles

In the Fall:
- Check your home for water leaks
- Have a heating professional check your heating system every year

- Protect your home from frozen pipes
- Run all gas-powered lawn equipment until the fuel is gone
- Test your emergency generator
- Have a certified chimney sweep inspect and clean the flues and check your fireplace damper
- Remove bird nests from chimney flues and outdoor electrical fixtures
- Inspect and clean dust from the covers of your smoke and carbon monoxide alarms
- Make sure the caulking around doors and windows is adequate to reduce heat/cooling loss
- Make sure that the caulking around your bathroom fixtures is adequate to prevent water from seeping into the sub-flooring

In the Winter:

- Clean the gutters and downspouts
- Confirm firewood at least 20 feet away from your home
- Remove screens from windows and install storm windows
- Familiarize responsible family members with the gas main valve and other appliance valves
- Clean the clothes dryer exhaust duct, damper and space under the dryer
- Make sure all electrical holiday decorations have tight connections
- Clean the kitchen exhaust hood and air filter
- Check the water hoses on the clothes washer, refrigerator icemaker and dishwasher for cracks and bubbles
- Check your water heater
- Test all AFCI and GFCI devices

Adapted from the home maintenance book by Ben Gromicko “Now that you’ve had a home inspection.” http://www.nachi.org/home-maintenance-book.htm

A Homeowner's Guide to Septic Systems

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.

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.

Top Four Things You Can Do to Protect Your Septic System

1. Regularly inspect your system and pump your tank as necessary.
2. Use water efficiently.
3. Don't dispose of household hazardous wastes in sinks or toilets.
4. Care for your drainfield.

HOW DOES A SEPTIC SYSTEM 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.

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.

Septic system aliases:
- On-lot system
- Onsite system
- Individual sewage disposal system
- Onsite sewage disposal system
- Onsite wastewater treatment system

TIP
To prevent buildup, sludge and floating scum need to be removed through periodic pumping of the septic tank. Regular inspections and pumping 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 is a bargain when you consider the cost of replacing the entire system. Your system will need pumping 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 a typical 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). Alternative systems with electrical float switches, pumps, or mechanical components need to be inspected more often, generally once a year. 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.

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.

- 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, visit http://www.epa.gov/watersense/index.html

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 or replacing your existing toilets with high-efficiency models.

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.

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.

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.

Septic System Dos and Don'ts
(adapted from National Small Flows Clearinghouse)

Dos

- Do ask your inspector if your system can handle your garbage disposal grinder.
- Do conserve water. Putting too much water into the system can eventually leak to system failure.
- Do repair leaky faucets or toilets, and install high-efficiency fixtures.
- Do avoid long showers.
- Do clean the toilets, sinks, showers, and tubs with a mild detergent or baking soda instead of commercial-grade cleaners and laundry detergents.
- Do ask your inspector about allowing the water softener to backflush into the septic system.
- Do keep records of repairs, pumpings, inspections, permits issued, and other system maintenance activities.
- Do keep a sketch of your system including measurements from two points on the house.
- Do have your septic system inspected and pumped as part of a regular home maintenance plan.
- Do have only grass over your septic system. Roots from nearby trees or shrubs could cause problems for the absorption area.
- Do make sure that a concrete riser is installed over the tank if the opening is not within 12 inches of the surface, providing easy access for measuring and pumping the tank.

Don'ts

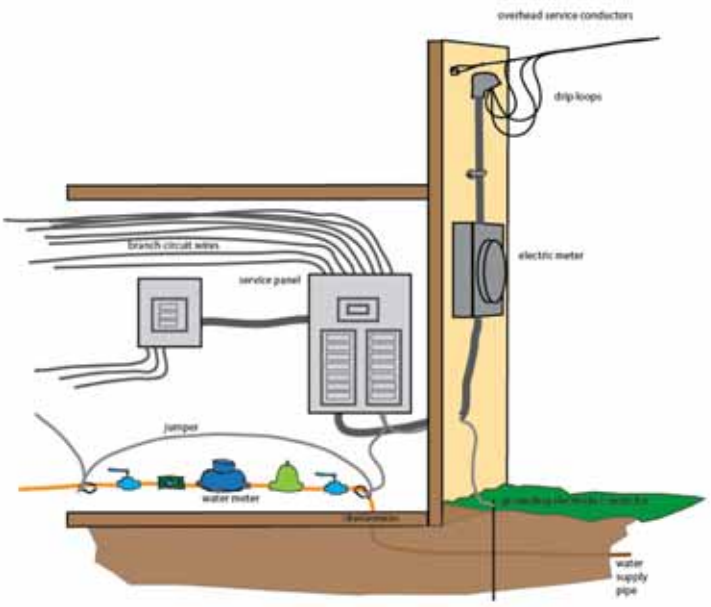
- Don't use your septic system like a trash can. Don't put dental floss, feminine hygiene products, condoms, diapers, cotton swabs, cigarette butts, coffee grounds, cat litter, paper towels, latex paint, pesticides, or other hazardous chemicals into your system.
- Don't use commercial-grade drain cleaners to clear a clogged drain. Instead, use boiling water or a drain snake to open clogs.
- Don't allow surface water to flow over the tank or absorption area.
- Don't drive heavy equipment, trucks or vehicles over 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.
- Don't dig in the absorption area.

Adapted from the public documents located at www.epa.gov/owm/septic/pubs

What Every Homeowner Should Know About the Electrical System in Their Home

Primary components are the service entry, service panel, and branch circuits. In unaltered buildings built since about 1940, the electrical system is likely to be intact and safe, although it may not provide the capacity required for the use of the building. Electrical capacity can be easily increased by bringing additional capacity in from the street and adding a larger service panel between the service entry and the existing panel. Existing circuits can continue to use the existing panel and new circuits can be fed through the new panel.

The electrical systems of residential buildings built prior to about 1940 may require overhaul or replacement, depending on the condition of the electrical system. Parts of these older systems may function adequately.



8.1 Service Entry

Service. Service is a term used to describe the conductors and equipment for delivering electricity from the utility company to the wiring system of the building served. Only one is typically installed for a dwelling. A minimum of 100-amp service is needed for a single residential dwelling unit.

Service panel. It is typically referred to as the “panelboard” or “main electric panel.” The first point of disconnect for the conductors from the utility company is at the “main panel.”

Overhead wires. Overhead wires from the street should be greater than 10 feet above the ground, not in contact with tree branches or other obstacles, and not reachable from nearby windows or other accessible areas. The wires should be securely attached to the building and have drip loops where they enter the weatherhead. Wires should not be located over swimming pools.

Electric meter. The electric meter and its base should be weatherproof and securely fastened. Advise the utility company of any problems with the meter.

Service entrance conductor. The insulation of the service entrance conductor should be completely intact. If the main service panel is located inside the building, the conductor’s passage through the wall should be sealed against moisture.

8.2 Main Electrical Service Panel (Breaker Box)

The main electrical service panel is the distribution center for electric service within the building. The primary function of the breakers or fuses (overcurrent protection devices) is to protect the house wiring from overloads.

All service panels must have covers or dead fronts. All openings should be closed.

Main disconnect. A means of disconnect for service must be located either outside or inside the dwelling unit nearest the point of entrance of the service conductors. No more than six hand movements or no more than six circuit breakers may be used to disconnect all service. Typically a main disconnect switch is required by the local authority. The main disconnect should be clearly marked to identify it as the service disconnect.

Condition and location. Water marks or rust on a service panel mounted inside the building may indicate water infiltration along the path of the service entrance conductor. Service panels mounted outdoors should be watertight. The service panel should have a workable space in front of it. The service panel should not be located inside a bathroom, over the stairs, or inside a clothes closet.

Amperage rating. The amperage rating of the main disconnect should not be less than 60-amps. It should be labeled or identified 100-amps or greater.

The ampacity of the service entry conductor may be determined by a building inspector by noting the markings (if any) on the conductor cable and finding the rating. If the service

entry conductor is in a conduit, there may be markings on the conductor wires as they emerge from the conduit into the service panel. The ampere rating may be found on the service panel or service disconnect switch.

Grounding. A building inspector may be able to confirm that the service panel is properly grounded. Its grounding conductor should run to an exterior grounding electrode or be clamped to the metal water service inlet pipe between the exterior wall and the water meter.

Grounding electrode is a device that makes an electrical connection to the earth. A grounding electrode can be rebar in a footer, a metal underground water supply pipe within 10 feet of contact with the earth and a **grounding rod**.

GFCI. A GFCI (ground fault circuit interrupter) outlet is a device that adds a greater level of safety by reducing the risk of electric shock. Most building codes now require that GFCI protection be provided in wet locations such as the following: all kitchen counter receptacles; all bathroom receptacles; all exterior receptacles; receptacles in laundry and utility rooms; receptacles next to wet bar sinks; all garage and unfinished basement receptacles, except receptacles that are not readily accessible or single receptacles for appliances that are not easily moved; receptacles near a pool, spa, or hot tub and; light fixtures near water.

Downstream. A GFCI outlet may be wired in a branch circuit, which means other outlets and electrical devices may share the same circuit and breaker. When a properly wired GFCI trips, the other devices downstream from it will also lose power.

If you have an outlet that doesn't work, and the breaker is not tripped, look for a GFCI outlet that may have tripped. The non-working outlet may be downstream from a GFCI device. The “dead” outlets may not be located near the GFCI outlet; they may be several rooms away or even on a different floor.

GFCI outlets should be tested periodically - at least once a year. All GFCI devices have test buttons.

AFCI. All 15-amp and 20-amp 120-volt circuits for dining rooms, living rooms, bedrooms, sunrooms, closets, hallways, or similar areas must be AFCI protected. An arc fault circuit interrupter (AFCI) is a circuit breaker designed to prevent fires by detecting non-working electrical arcs and disconnect power before the arc starts a fire. The AFCI should distinguish between a working arc that may occur in the brushes of a vacuum sweeper, light switch, or other household devices and a non-working arc that can occur, for instance, in a lamp cord that has a broken conductor in the cord from overuse. Arc faults in a home are one of the leading causes for household fires.

AFCIs resemble a GFCI (Ground-Fault Circuit Interrupter) in that they both have a test button, though it is important to distinguish between the two. GFCIs are designed to protect against electrical

shock, while AFCIs are primarily designed to protect against fire.

Overcurrent protection. A breaker or fuse is referred to as an overcurrent protection device. It is recommended that a homeowner should turn all circuit breakers on and off manually and make sure they are in functional condition.

The rating of the fuse or circuit breaker for each branch circuit may be checked by a building inspector or electrician. The amperage of the fuse or circuit breaker should not exceed the capacity of the wiring in the branch circuit it protects. Most household circuits use #14 copper wire, which should have 15-amp protection. There may be one or more circuits with #12 copper wire, which should have 20-amp protection. Large appliances, such as electric water heaters and central air conditioners, may require 30-amp service, which is normally supplied by #10 copper wire. If there were an electric range, it would require a 40-amp or 50-amp service with #6 copper wire.

Identification. Each circuit should be clearly and specifically identified as to its purpose. No two circuits should be labeled the same. No circuit should be identified in a way that may be subject to change with occupancy. For example, no breaker should be labeled “Ben’s room.”

8.3 Branch Circuits

The oldest wiring system that may still be acceptable, and one still found fairly often in houses built before 1930, is “**knob and tube**.” This system utilizes porcelain insulators (knobs) for running wires through unobstructed spaces, and porcelain tubes for running wires through building components such as studs and joists. Knob and tube wiring should be replaced during rehabilitation; but if it is properly installed, needs no modification, has adequate capacity, is properly grounded, has no failed insulation, and is otherwise in good condition, it can be an acceptable wiring system and is still allowed in many localities. Check with local building code officials. Also check the terms and conditions of the **home insurance policy** to see if “knob and tube” wiring is excluded. The greatest problem with such wiring is its insulation, which turns dry and brittle with age and often falls off on contact, leaving the wire exposed. Knob and tube wiring is known to have caused house fires.

Approved wire types include:

- NM (non-metallic) cable, often called by the trade name “Romex”, a plastic covered-cable for use in dry locations (older NM cable may be cloth covered).
- NMC, similar to NM but rated for damp locations.
- UF (underground feeder), a plastic-covered waterproof cable for use underground.
- AC (armored cable), also called BX, a flexible metal-covered cable.
- MC (metal-clad cable), a flexible metal-covered cable with a green insulated ground conductor.
- EMT (electrical metallic tubing), also called “thinwall,” a metal conduit through which the wires are run in areas where maximum protection is required.

Aluminum wire. Aluminum wire was used in residential buildings primarily during the 1960s and early 1970s, and is a potential fire hazard.

According to the U.S. Consumer Product Safety Commission, fires and even deaths have been caused by the use of aluminum wiring in residential homes. Problems due to expansion and arcing at the connections can cause overheating between the wire and the devices, or at wire splices. The connections can become hot enough to start a fire.

Aluminum wire should be attached only to approved devices (marked “CO-ALR” or “CU-AL”) or with connectors.

Problems with aluminum wiring occur at connections, so feel cover plates for heat, smell for a distinctive odor in the vicinity of outlets and switches, and look for sparks and arcing in switches or outlets and for flickering lights. Whenever possible, aluminum wire and its devices should be replaced with copper wire and devices appropriate for copper. It is difficult to find aluminum branch wiring in a home during a visual inspection. For a thorough investigation, an electrician should be hired.

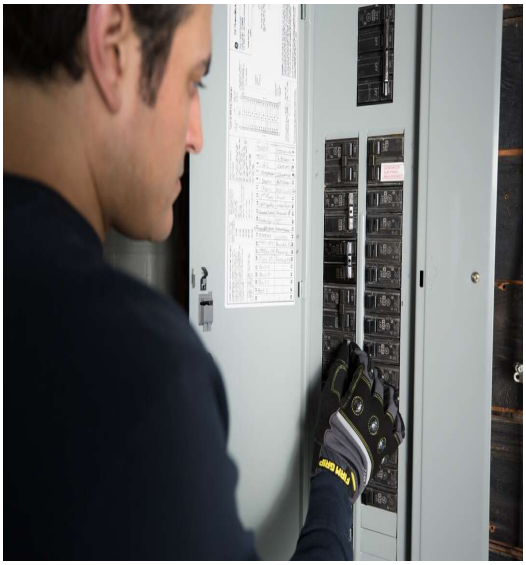
Smoke Detectors. After moving in, consider replacing all of the smoke/fire detectors in the entire house. The building should have functioning smoke detectors. Detectors should be wired to a power source and also should contain a battery. Smoke detectors do not last forever. Replace detectors according to manufacturer’s recommendations. Test the detectors regularly.

Replace batteries when you change your clocks for daylight savings time changes.

8.4 Inspection Standards

The inspector is required to inspect the service panel and overcurrent devices, but is not required to operate or reset overcurrent devices. During a home inspection, a representative number of switches, receptacles, lighting fixtures, and AFCI-protected receptacles are inspected - not each and every one.

The inspector shall report the presence of solid conductor aluminum branch circuit wiring ONLY if it is readily visible. The measurement of the amperage or voltage of the electrical service is not required by the SOP. Exterior accent wiring is not part of a home inspection.



Information was adapted from the home maintenance book authored by Ben Gromicko titled, “Now that you’ve had a home inspection.” http://www.nachi.org/home-maintenance-book.htm

Homeowner’s Guide: Being Energy Efficient

Most people don’t know how easy it is to make their homes run on less energy. Drastic reductions in heating, cooling and electricity costs can be accomplished through very simple changes, most of which homeowners can do themselves. Of course, for homeowners who want their homes to take advantage of the most up-to-date knowledge and systems in home energy-efficiency, Certified property inspectors can perform in-depth testing to find the best energy solutions for your particular home.

Why make your home more energy efficient? Here are a few good reasons:

- Federal, state, utility and local jurisdictions' financial incentives, such as tax breaks, are very advantageous in most parts of the U.S.
- It saves money. It costs less to power a home that has been converted to be more energy-efficient.
- It increases indoor comfort levels.
- It reduces our impact on climate change. Many scientists now believe that excessive energy consumption contributes significantly to global warming.
- It reduces pollution. Conventional power production introduces pollutants that find their way into the air, soil and water supplies.

1. Find better ways to heat and cool your house.

As much as half of the energy used in homes goes toward heating and cooling. The following are a few ways that energy bills can be reduced through adjustments to the heating and cooling systems:

- Install a ceiling fan. Ceiling fans can be used in place of air conditioners, which require a large amount of energy.
- Periodically replace air filters in air conditioners and heaters.
- Set thermostats to an appropriate temperature. Specifically, they should be turned down at night and when no one is home. In most homes, about 2% of the heating bill will be saved for each degree that the thermostat is lowered for at least eight hours each day. Turning down the thermostat from 75° F to 70°F, for example, saves about 10% on heating costs.
- Install a programmable thermostat. A programmable thermostat saves money by allowing heating and cooling appliances to be automatically turned down during times that no one is home and at night. Programmable thermostats contain no

mercury and, in some climate zones, can save up to $150 per year in energy costs.
- Install a wood stove or a pellet stove. These are more efficient sources of heat than furnaces.
- At night, curtains drawn over windows will better insulate the room.

2. Install a tankless water heater.
Demand water heaters (tankless or instantaneous) provide hot water only as it is needed. They don't produce the standby energy losses associated with storage water heaters, which will save on energy costs. Demand water heaters heat water directly without the use of a storage tank. Therefore, they avoid the standby heat losses required by traditional storage water heaters. When a hot water tap is turned on, cold water travels through a pipe into the unit. Either a gas burner or an electric element heats the water. As a result, demand water heaters deliver a constant supply of hot water. You don't need to wait for a storage tank to fill up with enough hot water.

3. Replace incandescent lights.
The average household dedicates 11% of its energy budget to lighting. Traditional incandescent lights convert approximately only 10% of the energy they consume into light, while the rest becomes heat. The use of new lighting technologies, such as light-emitting diodes (LEDs) and compact fluorescent lamps (CFL), can reduce energy use required by lighting by 50% to 75%. Advances in lighting controls offer further energy savings by reducing the amount of time lights are on but not being used. Here are some facts about CFLs and LEDs:
- CFLs use 75% less energy and last about 10 times longer than traditional incandescent bulbs.
- LEDs last even longer than CFLs and consume less energy.
- LEDs have no moving parts and, unlike CFLs, they contain no mercury.

4. Seal and insulate your home.
Sealing and insulating your home is one of the most cost-effective ways to make a home more comfortable and energy efficient -– and you can do it yourself. A tightly sealed home can improve comfort and indoor air quality while reducing utility bills. An InterNACHI energy auditor can be hired to assess envelope leakage and recommend fixes that will dramatically increase comfort and energy savings.
The following are some common places where leakage may occur:
- electrical outlets;
- mail slots;
- around pipes and wires;
- wall- or window-mounted air conditioners;
- attic hatches;
- fireplace dampers;
- weatherstripping around doors;
- baseboards;
- window frames; and
- switch plates.

Because hot air rises, air leaks are most likely to occur in the attic. Homeowners can perform a variety of repairs and maintenance to their attics that save them money on cooling and heating, such as:

- Plug the large holes. Locations in the attic where leakage is most likely to be the greatest are where walls meet the attic floor, behind and under attic knee walls, and in dropped-ceiling areas.
- Seal the small holes. You can easily do this by looking for areas where the insulation is darkened. Darkened insulation is a result of dusty interior air being filtered by insulation before leaking through small holes in the building envelope. In cold weather, you may see frosty areas in the insulation caused by warm, moist air condensing and then freezing as it hits the cold attic air. In warmer weather, you’ll find water staining in these same areas. Use expanding foam or caulk to seal the openings around plumbing vent pipes and electrical wires. Cover the areas with insulation after the caulk is dry.
- Seal up the attic access panel with weatherstripping. You can cut a piece of fiberglass or rigid foam board insulation the same size as the attic hatch and glue it to the back of the attic access panel. If you have pull-down attic stairs or an attic door, these should be sealed in a similar manner.

5. Install efficient shower heads and toilets.

The following systems can be installed to conserve water usage in homes:

- low-flow shower heads. They are available in different flow rates, and some have a pause button which shuts off the water while the bather lathers up;
- low-flow toilets. Toilets consume 30% to 40% of the total water used in homes, making them the biggest water users. Replacing an older 3.5-gallon toilet with a modern, low-flow 1.6-gallon toilet can reduce usage an average of two gallons-per-flush (GPF), saving 12,000 gallons of water per year. Low-flow toilets usually have "1.6 GPF" marked on the bowl behind the seat or inside the tank;
- vacuum-assist toilets. These types of toilets have a vacuum chamber which uses a siphon action to suck air from the trap beneath the bowl, allowing it to quickly fill with water to clear waste. Vacuum toilets are relatively quiet; and
- dual-flush toilets. Dual-flush toilets have been used in Europe and Australia for years, and are now gaining in popularity in the U.S. Dual-flush toilets let you choose between a 1-gallon (or less) flush for liquid waste, and a 1.6-gallon flush for solid waste. Dual-flush 1.6-GPF toilets reduce water consumption by an additional 30%.

6. Use appliances and electronics responsibly.

Appliances and electronics account for about 20% of household energy bills in a typical U.S. home. The following are tips that will reduce the required energy of electronics and appliances:

- Refrigerators and freezers should not be located near the stove, dishwasher or heat vents, or exposed to direct sunlight. Exposure to warm areas will force them to use more energy to remain cool.

- Computers should be shut off when not in use. If unattended computers must be left on, their monitors should be shut off. According to some studies, computers account for approximately 3% of all energy consumption in the United States.
- Use efficient “Energy Star”-rated appliances and electronics. These devices, approved by the DOE and the EPA’s Energy Star Program, include TVs, home theater systems, DVD players, CD players, receivers, speakers and more. According to the EPA, if just 10% of homes used energy-efficient appliances, it would reduce carbon emissions by the equivalent of 1.7 million acres of trees.
- Chargers, such as those for laptops and cell phones, consume energy when they are plugged in. When they are not connected to electronics, chargers should be unplugged.
- Laptop computers consume considerably less electricity than desktop computers.

7. Install daylighting as an alternative to electrical lighting.

Daylighting is the practice of using natural light to illuminate the home's interior. It can be achieved using the following approaches:

- skylights. It’s important that they be double-pane or they may not be cost-effective. Flashing skylights correctly is key to avoiding leaks;
- lightshelves. Light shelves are passive devices designed to bounce light deep into a building. They may be interior or exterior. Light shelves can introduce light into a space up to 2Ā times the distance from the floor to the top of the window, and advanced light shelves may introduce four times that amount;
- clerestory windows. Clerestory windows are short, wide windows set high on the wall. Protected from the summer sun by the roof overhang, they allow winter sun to shine through for natural lighting and warmth; and
- light tubes. Light tubes use a special lens designed to amplify low-level light and reduce light intensity from the midday sun. Sunlight is channeled through a tube coated with a highly reflective material, then enters the living space through a diffuser designed to distribute light evenly.

8. Insulate windows and doors.

About one-third of the home's total heat loss usually occurs through windows and doors. The following are ways to reduce energy lost through windows and doors:

- Seal all window edges and cracks with rope caulk. This is the cheapest and simplest option.
- Windows can be weatherstripped with a special lining that is inserted between the window and the frame. For doors, weatherstrip around the whole perimeter to ensure a tight seal when closed. Install quality door sweeps on the bottom of the doors, if they aren't already in place.
- Install storm windows at windows with only single panes. A removable glass frame can be installed over an existing window.
- If existing windows have rotted or damaged wood, cracked glass, missing putty, poorly fitting sashes, or locks that don't work, they should be repaired or replaced.

9. Cook smart.

An enormous amount of energy is wasted while cooking. The following recommendations and statistics illustrate less wasteful ways of cooking:

- Convection ovens are more efficient that conventional ovens. They use fans to force hot air to circulate more evenly, thereby allowing food to be cooked at a lower temperature. Convection ovens use approximately 20% less electricity than conventional ovens.
- Microwave ovens consume approximately 80% less energy than conventional ovens.
- Pans should be placed on the correctly-sized heating element or flame.
- Lids make food heat more quickly than pans that do not have lids.
- Pressure cookers reduce cooking time dramatically.
- When using conventional ovens, food should be placed on the top rack. The top rack is hotter and will cook food faster.

10. Change the way you wash your clothes.

- Do not use the "half load" setting on your washer. Wait until you have a full load of clothes, as the "half load" setting saves less than half of the water and energy.
- Avoid using high-temperature settings when clothes are not that dirty. Water that is 140 degrees uses far more energy than 103 degrees for a "warm" setting, but 140 degrees isn't that much better for washing purposes.
- Clean the lint trap before you use the dryer, every time. Not only is excess lint a fire hazard, but it will prolong the amount of time required for your clothes to dry.
- If possible, air-dry your clothes on lines and racks.
- Spin-dry or wring clothes out before putting them into a dryer.

Homeowners who take the initiative to make these changes usually discover that the energy savings are more than worth the effort. However, you should consider that inspectors can make this process much easier and perform a more comprehensive assessment of energy saving potential than you can. For a qualified inspector, visit www.InspectorSeek.com. Ask the inspector if they are trained in performing energy inspections.

Adapted from articles and information at http://www.nachi.org.

Homeowner Guide to Water Quality: Drinking Water

The United States has one of the safest water supplies in the world. However, national statistics don’t tell you specifically about the quality and safety of the water coming out of your tap. That’s because drinking water quality varies from place to place, depending on the condition of the source water from which it is drawn, and the treatment it receives. Now you have a new way to find information about your drinking water if it comes from a public water supplier (The EPA doesn’t regulate private wells, but recommends that well owners have their water tested annually.) Starting in 1999, every community water supplier must provide an annual report (sometimes called a "consumer confidence report") to its customers. The report provides information on your local drinking water quality, including the water’s source, the contaminants found in the water, and how consumers can get involved in protecting drinking water. You may want more information, or you may have more questions. One place you can go is to your water supplier, who is best equipped to answer questions about your specific water supply.

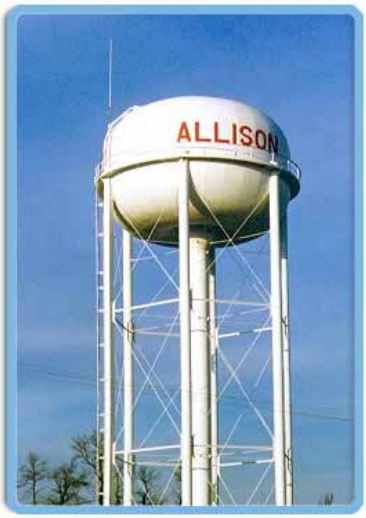
What contaminants may be found in drinking water?

There is no such thing as naturally pure water. In nature, all water contains some impurities. As water flows in streams, sits in lakes, and filters through layers of soil and rock in the ground, it dissolves or absorbs the substances that it touches. Some of these substances are harmless. In fact, some people prefer mineral water precisely because minerals give it an appealing taste. However, at certain levels, minerals, just like man-made chemicals, are considered contaminants that can make water unpalatable or even unsafe. Some contaminants come from the erosion of natural rock formations. Other contaminants are substances discharged from factories, applied to farmlands, or used by consumers in their homes and yards. Sources of contaminants might be in your neighborhood or might be many miles away. Your local water quality report tells which contaminants are in your drinking water, the levels at which they were found, and the actual or likely source of each contaminant. Some ground water systems have established wellhead protection programs to prevent substances from contaminating

their wells. Similarly, some surface-water systems protect the watershed around their reservoir to prevent contamination. Right now, states and water suppliers are working systematically to assess every source of drinking water, and to identify potential sources of contaminants. This process will help communities to protect their drinking water supplies from contamination.

Where does drinking water come from?

A clean, constant supply of drinking water is essential to every community. People in large cities frequently drink water that comes from surface-water sources, such as lakes, rivers and reservoirs. Sometimes, these sources are close to the community.



Other times, drinking water suppliers get their water from sources many miles away. In either case, when you think about where your drinking water comes from, it's important to consider not just the part of the river or lake that you can see, but the entire watershed. The watershed is the land area over which water flows into the river, lake or reservoir. In rural areas, people are more likely to drink ground water that was pumped from a well. These wells tap into aquifers, the natural reservoirs under the earth's surface, that may be only a few miles wide, or may span the borders of many states. As with surface water, it is important to remember that activities many miles away from you may affect the quality of ground water. Your annual drinking water quality report will tell you where your water supplier gets your water.

How is drinking water treated?

When a water supplier takes untreated water from a river or reservoir, the water often contains dirt and tiny pieces of leaves and other organic matter, as well as trace amounts of certain contaminants. When it gets to the treatment plant, water suppliers often add chemicals, called coagulants, to the water. These act on the water as it flows very slowly through tanks so that the dirt and other contaminants form clumps that settle to the bottom. Usually, this water then flows through a filter for removal of the smallest contaminants, such as viruses and Giardia. Most ground water is naturally filtered as it passes through layers of the earth into underground reservoirs known as aquifers. Water that suppliers pump from wells generally contains less organic material than surface water, and may not need to go through any or all of these treatments. The quality of the water will depend on local conditions. The most common drinking water treatment, considered by many to be one of the most important scientific advances of the 20th century, is disinfection. Most water suppliers add chlorine or another disinfectant to kill bacteria and other germs. Water suppliers use other treatments as needed, according to the quality of their source water. For example, systems whose water is contaminated with organic chemicals can treat their water with activated carbon, which adsorbs or attracts the chemicals dissolved in the water.

What if I have special health needs?

People who have HIV/AIDS, are undergoing chemotherapy, take steroids, or for another reason have a weakened immune system may be more susceptible to microbial contaminants, including Cryptosporidium, in drinking water. If you or someone you know fall into one of these categories, talk to your healthcare provider to find out if you need to take special precautions, such as boiling your water. Young children are particularly susceptible to the effects of high levels of certain contaminants, including nitrate and lead. To avoid exposure to lead, use water from the cold tap for making baby formula, drinking and cooking, and let the water run for a minute or more if the water hasn't been turned on for six or more hours. If your water supplier alerts you that your water does not meet the EPA's standard for nitrates, and you have children under 6 months old, consult your healthcare provider. You may want to find an alternate source of water that contains lower levels of nitrates for your child.

What are the health effects of contaminants in drinking water?

The EPA has set standards for more than 80 contaminants that may be present in drinking water and pose a risk to human health. The EPA sets these standards to protect the health of everybody, including vulnerable groups like children. The contaminants fall into two groups, according to the health effects that they cause. Your local water supplier will alert you through the local media, direct mail, or other means if there is a potential acute or chronic health effect from compounds in the drinking water.

You may want to contact them for additional information specific to your area. Acute effects occur within hours or days of the time that a person consumes a contaminant. People can suffer acute health effects from almost any contaminant if they are exposed to extraordinarily high levels (as in the case of a spill). In drinking water,microbes, such as bacteria and viruses, are the contaminants with the greatest chance of reaching levels high enough to cause acute health effects. Most people's bodies can fight off these microbial contaminants the way they fight off germs, and these acute contaminants typically don't have permanent effects. Nonetheless, when high-enough levels occur, they can make people ill, and can be dangerous or deadly for a person whose immune system is already weak due to HIV/AIDS, chemotherapy, steroid use, or another reason. Chronic effects occur after people consume a contaminant at levels over the EPA's safety standards for many years. The drinking water contaminants that can have chronic effects are chemicals (such as disinfection byproducts, solvents, and pesticides), radionuclides (such as radium), and minerals (such as arsenic). Examples of these chronic effects include cancer, liver and kidney problems, and reproductive difficulties.

Who is responsible for drinking water quality?

The Safe Drinking Water Act gives the Environmental Protection Agency (EPA) the responsibility for setting national drinking water standards that protect the health of the 250 million people who get their water from public water systems. Other people get their water from private wells which are not subject to federal regulations. Since 1974, the EPA has set national standards for over 80 contaminants that may occur in drinking water. While the EPA and state governments set and enforce standards, local governments and private water suppliers have direct responsibility for the quality of the water that flows to your tap. Water systems test and treat their water, maintain the distribution systems that deliver water to consumers, and report on their water quality to the state. States and the EPA provide technical assistance to water suppliers and can take legal action against systems that fail to provide water that meets state and EPA standards.

What is a violation of a drinking water standard?

Drinking water suppliers are required to monitor and test their water many times, for many things, before sending it to consumers. These tests determine whether and how the water needs to be treated, as well as the effectiveness of the treatment process. If a water system consistently sends to consumers water that contains a contaminant at a level higher than EPA or state health standards regulate, or if the system fails to monitor for a contaminant, the system is violating regulations, and is subject to fines and other penalties. When a water system violates a drinking water regulation, it must notify the people who drink its water about the violation, what it means, and how they should respond. In cases where the water presents an immediate health threat, such as when people need to boil water before drinking it, the system must use television, radio and newspapers to get the word out as quickly as possible. Other notices may be sent by mail, or delivered with the water bill. Each water suppliers' annual water quality report must include a summary of all the violations that occurred during the previous year.

How can I help protect my drinking water?

Using the new information that is now available about drinking water, citizens can be aware of the challenges of keeping drinking water safe and take an active role in protecting drinking water. There are lots of ways that individuals can get involved. Some people will help clean up the watershed that is the source of their community's water.

Other people might get involved in wellhead protection activities to prevent the contamination of the ground water source that provides water to their community. These people will be able to make use of the information that states and water systems are gathering as they assess their sources of water. Concerned citizens may want to attend public meetings to ensure that their community's need for safe drinking water is considered in making decisions about land use. You may wish to participate when your state and water system make funding decisions. And all consumers can do their part to conserve water and to dispose properly of household chemicals.

Adapted from information at http://www.nachi.org

Homeowner’s Safety Guidelines for Home Pools

Swimming pools should always be happy places. Unfortunately, each year thousands of American families confront swimming pool tragedies, drownings and near-drownings of young children. We want to prevent these tragedies. These are guidelines for pool barriers that can help prevent most submersion incidents involving young children. These guidelines are not intended as the sole method to minimize pool drowning of young children, but include helpful safety tips for safer pools.

Each year, hundreds of young children die and thousands come close to death due to submersion in residential swimming pools. The Consumer Product Safety Commission (CPSC) has estimated that each year, about 300 children under the age of 5 drown in swimming pools. Hospital emergency-room treatment is required for more than 2,000 children under 5 who were submerged in residential pools. The CPSC did an extensive study of swimming pool accidents, both fatal drownings and near-fatal submersions, in California, Arizona and Florida -- states in which home swimming pools are very popular and used during much of the year.

- In California, Arizona and Florida, drowning was the leading cause of accidental death in and around the home for children under the age of 5.
- Seventy-five percent of the children involved in swimming pool submersion or drowning accidents were between 1 and 3 years old.
- Boys between 1 and 3 were the most likely victims of fatal drownings and near-fatal submersions in residential swimming pools.
- Most of the victims were in the presence of one or both parents when the swimming pool accident occurred.

- Nearly half of the child victims were last seen in the house before the pool accident occurred. In addition, 23% of the accident victims were last seen on the porch or patio, or in the yard.
- This means that 69% of the children who became victims in swimming pool accidents were not expected to be in or at the pool, but were found drowned or submerged in the water.
- Sixty-five percent of the accidents occurred in a pool owned by the victim's immediate family, and 33% of the accidents occurred in pools owned by relatives or friends.
- Fewer than 2% of the pool accidents were the result of children trespassing on property where they didn't live or belong.
- Seventy-seven percent of the swimming pool accident victims had been missing for five minutes or less when they were found in the pool, drowned or submerged.

The speed with which swimming pool drownings and submersions can occur is a special concern: by the time a child's absence is noted, the child may have drowned. Anyone who has cared for a toddler knows how fast young children can move. Toddlers are inquisitive and impulsive, and lack a realistic sense of danger. These behaviors, coupled with a child's ability to move quickly and unpredictably, make swimming pools particularly hazardous for households with young children.

Swimming pool drownings of young children have another particularly insidious feature: these are silent deaths. It is unlikely that splashing or screaming will occur to alert a parent or caregiver that a child is in trouble. The best way to reduce child drownings in residential pools is for pool owners to construct and maintain barriers that prevent young children from gaining access to pools. However, there are no substitutes for diligent supervision.

Why the Swimming Pool Guidelines Were Developed

Young child can get over a pool barrier if the barrier is too low, or if the barrier has handholds or footholds for a child to use for climbing. The guidelines recommend that the top of a pool barrier be at least 48 inches above grade, measured on the side of the barrier which faces away from the swimming pool. Eliminating handholds and footholds, and minimizing the size of openings in a barrier's construction, can prevent inquisitive children from climbing pool barriers.

For a solid barrier, no indentations or protrusions should be present, other than normal construction tolerances and masonry joints. For a barrier (fence) made up of horizontal and vertical members, if the distance between the tops of the horizontal members is less than 45 inches, the horizontal members should be on the swimming pool-side of the fence. The spacing of the vertical members should not exceed 1-3/4 inches. This size is based on the foot-width of a young child, and is intended to reduce the potential for a child to gain a foothold. If there are any decorative cutouts in the fence, the space within the cutouts should not exceed 1-3/4 inches.

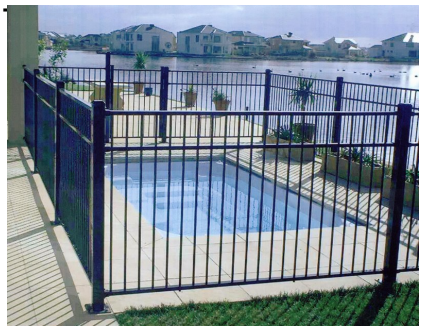
The definition of pool includes spas and hot tubs. The swimming pool-barrier guidelines, therefore, apply to these structures, as well as to conventional swimming pools.

How to Prevent a Child from Getting OVER a Pool Barrier

A successful pool barrier prevents a child from getting OVER, UNDER or THROUGH, and keeps the child from gaining access to the pool except when supervising adults are present.

The Swimming Pool-Barrier Guidelines

If the distance between the tops of the horizontal members is more than 45 inches, the horizontal members can be on the side of the fence facing away from the pool. The spacing between vertical members should not exceed 4 inches. This size is based on the head-breadth and chest depth of a young child, and is intended to prevent a child from passing through an opening. Again, if there are any decorative cutouts in the fence, the space within the cutouts should not exceed 1-3/4 inches.



For a chain-link fence, the mesh size should not exceed 1-1/4 inches square, unless slats fastened at the top or bottom of the fence are used to reduce mesh openings to no more than 1-3/4 inches.
For a fence made up of diagonal members (lattice work), the maximum opening in the lattice should not exceed 1-3/4 inches.

Above-ground pools should have barriers. The pool structure itself can sometimes serves as a barrier, or a barrier can be mounted on top of the pool structure. Then, there are two possible ways to prevent young children from climbing up into an above-ground pool. The steps or ladder can be designed to be secured, locked or removed to prevent access, or the steps or ladder can be surrounded by a barrier, such as those described above. For any pool barrier, the maximum clearance at the bottom of the barrier should not exceed 4 inches above grade, when the measurement is done on the side of the barrier facing away from the pool.

If an above-ground pool has a barrier on the top of the pool, the maximum vertical clearance between the top of the pool and the bottom of the barrier should not exceed 4 inches. Preventing a child from getting through a pool barrier can be done by restricting the sizes of openings in a barrier, and by using self-closing and self-latching gates. To prevent a young child from getting through a fence or other barrier, all openings should be small enough so that a 4-inch diameter sphere cannot pass through. This size is based on the head- breadth and chest-depth of a young child.

Gates

There are two kinds of gates which might be found on a residential property. Both can play a part in the design of a swimming pool barrier.

Pedestrian gates are the gates people walk through. Swimming pool barriers should be equipped with a gate or gates which restrict access to the pool. A locking device should be included in the gate's design. Gates should open out from the pool and should be self-closing and self-latching. If a gate is properly designed, even if the gate is not completely latched, a young child pushing on the gate in order to enter the pool area will at least close the gate and may actually engage the latch. When the release mechanism of the self-latching device is less than 54 inches from the bottom of the gate, the release mechanism for the gate should be at least 3 inches below the top of the gate on the side facing the pool. Placing the release mechanism at this height prevents a young child from reaching over the top of a gate and releasing the latch. Also, the gate and barrier should have no opening greater than 1/2-inch within 18 inches of the latch release mechanism. This prevents a young child from reaching through the gate and releasing the latch.

Other gates should be equipped with self-latching devices. The self-latching devices should be installed as described for pedestrian gates.

How to Prevent a Child from Getting UNDER or THROUGH a Pool Barrier

In many homes, doors open directly onto the pool area or onto a patio which leads to the pool. In such cases, the wall of the house is an important part of the pool barrier, and passage through any doors in the house wall should be controlled by security measures. The importance of controlling a young child’s movement from the house to the pool is demonstrated by the statistics obtained during the CPSC’s study of pool incidents in California, Arizona and Florida. Almost half (46%) of the children who became victims of pool accidents were last seen in the house just before they were found in the pool.

All doors which give access to a swimming pool should be equipped with an audible alarm which sounds when the door and/or screen are opened. The alarm should sound for 30 seconds or more within seven seconds after the door is opened. It should also be loud, at least 85 decibels, when measured 10 feet away from the alarm mechanism. The alarm sound should be distinct from other sounds in the house, such as the telephone, doorbell and smoke alarm. The alarm should have an automatic re-set feature. Because adults will want to pass through house doors in the pool barrier without setting off the alarm, the alarm should have a switch that allows adults to temporarily de-activate the alarm for up to 15 seconds. The de-activation switch could be a touch pad (keypad) or a manual switch, and should be located at least 54 inches above the threshold of the door covered by the alarm. This height was selected based on the reaching ability of young children.

Power safety covers can be installed on pools to serve as security barriers. Power safety covers should conform to the specifications in ASTM F 1346-91. This standard specifies safety performance requirements for pool covers to protect young children

from drowning. Self-closing doors with self-latching devices could also be used to safeguard doors which give ready access to a swimming pool.

Indoor Pools

When a pool is located completely within a house, the walls that surround the pool should be equipped to serve as pool safety barriers. Measures recommended above where a house wall serves as part of a safety barrier also apply for all the walls surrounding an indoor pool.

Guidelines

An outdoor swimming pool, including an in-ground, above-ground, or on-ground pool, hot tub, or spa, should be provided with a barrier which complies with the following:

1. The top of the barrier should be at least 48 inches above grade, measured on the side of the barrier which faces away from the swimming pool. The maximum vertical clearance between grade and the bottom of the barrier should be 4 inches measured on the side of the barrier which faces away from the swimming pool. Where the top of the pool structure is above grade, such as an above-ground pool, the barrier may be at ground level, such as the pool structure, or mounted on top of the pool structure. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier should be 4 inches.

2. Openings in the barrier should not allow passage of a 4-inch diameter sphere.

3. Solid barriers, which do not have openings, such as a masonry and stone wall, should not contain indentations or protrusions, except for normal construction tolerances and tooled masonry joints.

4. Where the barrier is composed of horizontal and vertical members, and the distance between the tops of the horizontal members is less than 45 inches, the horizontal

members should be located on the swimming pool-side of the fence. Spacing between vertical members should not exceed 1-3/4 inches in width. Where there are decorative cutouts, spacing within the cutouts should not exceed 1-3/4 inches in width.

5. Where the barrier is composed of horizontal and vertical members, and the distance between the tops of the horizontal members is 45 inches or more, spacing between vertical members should not exceed 4 inches. Where there are decorative cutouts, spacing within the cutouts should not exceed 1-3/4 inches in width.

6. The maximum mesh size for chain-link fences should not exceed 1-3/4 inch square, unless the fence is provided with slats fastened at the top or the bottom which reduce the openings to no more than 1-3/4 inches.

7. Where the barrier is composed of diagonal members, such as a lattice fence, the maximum opening formed by the diagonal members should be no more than 1-3/4 inches.

8. Access gates to the pool should be equipped to accommodate a locking device. Pedestrian access gates should open outward, away from the pool, and should be self-closing and have a self-latching device. Gates other than pedestrian access gates should have a self-latching device, where the release mechanism of the self-latching device is located less than 54 inches from the bottom of the gate.

- The release mechanism should be located on the pool-side of the gate at least 3 inches below the top of the gate.
- The gate and barrier should have no opening greater than 1/2-inch within 18 inches of the release mechanism.

9. Where a wall of a dwelling serves as part of the barrier, one of the following should apply:

- All doors with direct access to the pool through that wall should be equipped with an alarm which produces an audible warning when the door and its screen, if present, are opened. The alarm should sound continuously for a minimum of 30 seconds within seven seconds after the door is opened. The alarm should have a minimum sound pressure rating of 85 dBA at 10 feet, and the sound of the alarm should be distinctive from other household sounds, such as smoke alarms, telephones and doorbells. The alarm should automatically re-set under all conditions. The alarm should be equipped with manual means, such as touchpads or switches, to temporarily de-activate the alarm for a single opening of the door from either direction. Such de-activation should last for no more than 15 seconds. The de-activation touch pads or switches should be located at least 54 inches above the threshold of the door.
- The pool should be equipped with a power safety cover which complies with ASTM F1346-91.
- Other means of protection, such as self-closing doors with self-latching devices, are acceptable as long as the degree of protection afforded is not less than the protection afforded by the above.

10. Where an above-ground pool structure is used as a barrier, or where the barrier is mounted on top of the pool structure, and the means of access is a ladder or steps, then:

- The ladder to the pool or steps should be capable of being secured, locked or removed to prevent access.
- The ladder or steps should be surrounded by a barrier. When the ladder or steps are secured, locked, or removed, any opening created should not allow the passage of a 4-inch diameter sphere.

These guidelines are intended to provide a means of protection against potential drownings of children under 5 years of age by restricting access to residential swimming pools, spas and hot tubs.

Exemptions

A portable spa with a safety cover which complies with ASTM F1346-91 should be exempt from the guidelines presented here. Swimming pools, hot tubs, and non-portable spas with safety covers should not be exempt from these provisions.

Adapted from information at http://www.nachi.org.

Maintaining Your Roof

Roofs play a key role in protecting building occupants and interiors from outside weather conditions, primarily moisture. The roof, insulation and ventilation must all work together to keep the building free of moisture. Roofs also provide protection from the sun. In fact, if designed correctly, roof overhangs can protect the building's exterior walls from moisture and sun. The concerns regarding moisture, standing water, durability and appearance are different, reflected in the choices of roofing materials.

Maintaining Your Roof

Homeowner maintenance includes cleaning the leaves and debris from the roof’s valleys and gutters. Debris in the valleys can cause water to wick under the shingles and cause damage to the interior of the roof. Clogged rain gutters can cause water to flow back under the shingles on the eaves and cause damage, regardless of the roofing material. including composition shingle, wood shake, tile or metal. The best way to preserve your roof is to stay off it. Also, seasonal changes in the weather are usually the most destructive forces.

A leaky roof can damage ceilings, walls and furnishings. To protect buildings and their contents from water damage, roofers repair and install roofs made of tar or asphalt and gravel; rubber or thermoplastic; metal; or shingles made of asphalt, slate, fiberglass, wood, tile, or other material. Roofers also may waterproof foundation walls and floors.

There are two types of roofs: flat and pitched (sloped). Most commercial, industrial and apartment buildings have flat or slightly sloping roofs. Most houses have pitched roofs. Some roofers work on both types; others specialize. Most flat roofs are covered with several layers of materials. Roofers first put a layer of insulation on the roof deck. Over the insulation, they then spread a coat of molten bitumen, a tar-like substance. Next, they install partially overlapping layers of roofing felt, a fabric saturated in bitumen, over the surface. Roofers use a mop to spread hot bitumen over the surface and under the next layer. This seals the seams and makes the surface watertight. Roofers repeat these steps to build up the desired number of layers, called plies. The top layer either is glazed to make a smooth finish or has gravel embedded in the hot bitumen to create a rough surface. An increasing number of flat roofs are covered with a single-ply membrane of waterproof rubber or thermoplastic compounds. Roofers roll these sheets

over the roof’s insulation and seal the seams. Adhesive mechanical fasteners, or stone ballast hold the sheets in place. The building must be of sufficient strength to hold the ballast.

Most residential roofs are covered with shingles. To apply shingles, roofers first lay, cut, and tack 3-foot strips of roofing felt lengthwise over the entire roof. Then, starting from the bottom edge, they staple or nail overlapping rows of shingles to the roof. Workers measure and cut the felt and shingles to fit intersecting roof surfaces and to fit around vent pipes and chimneys. Wherever two roof surfaces intersect, or where shingles reach a vent pipe or chimney, roofers cement or nail flashing strips of metal or shingle over the joints to make them watertight. Finally, roofers cover exposed nailheads with roofing cement or caulking to prevent water leakage. Roofers who use tile, metal shingles or shakes follow a similar process. Some roofers also water-proof and damp-proof masonry and concrete walls and floors. To prepare surfaces for waterproofing, they hammer and chisel away rough spots, or remove them with a rubbing brick, before applying a coat of liquid waterproofing compound. They also may paint or spray surfaces with a waterproofing material, or attach a waterproofing membrane to surfaces. When damp-proofing, they usually spray a bitumen-based coating on interior or exterior surfaces.

A number of roofing materials are available...

Asphalt

Asphalt is the most commonly used roofing material. Asphalt products include shingles, roll-roofing, built-up roofing, and modified bitumen membranes. Asphalt shingles are typically the most common and economical choice for residential roofing. They come in a variety of colors, shapes and textures. There are four different types: strip, laminated, interlocking, and large individual shingles. Laminated shingles consist of more than one layer of tabs to provide extra thickness. Interlocking shingles are used to provide greater wind resistance. And large individual shingles generally come in rectangular and hexagonal shapes. Roll-roofing products are generally used in residential applications, mostly for underlayments and flashings. They come in four different types of material: smooth-surfaced, saturated felt, specialty-eaves flashings, and mineral-surfaced. Only mineral-surfaced is used alone as a primary roof covering for small buildings, such as sheds. Smooth-surfaced products are used primarily as flashing to seal the roof at intersections and protrusions, and for providing extra deck protection at the roof's eaves and valleys. Saturated felt is used as an underlayment between the roof deck and the roofing material. Specialty-eaves flashings are typically used in climates where ice dams and water backups are common. Built-up roofing (or BUR) is the most popular choice of roofing used on commercial, industrial and institutional buildings. BUR is used on flat and low-sloped roofs and consists of multiple layers of bitumen and ply sheets. Components of a BUR system include the roof deck, a vapor retarder, insulation, membrane, and surfacing material. A modified bitumen-membrane assembly consists of continuous plies of saturated felts, coated felts, fabrics or mats between which alternate layers of bitumen are applied, either surfaced or unsurfaced. Factory surfacing, if

applied, includes mineral granules, slag, aluminum or copper. The bitumen determines the membrane's physical characteristics and provides primary waterproofing protection, while the reinforcement adds strength, puncture-resistance and overall system integrity.

Metal

Most metal roofing products consist of steel or aluminum, although some consist of copper and other metals. Steel is invariably galvanized by the application of a zinc or a zinc-aluminum coating, which greatly reduces the rate of corrosion. Metal roofing is available as traditional seam and batten, tiles, shingles and shakes. Products also come in a variety of styles and colors. Metal roofs with solid sheathing control noise from rain, hail and bad weather just as well as any other roofing material. Metal roofing can also help eliminate ice damming at the eaves. And in wildfire-prone areas, metal roofing helps protect buildings from fire, should burning embers land on the roof. Metal roofing costs more than asphalt, but it typically lasts two to three times longer than asphalt and wood shingles.

Wood

Wood shakes offer a natural look with a lot of character. Because of variations in color, width, thickness, and cut of the wood, no two shake roofs will ever look the same. Wood offers some energy benefits, too. It helps to insulate the attic, and it allows the house to breathe, circulating air through the small openings under the felt rows on which wooden shingles are laid. A wood shake roof, however, demands proper maintenance and repair, or it will not last as long as other products. Mold, rot and insects can become a problem. The life-cycle cost of a shake roof may be high, and old shakes can't be recycled. Most wood shakes are unrated by fire safety codes. Many use wipe or spray-on fire retardants, which offer less protection and are only effective for a few years. Some pressure-treated shakes are impregnated with fire retardant and meet national fire safety standards. Installing wood shakes is more complicated than roofing with composite shingles, and the quality of the finished roof depends on the experience of the contractor, as well as the caliber of the shakes used. The best shakes come from the heartwood of large, old cedar trees, which are difficult to find. Some contractors maintain that shakes made from the outer wood of smaller cedars, the usual source today, are less uniform, more subject to twisting and warping, and don't last as long.

Concrete and Tile

Concrete tiles are made of extruded concrete that is colored. Traditional roofing tiles are made from clay. Concrete and clay tile roofing systems are durable, aesthetically appealing, and low in maintenance. They also provide energy savings and are environmentally friendly. Although material and installation costs are higher for concrete and clay tile roofs, when evaluated on a price-versus-performance basis, they may out-perform other roofing materials. Tile adorns the roofs of many historic buildings, as well as modern structures. In fact, because of its extreme durability, longevity and safety, roof tile is the most prevalent roofing material in the world. Tested over centuries, roof

tile can successfully withstand the most extreme weather conditions including hail, high wind, earthquakes, scorching heat, and harsh freeze-thaw cycles. Concrete and clay roof tiles also have unconditional Class A fire ratings, which means that, when installed according to building code, roof tile is non-combustible and maintains that quality throughout its lifetime. In recent years, manufacturers have developed new water-shedding techniques and, for high-wind situations, new adhesives and mechanical fasteners. Because the ultimate longevity of a tile roof also depends on the quality of the sub-roof, roof tile manufacturers are also working to improve flashings and other aspects of the underlayment system. Under normal circumstances, properly installed tile roofs are virtually maintenance-free. Unlike other roofing materials, roof tiles actually become stronger over time. Because of roof tile's superior quality and minimal maintenance requirements, most roof tile manufacturers offer warranties that range from 50 years to the lifetime of the structure.

Concrete and clay tile roofing systems are also energy-efficient, helping to maintain livable interior temperatures (in both cold and warm climates) at a lower cost than other roofing systems. Because of the thermal capacity of roof tiles and the ventilated air space that their placement on the roof surface creates, a tile roof can lower air-conditioning costs in hotter climates, and produce more constant temperatures in colder regions, which reduces potential ice accumulation. Tile roofing systems are made from naturally occurring materials and can be easily recycled into new tiles or other useful products. They are produced without the use of chemical preservatives, and do not deplete limited natural resources.

Single-Ply

Single-ply membranes are flexible sheets of compounded synthetic materials that are manufactured in a factory. There are three types of membranes: thermosets, thermoplastics, and modified bitumens. These materials provide strength, flexibility, and long-lasting durability. The advantages of pre-fabricated sheets are the consistency of the product quality, the versatility in their attachment methods, and, therefore, their broader applicability. They are inherently flexible, used in a variety of attachment systems, and compounded for long-lasting durability and watertight integrity for years of roof life. Thermoset membranes are compounded from rubber polymers. The most commonly used polymer is EPDM (often referred to as "rubber roofing"). Thermoset membranes make successful roofing materials because they can withstand the potentially damaging effects of sunlight and most common chemicals generally found on roofs. The easiest way to identify a thermoset membrane is by its seams, which require the use of adhesive, either liquid or tape, to form a watertight seal at the overlaps. Thermoplastic membranes are based on plastic polymers. The most common thermoplastic is PVC (polyvinyl chloride) which has been made flexible through the inclusion of certain ingredients called plasticizers. Thermoplastic membranes are identified by seams that are formed using either heat or chemical welding. These seams are as strong or stronger than the membrane itself. Most thermoplastic membranes are manufactured to include a reinforcement layer, usually polyester or fiberglass, which provides increased strength and dimensional stability. Modified bitumen membranes are

hybrids that incorporate the high-tech formulation and pre-fabrication advantages of single-ply with some of the traditional installation techniques used in built-up roofing. These materials are factory-fabricated layers of asphalt, "modified" using a rubber or plastic ingredient for increased flexibility, and combined with reinforcement for added strength and stability. There are two primary modifiers used today: APP (atactic polypropylene) and SBS (styrene butadiene styrene). The type of modifier used may determine the method of sheet installation. Some are mopped down using hot asphalt, and some use torches to melt the asphalt so that it flows onto the substrate. The seams are sealed by the same technique.

Are You at Risk?

If you aren't sure whether your house is at risk from natural disasters, check with your local fire marshal, building official, city engineer, or planning and zoning administrator. They can tell you whether you are in a hazard area. Also, they usually can tell you how to protect yourself and your house and property from damage. It is never a bad idea to ask an InterNACHI inspector whether your roof is in need of repair during your next scheduled inspection. Protection can involve a variety of changes to your house and property which that can vary in complexity and cost. You may be able to make some types of changes yourself. But complicated or large-scale changes and those that affect the structure of your house or its electrical wiring and plumbing should be carried out only by a professional contractor licensed to work in your state, county or city. One example is fire protection, accomplished by replacing flammable roofing materials with fire-resistant materials. This is something that most homeowners would probably hire a contractor to do.

Replacing Your Roof

The age of your roof is usually the major factor in determining when to replace it. Most roofs last many years, if properly installed, and often can be repaired rather than replaced. An isolated leak usually can be repaired. The average life expectancy of a typical residential roof is 15 to 20 years. Water damage to a home’s interior or overhangs is commonly caused by leaks from a single weathered portion of the roof, poorly installed flashing, or from around chimneys and skylights. These problems do not necessarily mean you need a new roof.

Fire-Resistant Materials

Some roofing materials, including asphalt shingles, and especially wood shakes, are less resistant to fire than others. When wildfires and brush fires spread to houses, it is often because burning branches, leaves, and other debris buoyed by the heated air and

carried by the wind fall onto roofs. If the roof of your house is covered with wood or asphalt shingles, you should consider replacing them with fire-resistant materials. You can replace your existing roofing materials with slate, terra cotta or other types of tile, or standing-seam metal roofing. Replacing roofing materials is difficult and dangerous work. Unless you are skilled in roofing and have all the necessary tools and equipment, you will probably want to hire a roofing contractor to do the work. Also, a roofing contractor can advise you on the relative advantages and disadvantages of various fire-resistant roofing materials.

Hiring a Licensed Contractor

One of the best ways to select a roofing contractor is to ask friends and relatives for recommendations. You may also contact a professional roofers association for referrals. Professional associations have stringent guidelines for their members to follow. The roofers association in your area will provide you with a list of available contractors. Follow these guidlines when selecting a contractor:

- get three references and review their past work;
- get at least three bids;
- get a written contract, and don't sign anything until you completely understand the terms;
- pay 10% down or $1,000 whichever is less;
- don't let payments get ahead of the work;
- don't pay cash;
- don't make final payment until you're satisfied with the job; and
- don't rush into repairs or be pressured into making an immediate decision.

You've Chosen the Contractor... What About the Contract?

Make sure everything is in writing. The contract is one of the best ways to prevent problems before you begin. The contract protects you and the contractor by including everything you have both agreed upon. Get all promises in writing and spell out exactly what the contractor will and will not do.

...and Permits?

Your contract should call for all work to be performed in accordance with all applicable building codes. The building codes set minimum safety standards for construction. Generally, a building permit is required whenever structural work is involved. The contractor should obtain all necessary building permits. If this is not specified in the contract, you may be held legally responsible for failure to obtain the required permits. The building department will inspect your roof when the project has reached a certain stage, and again when the roof is completed.

...**and Insurance?**

Make sure the contractor carries workers' compensation insurance and general liability insurance in case of accidents on the job. Ask to have copies of these policies for your job file. You should protect yourself from mechanics' liens against your home in the event the contractor does not pay subcontractors or material suppliers. You may be able to protect yourself by having a "release of lien" clause in your contract. A release of lien clause requires the contractor, subcontractors and suppliers to furnish a "certificate of waiver of lien." If you are financing your project, the bank or lending institution may require that the contractor, subcontractors and suppliers verify that they have been paid before releasing funds for subsequent phases of the project.

Keep these points in mind if you plan to have your existing roofing materials replaced:

- Tile, metal, and slate are more expensive roofing materials, but if you need to replace your roofing anyway, it may be worthwhile to pay a little more for the added protection these materials provide.
- Slate and tile can be much heavier than asphalt shingles or wood shingles. If you are considering switching to one of these heavier coverings, your roofing contractor should determine whether the framing of your roof is strong enough to support them.
- If you live in an area where snow loads are a problem, consider switching to a modern standing-seam metal roof, which will usually shed snow efficiently.

Adapted from the information at http://www.nachi.org

Homeowner’s Guide to Stucco

The Preservation and Repair of Historic Stucco

The term "stucco" is used to describe a type of exterior plaster applied as a two- or three-part coating directly onto masonry, or applied over wood or metal lath to a log or wood frame structure. Stucco is found in many forms on historic structures throughout the United States. It is so common, in fact, that it frequently goes unnoticed, and is often disguised or used to imitate another material. Historic stucco is also sometimes incorrectly viewed as a sacrificial coating, and consequently removed to reveal stone, brick or logs that historically were never intended to be exposed. Age and lack of maintenance hasten the deterioration of many historic stucco buildings. Like most historic building materials, stucco is at the mercy of the elements, and even though it is a protective coating, it is particularly susceptible to water damage. Stucco is a material of deceptive simplicity; in most cases, its repair should not be undertaken by a property owner unfamiliar with the art of plastering. Successful stucco repair requires the skill and experience of a professional plasterer. Although several stucco mixes are representative of different periods, they are provided here for reference. Each project is unique, with its own set of problems that require individual solutions.

Historical Background

Stucco has been used since ancient times. Still widely used throughout the world, it is one of the most common of traditional building materials. Up until the late 1800s, stucco, like mortar, was primarily lime-based, but the popularization of Portland cement changed the composition of stucco, as well as mortar, to a harder material. Historically, the term "plaster" has often been interchangeable with "stucco"; the term is still favored by many, particularly when referring to the traditional lime-based coating. By the 19th

century "stucco," although originally denoting fine interior ornamental plasterwork, had gained wide acceptance in the United States to describe exterior plastering. "Render" and "rendering" are also terms used to describe stucco, especially in Great Britain. Other historic treatments and coatings related to stucco, in that they consist (at least in part) of a similarly plastic or malleable material, include: parging and pargeting, wattle and daub, "cob" or chalk mud, pise de terre, rammed earth, briquete entre poteaux or bousillage, half-timbering, and adobe. All of these are regional variations on traditional mixtures of mud, clay, lime, chalk, cement, gravel or straw. Many are still used today.

Revival Styles Promote the Use of Stucco

The introduction of the many revival styles of architecture around the turn of the 20th century, combined with the improvement and increased availability of Portland cement, resulted in a craze for stucco as a building material in the United States. Beginning about 1890 and gaining momentum into the 1930s and 1940s, stucco was associated with certain historic architectural styles, including: Prairie; Art Deco and Art Moderne; Spanish Colonial, Mission, Pueblo, Mediterranean, English Cotswold Cottage, and Tudor Revival styles; as well as the ubiquitous bungalow and four-square house. The fad for Spanish Colonial Revival, and other variations on this theme, was especially important in furthering stucco as a building material in the United States during this period, since stucco clearly looked like adobe.

Although stucco buildings were especially prevalent in California, the Southwest and Florida, ostensibly because of their Spanish heritage, this period also spawned stucco-coated, revival-style buildings all over the United States and Canada. The popularity of stucco as a cheap and readily available material meant that, by the 1920s, it was used for an increasing variety of building types. Resort hotels, apartment buildings, private mansions and movie theaters, railroad stations, and even gas stations and tourist courts took advantage of the "romance" of period styles, and adopted the stucco construction that had become synonymous with these styles.

A Practical Building Material

Stucco has traditionally been popular for a variety of reasons. It was an inexpensive material that could simulate finely dressed stonework, especially when scored or lined, in the European tradition. A stucco coating over a less finished and less costly substrate, such as rubblestone, fieldstone, brick, log or wood frame, gave the building the appearance of being a more expensive and important structure. As a weather-repellent coating, stucco protects the building from wind and rain penetration, and also offers a certain amount of fire protection. While stucco was usually applied during construction as part of the building design, particularly over rubblestone or fieldstone, in

some instances, it was added later to protect the structure, or when a rise in the owner's social status demanded a comparable rise in his standard of living.

Composition of Historic Stucco

Before the mid-to late 19th century, stucco consisted primarily of hydrated or slaked lime, water and sand, with straw or animal hair mixed in as a binder. Natural cements were frequently used in stucco mixes after their discovery in the United States during the 1820s. Portland cement was first manufactured in the United States in 1871, and it gradually replaced natural cement. After about 1900, most stucco was composed primarily of Portland cement, mixed with some lime. With the addition of Portland cement, stucco became even more versatile and durable. No longer used just as a coating for a substantial material like masonry or log, stucco could now be applied over wood or metal lath attached to a light wood frame. With this increased strength, stucco ceased to be just a veneer and became a more integral part of the building structure.
Today, gypsum, which is hydrated calcium sulfate or sulfate of lime, has, to a great extent, replaced lime. Gypsum is preferred because it hardens faster and has less shrinkage than lime. Lime is generally used only in the finish coat in contemporary stucco work.

The composition of stucco depends on local custom and available materials. Stucco often contains substantial amounts of mud or clay, marble or brick dust, or even sawdust, and an array of additives ranging from animal blood or urine, to eggs, keratin or gluesize (animal hooves and horns), varnish, wheat paste, sugar, salt, sodium silicate, alum, tallow, linseed oil, beeswax, and wine, beer or rye whiskey. Waxes, fats and oils were included to introduce water-repellent properties, sugary materials reduced the amount of water needed and slowed down the setting time, and alcohol acted as an air entrainer. All of these additives contribute to the strength and durability of the stucco.

The appearance of much stucco was determined by the color of the sand -- or sometimes burnt clay -- used in the mix. Often, stucco was also tinted with natural pigments, or the surface whitewashed or color-washed after stuccoing was completed. Brick dust could provide color, and other coloring materials that were not affected by lime, mostly mineral pigments, could be added to the mix for the final finish coat. Stucco was also marbled or marbleized -- stained to look like stone by diluting oil of vitriol (sulfuric acid) with water, and mixing this with a yellow ochre, or another color. As the 20th century progressed, manufactured and synthetic pigments were added at the factory to some prepared stucco mixes.

Methods of Application

Stucco is applied directly, without lath, to masonry substrates, such as brick, stone, concrete or hollow tile. But on wood structures, stucco, like its interior counterpart plaster, must be applied over lath in order to obtain an adequate key to hold the stucco. Thus, when applied over a log structure, stucco is laid on horizontal wood lath that has been nailed on vertical wood furring strips attached to the logs. If it is applied over a wood frame structure, stucco may be applied to wood or metal lath nailed directly to the wood frame; it may also be placed on lath that has been attached to furring strips. The furring strips are themselves laid over building paper covering the wood sheathing. Wood lath was gradually superseded by expanded metal lath introduced in the late 19th and early 20th centuries. When stuccoing over a stone or brick substrate, it was customary to cut back or rake out the mortar joints, if they were not already recessed, by natural weathering or erosion, and sometimes the bricks themselves were gouged to provide a key for the stucco. This helped provide the necessary bond for the stucco to remain attached to the masonry, much like the key provided by wood or metal lath on frame buildings.

Like interior wall plaster, stucco has traditionally been applied as a multiple-layer process, sometimes consisting of two coats, but more commonly as three. Whether applied directly to a masonry substrate or onto wood or metal lath, this consists of a first "scratch" or "pricking-up" coat, followed by a second scratch coat, sometimes referred to as a "floating" or "brown" coat, followed finally by the "finishing" coat. Up until the late 19th century, the first and the second coats were of much the same composition, generally consisting of lime or natural cement, sand, perhaps clay, and one or more of the additives previously mentioned. Straw or animal hair was usually added to the first coat as a binder. The third, or finishing coat, consisted primarily of a very fine mesh-grade of lime and sand, and sometimes pigment. As already noted, after the 1820s, natural cement was also a common ingredient in stucco, until it was replaced by Portland cement. Both masonry and wood lath must be kept wet or damp to ensure a good bond with the stucco. Wetting these materials helps to prevent them from pulling moisture out of the stucco too rapidly, which results in cracking, loss of bond, and generally poor-quality stuccowork.

Traditional Stucco Finishes

Until the early 20th century when a variety of novelty finishes and textures were introduced, the last coat of stucco was commonly given a smooth, troweled finish, and

then scored or lined in imitation of ashlar. The illusion of masonry joints was sometimes enhanced by a thin line of white lime putty, graphite, or some other pigment. Some 19th century buildings feature a water table or raised foundation of roughcast stucco that differentiates it from the stucco surface above, which is smooth and scored. Other novelty and textured finishes associated with the "period" or revival styles of the early 20th century include: the English cottage finish, adobe and Spanish, pebble-dashed or dry-dash surface, fan and sponge texture, reticulated and vermiculated, roughcast (or wet dash), and sgraffito.

Regular Maintenance

Although A.J. Downing alluded to stuccoed houses in Pennsylvania that had survived for over a century in relatively good condition, historic stucco is inherently not a particularly permanent or long-lasting building material. Regular maintenance is required to keep it in good condition. Unfortunately, many older and historic buildings are not always accorded this kind of care. An InterNACHI inspector can be consulted for advice regarding stucco maintenance.

Because building owners knew stucco to be a protective, but also somewhat fragile coating, they employed a variety of means to prolong its usefulness. The most common treatment was to whitewash stucco, often annually. The lime in the whitewash offered protection and stability, and helped to harden the stucco. Most importantly, it filled hairline cracks before they could develop into larger cracks and let in moisture. To improve water repellency, stucco buildings were also sometimes coated with paraffin, another type of wax, or other stucco-like coatings, such as oil mastics.

Assessing Damage

Most stucco deterioration is the result of water infiltration into the building's structure, either through the roof, around chimneys, window and door openings, or excessive ground water or moisture penetrating through, or splashing up from the foundation. Potential causes of deterioration include: ground settlement lintel and door frame settlement; inadequate and leaking gutters and downspouts; intrusive vegetation; moisture migration within walls due to interior condensation and humidity; vapor drive problems caused by furnace, bathroom and kitchen vents; and rising damp resulting from excessive ground water and poor drainage around the foundation. Water infiltration will cause wood lath to rot, and metal lath and nails to rust, which eventually will cause stucco to lose its bond and pull away from its substrate.

After the cause of deterioration has been identified, any necessary repairs to the building should be made first before repairing the stucco. Such work is likely to include repairs designed to keep excessive water away from the stucco, such as roof, gutter, downspout and flashing repairs, improving drainage, and redirecting rainwater runoff and splash-back away from the building. Horizontal areas, such as the tops of parapet walls and chimneys, are particularly vulnerable to water infiltration, and may require modifications to their original design, such as the addition of flashing to correct the problem.

Previous repairs inexpertly carried out may have caused additional deterioration, particularly if executed in Portland cement, which tends to be very rigid and, therefore, incompatible with early, mostly soft lime-based stucco that is more flexible. Incompatible repairs, external vibration caused by traffic and construction, and building settlement can also result in cracks which permit the entrance of water and cause the stucco to fail.

Before beginning any stucco repair, an assessment of the stucco should be undertaken to determine the extent of the damage, and how much must be replaced or repaired. Testing should be carried out systematically on all elevations of the building to determine the overall condition of the stucco. Some areas in need of repair will be clearly evidenced by missing sections of stucco or stucco layers. Bulging or cracked areas are obvious places to begin. Unsound, punky or soft areas that have lost their key will echo with a hollow sound when tapped gently with a wooden or acrylic hammer or mallet.

Identifying the Stucco Type

Analysis of the historic stucco will provide useful information on its primary ingredients and their proportions, and will help to ensure that the new replacement stucco will duplicate the old in strength, composition, color and texture as closely as possible. However, unless authentic, period restoration is required, it may not be worthwhile, nor in many instances even possible, to attempt to duplicate all of the ingredients (particularly some of the additives) in creating the new stucco mortar. Some items are no longer available, and others, notably sand and lime -- the major components of traditional stucco -- have changed radically over time. For example, most sand used in contemporary masonry work is manufactured sand, because river sand, which was used historically, is difficult to obtain today in many parts of the country. The physical and visual qualities of manufactured sand versus river sand are quite different, and this affects the way stucco works, as well as the way it looks. The same is true of lime,

which is frequently replaced by gypsum in modern stucco mixes. And even if identification of all the items in the historic stucco mix were possible, the analysis would still not reveal how the original stucco was mixed and applied.

There are, however, simple tests that can be carried out on a small piece of stucco to determine its basic makeup. A dilute solution of hydrochloric (muriatic) acid will dissolve lime-based stucco, but not Portland cement. Although the use of Portland cement became common after 1900, there are no precise cutoff dates, as stuccoing practices varied among individual plasterers, and from region to region. Some plasterers began using Portland cement in the 1880s, but others may have continued to favor lime stucco well into the early 20th century. While it is safe to assume that a late-18th or early-19th century stucco is lime-based, late-19th or early-20th century stucco may be based on either lime or Portland cement. Another important factor to take into consideration is that an early lime-stucco building is likely to have been repaired many times over the ensuing years, and it is probable that at least some of these patches consist of Portland cement.

Planning the Repair

Once the extent of damage has been determined, a number of repair options may be considered. Small hairline cracks usually are not serious and may be sealed with a thin slurry coat consisting of the finish coat ingredients, or even with a coat of paint or whitewash.

Commercially available caulking compounds are not suitable materials for patching hairline cracks. Because their consistency and texture is unlike that of stucco, they tend to weather differently, and attract more dirt; as a result, repairs made with caulking compounds may be highly visible and unsightly. Larger cracks will have to be cut out in preparation for more extensive repair. Most stucco repairs will require the skill and expertise of a professional plasterer.

In the interest of saving or preserving as much as possible of the historic stucco, patching rather than wholesale replacement is preferable. When repairing heavily textured surfaces, it is not usually necessary to replace an entire wall section, since the textured finish, if well-executed, tends to conceal patches, and helps them to blend in with the existing stucco. However, because of the nature of smooth-finished stucco, patching a number of small areas scattered over one elevation may not be a successful repair approach unless the stucco has been previously

painted, or is to be painted following the repair work. On unpainted stucco, such patches are hard to conceal, because they may not match exactly or blend in with the rest of the historic stucco surface. For this reason, it is recommended, if possible, that stucco repair be carried out in a contained or well-defined area, or if the stucco is scored, the repair patch should be "squared-off" in such a way as to follow existing scoring. In some cases, especially in a highly visible location, it may be preferable to re-stucco an entire wall section or feature. In this way, any differences between the patched area and the historic surface will not be so readily apparent.

Repair of historic stucco generally follows most of the same principles used in plaster repair. First, all deteriorated, severely cracked and loose stucco should be removed down to the lath (assuming that the lath is securely attached to the substrate), or down to the masonry if the stucco is directly applied to a masonry substrate. A clean surface is necessary to obtain a good bond between the stucco and substrate. The areas to be patched should be cleaned of all debris with a bristle brush, and all plant growth, dirt, loose paint, oil and grease should be removed. If necessary, brick or stone mortar joints should then be raked out to a depth of approximately 5/8-inches to ensure a good bond between the substrate and the new stucco.

To obtain a neat repair, the area to be patched should be squared-off with a butt joint using a cold chisel, a hatchet, a diamond-blade saw, or a masonry bit. Sometimes, it may be preferable to leave the area to be patched in an irregular shape, which may result in a less conspicuous patch. Proper preparation of the area to be patched requires very sharp tools and extreme caution on the part of the plasterer not to break keys of surrounding good stucco by "over-sounding" when removing deteriorated stucco.

To ensure a firm bond, the new patch must not overlap the old stucco. If the stucco has lost its bond or key from wood lath, or the lath has deteriorated or come loose from the substrate, a decision must be made whether to try to re-attach the old lath, to replace deteriorated lath with new wood lath, or to leave the historic wood lath in place and supplement it with modern expanded metal lath. Unless authenticity is important, it is generally preferable (and easier) to nail new metal lath over the old wood lath to support the patch. Metal lath that is no longer securely fastened to the substrate may be removed and replaced in kind, or left in place and supplemented with new wire lath.

When repairing lime-based stucco applied directly to masonry, the new stucco should be applied in the same manner, directly onto the stone or brick. The stucco will bond onto the masonry itself without the addition of lath because of the irregularities in the masonry or those of its mortar joints, or because its surface has

been scratched, scored or otherwise roughened to provide an additional key. Cutting out the old stucco at a diagonal angle may also help secure the bond between the new and the old stucco. For the most part, it is not advisable to insert metal lath when re-stuccoing historic masonry in sound condition, as it can hasten deterioration of the repair work. Not only will attaching the lath damage the masonry, but the slightest moisture penetration can cause metal lath to rust. This will cause metal to expand, eventually resulting in spalling of the stucco, and possibly the masonry substrate, too.

If the area to be patched is properly cleaned and prepared, a bonding agent is usually not necessary. However, a bonding agent may be useful when repairing hairline cracks, or when dealing with substrates that do not offer a good bonding surface. These may include dense stone or brick, previously painted or stuccoed masonry, or spalling brick substrates. A good mechanical bond is always preferable to reliance on bonding agents. Bonding agents should not be used on a wall that is likely to remain damp or where large amounts of salt are present. Many bonding agents do not survive well under such conditions, and their use could jeopardize the longevity of the stucco repair.

A stucco mix compatible with the historic stucco should be selected after analyzing the existing stucco. It can be adapted from a standard traditional mix of the period, or based on one of the mixes included here. Stucco consisting mostly of Portland cement generally will not be physically compatible with the softer, more flexible, lime-rich historic stuccos used throughout the 18th and much of the 19th centuries. The differing expansion and contraction rates of lime stucco and Portland cement stucco will normally cause the stucco to crack. Choosing a stucco mix that is durable and compatible with the historic stucco on the building is likely to involve considerable trial and error, and probably will require a number of test samples, and even more, if it is necessary to match the color. It is best to let the stucco test samples weather as long as possible -- ideally, one year, or at least through a change of seasons -- in order to study the durability of the mix and its compatibility with the existing stucco, as well as the weathering of the tint, if the building will not be painted and color-match is an important factor.

If the test samples are not executed on the building, they should be placed next to the stucco remaining on the building to compare the color, texture and composition of the samples with the original. The number and thickness of stucco coats used in the repair should also match the original.

After thoroughly dampening the masonry or wood lath, the first scratch coat should be applied to the masonry substrate, or wood or metal lath, in a thickness that corresponds to the original (if extant), or generally about 1/4-inch to 3/8-inch. The scratch coat should be scratched or crosshatched with a comb to provide a key to hold the second coat. It usually takes 24 to 72 hours, and longer in cold weather, for each coat to dry

before the next coat can be applied. The second coat should be about the same thickness as the first, and the total thickness of the first two coats should generally not exceed about 5/8-inch. This second or leveling coat should be roughened using a wood float with a nail protruding to provide a key for the final or finish coat. The finish coat, about 1/4-inch thick, is applied after the previous coat has initially set. If this is not feasible, the base coat should be thoroughly dampened when the finish coat is applied later. The finish coat should be worked to match the texture of the original stucco.

Colors and Tints for Historic Stucco Repair

The color of most early stucco was supplied by the aggregate included in the mix -- usually, the sand. Sometimes, natural pigments were added to the mix, and 18th- and 19th-century scored stucco was often marbleized or painted in imitation of marble and granite. Stucco was also frequently coated with whitewash or a colorwash. This tradition later evolved into the use of paint, its popularity depending on the vagaries of fashion, as much as a means of concealing repairs. Because most of the early colors were derived from nature, the resultant stucco tints tended to be mostly earth tones. This was true until the advent of brightly colored stucco in the early decades of the 20th century. This was the so-called "Jazz Plaster" developed by O.A. Malone, the "man who put color into California," and who founded the California Stone Products Corporation in 1927. California stucco was revolutionary for its time as the first stucco/plaster to contain colored pigment in its pre-packaged factory mix.

When patching or repairing an historic stucco surface known to have been tinted, it may be possible to determine through visual or microscopic analysis whether the source of the coloring is sand, cement or pigment. Although some pigments or aggregates used traditionally may no longer be available, a sufficiently close color match can generally be approximated using sand, natural or mineral pigments, or a combination of these. Obtaining such a match will require testing and comparing the color of the dried test samples to the original. Successfully combining pigments in the dry stucco mix prepared for the finish coat requires considerable skill. The amount of pigment must be carefully measured for each batch of stucco. Overworking the mix can make the pigment separate from the lime. Changing the amount of water added to the mix, or using water to apply the tinted finish coat, will also affect the color of the stucco when it dries. Generally, the color obtained by hand-mixing these ingredients will provide a sufficiently close match to cover an entire wall or an area distinct enough from the rest of the structure that the color differences will not be obvious. However, it may not work for small patches conspicuously located on a primary elevation, where color differences will be especially noticeable. In these instances, it may be necessary to conceal the repairs by painting the entire patched elevation, or even the whole building.

Many stucco buildings have been painted over the years, and will require re-painting after the stucco repairs have been made. Limewash or cement-based paint, latex paint, or oil-based paint are appropriate coatings for stucco buildings. The most important factor to consider when re-painting a previously painted or coated surface is that the new paint be compatible with any coating already on the surface. In preparation for re-painting, all loose and peeling paint, and other coating material not firmly adhered to the

stucco, must be removed by hand-scraping or natural bristle brushes. The surface should then be cleaned.

Cement-based paints, most of which now contain some Portland cement and are really a type of limewash, have traditionally been used on stucco buildings. The ingredients were easily obtainable. Furthermore, the lime in such paints actually bonded or joined with the stucco and provided a very durable coating. In many regions, whitewash was applied annually during spring cleaning. Modern, commercially available, pre-mixed masonry and mineral-based paints may also be used on historic stucco buildings.
If the structure must be painted for the first time to conceal repairs, almost any of these coatings may be acceptable, depending on the situation. Latex paint, for example, may be applied to slightly damp walls or where there is an excess of moisture, but latex paint will not stick to chalky or powdery areas. Oil-based or alkyd paints must be applied only to dry walls; new stucco must cure up to a year before it can be painted with oil-based paint.

Contemporary Stucco Products
There are many contemporary stucco products on the market today. Many of them are not compatible, either physically or visually, with historic stucco buildings. Such products should be considered for use only after consulting with a specialist in historic masonry. However, some of these pre-packaged tinted stucco coatings may be suitable for use on stucco buildings dating from the late 19th and early 20th centuries, as long as the color and texture are appropriate for the period and style of the building. While some masonry contractors may, as a matter of course, suggest that a water-repellent coating be applied after repairing old stucco, in most cases, this should not be necessary, since color washes and paints serve the same purpose, and stucco itself is a protective coating.

Cleaning Historic Stucco Surfaces
Historic stucco buildings often exhibit multiple layers of paint or limewash. Although some stucco surfaces may be cleaned by water-washing, the relative success of this procedure depends on two factors: the surface texture of the stucco, and the type of dirt to be removed. If simply removing airborne dirt, smooth unpainted stucco, and heavily-textured painted stucco, may sometimes be cleaned using a low-pressure water wash, supplemented by scrubbing with soft natural bristle brushes, and possibly non-ionic detergents. Organic plant material, such as algae and mold, and metallic stains may be removed from stucco using poultices and appropriate solvents. Although these same methods may be employed to clean unpainted roughcast, pebble-dash, or any stucco surface featuring exposed aggregate, due to the surface irregularities, it may be difficult to remove dirt without also removing portions of the decorative textured surface. Difficulty in cleaning these surfaces may explain why so many of these textured surfaces have been painted.

When Total Replacement is Necessary
Complete replacement of the historic stucco with new stucco of either a traditional or modern mix will probably be necessary only in cases of extreme deterioration -- that is,

a loss of bond on over 40% to 50% of the stucco surface. Another reason for total removal might be that the physical and visual integrity of the historic stucco has been so compromised by prior incompatible and ill-conceived repairs that patching would not be successful.

When stucco no longer exists on a building, there is more flexibility in choosing a suitable mix for the replacement. Since compatibility of old and new stucco will not be an issue, the most important factors to consider are durability, color, texture and finish. Depending on the construction and substrate of the building, in some instances, it may be acceptable to use a relatively strong cement-based stucco mortar. This is certainly true for many late 19th and early 20th century buildings, and may even be appropriate to use on some stone substrates, even if the original mortar would have been weaker, as long as the historic visual qualities noted above have been replicated. Generally, the best principle to follow for a masonry building is that the stucco mix, whether for repair or replacement of historic stucco, should be somewhat weaker than the masonry to which it is to be applied in order not to damage the substrate.

General Guidance for Historic Stucco Repair

A skilled professional plasterer will be familiar with the properties of materials involved in stucco repair and will be able to avoid some of the pitfalls that would hinder someone less experienced. General suggestions for successful stucco repair parallel those involving restoration and repair of historic mortar and plaster. In addition, the following principles are important to remember:

- Mix only as much stucco as can be used in one-and-a-half to two hours. This will depend on the weather (mortar will harden faster under hot and dry, or sunny conditions). Experience is likely to be the best guidance. Any remaining mortar should be discarded; it should not be re-tempered.
- Stucco mortar should not be over-mixed. (Hand mix it for 10 to 15 minutes after adding water, or machine-mix for three to four minutes after all ingredients are in mixer.) Over-mixing can cause crazing and discoloration, especially in tinted mortars. Over-mixing will also tend to make the mortar set too fast, which will result in cracking and poor bonding or keying to the lath or masonry substrate.
- Wood lath or a masonry substrate, but not metal lath, must be thoroughly wetted before applying stucco patches so that it does not draw moisture out of the stucco too rapidly. To a certain extent, bonding agents also serve this same purpose. Wetting the substrate helps retard drying.
- To prevent cracking, it is imperative that stucco not dry too fast. Therefore, the area to be stuccoed should be shaded, or even covered, if possible, particularly in hot weather. It is also a good idea in hot weather to keep the newly stuccoed area damp, at approximately 90% humidity, for a period of 48 to 72 hours.
- Stucco repairs, like most other exterior masonry work, should not be undertaken in cold weather (below 40 degrees Fahrenheit, and preferably warmer), or if there is danger of frost.

Historic Stucco Textures

Most of the oldest stucco in the U.S. dating prior to the late 19th century will generally have a smooth, troweled finish (sometimes called a "sand" or "float" finish), possibly scored to resemble ashlar masonry units. Scoring may be incised to simulate masonry joints, the scored lines may be emphasized by black or white penciling, or the lines may simply be drawn or painted on the surface of the stucco. In some regions, at least as early as the first decades of the 19th century, it was not uncommon to use a roughcast finish on the foundation or base of an otherwise smooth-surfaced building. Roughcast was also used as an overall stucco finish for some out buildings, and other less-important types of structures.

A wide variety of decorative surface textures may be found on revival-style stucco buildings, particularly residential architecture. These styles evolved in the late 19th century and peaked in popularity in the early decades of the 20th century. Frank Lloyd Wright favored a smooth-finish stucco, which was imitated on much of the Prairie-style architecture inspired by his work. Some of the more picturesque surface textures include: English Cottage or English Cotswold finish; sponge finish; fan texture; adobe finish; and Spanish or Italian finish. Many of these finishes and countless other regional and personalized variations on them are still in use.

The most common early 20th-century stucco finishes are often found on bungalow-style houses, and include: spatter or spatterdash (sometimes called roughcast, harling or wetdash), and pebble-dash or drydash. The spatterdash finish is applied by throwing the stucco mortar against the wall using a whisk broom or a stiff fiber brush, and it requires considerable skill on the part of the plasterer to achieve a consistently rough wall surface. The mortar used to obtain this texture is usually composed simply of a regular sand, lime and cement mortar, although it may sometimes contain small pebbles or crushed stone aggregate, which replaces half the normal sand content. The pebble-dash or drydash finish is accomplished manually by the plasterer throwing or "dashing" dry pebbles (about 1/8-inch to 1/4-inch in size)onto a coat of stucco freshly applied by another plasterer. The pebbles must be thrown at the wall with a scoop with sufficient force and skill that they will stick to the stuccoed wall. A more even or uniform surface can be achieved by patting the stones down with a wooden float. This finish may also be created using a texturing machine.

Stucco on historic buildings is especially vulnerable not only to the wear of time and exposure to the elements, but also at the hands of well-intentioned "restorers" who may want to remove stucco from 18th and 19th century structures to expose what they believe to be the original or more "historic" brick, stone or log underneath. Historic stucco is a character-defining feature and should be considered an important historic building material, significant in its own right. While many 18th and 19th century buildings were stuccoed at the time of construction, others were stuccoed later for reasons of fashion or practicality. As such, it is likely that this stucco has acquired significance, over time, as part of the history and evolution of a building. Thus, even later, non-historic stucco should be retained, in most instances; and similar logic dictates that new stucco should not be applied to an historic building that was not stuccoed previously.

When repairing historic stucco, the new stucco should duplicate the old as closely as possible in strength, composition, color and texture.

Adapted from the information provided by http://www.nachi.org.

Household Hazards

This list of terms covers most of the common household dangers likely to be encountered by homeowners.

- **algae:** microorganisms that may grow to colonies in damp environments, including certain rooftops. They can discolor shingles; often described as "fungus."
- **alligatoring:** a condition of paint or aged asphalt brought about by the loss of volatile oils, and the oxidation caused by solar radiation; causes a coarse, "checking" pattern characterized by slipping of the new paint coating over the old coating to the extent that the old coating can be seen through the fissures. "Alligatoring" produces a pattern of cracks resembling an alligator hide, and is ultimately the result of the limited tolerance of paint or asphalt to thermal expansion and contraction.
- **asbestos:** a common form of magnesium silicate which was commonly used in various construction products because of its stability and resistance to fire. Asbestos exposure, caused by inhaling loose asbestos fibers, is associated with various forms of lung disease. Asbestos is the name given to certain inorganic minerals when they occur in fibrous form. Though fire-resistant, its extremely fine fibers are easily inhaled, and exposure to them over a period of years has been linked to cancers of the lung and the lung-cavity lining, and to asbestosis, a severe lung impairment. Asbestos is a naturally occurring mineral fiber sometimes found in older homes. It is hazardous to your health when a possibility exists of exposure to inhalable fibers. Homeowners should be alert for friable (readily crumbled or brittle) asbestos, and always seek professional advice in dealing with it.
- **bleeding:** the migration of a liquid to the surface of a component or into/onto an adjacent material.
- **blister:** an enclosed, raised spot evident on the surface of a building. They are mainly caused by the expansion of trapped air, water vapor, moisture or other gases.
- **blue stain:** a bluish or grayish discoloration of the sapwood caused the growth of certain mold-like fungi on the surface and in the interior of a piece, made possible by the same conditions that favor the growth of other fungi.
- **bubbling:** in glazing, open or closed pockets in a sealant caused by the release, production or expansion of gasses.
- **buckling:** the bending of a building material as a result of wear and tear, or contact with a substance such as water.
- **carbon monoxide (CO):** a colorless, odorless, highly poisonous gas formed by the incomplete combustion of carbon.

- **cohesive failure:** internal splitting of a compound resulting from over-stressing of the compound.
- **condensation:** water condensing on walls, ceiling and pipes; normal in areas of high humidity, usually controlled by ventilation or a dehumidifier.
- **corrosion:** the deterioration of metal by chemical or electrochemical reaction resulting from exposure to weathering, moisture, chemicals and other agents and media.
- **crater:** pit in the surface of concrete resulting from cracking of the mortar due to expansive forces associated with a particle of unsound aggregate or a contaminating material, such as wood or glass.
- **crazing:** a series of hairline cracks in the surface of weathered materials, having a web-like appearance; also, hairline cracks in pre-finished metals caused by bending or forming; see **brake metal**.
- **cupping:** a type of warping that causes boards to curl up at their edges.
- **damp-proofing:** a process used on concrete, masonry and stone surfaces to repel water, the main purpose of which is to prevent the coated surface from absorbing rainwater while still permitting moisture vapor to escape from the structure. Moisture vapor readily penetrates coatings of this type. Damp-proofing generally applies to surfaces above grade; waterproofing generally applies to surfaces below grade.
- **decay:** disintegration of wood and other substances through the action of fungi.
- **distortion:** alteration of viewed images caused by variations in glass flatness or in homogeneous portions within the glass; an inherent characteristic of heat-treated glass.
- **drippage:** bitumen material that drips through roof deck joints, or over the edge of a roof deck.
- **dry rot:** see **fungal wood rot**.
- **feathering strips:** tapered wood filler strips placed along the butt edges of old wood shingles to create a level surface when re-roofing over existing wood shingle roofs; aso called "horsefeathers."
- **fungal wood rot:** a common wood-destroying organism which develops when wood-containing material is exposed to moisture and poor air circulation for a long period of time (six-plus months); often and incorrectly referred to as "dry rot."
- **fungi (wood):** microscopic plants that live in damp wood and cause mold, stain and decay.
- **incompatibility:** descriptive of two or more materials which are not suitable to be used together.
- **lead-based paint:** Lead is a highly toxic metal that was used for many years in products found in and around homes. Lead may cause a range of health problems, from behavioral problems and learning disabilities, to seizures and death. Children age 6 and under are most at risk because their bodies are growing quickly.
- **migration:** spreading or creeping of a constituent of a compound onto/into adjacent surfaces; see **bleeding**.

- **mud cracks:** cracks developing from the normal shrinkage of an emulsion coating when applied too heavily.
- **mushroom:** an unacceptable occurrence when the top of a caisson concrete pier spreads out and hardens to become wider than the foundation's wall thickness.
- **photo-oxidation:** oxidation caused by rays of the sun.
- **ponding:** a condition where water stands on a roof for prolonged periods due to poor drainage and/or deflection of the deck.
- **pop-out:** see **stucco pop-out**.
- **radon:** a naturally-occurring, radioactive gas which is heavier than air and is common in many parts of the country. Radon gas exposure is associated with lung cancer. Mitigation measures may involve crawlspace and basement venting and various forms of vapor barriers.
- **scrap out:** the removal of all drywall material and debris after the home is "hung out" (installed) with drywall.
- **seasoning:** removing moisture from green wood in order to improve its serviceability.
- **settlement:** shifts in a structure, usually caused by freeze-thaw cycles underground.
- **sludge:** term for the waste material found in sump pump pits, septic systems and gutters.
- **spalling:** the chipping and flaking of concrete, bricks and other masonry where improper drainage and venting and freeze/thaw cycling exists.
- **splitting:** the formation of long cracks completely through a membrane. Splits are frequently associated with lack of allowance for expansion stresses. They can also be a result of deck deflection and a change in deck direction.
- **ultraviolet degradation:** a reduction in certain performance limits caused by exposure to ultraviolet light.
- **UV rays:** ultraviolet rays from the sun.
- **veining:** in roofing, the characteristic lines or "stretch marks" which develop during the aging process of soft bitumens.
- **warping:** any distortion in a material.
- **water vapor:** moisture existing as a gas in air.

Adapted from the information at http://www.nachi.org/

Lead Facts for Homeowners

Did you know the following facts about lead?

FACT: Lead exposure can harm young children and babies even before they are born.
FACT: Even children who seem healthy can have high levels of lead in their bodies.
FACT: You can get lead in your body by breathing or swallowing lead dust, or by eating soil or paint chips containing lead.
FACT: You have many options for reducing lead hazards. In most cases, lead-based paint that is in good condition is not a hazard.
FACT: Removing lead-based paint improperly can increase the danger to your family.

If you think your home might have lead hazards, read on to learn about lead and some simple steps to protect your family.

Health Effects of Lead

- Childhood lead poisoning remains a major environmental health problem in the U.S.
- Even children who appear healthy can have dangerous levels of lead in their bodies.
- People can get lead in their body if they:
    - put their hands or other objects covered with lead dust in their mouths;
    - eat paint chips or soil that contains lead; or
    - breathe in lead dust, especially during renovations that disturb painted surfaces.
- Lead is even more dangerous to children than adults because:
    - babies and young children often put their hands and other objects in their mouths. These objects can have lead dust on them;
    - children's growing bodies can absorb more lead; and
    - children's brains and central nervous systems are more sensitive to the damaging effects of lead.
- If not detected early, children with high levels of lead in their bodies can suffer from:
    - damage to the brain and nervous system;
    - behavioral and learning problems (such as hyperactivity);
    - slowed growth;
    - hearing problems; and

    - headaches.
- Lead is also harmful to adults. Adults can suffer from:
    - difficulties during pregnancy;
    - other reproductive problems (in both men and women);
    - high blood pressure;
    - digestive problems;
    - nerve disorders;
    - memory and concentration problems; and
    - muscle and joint pain

Where is Lead Found?
In general, the older your home, the more likely it has lead-based paint.

Paint

Many homes built before 1978 have lead-based paint. The federal government banned lead-based paint from housing in 1978. Some states stopped its use even earlier. Lead can be found:

- in homes in the city, country and suburbs;
- on apartments, single-family homes, and both private and public housing complexes;
- on the interior and exterior of the house;
- in the soil around a home. Soil can pick up lead from exterior paint and other sources, such as past use of leaded gas in cars;
- in household dust. Dust can pick up lead from deteriorating lead-based paint and from soil tracked into a home;
- in drinking water. Your home might have plumbing that uses lead pipes or lead solder. Call your local health department or water supplier to find out about testing your water. You cannot see, smell or taste lead, and boiling your water will not get rid of lead. If you think your plumbing might have lead in it:
    - Use only cold water for drinking and cooking.
    - Run water for 15 to 30 seconds before drinking it, especially if you have not used your water for a few hours.
- on the job. If you work with lead, you could bring it home on your hands or clothes. Shower and change clothes before coming home. Launder your work clothes separately from the rest of your family's clothes;
- in old (vintage or antique) painted toys and furniture;
- in food and liquids stored in lead crystal, lead-glazed pottery and porcelain;
- from lead smelters and other industries that release lead into the air;
- with hobbies that use lead, such as making pottery or stained glass, or refinishing furniture.
- in folk remedies that contain lead, such as "greta" and "azarcon" used to treat an upset stomach.

Where is Lead Likely to be a Hazard?

- Lead from paint chips, which you can see, and lead dust, which you can't always see, can be serious hazards.
- Peeling, chipping, chalking and cracking lead-based paint is a hazard and needs immediate attention.
- Lead-based paint may also be a hazard when found on surfaces that children can chew or that get a lot of wear-and-tear. These areas include:
    - windows and window sills;
    - doors and door frames;
    - stairs, railings and banisters; and
    - porches and fences.

Note: Lead-based paint that is in good condition is usually not a hazard.

- Lead dust can form when lead-based paint is dry-scraped, dry-sanded, or heated. Dust also forms when painted surfaces bump or rub together. Lead chips and dust can get on surfaces and objects that people touch. Settled lead dust can re-enter the air when people vacuum, sweep or walk through it.
- Lead in soil can be a hazard when children play in bare soil, or when people bring soil into the house on their shoes.

Checking Your Family and Home for Lead

- Have your children and home tested if you think your home has high levels of lead.
- Just knowing that a home has lead-based paint may not tell you if there is a hazard.

To reduce your child’s exposure to lead, get your child checked, have your home tested (especially if your home has paint in poor condition and was built before 1978), and fix any hazards you may have.

Your Family

- Children’s blood lead levels tend to increase rapidly from 6 to 12 months of age, and tend to peak at 18 to 24 months of age.
- Consult your doctor for advice on testing your children. A simple blood test can detect high levels of lead. Blood tests are important for:
    - children at ages 1 to 2;
    - children and other family members who have been exposed to high levels of lead; and
    - children who should be tested under your state or local health screening plan.

Your doctor can explain what the test results mean and if more testing will be needed.

Your Home

You can get your home checked in one of two ways (or both):

- A paint inspection tells you the lead content of every different type of painted surface in your home. It won't tell you whether the paint is a hazard or how you should deal with it.

- A risk assessment tells you if there are any sources of serious lead exposure, such as peeling paint and lead dust. It also tells you what actions to take to address these hazards.

Have qualified professionals do the work. There are standards in place for certifying lead-based paint professionals to ensure that the work is done safely, reliably and effectively. Be sure to ask your InterNACHI inspector about lead paint during your next inspection. Trained professionals use a range of methods when checking your home, including:

- a vsual inspection of paint condition and location;
- a portable x-ray fluorescence (XRF) machine;
- lab tests of paint samples; and
- surface-dust tests.

Note: Home test kits for lead are available, but studies suggest that they are not always accurate. Consumers should not rely on these tests before doing renovations or to assure safety.

What You Can Do to Protect Your Family

If you suspect that your house has lead hazards, you can take some immediate steps to reduce your family's risk:

- If you rent, notify your landlord of peeling or chipping paint.
- Clean up paint chips immediately.
- Clean floors, window frames, window sills, and other surfaces weekly. Use a mop, sponge or paper towel with warm water and a general all-purpose cleaner, or a cleaner made specifically for lead.

REMEMBER: NEVER MIX AMMONIA AND BLEACH PRODUCTS TOGETHER, SINCE THEY CAN FORM A DANGEROUS GAS.

- Thoroughly rinse sponges and mop heads after cleaning dirty and dusty areas.
- Wash children's hands often, especially before they eat, and before nap time and bed time.
- Keep play areas clean. Wash bottles, pacifiers, toys and stuffed animals regularly.
- Keep children from chewing window sills and other painted surfaces.
- Clean or remove shoes before entering your home to avoid tracking in lead from soil.
- Make sure children eat nutritious, low-fat meals high in iron and calcium, such as spinach and dairy products. Children with good diets absorb less lead.

In addition to day-to-day cleaning and good nutrition, you can temporarily reduce lead hazards by taking actions such as repairing damaged amd painted surfaces, and by planting grass to cover soil with high lead levels. These actions, called "interim controls," are not permanent solutions and will need ongoing attention. To permanently remove lead hazards, you must hire a certified lead-abatement contractor. Abatement (or permanent hazard elimination) methods include removing, sealing or enclosing lead-based paint with special materials. Just painting over the hazard with regular paint is not enough. Always hire a person with special training for correcting lead problems -- someone who knows how to do this work safely and has the proper equipment to clean

up thoroughly. Certified contractors will employ qualified workers and follow strict safety rules set by their state or the federal government. To be safe, hire an InterNACHI inspector trained in lead detection for your next inspection.

Are You Planning to Buy or Rent a Home Built Before 1978?

Many houses and apartments built before 1978 have paint that contains lead (called lead-based paint). Lead from paint, chips and dust can pose serious health hazards if not taken care of properly. Federal law requires that individuals receive certain information before renting or buying pre-1978 housing.

- Residential Lead-Based Paint Disclosure Program
  - LANDLORDS have to disclose known information on lead-based paint and lead-based paint hazards before leases take effect. Leases must include a disclosure form about lead-based paint.
  - SELLERS have to disclose known information on lead-based paint and lead-based paint hazards before selling a house. Sales contracts must include a disclosure form about lead-based paint. Buyers have up to 10 days to check for lead hazards.

If not conducted properly, certain types of renovations can release lead from paint and dust into the air.

- Pre-Renovation Education Program (PRE)
  - RENOVATORS have to give you a pamphlet titled “Protect Your Family from Lead in Your Home” before starting work.
- Take precautions before your contractor or you begin remodeling or renovations that disturb painted surfaces (such as scraping off paint or tearing out walls).
  - Have the area tested for lead-based paint.
  - Do not use a belt-sander, propane torch, heat gun, dry scraper or dry sandpaper to remove lead-based paint. These actions create large amounts of lead dust and fumes.
  - Lead dust can remain in your home long after the work is done.
  - Temporarily move your family (especially children and pregnant women) out of the apartment or house until the work is done and the area is properly cleaned. If you can't move your family, at least completely seal off the work area.
  - If you have already completed renovations or remodeling that could have released lead-based paint or dust, get your young children tested and follow the steps outlined to protect your family.

Adapted from the information at http://www.nachi.org

Do You Have a Well?: Radon in Water
A Guide For Homeowners

Well owners with elevated indoor radon levels should test their well water for radon. Radon in your water supply can increase your indoor radon level, although, in most cases, radon entering the home through water will be a small source of risk compared with radon entering from the soil. EPA estimates that indoor radon levels will increase by about **1 pCi/L for every 10,000 pCi/L of radon in water**. You can find publications and documents developed by EPA's Office of Ground Water and Drinking Water relating to radon in drinking water and the radon in drinking water rule at http://www.epa.gov/safewater/radon.html.

What do the results of your water test mean?

Estimate how much the radon in your water is elevating your indoor radon level by subtracting **1 pCi/L from your indoor air radon level for every 10,000 pCi/L of radon that was found in your water**. (For example: if you have **30,000 pCi/L of radon in your water, then 3 pCi/L** of your indoor measurement may have come from radon in water.) If most of the radon is not coming from your water, fix your house first and then retest your indoor air to make sure that the source of elevated radon was not your private well. If a large contribution of the radon in your house is from your water, you may want to consider installing a special water treatment system to remove radon. EPA recommends installing a water treatment system only when there is a proven radon problem in your water supply.

How is radon removed from water?

Radon can be removed from water by using one of two methods: aeration treatment or granular activated carbon (GAC) treatment. Aeration treatment involves spraying water or mixing it with

air, and then venting the air from the water before use. GAC treatment filters water through carbon. Radon attaches to the carbon and leaves the water free of radon. The carbon may need special handling in its disposal if it is used at a high radon level or if it has been used for a long time. In either treatment, it is important to treat the water where it enters your home (point-of-entry device) so that all the water will be treated. Point-of-use devices, such as those installed on a tap or under the sink, will only treat a small portion of your water and are not effective in reducing radon in your water. It is important to maintain home water treatment units properly because failure to do so can lead to other water contamination problems. Some homeowners opt for a service contract from the installer to provide for carbon replacement and general system maintenance.

The 1996 Safe Drinking Water Act Amendments required EPA to establish several new, health-based drinking water regulations, including a multimedia approach to address the public health risks from radon.

Breathing radon in the indoor air of homes is the primary public health risk from radon, contributing to about 20,000 lung cancer deaths each year in the United States, according to a 1999 landmark report this year by the National Academy of Sciences (NAS) on radon in indoor air (BEIR VI). Radon is the second leading cause of lung cancer in the United States. Based on a second NAS report on radon in drinking water, EPA estimates that radon in drinking water causes about 168 cancer deaths per year, 89 percent from lung cancer caused by breathing radon released from water, and 11 percent from stomach cancer caused by drinking radon-containing water.

- NAS Report Executive Summary: "Risk Assessment of Radon in Drinking Water" http://www.nap.edu/catalog.php?record_id=6287
- INITIAL EPA PERSPECTIVES on NAS Report: "Risk Assessment of Radon in Drinking Water" http://www.epa.gov/safewater/radon/remove/nasdw.html
- NAS Report and EPA's Approach to Setting Limits for Radon in Drinking Water http://www.epa.gov/safewater/radon/remove/approach.html

Where and how does radon get into drinking water?

While most radon-related deaths are due to radon gas accumulated in houses from seepage through cracks in the foundation, 30 to 1,800 deaths per year are attributed to radon from household water. Showering, washing dishes, and laundering can disturb the water and release radon gas into the air you breathe.

What are the symptoms of radon exposure?

Drinking water that has high levels of radon may be a health risk, but breathing air high in radon concentration is more harmful to your health. Breathing in radon gas over a long period of time can increase your risk of getting lung cancer. Drinking water contaminated by radon may increase your chances of developing stomach cancer.

What should I do if I have concerns about radon exposure?

See your health care provider to discuss your concerns.

How is radon exposure diagnosed?

Before you test your water for radon, you should test the air. If the indoor radon level is high and you use groundwater, test your water. If the radon level is low in the air, there is no need to test your water. Test results are expressed in picocuries of radon per liter of water (pCi/l). In general, 10,000 pCi/l of radon in water contributes roughly 1 pCi/l of airborne radon throughout the house. The U.S. Environmental Protection Agency (EPA) currently advises consumers to take action if the total household air level is above 4 pCi/l.

What is the treatment for radon exposure?

For waterborne radon, a simple step is to make sure your bathroom, laundry room, and kitchen are well ventilated. If your well water only has moderate levels of radon, this may adequately reduce your exposure to waterborne radon. However, if your well has high levels of radon, you may need to use water treatment devices such as granular activated carbon (GAC) units and home aerators.

How do I remove radon from my home's drinking water?

Radon can be removed from water by using one of two methods:

- Aeration treatment—spraying water or mixing it with air and then venting the air from the water before use, or
- GAC treatment—filtering water through carbon. Radon attaches to the carbon and leaves the water free of radon. Disposing the carbon may require special handling if it is used at a high radon level or if it has been used for a long time.

In either treatment, it is important to treat the water where it enters your home (point-of-entry device) so that all the water will be treated. Point-of-use devices such as those installed on a tap or under the sink will only treat a small portion of your water and are not effective in reducing radon in your water. It is important to maintain home water treatment units properly because failure to do so can lead to other water contamination problems. Some homeowners use a service contract from the installer to provide carbon replacement and general system maintenance.

15 Tools That Every Homeowner Should Own

The following items are essential tools but this list is by no means exhaustive. Feel free to ask an InterNACHI inspector during your next inspection about other tools that you might find useful. http://www.nachi.org/

1. Plunger

A clogged sink or toilet is one of the most disturbing problems that you will face. With a plunger on hand, however, you can usually remedy these troubling plumbing issues relatively quickly. It is best to have two plungers -- one for the sink and one for the toilet.

2. Combination Wrench Set

One end of a combination wrench set is open and the other end is a closed loop. Nuts and bolts are manufactured in standard and metric sizes and because both varieties are widely used, so you'll need both sets of wrenches. For the most control and leverage, always pull the wrench toward you, instead of pushing on it. Also, avoid over-tightening.

3. Slip-Joint Pliers

Use slip-joint pliers to grab hold of a nail, a nut, a bolt, and much more. These types of pliers are versatile because of the jaws, which feature both flat and curved areas for gripping many types of objects. There is also a built-in slip-joint, which allows the user to quickly adjust the jaw size to suit most tasks.

4. Adjustable Wrench

Adjustable wrenches are somewhat awkward to use and can damage a bolt or nut if they are not handled properly. However, adjustable wrenches are ideal for situations where you need two wrenches of the same size. Screw the jaws all the way closed to avoid damaging the bolt or nut.

5. Caulking Gun

Caulking is the process of sealing up cracks and gaps in various structures and certain types of piping. Caulking can provide noise mitigation and thermal insulation, and control water penetration. Caulk should be applied only to areas that are clean and dry.

6. Flashlight

None of the tools in this list is of any use if you cannot visually inspect the situation. The problem, and solution, are apparent only with a good flashlight. A traditional two-battery flashlight is usually sufficient, as larger flashlights may be too unwieldy.

7. Tape Measure

Measuring house projects requires a tape measure, not a ruler or a yardstick. Tape measures come in many lengths, although 25 feet is best. Measure everything at least twice to ensure accuracy.

8. Hacksaw

These are great for cutting metal objects such as pipes, bolts and brackets. Hacksaws look thin and flimsy, but they'll easily cut through even the hardest of metals. Blades are replaceable, so focus your purchase on a quality hacksaw frame.

9. Torpedo Level

Only a level can be used to determine if something, such as a shelf, appliance or picture, is correctly oriented. The torpedo-style level is unique because it not only shows when an object is perfectly horizontal or vertical, but it also has a gauge that shows when an object is at a 45-degree angle. The bubble in viewfinder must be exactly in the middle, not merely close.

10. Safety Glasses / Goggles

For all tasks involving a hammer or a power tool, you should always wear safety glasses or goggles. They should also be worn while you mix chemicals.

11. Claw Hammer

A good hammer is one of the most important tools you can own. Use it to drive and remove nails, to pry wood loose from the house, and in combination with other tools. They come in a variety of sizes, although a 16-ounce hammer is the best all-purpose choice.

12. Screwdriver Set
It is best to have four screwdrivers: a small and large version of both a flat-head and a Phillips- head screwdriver. Electrical screwdrivers are sometimes convenient, but they're no substitute. Manual screwdrivers can reach into more places and they are less likely to damage the screw.

13. Wire Cutters
Wire cutters are pliers designed to cut wires and small nails. The “side-cutting” (unlike the stronger "end-cutting" style) style is handy, but not strong enough to cut small nails.

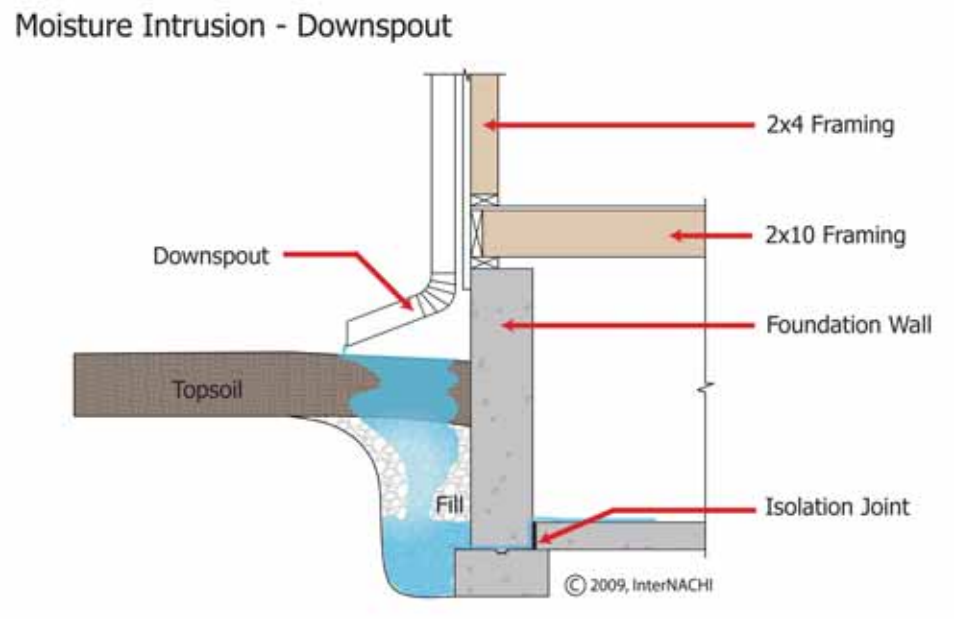
14. Respirator / Safety Mask
While paints and other coatings have become less toxic (and lead-free) over time, most still contain dangerous chemicals, which is why you should wear a mask to avoid accidentally getting them in your lungs. A mask should also be worn when working in dusty or dirty environments. Disposable masks usually come in packs of 10 and should be thrown away after use. Full and half-face respirators can be used to prevent the inhalation of very fine particles that ordinary facemasks will not not stop.

15. Duct Tape
This tape is extremely strong and adaptable. Originally, it was widely used to make temporary repairs to many types of military equipment. Today, it’s one of the key items specified for home emergency kits because it is water-resistant and extremely sticky.

In summary, the above is a list of tools that every homeowner should have.

Adapted from the articles and information at http://www.nachi.org.

Water Management & Damage Prevention:
A Guide for Homeowners



This article provides homeowners with basic information to make these decisions and take the appropriate actions to keep their homes dry and comfortable. Use the information in this article to effectively communicate to your clients about water management and moisture damage prevention.

Designing, building, and maintaining homes that manage moisture effectively is a process of making good decisions. While builders and designers provide most of the up-front decisions, like designing the roof system or specifying the foundation drainage details – over the long term the homeowner must understand basic moisture issues and make good decisions at the right times.

There is already plenty of useful guidance for homeowners on what to do (or not do) regarding moisture. This article does not "reinvent the wheel" but will instead rely on available guidance for homeowners.

This article includes inspection tips that may help an inspector to spot common types of home moisture problems during an inspection. Most (if not all) moisture-related problems could become serious and expensive if not taken care of quickly and completely. Therefore, it is important for an inspector to call out or recommend further evaluations and/or repairs by qualified professionals when any moisture intrusion is observed.

Houses and Water

Water, in its many forms, is an ever-present fact-of-life for a homeowner. Households can use hundreds of gallons of tap water on a daily basis. Lots of rainwater must be successfully shed by the roof and siding during rainstorms. Groundwater moves through the soil beneath the foundation. Indoor humidity levels are controlled for comfort. Moisture in the forms of condensation and water vapor is absorbed and released by the house itself.

When a well built home is properly maintained, water is a benefit and a pleasure. On the other hand, uncontrolled water in our homes can cause damage. It can lead to mold growth, rotten wood and structural damage.

It Repels Excess Water

The exterior surfaces of a house, from roof to foundation, make up its envelope or 'skin'. The skin is designed to shed or repel excess water. If it doesn't, expect trouble. When roof flashings, windows, foundation walls, and other building components are not properly maintained, rainwater will find its way into vulnerable parts of the house.

It Absorbs & Releases Excess Moisture

All houses must absorb and release moisture constantly, in order to maintain a healthy balance. If the house has 'breathing' problems, many types of moisture problems can develop. Trapped moisture - dampness that cannot be released, for one reason or another - is one of the primary causes of fungus and mold growth in a house. Fungi can literally 'eat' wood, causing decay, rot and, ultimately, structural damage. Trapped moisture in the walls can destroy the value of the insulation and raise heating and cooling costs. Wood that stays moist attracts carpenter ants and other insects that can accelerate structural problems.

It Transports Piped Water

Directly beneath the 'skin' of the house is a complex maze of pipes carrying fresh water through the house and drain lines to dispose of water after its use. There are dozens of pipe joints and specialized fittings throughout the house, any one of which can develop a leak and cause moisture damage.

It Needs a Firm, Dry Foundation

The best foundation is a dry foundation. A water-damaged foundation is extremely expensive to repair and can lead to damage in the rest of the house. Ground water, flood water, or even rainwater from a misdirected downspout, can undermine the foundation and cause settling cracks, wet floors and walls, and lead to undesirable conditions.

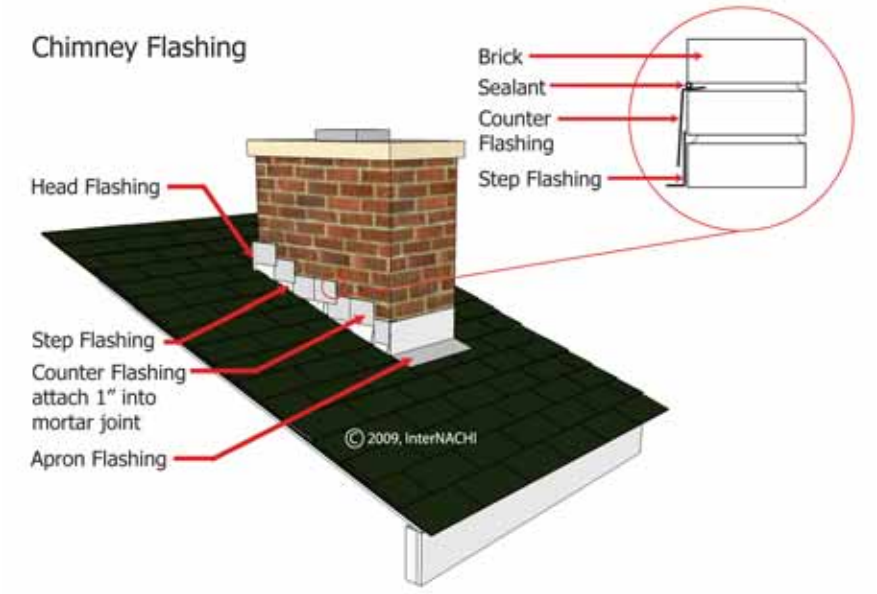
Frequent Causes of Moisture Damage

Unwanted water can intrude through cracks in the protective skin of the house. It can also accumulate from interior moisture sources.

The most common sources of moisture problems at the exterior a house include:

Roof and Flashing

Roofing materials can wear out, break, rust, blow off, or otherwise fail and expose the roof deck and structural components beneath to moisture intrusion and damage.



Most leaks occur around penetrations through the roof, such as at a chimney, plumbing vent, exhaust fan or skylight. Flashings and sealant joints around these penetrations can crack, fail and leak. Intersections of roof surfaces with walls are also a common leakage point.

Old or defective shingles can curl and crack, allowing moisture intrusion. If old shingles aren't removed before new roof shingles are applied, it can reduce the life of the new roof. Chimney caps can crack allowing water into interior areas of the chimney.

Shingle edges can fail, forcing rainwater to accumulate between the roof and gutter.

Flat or low-pitched roofs have unique maintenance needs and are susceptible to water problems because they may not drain as quickly as roofs with a steeper pitch.

Flat roof drains or scuppers can clog and hold water on the roof, increasing the risk, not only of a leak, but also of a possible collapse of the entire roof under the weight of the water.

Gutters & Downspouts

Clogged gutters can force rainwater to travel up onto the roof under shingles, or to overflow and travel down the inside of the wall, or to overflow and collect at the home's foundation.

First floor gutters can overflow if second floor gutters have been mistakenly directed to drain into them.

An insufficient number of or undersized downspouts can cause gutters to overflow.

Downspouts that don't empty far enough away from foundation walls can lead to foundation wall damage and a wet basement.

Ice Dams

Inadequate attic insulation allows heat to escape from the house into the attic, which can turn rooftop snow into an ice-dam along the eaves. Ice dams frequently force moisture to back up under the roof shingles where it can drip into the attic or walls.

Clogged or frozen gutters can act like ice dams, pushing moisture up under the shingles and into the house.

Soffits and Fascias

Damaged soffits (horizontal surfaces under the eaves) can allow snow or rain to be blown into the attic, damaging the insulation, ceilings and walls.

Fascia boards (vertical roof trim sections) are damaged, allowing the moisture from rain and snow into the attic and atop interior walls.

Weep Holes

Weep holes, which are designed to allow moisture to escape from behind walls, can become

blocked.

Weep holes can freeze, forcing moisture to back up inside the wall cavity.

Weep holes can become clogged with landscape mulch, soil or other material.

Landscape or Grading

Recent landscape modifications may have resulted in water drainage back towards the foundation, rather than away from it.

A newly built home lot may have been graded improperly, or the original foundation backfill may have settled over time, causing drainage problems.

Automatic sprinklers may be spraying water onto or too close to the foundation walls.

Window & Door Flashing or Seals

Cracked, torn or damaged seals, weather stripping, and flashing around windows or doors can allow windblown moisture to penetrate your house.

Improperly installed windows and doors can allow moisture into the wall.

Failed or worn weather-stripping can allow wind-driven rain to penetrate a closed window or door.

Groundwater or Rainwater

Groundwater or misdirected rainwater collects during wet seasons along the foundation wall or beneath the floor or slab. Unless it is directed away from the structure by a sump pump or corrected drainage, this moisture can lead to mold growth, wall failure and other destructive moisture problems.

Condensation

Condensation on windows can, at a minimum, damage windowsills and finishes. At worst it can damage walls and floors as well.

Condensation on un-insulated pipes can collect nearby or travel along a pipe, to accumulate far from the original source.

Condensation can form inside improperly built walls, and lead to serious water damage and biological growth that are hidden from sight.

HVAC

Lapses in regular maintenance can lead to moisture and comfort problems, ranging from clogged drain pans to iced-up cooling coils and mold within the system.

Failure to clean and service air conditioners regularly can lead to diminishing performance, higher operating costs and potential moisture problems.

Humidifiers can add too much moisture to a house, leading to dampness and mold.

Sump Pump

Neglecting to test a sump pump routinely - especially if it is rarely used - can lead to severe water damage, especially when a heavy storm, snow melt, or flooding sends water against the home.

Overload of the sump pump, due to poor drainage elsewhere on the property, can lead to pump failure. Frequent sump operation can be a sign of excessive water buildup under the basement floor, due to poorly sloped landscaping, poor rain runoff, gutter back-flows and other problems.

Lack of a back-up sump pump, which can be quickly installed in the event the first pump fails, can lead to serious water damage and property loss. This is especially important if the sump pump is relied upon to maintain a dry basement, or if the house is located in an area of seasonally high groundwater. Sump failure can cause extensive water damage and the loss of valuable personal belongings.

This information was adapted from the home maintenance book authored by Ben Gromicko titled, “Now that you’ve had a home inspection.” http://www.nachi.org/home-maintenance-book.htm