



## New Year and New Name

The Wellhead Protection Section changed its name and is now known as the Well Installation Section. The new name aligns better with the Well Installation Board and contractors that install wells and pumps as described in the Missouri Well Construction Rules. The name change also helps avoid confusion with watershed protection areas around public wells. The new name better describes what the section does and those we serve and regulate.

## Well Installation Board Update

The Well Installation Board met in regular session November 3, 2017, at the Missouri Career Center at 1100 South Bypass in Kennett. The agenda was light but included legislative updates, the Governor's Red Tape Reduction Initiative, section updates, and the status of the Groundwater Protection Fund. Revenues generated from certification and registration fees that support the Wellhead Protection Section are down 13 percent from October 2016 to October 2017 and down 9 percent comparing October 2015 to October 2017. The Groundwater Protection Fund is declining, however, a fee increase is not recommended this fiscal year. The last fee increase was in 2009. New rule development is on hold pending Red Tape Reduction review per the Governor's Executive Order issued earlier 2017.

Mr. Robert Lawrence retired from the Board in 2017. The Board and department staff recognized Mr. Lawrence for his many years of service as Board chairman and as Board member. Governor Greitens issued a proclamation which was read during the meeting, and a plaque was presented to Mr. Lawrence. The next Board meeting is scheduled for March 2, 2018, at the Missouri Geological Survey in Rolla. If you have any interest in serving or know someone willing to serve on the Well Installation Board, there are four vacancies. Vacancies are for a water well installation contractor, private well user, public well user, and monitoring well installation contractor. You can apply by visiting Governor Greitens' website at [governor.mo.gov](http://governor.mo.gov). Go to the "Get Involved" tab near the top of the page and click on Boards and Commissions to apply.

## Updated Forms

We have been working the last couple of years to update all of our forms, and make them more user-friendly. At this time, all of our forms have been updated and can be found on our website at [dnr.mo.gov](http://dnr.mo.gov) under the forms and permits tab. You also may enter and submit your forms online at [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells). If you need assistance or are a first time user of the system, please feel free to give our office a call at 573-368-2165 and we will walk you through the process. Many of our frequent users find the online services fast, friendly and easy to navigate!

## Geotechnical Well or Boring

This term has been used broadly by industry to cover numerous excavations. There is much confusion and misinformation as to whether geotechnical holes are regulated. Some contractors or consultants will use this term in an effort to exempt a boring or other excavation from Missouri Well Construction Rules (MWCR). In reality, there are very few circumstances where an excavation or boring is exempted from MWCR. The following definition of a geotechnical well or boring will clarify what is regulated.

A geotechnical well or boring means a monitoring well used to collect or evaluate subsurface data to determine the properties of geologic materials such as type, chemical composition, compressibility, strength, or structure. However, geotechnical borings for construction foundation data, wells drilled in the construction phase of piers, shafts, caissons, mini-piles, soil and rock anchors, soil and rock grouting procedures on surface water impoundment structures, pressure relief wells, roads, buildings or other construction sites that utilize drilling within the structure to be built are exempt from the MWCR.

Soil borings are the most common type of "geotechnical hole." Soil borings are considered temporary monitoring wells that have to be plugged within 30 days as required by MWCR. A plugging record and fee is required. An unrestricted permitted monitoring well installation contractor is required to perform all work for any type of drilling or boring that is regulated by the MWCR.

Any excavation or borehole that is exempt from MWCR should be plugged, excavated or incorporated into the construction project being built. As always, any well, boring or excavation that is less than 10 feet deep is not regulated. When in doubt if a well or boring is regulated, it's always best to ask the Well Installation Section for clarification before drilling.

# Drilling Discharges and Waters of the State

Lakefront property can be very attractive and in high demand. As demand increases, developers may want to maximize by increasing the number of properties with shoreline. This may result in small lots that can pose problems when siting a new well. Required setback distances sometimes cannot be met when trying to site locations for a well, septic system and a house. This often is compounded when accounting for the location of neighboring wells and septic systems.

When a suitable site for a well is found, drilling contractors must ensure that drilling fluids, cuttings and foam do not enter the lake, because they could violate water quality standards. "Waters of the State," defined as "All rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state," are subject to State and Federal Clean Water Laws and Regulations. Regulation 10 CSR 20-7.031(4) (B) states, "Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses." Sub section (C) further



states, "Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity."

Drilling contractors should adopt best management practices to reduce and control drilling wastewater on site. Containment basins, filtering devices or land application of wastewater is recommended. Containment basins and filtering devices (straw bales, filter cloth or synthetic membrane) reduce the amount of suspended solids and allow discharge of clear water in a controlled manner. Land application is allowable provided landowner approval is obtained and application rates are slow enough to prevent ponding, pooling or runoff. Water Pollution Regulation 10 CSR 20-6.010 (1) B (7), exempts the discharge of drilling fluids from all types of well construction from permit requirements provided pollution of waters of the state is not occurring.

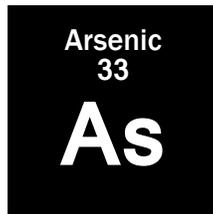
For additional information contact your local Missouri Department of Natural Resources regional office: Kansas City 816-622-7000, Springfield 417-891-4300, Poplar Bluff 573-840-9750, St. Louis 314-416-2960, Macon 660-385-8000.

## Arsenic in Water Wells

Arsenic is a naturally-occurring element in soils, rocks, and even plants. It can be released into the environment as a result of the erosion of rocks, volcanic action and forest fires. It also can enter the environment as a by-product of certain human activities.

Arsenic is a concern due to several effects it can have on the human body. A study by the National Academy of Sciences found high levels of arsenic in drinking water can cause bladder, lung and skin cancer and may cause kidney and liver cancer. The same study found arsenic may also directly damage the central and peripheral nervous systems, the heart, and blood vessels and may cause birth defects and reproductive problems.

Because it occurs naturally in the environment and also as a by-product of human activities, arsenic can enter drinking water sources through aquifer regeneration natural processes or as runoff into surface water sources. It tends to be more prevalent in groundwater supplies than surface water sources. Arsenic can be present in drinking water at concentrations recognized to be hazardous to human health and not be seen or tasted. EPA National Primary Drinking Water Regulations set a maximum contaminant level (MCL) of 0.010 milligram per liter (mg/L) or 0.010 parts per million (ppm), which is equivalent to 10 parts per billion (ppb). To put that in perspective, 10 ppb is roughly equivalent to a few drops of ink in an Olympic-size swimming pool. Because it can be harmful at levels well below the taste and odor threshold, it is important to have water tested for arsenic. The U.S. Geological Survey collected and analyzed arsenic in potable water from 18,850 wells in 595 counties across the United States over the last 20 years. These wells are used for irrigation, industrial purposes, research, and both public and private water supplies. Arsenic was found in several areas of



Missouri. When arsenic is found in a drinking water supply above the MCL, two typical methods of treatment may be used once the source has been identified.

If it is from a point discharge (industrial or specific dumping of waste, etc.), removing the source can lower the levels to an acceptable range. If it is from a specific aquifer or zone, casing or lining out the source is a viable option. If it is from a nonpoint source (such as erosion of an arsenic-bearing soil or bedrock source or widespread agricultural runoff into the recharge basin of a surface supply), treatment of drinking water for arsenic removal often is more cost effective. Several technologies are available to remove arsenic from a drinking water supply, such as ion exchange, activated alumina, reverse osmosis, and nanofiltration. All of these have ranges where they are most effective, and the method most viable will depend on the water chemistry makeup at a specific location. The important thing to remember is arsenic can be present at levels that exceed health-based standards and not be seen or tasted in the water supply; testing is the only effective method of detection.

Sources:

U.S. Environmental Protection Agency's Office of Water, Office of Ground Water and Drinking Water, "Arsenic in Drinking Water-Treatment Technologies."

National Resources Defense Council, "Arsenic in Drinking Water, FAQ."

National Academy of Sciences, Commission on Life Sciences, "Arsenic in Drinking Water, 1999."

United States Geological Survey, USGS Fact Sheet 063-00, "Arsenic in Ground-Water Resources of the United States."

## How Much Water Do We Use?

Did you know Missourians use 8,570 million gallons of fresh water per day? Keep in mind, 1,810 million gallons is groundwater. Another large number is the amount of water Missourians used for domestic purposes: 529 million gallons a day. That is a lot of water! How do we use that much water?

To start, the average person in the United States uses 100 gallons of water per day. Only a small portion is used for drinking. Most of the water is used for other purposes such as toilet flushing, bathing, cooking, cleaning, and lawn watering. Below are approximate amounts of water used for a few common household purposes:

Laundry: 25 gallons per load for newer models. Older models may use up to 40 gallons per load.

Bath: 36 gallons per “full tub.”

Shower: Water saving shower heads flow at 2 gallons per minute. Older shower heads can have a flow of as much as 5 gallons per minute. This means a 15 minute shower could use 30 to 75 gallons of water.

Toilets: Water saving toilets use 1.6 gallons per flush. Older models can use up to 4 gallons per flush. The average person visits the restroom 7 times a day, making the amount of water used to flush 11 to 28 gallons a day.

## Contractor and Apprentice Well and Pump Installation Testing Schedule

The following 2018 testing dates are scheduled at the Missouri Geological Survey, Annex Building, 1251 Gale Drive, Rolla. All tests begin at 9 a.m. Testing dates may be modified if necessary. Please bring a picture ID with you to the testing site.

March 14, 2018	August 15, 2018
April 18, 2018	September 12, 2018
May 16, 2018	October 17, 2018
June 13, 2018	November 14, 2018
July 18, 2018	December 12, 2018

If you are applying for a non-restricted permit, please be sure to bring your global positioning unit (GPS) and operating manual to the test site. Your GPS unit should be programmed to read in degrees, minutes and seconds in accordance with 10 CSR 23-3.060(5). If you have questions concerning this schedule or testing please call 573-368-2450.

For your convenience, the apprentice/restricted exam can now be completed online, at [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells). Please contact the Wellhead Protection section at 573-368-2165 to obtain a test ID. Persons with disabilities who may require special services may contact Jeannie Hoyle at 573-368-2450.

Handwashing: 1 gallon per wash. If you wash before each meal and after each restroom break, that is 10 gallons a day.

Drinking and Cooking: Approximately 2 gallons per person.

Dishwashing by hand: 8-27 gallons, depending on age of faucet and how you wash.

Dishwashers: EngeryStar models use 6 gallons per wash cycle. Older models can use up to 16 gallons per cycle.

Outdoor watering: 2 gallons per minute, depending on the force of the faucet2.

It doesn't take long for all of the different uses to add up to 100 gallons. Can you think of ways to reduce the amount of water you use?

Sources:

1) Maupin, M.A., Kenny, J.F., Hutson, S.S., Lovelace, J.K., Barber, N.L., and Linsey, K.S., 2014, Estimated use of water in the United States in 2010: U.S. Geological Survey Circular 1405, 56 p., <https://dx.doi.org/10.3133/cir1405>.

2) USGS Water Questions and Answers How much water does the average person use at home per day?

<https://water.usgs.gov/edu/qa-home-percapita.html>,

Page last modified 12/2/2016, accessed 11/8/2017.

## Welcome Apprentice Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted apprentice contractor community:

Allstate Consultants LLC – Tyler Lane  
Douglas Pump Service – Thomas Kennamer  
H & P Pump Service – James Priest  
Maggards Pump Service – Thomas Trotter  
Terracon Consultants – Anthony Christensen-McDonald

## Welcome Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted contractor community:

Allstate Consultants – Christina Judas  
Apex Envirotech – Thomas Landwehr  
Arcadis – Warren French, Daniel Bernasconi  
Associated Environmental Inc. – Joseph Datin  
Burns & McDonnell Engineering – Jacob Burch,  
Emma Cochran  
Civil & Environmental – Mark Kohrt  
H & P Pump Service – Robert Hollingshad  
KJ Environmental – Jeffrey Liles  
Risk Assessment & Management – Deepankar Vaidya  
Thiele Geotech Inc. – Jeremy Davis

# Farewell

The people addressed below are no longer permitted to operate as contractors according to the Water Well Drillers Act and Missouri Well Construction Regulations:

A to Z – Clara Hunsaker  
AAA Drilling & Pump – Casey Williams  
Aerostar – Timothy Cullen  
AMEC Foster Wheeler – Dale Markley  
Arcadis – Andrew Shelton  
Ark-MO Well Drilling – Robert Lawrence  
B & H Well Drlg/Heinlein Pump – Robert Schmitz  
B B J Group – Leah Gies  
Bolivar Plumbing – John Gifford  
Buffalo Pump Service – Mark Pinkley, Don Pinkley  
Burge Irrigation – Andrew Chasteen  
Burns & McDonnell – David Horne, John Hesemann,  
Kevin Fagan  
Cart Well Co. Inc. – Charles Givens (Deceased)  
Cardno – James Barry  
Cascade Drilling – Jerry Beardmore  
CH2M Hill – Jeffrey Haberl, Zachary Dolbeare,  
Rachel Grand  
Christy Minerals Co. – Jeffrey Porter  
Compton Irrigation – Paul Allen  
Crawford Drilling – Robert Wideman  
D J Enterprise – David Richter  
Dawson-Dodd Heat & Cooling – Patrick Dodd  
Dirty Dog Drilling – Mark Baetje  
Douglas Pump – Anthony Smerk  
EMR INC. – Charles Gross  
Enviro-Co LLC – Brian Lillie  
Environmental Loop Service – Ronald Willis  
Environmental Works – Robert Lanning, Wesley Gregg,  
Douglas Jones, Robert Traverson III  
Ernst Heating & Cooling – Roger Ernst  
Faszold Service – Michael Faszold SR  
Fennwald Plumbing – Tabitha Aldridge  
Fine Environmental – Robert Fine II  
Geoenergy – Kevin Sperfslage  
Geotechnology – Stephen Tepatti (Deceased)  
Green Rock Inc. – Lisa Larsen  
Ground Source Systems – Phillip Hawkins  
Groundwater & Environmental – Samuel Adams,  
Stacy Dwyer, Brian Idstein  
Groundwater Control – James Schmitt  
Hole Products – Mathew Cooper  
Hughes Well Drilling & Pump – John Stroud  
Huston Pump – Nathan Anderson  
Hydro-Logic Inc. – Donald Dulaney  
Ingenae LLC – Francis Phillips  
Irrigation Central – Justin Brandon  
Jerry Williams Pump & Well – Eric Bergsieker  
Jim Gates Pump Service – Jim Gates  
Landmark Environmental – Chris Neustadt (Deceased)  
Layne-Arkansas Co. – James Epperson  
Layne Christensen Co. – Jason Gerwing  
Lebanon Pump & Drilling – Richard Frank  
Leftys Pump & Drilling – Kyle Lebow  
Long Refrigeration – Douglas Long  
Maggards Pump Service – Jarrod Kleeman  
Marshall Eye Drilling – Richard David Henry  
McCrays Welding & Ditching – Mason Horstman  
McFadden Environmental – Kenneth McFadden  
Meyer Drilling – Dale Meyer  
Lavys Water Well – Darla Mennemeyer  
Midwest Hydro Drilling – Steven Young  
Mike Matthews Drilling – Michael Matthews  
Missouri Machinery & Eng. – Kerry Friedman  
Missouri Department of Natural Resources – Brian Allen,  
Evan Kifer, Daniel Scollan, Valerie Garrett,  
Cedric Cunigan, Robert Hinkson, John Pate,  
Bradley Swank, David Walker  
Neal Harris Service – Geoff Rader  
Orbis Geothermal – Bob Mills  
Ozark Pump & Supply – Brian Hocum  
PSI – Scott Brown  
Palmerton & Parrish – Richard Dunn  
R L (Butch) Tellman Enterprises – Russell Tellman  
R & S Well Drilling – Rick Roberts  
Redox Tech LLC – Edward Escochea  
Replogle – Johnny Replogle  
Ridge Runner Companies – Patrick Mathes  
Riverfront Environmental Inc. – Craig Lanouette  
Roberts Environmental – Brian Schilling  
Saberprobe LLC – Thomas Payton  
SCS Aquaterra – Leah Meyer  
Seagull Environmental Technologies – Cosmo Canacari  
Service Experts – Geoff Rader  
Shoemaker Plumbing – Randy Shoemaker (Deceased)  
St. John Mittelhauser – Paul Christian  
Summers Well Drilling – David Summers  
Sunbelt Environmental Services – Curtis Kellum  
Swift River Environmental – Stephen Wampler  
Terracon Consulting – Amanda Flageolle, Travus McCroskey  
The Whippoorwill Group – Christopher Byrne  
Tommy Schnell Well Drilling – Tommy Schnell  
TRC Environmental – Richard Wetherbee  
Tri County Pump & Plumbing – Gary Kuster  
Trileaf Corp – Arthur Leverenz  
Van Booven Heating & Cooling – Daniel Van Booven  
Van Hoecke Contracting – Michael Van Hoecke  
West Central Environmental – Edward Creaden  
Wil-Co Drilling – Nathan Aaron Wilson  
Wilson Heating & Cooling – Robert Wilson

# Overview of Nonaqueous Phase Liquid Contaminants

Nonaqueous Phase Liquids (NAPLs) are liquid solution contaminants such as dry cleaning fluids, oil, and gasoline that do not dissolve or mix in water and exhibit different behavior and properties than dissolved contaminants. Once released into the groundwater, NAPLs can move rapidly making complete remediation difficult. These pollutants are associated with human activity and can cause severe environmental and health hazards. An aquifer contaminated with NAPL can remain so for decades or longer.

NAPLs exist as a separate, immiscible phase when in contact with water or air. NAPLs typically are classified as either LNAPLs which are less dense than water, or DNAPLs which have a greater density than water.

A Light Nonaqueous Phase Liquid (LNAPL) has a lower specific gravity than water and therefore, it floats. Gasoline, benzene, toluene, and xylene are common examples of LNAPLs. When spilled, a NAPL will migrate down into the subsurface under the force of gravity. Some of the liquid will be held by capillary action within the soil pore space and if a sufficient quantity is released, it will migrate to the water table and will move laterally along the upper boundary of the saturated zone.

A Dense Nonaqueous Phase Liquid (DNAPL) is denser than water and therefore sinks through the water column. Examples of DNAPLs are chlorinated solvents like carbon tetrachloride, trichloroethylene (TCE), or perchloroethylene (PCE), coal tar, creosote, PCBs and heavy crude oil. When a DNAPL is spilled, it can infiltrate the ground sink below the water table

until it encounters an impermeable surface such as a clay lens or bedrock surface. DNAPLs can penetrate along joints and fractures deep below the water surface and are very difficult to locate.

In Missouri's mature karst terrain, NAPL contamination situation can become more complex. In this setting, hydraulic conductivity is highly variable within short vertical and horizontal distances. Groundwater flow is influenced by the existence of solution channels and other significant conduits. The shape of the contaminant plume becomes a function of the geometry of the network of joints, fractures, and other conduits. Identification of these pathways and prediction of plume migration under these conditions becomes difficult if not impossible.

Migration of NAPLs also can be affected by drilling activities. Drilling, pumping, heavy equipment operation, excavation, and vibrations from drilling can mobilize NAPL from pore spaces within the subsurface. Pumping can change the local groundwater gradient to influence the migration of LNAPL along the water table, and drilling can create a pathway for DNAPL to penetrate deeper into the subsurface along the well bore.

It may be difficult, or sometimes impossible to restore a NAPL-contaminated aquifer to safe drinking-water quality, and contamination can affect aquifers long term. Prior to drilling, contact the department for information regarding spills or releases associated with any facility in question. Great care should be taken to prevent further spreading of NAPLs.

## Well Installation Section Staff 573-368-2165

Staff Website: [dnr.mo.gov/geology/geosrv/wellhd/job.htm](http://dnr.mo.gov/geology/geosrv/wellhd/job.htm)  
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*The Connection* is published by the Missouri Department of Natural Resources' Missouri Geological Survey. Suggestions, ideas and comments concerning this newsletter are welcome. Send comments to: Missouri Department of Natural Resources' Missouri Geological Survey, Well Installation Section, PO Box 250, Rolla, MO 65402-0250, phone: 573-368-2165 or fax: 573-368-2317.