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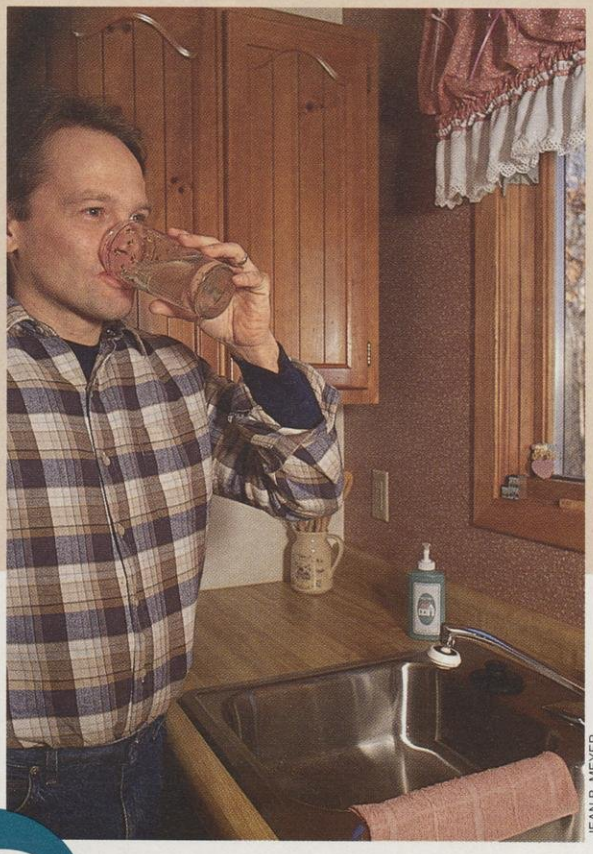
YOUR PERSONAL WATER SUPPLY



JEAN B. MEYER

Plentiful and pure

Having a reliable supply of water fit to drink is part location, part dedication. Unlike Nevada or Arizona, Wisconsin has been especially well-endowed with water. Bound by two Great Lakes and the Mississippi River, dotted with 14,949 inland lakes, crossed by 7,446 rivers and streams and set above aquifers storing two quadrillion gallons of water — all replenished annually by an average 30 inches of precipitation — Wisconsin is one wet place.

Still, the luck of the geographical draw doesn't guarantee a pure, drinkable water supply. If Wisconsin's abundant water resources can't be channeled to homes, farms, businesses and industries safely and efficiently, we might as well be living in a desert or on an arid plain.

M.E. DIEMER, STATE HISTORICAL SOCIETY OF WISCONSIN

Finding ways to bring people a dependable supply of safe drinking water is a Wisconsin tradition. A University of Wisconsin demonstration truck and crew hit the road in 1929 to help farmers design modern water systems for the home and barn.

No matter how water arrives at the faucet, it didn't get there without a lot of hard, costly work. Regular maintenance protects your investment in pumps and pipes, but only constant vigilance guards the resource itself. What we do on land and on lakes and rivers affects the quality of the water we drink.

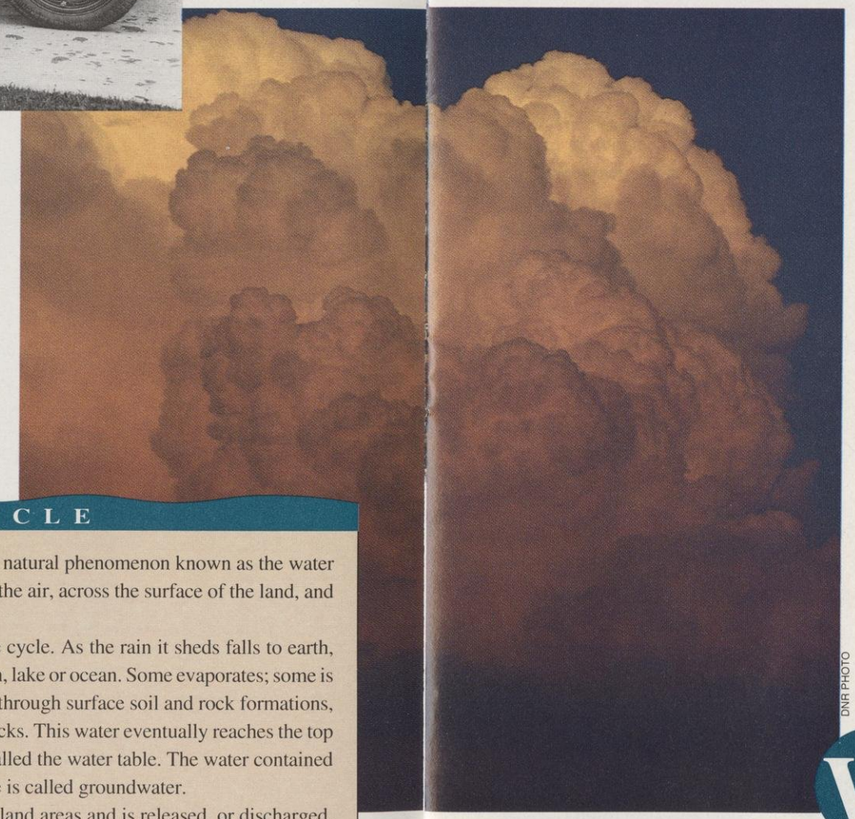
Location and dedication. Wisconsin is fortunate to have the former, but it is the latter — on the part of you and your community — that will ensure a safe, plentiful water supply in the years to come. Understanding more about where your water comes from and what happens to it on the way to the tap is the beginning of that commitment.

THE WATER CYCLE

Your drinking water is the product of a natural phenomenon known as the water cycle, which keeps water moving through the air, across the surface of the land, and underground. Here's how it works:

Pick a bursting cloud as the start of the cycle. As the rain it sheds falls to earth, some flows downhill as runoff into a stream, lake or ocean. Some evaporates; some is taken up by plants. The rest trickles down through surface soil and rock formations, traveling through pore spaces and open cracks. This water eventually reaches the top of a water-saturated layer of soil or rock called the water table. The water contained in the saturated layer below the water table is called groundwater.

Groundwater flows from upland to lowland areas and is released, or discharged, in lakes, streams and wetlands — places where the water table meets the land surface. The sun releases energy, causing evaporation from surface waters. The process that returns water to the atmosphere from water and land surfaces and by the activity of living plants is called evapotranspiration. When water vapor accumulates in the atmosphere and clouds begin to form, the water cycle begins anew.



DNR PHOTO

A cumulonimbus cloud brings rain and another revolution of the hydrologic, or water cycle. As rain trickles down into lakes, rivers and aquifers — underground rock or soil layers that hold water — it carries along a little of what was on the surface, such as lawn fertilizers, motor oil, road salt, pesticides and bacteria. Soil filters out most impurities, but some may remain in the water.

Gambling on good water

If a private well is properly installed, the owner can be reasonably assured of a safe, drinkable water supply. Sometimes, though, there's no luck of the draw.

Rural property owner Paul Egide has a direct connection to the underworld.

A foot or two of capped pipe protruding from his front yard is the only evidence of his link to a dark, damp place two hundred feet below.

Egide has a private well. He's not alone. More than 700,000 private wells provide drinking water for farms and rural homes across the state. The great majority of those wells — nearly 95 percent — come up aces, producing a dependable supply of water fit to drink. But a few are real jokers. Whether nature or man dealt the bad hand, it's no laughing matter when problems visit a private well.

STATE HISTORICAL SOCIETY OF WISCONSIN

This open well served a Wood County family in 1934. Surface runoff flowed into unsealed wells, contaminating groundwater with bacteria. To protect public health and groundwater, the 1936 Wisconsin Well Code set standards for proper well construction.

What's underground comes around

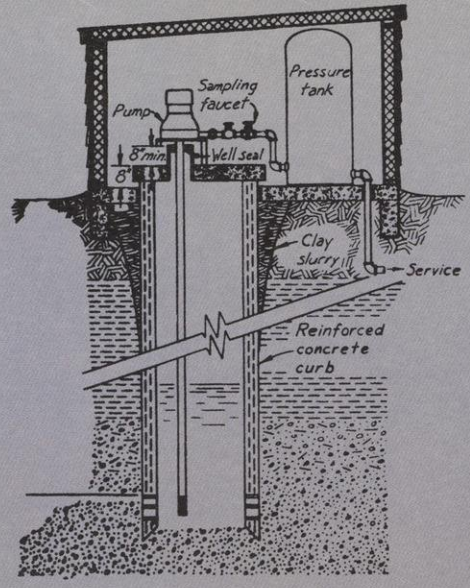
Egide's home rests in the gently rolling hills of southwestern Dane County, an area underlain by several rock layers, one of which is known as the St. Peter Sandstone.

This rock layer was deposited some 475 million years ago. At that time, Wisconsin's hilly landscape was flooded by a prehistoric sea. Sandy sediments began filling in the valleys and just barely coating the crests of once-exposed hilltops. As a result, the sandstone varies greatly in thickness, even within short distances. It may be hundreds of feet thick in some places; only a few feet thick in others.

Groundwater collects in the open spaces and fractures of the crumbly sandstone, and it was into this layer that Egide's well was installed. "I noticed a lot of green water stains on pipes and fixtures," he said. "I was uncertain about the cause."

A test showed the water coming up through the 100-foot-deep well wasn't the average "hard" Dane County brew. "Water in the St. Peter Sandstone formation has a reputation for being low in dissolved solids and having a low pH," says Tom Riewe, a hydrogeologist with the DNR Bureau of Water Supply. "A low pH means the water is acidic. It will corrode metal — copper pipes, for instance."

A pH adjustment system was installed to help raise the pH of Egide's water by slowly pumping a weak chemical solution into the water supply. Purchasing the



A cross-section of a well. In this case, the pump is at the top of the well, inside a small building called a pumphouse. Submersible pumps are located inside the well below the water line. The tank to the right holds water under pressure until it's needed.

A BIG STRAW

...essentially, that's what a well is. A long, narrow straw reaching down through layers of soil and rock, creating a path for groundwater to be drawn up to the surface.

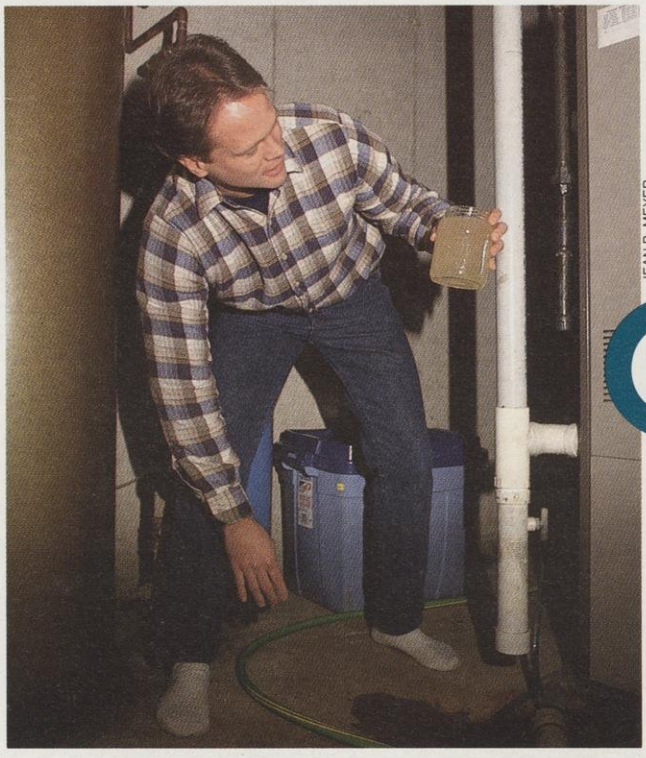
About two-thirds of Wisconsin's population drinks water drawn from wells. Groundwater might arrive at your faucet from a large municipal well several hundred feet deep serving thousands of homes. Or it may come from a private well in the backyard that provides just enough flow for you and your family.

There are a number of ways to construct a well. The hole may be drilled, driven or bored. The composition of the soil and rock layers in the area and the depth to suitable water determine the type of method used.

Without reinforcement, a well hole in soil or soft rock would crumble in on itself before long, so wells generally are cased and screened. The casing, usually a long steel pipe, extends from a few feet above the surface down the well hole to just below the top or directly into the water-bearing layer. Screening is placed in the lower section of the hole, allowing groundwater to seep in but keeping soil, sand and rocks out. Wells drilled in firm rock are cased at the top, and the bottom part of the hole is left open.

Without a pump, most groundwater would remain underground. Pumps may be installed inside the well casing below the water level, or outside and apart from the well. Pumped through pressurized pipes, the water eventually arrives at your tap.

Wells — big straws for sipping groundwater. Wells are safe, dependable sources of water if sited wisely and built correctly. Remember, though, that a well is only as good as the water it draws, and the water it draws is affected by natural forces and human action.



JEAN B. MEYER

Most wells produce water that's safe to drink, but natural dissolved minerals sometimes impart off tastes and other qualities to groundwater, as Paul Egide can attest.

chemical and filling the feed tank became another household chore.

Then the pump went out in Egide's well. "When a well driller tried to pull the pump out, the drillhole collapsed and the pump wouldn't budge," he recalled. Egide needed a new well. The driller hoped that by installing a deeper well — down to 200 feet — Egide could bypass the St. Peter Sandstone formation and come up with more neutral water that wouldn't need pH adjusting.

The well site must have been over one of the thicker parts of the formation. Although water from the new well has a slightly higher pH and is somewhat less acidic, Egide still has to adjust his water. "And now, we've got a problem we didn't have before — iron." The rusty, reddish-brown water stains sinks and fixtures and has a strong, sometimes unpleasant taste.

"I'm thinking about putting in a filtering system for the iron," Egide says. "What else can I do?"

Gas at the pump

The problems Paul Egide experienced with his water supply stemmed from natural sources underground. For 13 private well owners in Milladore, however, trouble began on the surface, then trickled down.

The Wood County village of 250 tucked between Marshfield and Stevens Point had water high in iron and sulfur. "It never was the greatest-tasting water in the world," says Fred Bailey, a DNR water supply specialist in the Wisconsin Rapids

Area Office. "But then it started getting worse."

Seven private well owners complained of foul smells emanating from their taps. Gasoline that had leached into groundwater was the source of the problem. By August 1991, the gas had spread to six more wells.

"The gas could have come from underground tanks at three sites, where there used to be a body shop, a garage, and a service station," Bailey says. "The tanks had been removed, but the gas leaked into the groundwater."

Bailey coordinates the delivery of bottled drinking water to the 13 households with contaminated wells. "In eight of the homes, the well water can only be used to flush toilets — no showers, no clothes washing, no watering plants," says Bailey. Four homes have bulk water tanks to store clean water.

The Milladore wells draw water from fractures in granite bedrock — not unlike squeezing blood from a stone. Drilling wells in this hard rock is costly and not always successful. "We did try to install one new well, and we found gas 55 feet down in the cracks," Bailey noted. "We drilled deeper, but there wasn't any water in the fractures to supply a well."

Bailey believes the only solution for Milladore is to put in a few neighborhood wells that would each serve several homes, or to build one large city well and get everyone in town on a public water supply. Securing the hefty financing for either project will be a challenge for the small community. The likelihood of payment from the former owners of the contaminated sites is slim and federal grant money is scarce.

"I remember at a public meeting, one Milladore resident stood up and said, 'We can't wait years for water — we need something now,' " Bailey recalled. "I wish there was a safe, quick and inexpensive way to do this, too. But there isn't. It's just going to take time."

ALL'S WELL THAT ENDS WELL

The Wisconsin Well Construction Code first set standards for well construction in 1936 to keep drinking water safe from bacterial contamination and to protect groundwater. Today, the code continues to guide the well drillers and pump installers who help bring groundwater to two-thirds of Wisconsin's residents.

The code lists the distances required between a well and septic tanks, sewer lines, animal yards, manure pits, fertilizer and pesticide storage sites, lakes, streams, underground fuel tanks, landfills and other potential sources of contamination. It also requires that wells be sealed to prevent surface contamination. And there's much more, as any well driller or pump installer who knows the code inside and out would tell you.

You can learn a lot from reputable, experienced and licensed drillers or installers. They'll tell you about local soil and water conditions, and they can evaluate an existing well.

Drillers who install wells are responsible for flushing the well, test pumping it, disinfecting it, collecting a water sample for bacteriological tests, and giving a well constructor's report to the owners and to the Department of Natural Resources. The report contains a record of the soil and rock layers penetrated by the well and lists the work performed and materials used — important information to have on hand if you ever have problems with your well. A pump installer, if different from the driller, must disinfect the well and collect a water sample to check for bacteria.

There's another important service well drillers perform: Filling in and sealing old, unused wells. Bacteria and other contaminants enter groundwater through these crumbling hazards. A well driller or DNR water supply specialist can tell you how to do the job properly if you'd like to tackle it yourself.

Drilling a new well is a tough, dirty job best left to the pros. Well drillers also fill in and seal old, unused wells, which can give contaminants a direct channel to groundwater.

BUREAU OF WATER SUPPLY

A small water filter saturated with iron and grit.

SOME COMMON WATER PROBLEMS

Your water may have some of these characteristics. Have it tested first, then contact your local water utility or DNR water supply specialist to discuss remedies.

PROBLEM	SYMPTOM	CAUSE	TREATMENT
Hard Water	soap scum; white deposits in pipes, water heater, kettles	calcium and magnesium in water	cation-exchange water softener
Grittiness	abrasive water, residual grit left in sink or tub	fine sand or silt	repair or replace well screen; install sand filter
Odor	fishy, musty or earthy smell	organic matter, algae	activated carbon filter; chlorination
	chlorine smell	chlorination in public or private well	activated carbon filter
	rotten egg, sulfurous smell	dissolved hydrogen sulfide	greensand filter
		sulfur or iron bacteria	disinfect well and all plumbing with bleach
	gasoline smell	leaking underground storage tanks; fuel spills on surface	activated carbon filter on short-term basis; seek new water supply
	chemical odor	industrial wastes	activated carbon filter on short-term basis; seek new water supply
Acid Water	green stains on sinks; blue-green cast to water	acid or carbon dioxide in water reacting with copper pipes	install pH neutralizer or filter; make well deeper
Taste	salty or brackish flavor	high chloride or magnesium content	reverse osmosis; distillation; water softener
	metallic taste	low pH or high metal concentration in water	pH neutralizer; filters
Yellow Water	yellowish cast to water; yellow stains on washable clothes and bathroom fixtures	tannins created from water passing through decaying vegetation	anion-exchange water softener; activated carbon filter
Red Water, Iron Water	brown-red stains on fixtures, dishes and laundry; water turns red when heated, darkens coffee, tea and other beverages	dissolved iron; water appears clear when first drawn at faucet	water softener; iron filter
	reddish-colored water with particles settling to bottom of a glass	precipitated iron; water not clear when first drawn at faucet	greensand filter; water softener
	brownish cast to water; no settling of particles; slime in toilet tank	iron bacteria	disinfect well and plumbing with bleach
Black Water	black stains on fixtures and laundry	interaction of carbon dioxide or organic matter with manganese	manganese filters

The hard way

Calcium and magnesium are measured in grains per gallon (gpg) or parts per million (ppm).

Grains Per Gallon	Parts Per Million	Rating
less than 1.0	less than 17.1	soft
1.0-3.5	17.1-60	slightly hard
3.5-7.0	60-120	moderately hard
7.0-10.5	120-180	hard
over 10.5	over 180	very hard

JOHN MOLINE

Groundwater picks up unique tastes, colors and odors from different layers of soil and rock.

DNR PHOTO

SCUM AND SCALE, HARD AND SOFT

A glass of water may appear clear and transparent to the eye. But don't be fooled. Depending on the rocks and soil it's drawn from, water may contain a whole spectrum of minerals, or dissolved solids.

Water is the universal solvent — it picks up some of everything it touches. Water eats away at calcium, magnesium, iron and other minerals lodged in water-bearing soil and rock layers underground. The minerals dissolve in the water over long periods of time. Minerals impart color and taste (good and bad) to water, as well as a quality known as hardness.

When it's heated, hard water forms scale — a crusty white deposit of carbonate salts — on the insides of pipes, boilers and coffee pots. The minerals in hard water react with the fatty acids in soap, creating scum, source of the infamous slimy bathtub ring. Soap doesn't lather well in hard water.

Hard water isn't harmful to drink, but scale deposits may eventually clog plumbing and scum makes household cleanup a real battle. That's why many people install water softeners to tame the hard water they don't use for drinking.

Testing 1-2-3

Bill Rock wants you to take a test. Not once, not twice, but over and over again. It's not that he's a taskmaster. It's just that Bill, chief of the private water supply section in DNR's Bureau of Water Supply, wants to make sure you're drinking the best, safest water possible.

"Private wells are prone to contamination because they're relatively close to the surface," says Rock. "A well that's good one year may have problems the next. So it's important to sample private water supplies regularly."

Rock says well owners should test their water for any contaminants they're concerned about, based on their knowledge of nearby conditions. Here are 10 tips for testing:

1. All new or newly acquired wells should be sampled at *least once* for **bacteria** and **nitrate**. Thereafter…

2. …test for **bacteria** yearly, and whenever the water changes in taste, odor, color or appearance.

3. …sample for **nitrates** once every five years if levels are low. If the first sample shows elevated levels (above 5 milligrams per

BUREAU OF WATER SUPPLY

An old irrigation well bursts with clear, sparkling water; a battered cup tempts the thirsty. No matter how good it looks, it's best to test water from private wells regularly. Some groudwater contaminants can't be seen, tasted or smelled.

DNR PHOTO

Careful water testing ensures accurate results.

liter—mg/l — as N) consider testing annually. Test for nitrate before giving the water to infants or using it in baby formula; do not give the water to infants if tests show 10 or more mg/l as N. A sample is also in order when a potential source of nitrate—an animal feedlot or sewage absorption field, for instance — is nearby.

4. …test for **atrazine** at least once if the pesticide is used in the area and your soil is not clayey.

5. …test for other **pesticides** at least once if they are used nearby and atrazine was not used.

6. …test for **lead** at least once if your water is naturally soft and your home was constructed before 1985.

7. …sample for **radium** and **radon** if there are known problems with radioactivity nearby.

8. …sample for **VOCs** (volatile organic compounds) if the well is near a gasoline storage area, an old or new landfill, other facilities where chemicals were used, or if you notice a solvent taste or odor.

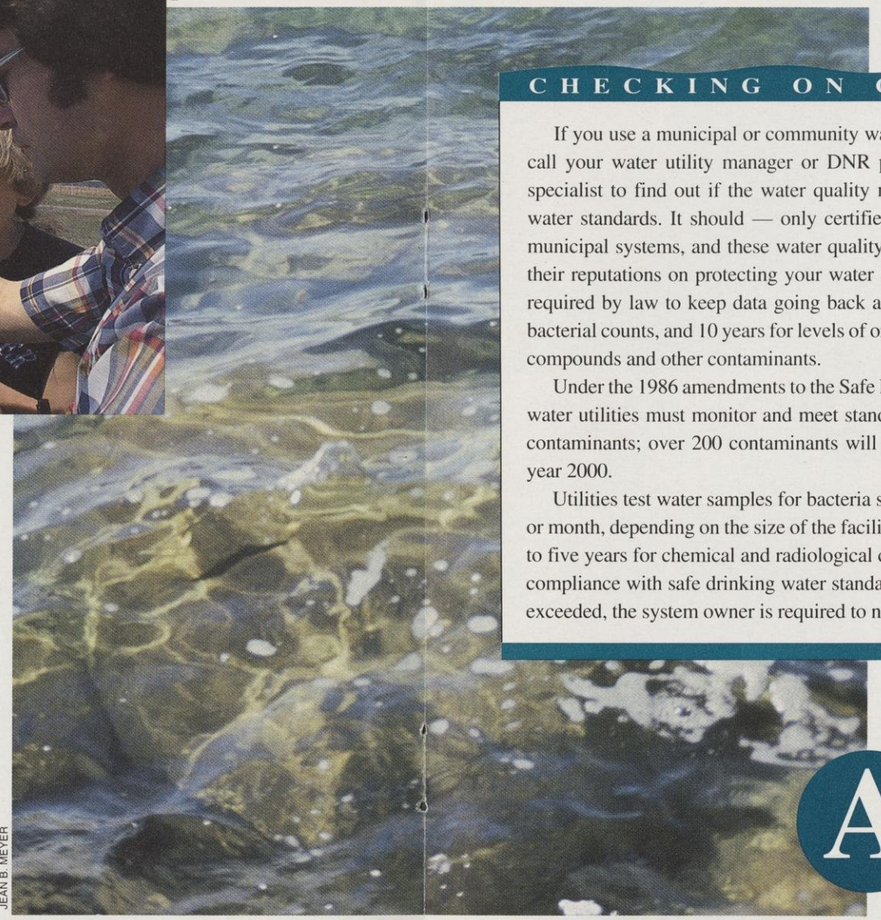
9. …test for **taste** and **odor** problems anytime the water has an off flavor or smell.

10. …if you'd like more information, write the DNR Bureau of Water Supply, Box 7921, Madison WI 53707 for brochures on the following drinking water contaminants: atrazine; bacteria; iron bacteria; sulfur bacteria; lead; nitrate; pesticides; radium; and VOCs.

WHO CAN TEST MY WATER?

The State Laboratory of Hygiene will test your drinking water for bacteria, nitrate, fluoride and atrazine, a pesticide. The 1992 price is $14 for each test of bacteria, nitrate and fluoride. These three tests can be made from the same sample bottle of water. For a test kit, call the lab at 1-800-442-4618; in Madison, call (608) 262-1210. The atrazine test costs $17 and requires a separate sample bottle. Call 1-800-334-1641; in Madison, the number is (608) 265-2071. Or write The State Laboratory of Hygiene, 465 Henry Mall, Madison WI 53706.

Private labs certified by the departments of Natural Resources and Health and Social Services can also test your water for bacteria, nitrate, pesticides, taste and odor problems, VOCs, lead, and radium and radon. For a list of certified labs, contact a DNR water supply specialist or write the Central Wisconsin Groundwater Center, Nelson Hall, University of Wisconsin-Stevens Point, Stevens Point WI 54481, or phone (715) 346-4270.



JEAN B. MEYER

Clean water is a precious resource.

MAUREEN MECOZZI

You only need a small sample of water to find out a lot about your well.

CHECKING ON CITY WATER

If you use a municipal or community water system, you can call your water utility manager or DNR public water supply specialist to find out if the water quality meets state drinking water standards. It should — only certified operators can run municipal systems, and these water quality professionals stake their reputations on protecting your water supply. Systems are required by law to keep data going back at least five years on bacterial counts, and 10 years for levels of organic and inorganic compounds and other contaminants.

Under the 1986 amendments to the Safe Drinking Water Act, water utilities must monitor and meet standards for 83 priority contaminants; over 200 contaminants will be regulated by the year 2000.

Utilities test water samples for bacteria several times a week or month, depending on the size of the facility. Tests every three to five years for chemical and radiological contaminants ensure compliance with safe drinking water standards. If standards are exceeded, the system owner is required to notify water consumers through local newspapers or with a written notice in the next bill, and in special cases through local radio and TV. Then, the utility must develop and carry out long-term solutions to the problem.

Facilities are scrutinized during annual inspections by DNR water supply staff and other water quality professionals, who look for deteriorating equipment that must be repaired or replaced. DNR water supply staff also review plans for new construction or renovation of an existing water system, to get things built correctly from the start.

Ask your water utility manager for a copy of the most recent water analyses and an explanation of what the figures mean. Remember, though, that the test often tells you the condition of the water when it left the reservoir or water treatment plant. It may not tell you the condition of your water at the tap — a problem if you're concerned about lead, which may leach into water from old plumbing and lead solder.

A full glass

You know the story about the glass of water...it's half empty or half full, depending on your viewpoint.

The two halves of DNR's Water Supply Program prefer to view that glass as brimming with safe, good quality water. People in both sections — public water supply and private water supply — aim to fulfill your water needs to the utmost, every day, year in and year out.

As the name implies, public water supply staff work with water systems serving a lot of people. They review and approve plans for water treatment plants. They inspect existing plants to make sure everything is in good working order. They train waterworks operators for facilities around the state — and then they review and respond to the reports operators submit. Public water staff test municipal water systems for bacteria, and oversee sampling programs for other contaminants. They revise codes for sampling, and for the design and operation of water systems to help keep plants up-to-date.

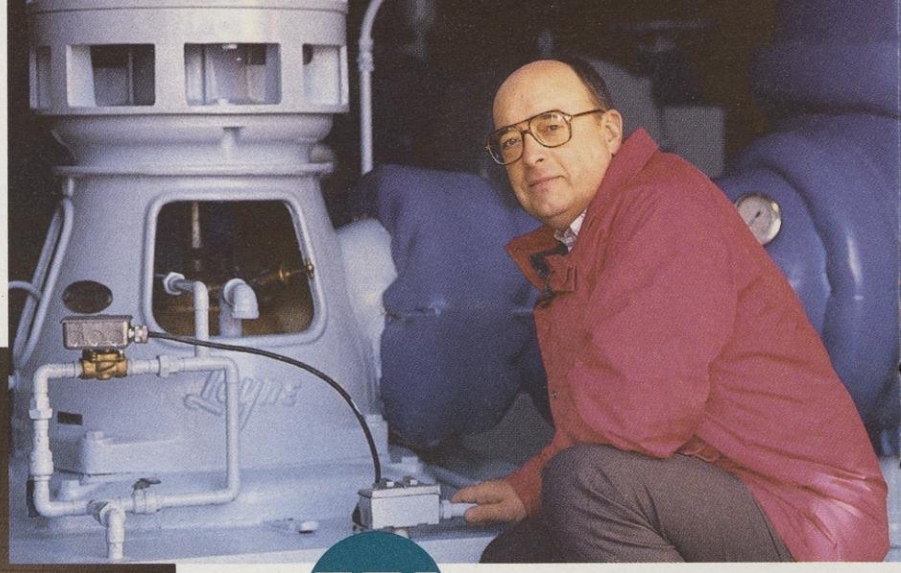
In short, DNR public water supply people are involved in practically every aspect of your drinking water...except the bill!

Private water supply staff focus on individual wells. They offer information on private wells to prospective home buyers through the Well Inventory Program. They license and provide continuing education to well drillers and pump installers. They inspect wells, encourage private well owners to test their water, and offer advice when well owners have questions about water quality.

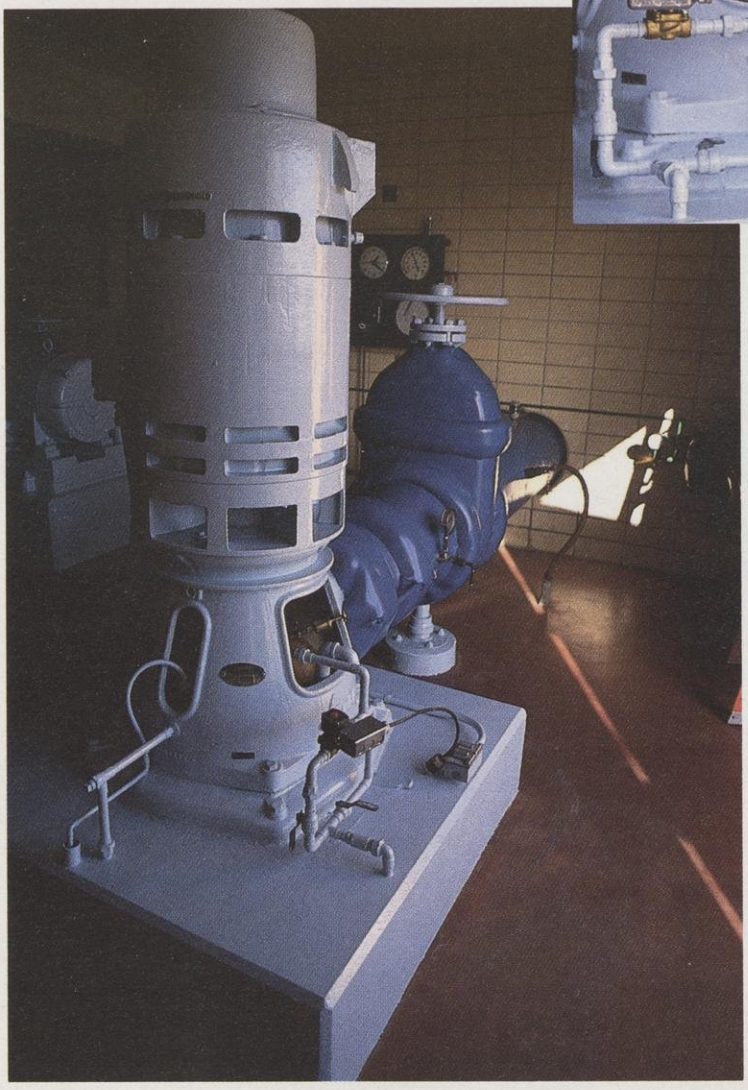
Private water supply staff review well drillers' construction reports, and monitor equipment design and drilling methods to see if improvements can be made.

In short, DNR private water supply staff keep close watch on the construction of those underground straws and are ready to help whenever you've got a question about your well.

So drink your water with confidence — and remember, the safety and quality of your personal water supply is the goal of DNR's Water Supply Program.



(right) Jim Blotz watches over one of the 24 wells bringing Madison an average 32 million gallons of water every day. Each well serves two square miles of the city.



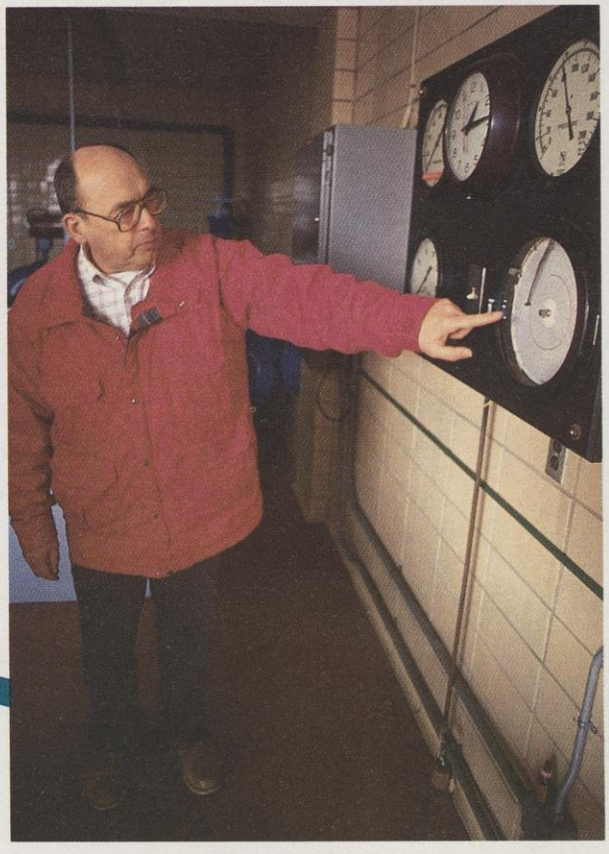
Whether their neighbors number in the hundreds, or in the hundreds of thousands, few city dwellers are aware of the complex systems bringing drinking water into their homes.

Jim Blotz, principal civil engineer for the City of Madison Water Utility, thinks that's a shame. "What could be more interesting than plumbing?" asks Blotz, who's worked for the utility for 27 years.

What, indeed? Let Jim take you on a guided tour of a Capitol City well.

(above) Sunk 802 feet down to granite bedrock, this well is just two blocks from the Capitol. Madison's four lakes offer plenty of water for recreation, but the city drinks groundwater. "Groundwater doesn't require as much treatment as surface water," says Jim. The groundwater is pumped through the blue pipe into a storage reservoir behind the wall, where sediments settle out and chlorine and fluoride are added before the water is piped to customers.

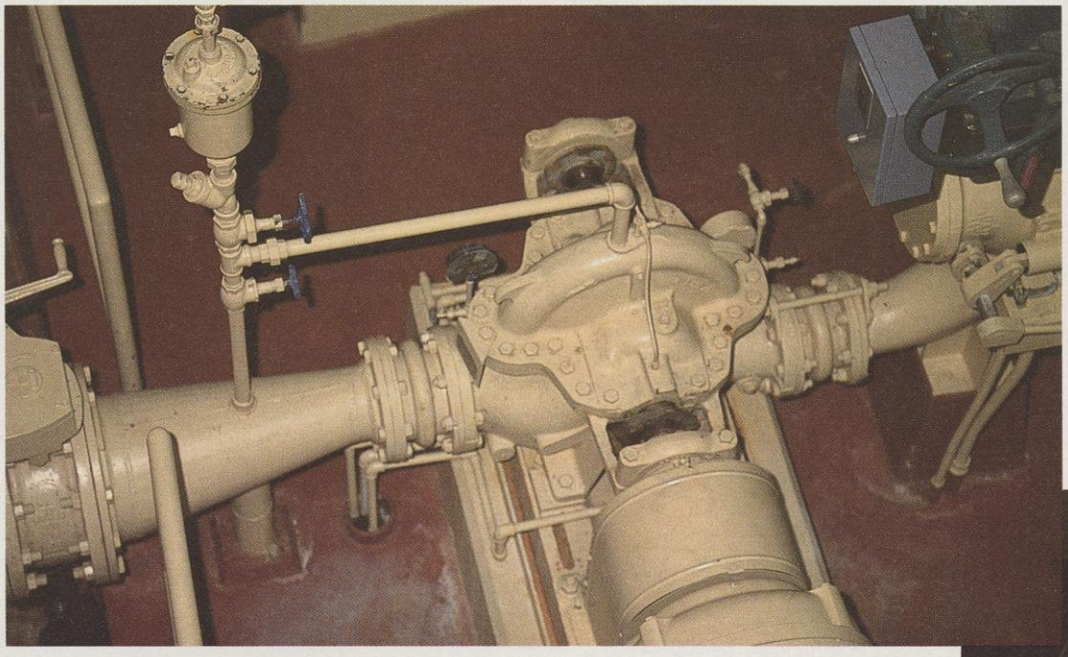
(right) Meters track water pressure and pumpage 24 hours a day to keep faucets flowing at the flip of the tap. Madisonians consume twice as much water in summer as they do in winter.



Meet a municipal water system

Public systems provide safe drinking water to half of Wisconsin's population. Here's how one system works.

PHOTOS BY ROBERT QUEEN

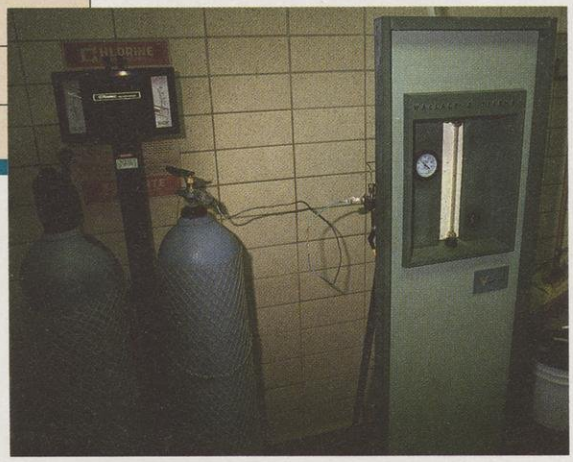


(left) It takes a battalion of powerful pumps to move water through Madison's 650 miles of mains. Water from several wells is combined in the mains; service pipes direct water from the mains to homes and business. Water mains last an average of 75 years.

(below) A weak solution of fluoride added to the water supply helps prevent tooth decay. Drink up!

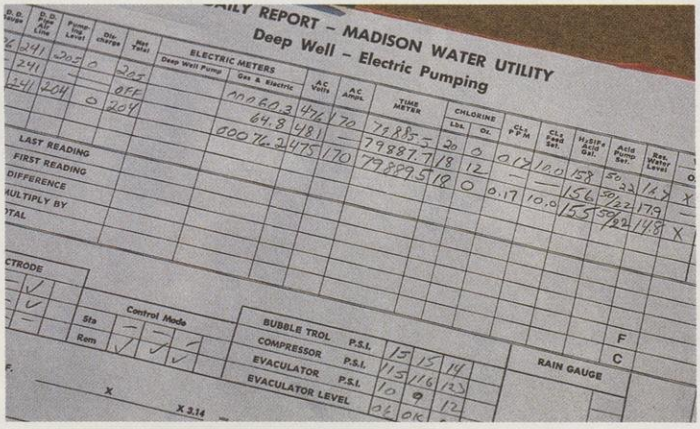
MADISON WATER QUALITY

Substance	Required # of Tests Per Year	# of Tests in 1991	# of Tests in December , 1991
Chlorine	104	320	16
Fluoride	6,570	16,078	1,311
Bacteria	1,560	2,514	210
VOCs	28	47	–
Pesticides	1 every 3 yrs.	4	–
Trihalomethanes	4	4	1
Inorganics	18 every 3 yrs.	48	–

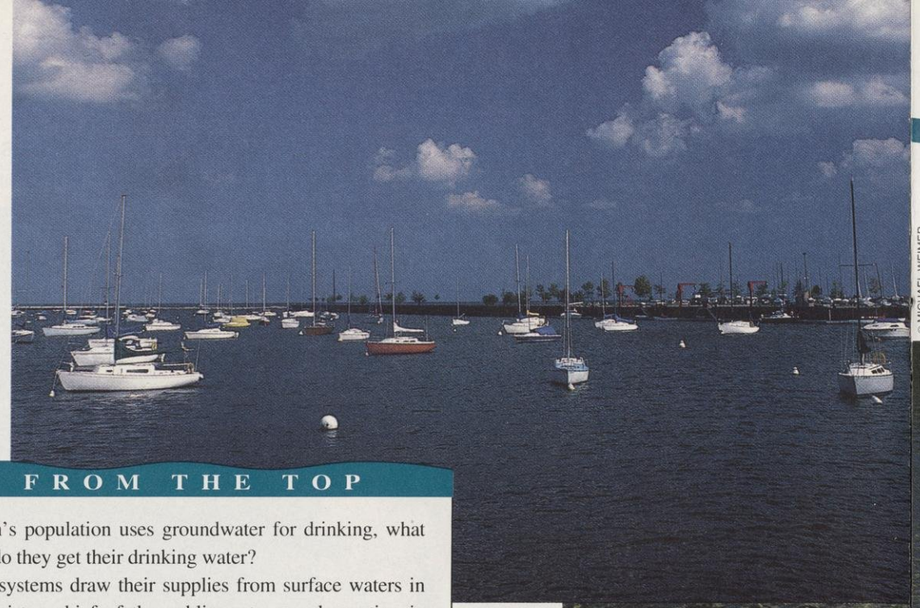


(above) Liquid chlorine stored in tanks boils at room temperature and is fed into water as a gas. Chlorine kills bacteria, disinfecting the water.

(data chart) As the numbers show, Madison tests drinking water far more often than required by law, as do most other municipal systems. "Safety is our first concern," says Blotz.



(left) Meticulous recordkeeping pinpoints problems early on. Regular maintenance keeps equipment operating at top form.



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A lazy day on Lake Michigan hides a flurry of activity below the surface. Large intake pipes several feet in diameter bring surface water to municipal treatment plants up and down Wisconsin's east coast.

TAKING IT FROM THE TOP

If two-thirds of Wisconsin's population uses groundwater for drinking, what about the other third? Where do they get their drinking water?

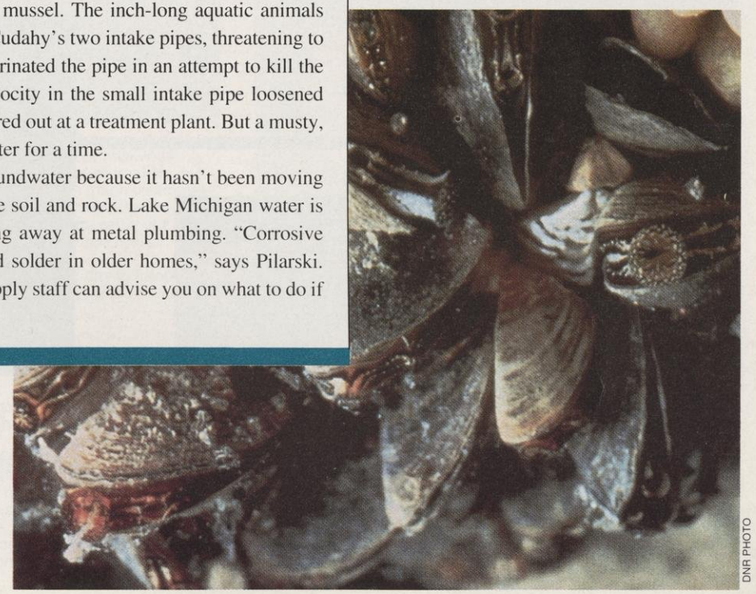
"Twenty municipal water systems draw their supplies from surface waters in Wisconsin," says Bob Baumeister, chief of the public water supply section in DNR's Bureau of Water Supply. The majority of surface water users live in Milwaukee and other communities in the southeastern corner of the state, where Lake Michigan serves as the major thirst quencher.

"With a source of fresh water this large, Milwaukee's always able to meet customer demand, even during dry times," says Greg Pilarski of DNR's Southeast District. "At the height of the drought in 1988, the Milwaukee Water Utility was criticized for not restricting lawn sprinkling. Restrictions really weren't needed — the water system hadn't even approached pumping capacity." The water is drawn from the lake through large intake pipes several feet in diameter.

Systems that depend on surface water face different problems than groundwater-based supplies. "In very hot summers, we get big algae blooms on the lake," says Pilarski. "The algae decomposes in the water. That's when the taste and odor calls start coming in!"

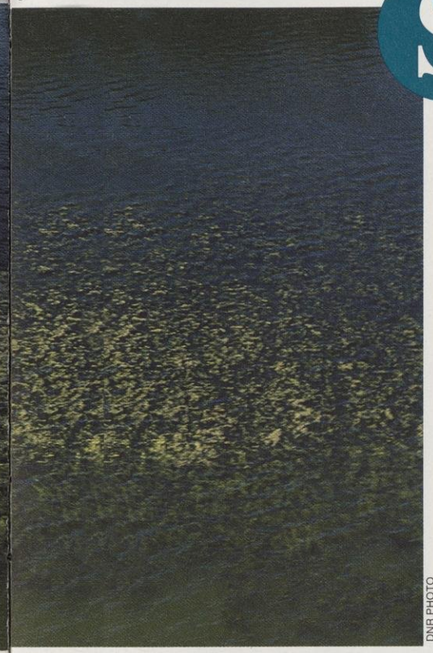
The city of Cudahy, just south of Milwaukee, experienced five days of foul water in November 1991, courtesy of the zebra mussel. The inch-long aquatic animals formed a massive colony on the larger of Cudahy's two intake pipes, threatening to clog the opening. The city closed and chlorinated the pipe in an attempt to kill the creatures. Meanwhile, increased water velocity in the small intake pipe loosened sediments inside the pipe, which were filtered out at a treatment plant. But a musty, swampy odor and taste remained in the water for a time.

Surface water is usually softer than groundwater because it hasn't been moving underground dissolving minerals out of the soil and rock. Lake Michigan water is also somewhat corrosive, capable of eating away at metal plumbing. "Corrosive water dissolves the lead used in pipes and solder in older homes," says Pilarski. Your public water utility or DNR water supply staff can advise you on what to do if lead is present in your water supply.



DNR PHOTO

Zebra mussels form colonies on Great Lakes underwater intake pipes, clogging the openings. Water utilities have tried everything from scraping, blasting and even parboiling the tenacious mollusks, but they keep on coming back.



DNR PHOTO

Algae: One of the reasons surface water must be treated before it reaches the tap.

Should I treat my water?

Concern about the safety of drinking water makes many people wonder if it's time to take precautions. The answer is...maybe.

The hucksters circulating around Hudson in the fall of 1991 thought they had a good thing going. With a water supply plagued by VOCs, the residents of the St. Croix County town were likely marks for water purifiers. Never mind the fact that the water treatment systems they promoted weren't designed to remove VOCs.

Unscrupulous sales tactics like these prey upon public fears that water is no longer fit to drink. It's true that new chemicals and contaminants threaten water supplies each year. It does take time and money for public water treatment utilities to make improvements to handle chemical or microbiological contamination. And tests that detect contaminants in parts per billion and even parts per trillion make some consumers feel their water isn't as pure as they thought.

Still, many people buy water treatment equipment they don't need to cure a problem that never existed, especially in areas served by public systems. Water supplied through a municipal system must meet stringent water quality and health standards before it is piped to homes. Unless you've been notified otherwise by your water utility, you can rest assured that the water is safe to drink right out of the tap. Treatment devices are unnecessary — unless you want improve the aesthetics (taste, odor, color) of the water provided.

Whether your water comes from a private well or a public supply, it's wise to do your homework before purchasing any water treatment device.

Start with an investigation

Although his official title is environmental engineer in DNR's Bureau of Water Supply, Bob Schaefer might better be

STEPS IN PUBLIC WATER TREATMENT

Public systems treat water before it reaches your tap. Systems using groundwater may not need to follow all the steps, because groundwater is filtered somewhat by soil as it travels under the surface.

1. **Intake**: Water is drawn from the source — a lake or groundwater. Debris is screened out as the water flows into the treatment plant.
2. **Chemical addition**: Aluminum sulfate (alum), polymers and/or chlorine are mixed into the water to kill bacteria, improve taste and help settle solids still suspended in the water.
3. **Coagulation and flocculation**: The alum and other chemicals coagulate, or cling to particles in the water. The particles stick together and form large particles called floc.
4. **Sedimentation**: The water and the floc particles flow into a sedimentation basin. The floc settles to the bottom and is removed from the water.
5. **Filtration**: The water flows from the sedimentation basin into filters — layers of sand and gravel. The filters remove any particles left in the water.
6. **Disinfection**: A small amount of chlorine, or other disinfecting chemical, is added to kill bacteria and keep water safe as it travels to customers. In some water systems, especially those using groundwater, this is the only treatment provided.
7. **Storage**: The water is stored briefly in a closed tank or reservoir to give the chlorine time to disinfect the water. The water then flows into the distribution system.

Source: American Water Works Association

called a hydrophysician: People talk to Bob about their weird water ailments; he listens, makes a diagnosis, and suggests a remedy.

"If you think you've got a problem with your water, the first thing you need to do is have the water tested," says Bob. "Find out what's in it, what's causing your trouble. Don't rush out and buy water treatment equipment without a water test first, because you may end up with some expensive gizmo that can't take care of your specific problem."

Tests aren't cheap, especially for VOCs and other contaminants, but the money is well spent if it leads to a safer, more pleasing water supply. Expect to pay about $20-30 for a lead test and $90-200 for a battery of VOC tests. Tests for bacteria, and for iron, hardness and other taste and odor problems generally run about $10-20. Have the tests done by a state-certified laboratory. When the test results are in, talk to a DNR water supply specialist or to a reputable water treatment professional. They can tell you about the kinds of water treatment units best suited to correct your problem. (Be sure to check the credentials and references of anyone selling or installing water treatment equipment.) Remember, no one system works equally well under every circumstance because water varies so greatly across the state.

Any water treatment device hooked up to a plumbing system must be approved by the Department of Industry, Labor and Human Relations (DILHR). "Wisconsin's the only state that has a certification program for water treatment devices," says Schaefer. "We have a tradition of actively protecting water quality. Wisconsin industries are national leaders in researching and developing water treatment products."

Before you buy water treatment equipment, ask the dealer or plumber for a copy of the DILHR letter of approval. The letter indicates what contaminants and the amount of those contaminants the equipment is capable of removing; whether the device is for POE (Point of Entry, for the whole plumbing system) or POU (Point of Use, for a specific faucet); how much water pressure is needed to run the equipment; and more. The letter is your guarantee that, provided it is installed and maintained properly, the device will adequately treat specific water problems.

There are five basic types of water treatment devices:

- **filters** made of fabric, fiber, ceramic or other screening materials remove particles from water, such as grit, sediment, dirt, asbestos fibers and rust.

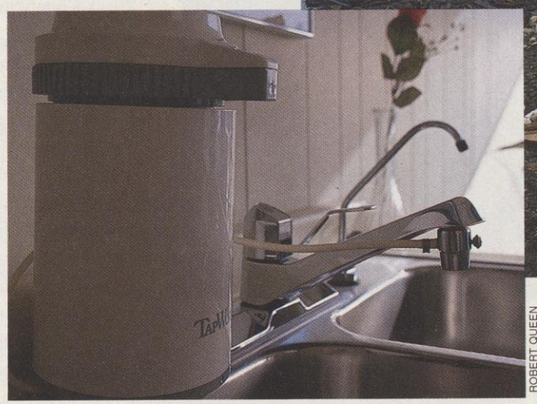
- **activated carbon or charcoal filters** work by adsorption — impurities in the water bond strongly to the charcoal. These filters eliminate odors and tastes, and remove some pesticides and organic chemicals. Specially made activated carbon filters can remove lead from drinking water.

- **reverse osmosis (RO) units** remove salts, metals (including lead), asbestos, minerals, nitrates and some organic chemicals by allowing tap water to pass through a cellophane-like membrane.

- **distillation units** first boil the water, then condense the steam and collect it in a storage tank. Metals, salts, minerals, fibers and some organic compounds don't vaporize and are left behind.

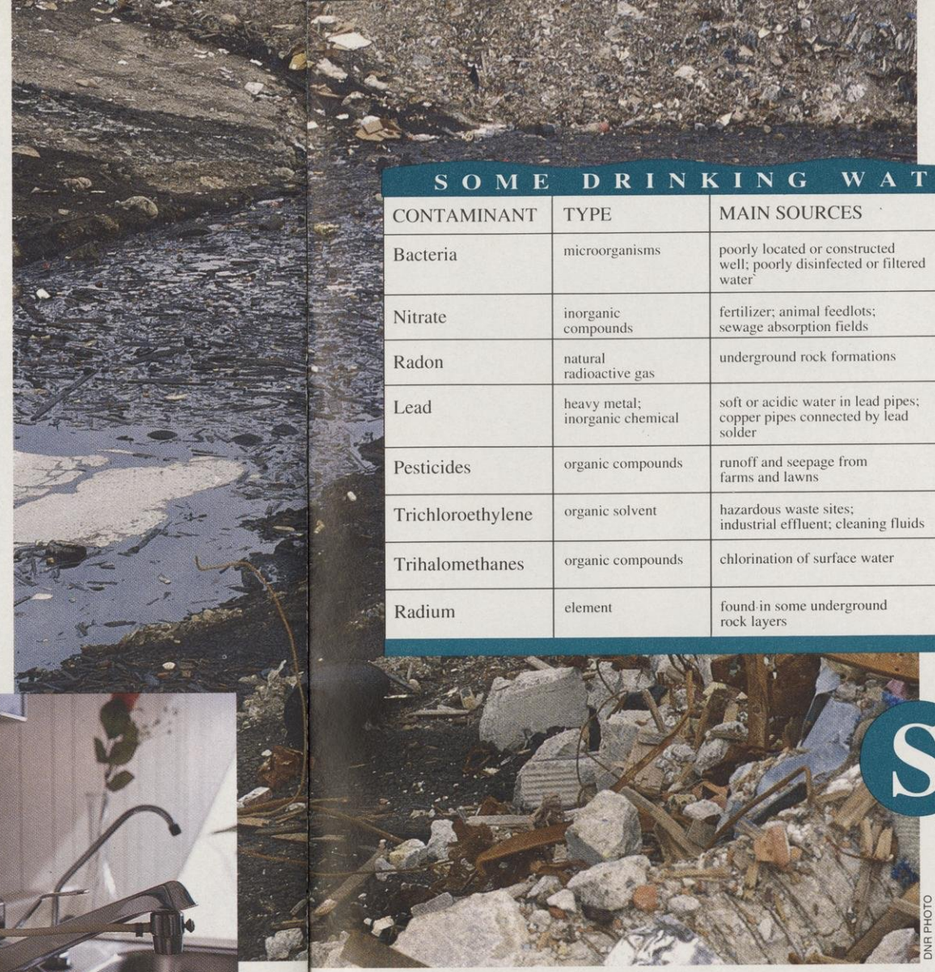
- **water softening units** work by passing hard water across a bed of tiny resin beads. Ions in the water bond to the resin and are removed from the water supply. Ion exchange can reduce sediment, iron, manganese, barium and radium levels in water.

Water treatment devices alone won't ensure a good water supply. "When you start adding treatment equipment to your plumbing system, you've got to be prepared to do routine maintenance — changing filters and the like — to keep everything running right," Schaefer says. "And there are continuing costs involved, too, for new filters, chemicals, and so on. Plus, if you want reassurance that the device is removing a contaminant you can't see, smell or taste, you'll have to test the water regularly. So choose equipment carefully, and keep it simple!"



ROBERT QUEEN

A countertop distillation jug.



DNR PHOTO

Abandoned dumps can leach a nasty cocktail of contaminants into groundwater. But seemingly small actions, like dumping paint strippers or other household chemicals down the drain, affect groundwater and surface waters, too.

SOME DRINKING WATER CONTAMINANTS

CONTAMINANT	TYPE	MAIN SOURCES	HEALTH EFFECTS	MEANS OF TREATMENT
Bacteria	microorganisms	poorly located or constructed well; poorly disinfected or filtered water	intestinal and other diseases	repair or replace well
Nitrate	inorganic compounds	fertilizer; animal feedlots; sewage absorption fields	methemoglobinemia, a blood disorder affecting infants	anion-exchange water softener; reverse osmosis; distillation
Radon	natural radioactive gas	underground rock formations	possibly cancer	activated carbon filters; aeration; reduce radon levels in indoor air
Lead	heavy metal; inorganic chemical	soft or acidic water in lead pipes; copper pipes connected by lead solder	developmental and learning disabilities in children; low birth weight	cation-exchange water softeners; carbon filters; reverse osmosis; distillation
Pesticides	organic compounds	runoff and seepage from farms and lawns	in high doses, liver, kidney or nervous system damage; possibly cancer	carbon filters; reverse osmosis
Trichloroethylene	organic solvent	hazardous waste sites; industrial effluent; cleaning fluids	in high doses, nervous system damage; possibly cancer	carbon filters; distillation; aeration
Trihalomethanes	organic compounds	chlorination of surface water	possibly cancer	carbon filters; distillation; aeration
Radium	element	found in some underground rock layers	exposure over a lifetime may cause cancer	cation-exchange water softeners; reverse osmosis; distillation

Small parts

Sophisticated water-testing techniques can reveal contaminants at increasingly lower levels. Here's a comparison:

One part per million = One drop in 10 gallons, or a small fish tank

One part per billion = One drop in 10,000 gallons, or an above-ground backyard pool

One part per trillion = One drop in 10,000,000 gallons, or 50 Olympic-size swimming pools

ROBERT QUEEN

Impurities are removed as water passes through filters and a thin membrane in a reverse osmosis (RO) unit. About four gallons of water must flow through the unit to produce one gallon of RO-filtered water.

Watching over your water

Guaranteeing nearly 5 million people a dependable supply of safe drinking water requires coordination and cooperation between state and local government and you, the consumer.

When you've got questions about your private well or public water system, there are people all across the state who can help with the answers:

1. **DNR water supply specialists** at the six district offices can tell you more about the Wisconsin Well Code, show you how to disinfect your well, discuss sources of contamination, give advice on water purifiers and drinking water problems, and provide lists of laboratories certified to do water analyses.

Southern District
3911 Fish Hatchery Rd.
Fitchburg, WI 53711
(608) 275-3266

Western District
1300 Clairemont Ave.
Eau Claire, WI 54702
(715) 839-3700

Southeast District
2300 N. Dr. Martin
Luther King, Jr. Dr.
Milwaukee, WI 53212
(414) 263-8500

North Central District
107 Sutliff Ave.
Rhinelander, WI 54501
(715) 362-7616

Lake Michigan District
1125 N. Military Ave.
Green Bay, WI 54307
(414) 492-5800

Northwest District
Highway 70 West,
Box 309
Spooner, WI 54801
(715) 635-2101

2. **Your local water utility** can tell you about your public water supply. Your **local public health department** can answer questions about bacteria, lead and other water-related health concerns. Check the "City-Town-Village Government" section of the phone book under "Water Utility" or "Public Works."

3. **The Wisconsin Geological and Natural History Survey** has well construction reports, maps and information on aquifers and rock strata. For a list of publications, write: Wisconsin Geological and Natural History Survey, 3817 Mineral Point Road, Madison, WI 53705, or call (608) 262-1705.

4. **Your county University of Wisconsin-Extension** office has booklets on safe drinking water, well testing and groundwater protection. Look for the address and phone number under "County" in the phone book white pages.

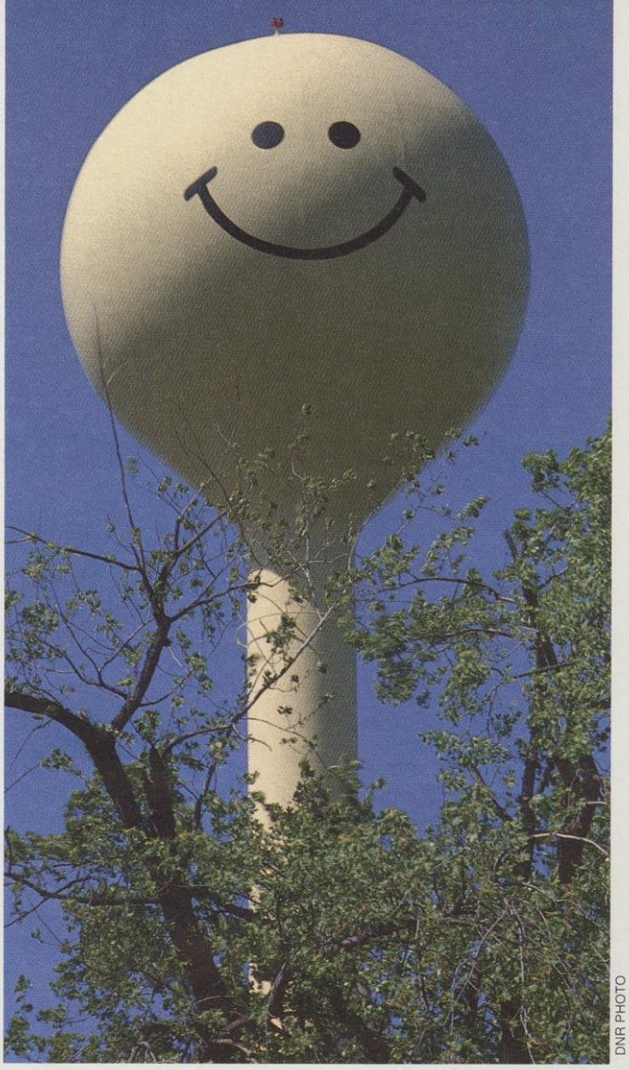
5. **The Department of Industry, Labor and Human Relations** has product information on septic systems and water treatment equipment. Write DILHR, Safety & Buildings Division, P.O. Box 7969, Madison, WI 53707.

6. **The Department of Agriculture, Trade and Consumer Protection** licenses water bottlers, offers information on pesticide use, and keeps tabs on fly-by-night water treatment scams. Write DATCP, 801 W. Badger Rd., Madison WI 53708.

7. **The Division of Health** certifies laboratories for bacteria analysis. For a list of labs, write the Department of Health and Social Services, Division of Health, Bureau of Environmental Health, 1414 E. Washington Ave, Madison WI 53702 or call (608) 266-5651.

8. **The Central Wisconsin Groundwater Center** is a clearinghouse for information on water quality issues in Wisconsin's Central Sands area. The Center maintains a database of private water test results and offers educational materials and programs. Write CWGC, Nelson Hall, University of Wisconsin-Stevens Point, Stevens Point WI 54481.

9. **Licensed well drillers and pump installers** in you area know about local water quality and soil conditions. They can evaluate your well, help you secure laboratory services and do well abandonments. Check the phone book yellow pages under "Water Well Drilling & Service" or "Pumps."



DNR PHOTO

Safe drinking water makes everybody happy.

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Written by Maureen Mecozzi
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