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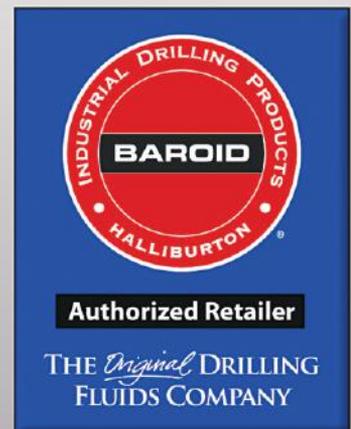
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So, let me ask you - Did you guess the answer to the question I posed last month? Or haven't you had a chance during the holidays to read your copy of *WorldWide Drilling Resource*? The hint is to the right here for you again. Send your guess in and see what you just may win for being so smart! It was ironic as I received my first Christmas card from nephew Richie and his wife Kelly down in Bronson, Florida - it had those words on the cover of the card.

We gave a special thank-you to all our advertisers in the December issue too! Were you one of them? Would you like to be? Have you heard of our *WWD* Reward Points Program? What? You haven't? Well no matter what kind of ad you place with the *WWD* Team, you receive points for each and every dollar you spend here at **WorldWide Drilling Resource, Inc.** So, get on the phone - 850-547-0102 - e-mail - rewards@worldwidedrillingresource.com and our special professionals will explain it all to you. And best of all - you do nothing but place an advertisement

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I'm so proud of all this great team has managed to accomplish. That's one reason I am always smiling!



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HOT TOPICS FOR JANUARY 2017! EQUIPMENT MAINTENANCE:

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Recordkeeping

by Bill Corey

Only once have I been called to do a deposition. It was sometime in 2010. The problem was a customer who wanted to put a tank/pump combo in the attic of his penthouse apartment. He wasn't getting the water pressure he wanted, so he asked what he could do to increase the pressure. We talked about putting a jet pump and tank in line to increase his pressure to 50 psi. I told him, then sent a fax with instructions on how to put this all together - where to place the pressure relieve valve and so forth.

The lawyer was involved because the system failed and the man lost a million dollars worth of Japanese art. I told the lawyer what I told the man about setting up the system. When he asked how I remembered it all, I showed him my log book. It had the date and everything we talked about.

Afterward, I found out what really happened. The man was having some problems with his air conditioning and a guy was there to fix it. As they were talking, he mentioned he was starting to lose pressure again, so the A/C guy said he could take a look. So he adjusted the pressure switch to the point the pump could not hit the pressure and therefore it would not turn off. Of course, hot water cavitation occurred. Remember what this is? The water is not required, but the pump is spinning the impeller which causes the water to get hot. It gets hot enough to melt the pipes, which after about 20 minutes burst and the pump tried in vain to keep up with the water use, eventually flooding the place. The water ran down the walls and ruined the art. He of course felt someone else should pay even though it was his own fault for not following my instructions, and also allowing the A/C guy to "fix" the problem. We did not get sued or lose the case because I had records to show what I told the man.

Anytime you are working on someone else's property it is to your advantage to not only write down what work you performed, but also any conversation you had with the customer. It could keep you out of a lawsuit; but more importantly, it will help with future troubleshooting.

Here is another example: You're at a jobsite and you finish an install. I've told you in the past, always do a Shut-Off-Head Test. Why? So when you go back, all you have to do to see where the problem might be, is turn the pump on and look at the pressure. If it is not the same as it was when you first went there, check the depth to water and see if the water table has changed. If the change is what you had before, then you know the problem and can work on getting the pump closer to the water.

If not, then you start looking at the pump.

Next month we'll take a look at a sizing problem. Don't forget to keep good records.

Bill

Bill Corey may be contacted
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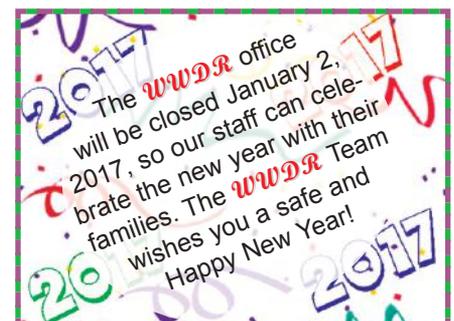
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Geotechnical Studies Underway in Oregon *Adapted from Information by the Oregon Department of Transportation*

In an effort to design a replacement for the aging Scottsburg Bridge, the Oregon Department of Transportation (ODOT) is drilling several holes into the riverbed on the downstream side of the bridge to obtain important geotechnical information which will be used to help design a new, more modern bridge. The Scottsburg Bridge was built in 1929, and has remained largely unchanged over the past 87 years. With its narrow lanes, tight corners at both ends, and low clearance, the time has come to consider replacing the bridge located along Oregon 38 (Umpqua Highway).

The plan involves drilling four holes, each 100 feet deep and 8 inches wide, from a barge on the west side of the bridge.



The 100-foot barge will be positioned so it only occupies a small slice of the river, leaving about 400 feet for other boats to pass by.

Over the years, ODOT has focused on maintaining the existing bridge and addressing problems as they arise. Repairing the existing bridge completely would require so many repairs and improvements, ODOT believes constructing a new bridge would be a better long-term investment. A new bridge could better accommodate modern traffic and would be more likely to withstand a large earthquake or other natural disaster than the current structure.

Although no funding has been secured for a new bridge, ODOT is designing a replacement bridge in the event the funding becomes available. The new bridge will be designed according to modern standards and due to the high cost of maintaining two structures, the old bridge would be removed. Depending on funding, a new bridge could be constructed as early as 2018.

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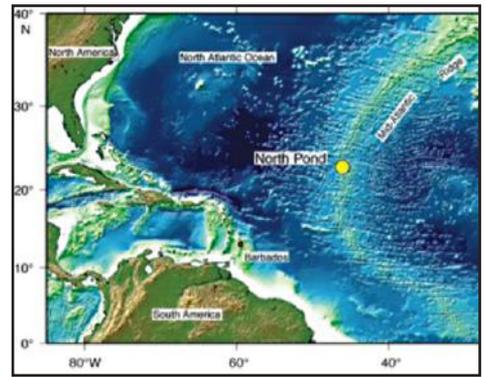
Looking for Life Deep in the Planet

Adapted from Information by the Marine Biological Laboratory

One of the more startling discoveries about life on earth in the past 25 years, is that it can - and does - flourish below the ocean floor, in the planet's dark, dense, rocky crust. The only way to get there is drilling through layers of sediment until rock is reached. Information on this widespread, yet buried marine biosphere is scarce.

A team led by Marine Biological Laboratory Associate Scientist Julie Huber added new details to our understanding of life way below the surface. She and her colleagues offered the first description of an active microbial community buried in cold oceanic crust at North Pond, an isolated sediment pond on the western flank of the Mid-Atlantic Ridge.

The oceanic crust is a hotbed of activity. Seawater runs through its rocky



The oceanic crust at North Pond is relatively young at 8 million years old; and its circulating fluids are cold in comparison to other crustal fluids.

crevices, creating a dynamic aquifer through which the entire volume of the ocean circulates every 200,000 years. Huber's team discovered the microbial community in North Pond crustal samples was oxygenated, heterogeneous, and noticeably distinct from the community found in seawater at the bottom of the ocean.

"In many cases, we found the same general group [of bacteria] in the crustal aquifer and bottom seawater, but different species within that group," said Huber. This indicates distinct differences in potential microbial activity between the two sites, such as more carbon fixation in the aquifer.

A paper by Huber and fellow researchers will be the first to describe the subseafloor microbial community in a cold crustal aquifer site. Prior work focused on the hot, volcanic fluids at mid-ocean ranges and the subseafloor microbes surviving there.

"The cold crustal aquifer is a different environment that is also globally important, not just in terms of life, but biogeochemical cycling," noted Huber. "We are only starting to discover how things proceed there."

Samples were obtained from a sub-seafloor observatory installed at North Pond by the Integrated Ocean Drilling Program in 2011. Combining genomic technologies with geotechnical measurements, Huber's team examined crustal fluid samples retrieved in 2012 from 164-820 feet beneath the seafloor, under more than 2 miles of seawater. The researchers are working on a time series to detect if and how the microbial community and fluid chemistry changes. Currently, 2014 samples are being analyzed, and more samples will be collected this year.



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by Jim Kuebelbeck

Pilot

I was not always a water dowser. There was a time when I actually was a young boy trying to grow up on a farm with my brothers and sisters. I had quite an imagination, and often marveled at the low-flying airplanes which sometimes flew over our farm. Almost every other evening during chore time, a large twin-engine plane flew low over our barn, and I would run outside and wildly wave, hoping by some odd chance the pilots would see me. My dad told me it wasn't likely to happen, but I ran out and waved every time I could hear the plane coming. Only much later did I learn it was a U.S. mail plane delivering to a larger town some ten miles from our farm.

One evening, the plane was flying especially low and seemed to bank a little when I waved. It was so low I told my dad I thought I could even see the pilot! "I really don't think so," he said, and I was a little sad at the time, but said nothing further.

A few evenings later, I heard the plane coming again, and this time it sounded even lower, and I yelled to my dad to come out of the barn to see it. This time as I waved, that big airplane flew so low, Dad and I could easily see the pilot waving back at us! Then to our disbelief, the big twin-engine plane made a big roaring circle directly over our yard and rocked its wings as it flew away. Dad and I couldn't believe it! To say I was more than overjoyed would be an understatement.

I decided then and there that I too would become a pilot someday. (I could never have imagined that someday years later my future wife would become a pilot as well.) After the memorable incident, however, my imagination ran wild. I was determined to become a pilot someday. In the meantime, I had a bit of dreaming to do.

I would build my very own "pretend" airplane, and asked one of my older sisters to help. We took one of my dad's old paint splattered sawhorses and turned it upside down in the tall grass beside the granary. I then placed a short board across two of the legs (for the back wing). I needed a much longer board for the front wing, but I needed some help with that, so I had my sister help me pull a long wooden plank from under the granary. We managed to get it balanced evenly across the other two legs of the sawhorse. My "airplane" was now complete!

I had planned to spend the rest of the afternoon "flying over enemy territory". After an imaginary take off, I flew along, gently banking left and right seemingly without a care in the world. Things were going great, and I "flew" low waving at people on the ground. Then suddenly, out of nowhere I spotted the Red Baron! I knew I needed to take evasive action, so I banked to the left and then to the right. In the excitement of the continuing dogfight, however, I happened to bank a little too far to the right. My right "wing" struck the ground and came off. A second later the left wing came off also. I guess I should have chosen a lighter board for the front wing, instead of the heavy plank, because when I "crashed", it put a nice gash on my forehead! (A person loses a bit of clear vision when blood runs into one's eyes.) When I ran into the house, my older sister guessed what happened. While my mother was putting iodine, gauze, and white adhesive tape over my injury, my sister couldn't resist saying, "Maybe you weren't meant to be a pilot after all!"

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Before we had a chance to clean up the crash site, my dad came into the driveway. He immediately jumped out of his truck, and ran right over to the tall grass by the granary. When he had seen the four black-and-white "legs" sticking up out of the tall grass, he assumed one of his precious calves had died belly-up on its back! I quickly realized my airplane building days had come to a sudden end. My head injury did heal over time, but I still have the scar to remind me of those wonderful carefree days.

Jim

Jim Kuebelbeck may be contacted via e-mail to michele@worldwidedrillingresource.com

BREAKING NEWS

Nucor Corporation Strengthens its HSS Steel Tubing Presence

Nucor Corporation announced it has acquired Independence Tube Corporation of Chicago, Illinois, and has also agreed to acquire Southland Tube of Birmingham, Alabama.

Independence Tube and Southland Tube manufacture hollow structural section (HSS) steel tubing, which is used in a broad array of structural and mechanical applications including nonresidential construction, infrastructure, and agricultural and construction equipment end-use markets.

Through these acquisitions, Nucor is building a market leadership position in the HSS steel tubing market and providing an additional channel to market for Nucor's sheet steel mills.



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WHO'S IN THE NEWS



During the California Groundwater Association (CGA) Annual Convention and Trade Show in October, the association presented Anita Tullis with the Woman of the Year Award in recognition of her outstanding and gracious service to CGA.

Additional announcements from CGA, Deep Foundations Institute, Association of Equipment Manufacturers, Curry Supply Co., and the Society for Mining, Metallurgy & Exploration are online now at worldwidedrillingresource.info/Whos2.pdf

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Advanced Water Recycling System for Oil and Gas Industry

Adapted from a News Release
by General Electric Company



FCL's (Federated Co-Operatives Limited's) Co-op Refinery Complex in Regina, Saskatchewan, Canada, has installed General Electric's (GE's) advanced water recycling technology for a wastewater improvement project which will enable the refinery to clean 100% of its wastewater on-site. Once fully operational, the complex will be the only refinery in North America to recycle all of its wastewater for steam production, which is used for heating, hydrogen production, powering equipment, and cooling towers.

"Water is a precious resource and our wastewater improvement project allows us to be efficient and sustainable by recovering every drop of water. With GE's technology, the Co-op Refinery Complex will clean and recycle all of its wastewater in a socially responsible and environmentally sound way to conserve water for Regina and the entire province of Saskatchewan," said Gil Le Dressay, vice president, refinery operations, FCL.

The current water source is a blend of well water and city water. Several years ago, the refinery expanded its operations to produce 30,000 more barrels of oil per day (BPD) taking it from 100,000 BPD to a 130,000-BPD facility, which also increased its water usage. Water use restrictions mandated the complex find a new source of water. GE offered a solution combining ZeeWeed* membrane bioreactor (MBR) technology and a high-efficiency reverse osmosis (HERO*) system to recycle and reuse two million gallons of wastewater per day. In addition to the water reuse solution, GE provides the refinery with wastewater specialty chemicals and monitoring solutions to provide system optimization.

After commissioning, the refinery will reduce its use of freshwater by 28% on an annual basis. By recycling 100% of its wastewater on-site, the complex will significantly decrease volatile organic compound emissions from its wastewater ponds and reduce the associated nuisance odors.

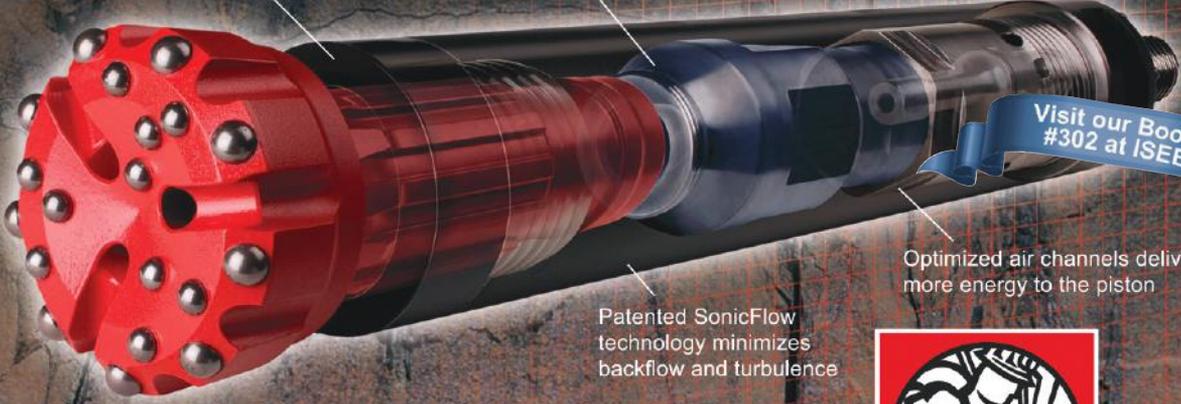
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Computer Maintenance

Adapted from Information by Goodwill Community Foundation, Inc.

Just about every office has a computer; maintaining the physical computer is important to promoting the longevity of your equipment. Dust is your computer's main enemy. Here are some basic cleaning tips for desktop computers:

Cleaning the keyboard

Dust, food, liquid, and other particles can get stuck underneath the keys on your keyboard, which can prevent it from working properly. These basic cleaning tips can help keep your keyboard clean.

1. Unplug the keyboard from the computer.
2. Turn the keyboard upside down and gently shake it to remove dirt and dust.
3. Use a can of compressed air to clean between the keys.
4. Moisten a cotton cloth or paper towel with rubbing alcohol and use it to clean the tops of the keys. Do not pour alcohol or any other liquid directly onto the keys.
5. Reconnect the keyboard to the computer once it is dry.

Additionally, you should clean the sides and back of the monitor to avoid a buildup of dust and dirt. Use an antistatic or microfiber cloth to lightly dust your computer monitor and casing. Do not use furniture cleaners or strong solvents. Use a can of compressed air to blow out debris from the air intake slots.

Don't restrict airflow around your computer. A computer can generate a lot of heat, so the casing has fans to keep it from overheating. Avoid stacking papers, books, and other items around your computer.

Many computer desks have an enclosed compartment for the computer case. If you have this type of desk, you may want to position the case so it is not against the backside of the desk. If the compartment has a door, you may want to leave it open to improve airflow.

Cleaning your computer on a regular basis will help keep it working properly and avoid expensive repairs.



A large advertisement for the IGSHPA Conference & Expo. The top half features the words "DIG IN" in large, bold, black letters, where the letters are filled with a dark, textured material like soil or sand. Below this, the text "IGSHPA Conference & Expo | March 14-16, 2017 | Denver, CO" is displayed in a blue and orange font. The bottom half of the advertisement is a collage of four smaller images: a man in a suit talking to a woman, a group of people in a meeting, a man in a lab coat looking at a screen, and a city skyline.

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To learn more or register visit igshpaconference.com





Is Your Life Purpose What You Have, What You Do, or Who You Are?

by Tim Connor

Many people send mixed messages to their family, customers, employees, or even total strangers, creating confusion, a lack of trust, and yes a lack of integrity with what they believe, stand for, or how they will be remembered or even who they really are.

Is it fame you seek, or fortune, power, wealth, love, influence, achievement, control, stuff, recognition, approval, success? All of these, or something else? Or, is it inner peace, contentment, service, joy, happiness, or salvation and the inner sense your life was more than what you had or what you did while you were here?

Having traveled the world for over 40 years meeting thousands of people in all walks of life in many cultures, you would be amazed at how many people want the previously listed latter examples, but believe they can achieve them by achieving or focusing on the former ones.

When the end comes for each of us - and it will one day - what do you think will really matter or how will we be remembered even if we are remembered? Will it be the car we drove, the house we lived in, our net worth, or the lives we touched in a positive way and a legacy of compassion, understanding, support, and giving? What do you think? How do you want to be remembered? What do you want your legacy to be?

You've heard it - you can't take it with you. Yes, I'm sure a few of you are thinking - but while I was here I had a great life - traveled the world, ate in the best restaurants, and had a life of pleasure. Let me ask you - did you live a life of joy? Did you live a life for others, or for yourself? Did you give more than you received?

When I look in the eyes of others I often see superficial desires and dreams, but when given the chance and the ability to see into their hearts I often see pain, disappointment, regret, and a sense of emptiness no matter their status, fame, or wealth.

I have had the pleasure of knowing many millionaires and a couple of billionaires during my life, as well as many people who struggled to survive day to day and I am amazed at how life's simple and free pleasures meant more to them than any amount of money could ever buy.

I have stood by the bedsides of a few friends who left here with a smile instead of sadness, and a few who left with regret. For all of them it was over. No second chances here, but after they left here, who knows? You know what the common traits were in both groups? Their final thoughts - the folks who left with a smile achieved their dreams of service, kindness, and caring while the others still had far too many things on their financial bucket lists - never to be realized. How sad.

This article is not about them or me, but you. Are you living your life searching for what you want or what you can share, what you own or what you can give, what you accomplish or how you can help others achieve, what you do or how you can help others rise up, and what you meant to others or how others could contribute to you?

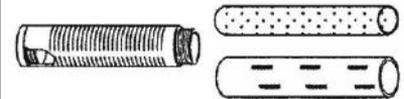
Until you can honestly answer these questions and others, and live with an inside-out integrity consistent with basic human values, purpose, and consistency, I guarantee you will live a life of uncertainty, disappointment, frustration, and often sadness and regret. Is it worth it? Time will tell! And guess what - it's your choice!

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New Mineral Discovered

Adapted from a News Release by Michigan Technological University

According to the International Mineralogical Association, there are 5179 official minerals. The Association's Commission on New Minerals, Nomenclature and Classification receives more than 80 proposals each year for new minerals. However, many turn out to be variations of existing minerals, so rigorous testing is used to determine the chemistry and crystal structure of the samples.

John Jaszczak, a professor of physics, was examining a mineral sample in the basement of Fisher Hall at Michigan Tech. As he studied the specimen, sent to him by the Smithsonian Institute's National Museum of Natural History, he knew something was very unusual about the sample.

Acting on a gut feeling, he decided to look into it further. Using Raman spectrometry and scanning electron microscopy, he noticed tiny whiskers which were a layered structure rich in molybdenum, lead, and sulfur which he felt could be a new mineral. Jaszczak pulled together a team to prove his theory, and he was right! The tiny, silvery, cylindrical whiskers were indeed a new mineral - merelaniite.

On large crystals, these tiny whiskers, which look like hairs to the naked eye, have probably been cleaned off the host rocks of more recognizable minerals from the famous gem mines near Merelani in Tanzania.

"Minerals have a natural wow factor, and while we use many of them daily without thinking twice, some specimens are truly art," Jaszczak said, adding minerals like tanzanite and tsavorite, which come from the same mines as merelaniite, can be more eye-catching, but it doesn't diminish the value of less showy minerals.

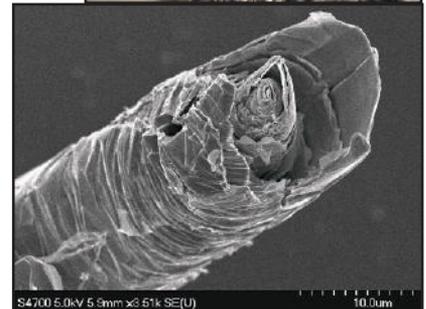
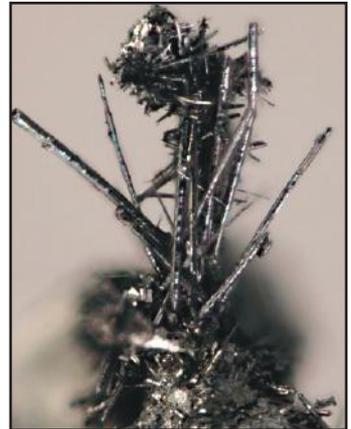
"The Merelani district has been famous since the late 1960s for the blue gem variety of zoisite known as tanzanite, but this is really a mineral collector's paradise and an exciting place to look for new minerals," said Jaszczak, who has coauthored three other papers on the district's minerals. "The importance of the area is the reason we wanted to give tribute to the miners and name merelaniite for the district."

Although Raman spectroscopy gave Jaszczak hard evidence the mineral may be new, more work needed to be done. Since merelaniite is composed of two different kinds of layers at the atomic scale, and because they curve to form cylinders with a scroll-like structure, it was particularly difficult to determine the fundamental crystallographic parameters. The chemistry of the new mineral was also a challenge to determine with precision. For both of these challenges, Jaszczak needed additional help. So he teamed up with Mike Rumsey and John Spratt at the Natural History Museum in London to determine the chemical composition of the new mineral with precision.

To understand the crystal structure, Steve Hackney, professor of materials science at Michigan Tech, was able to provide crucial high-resolution images and diffraction patterns using transmission electron microscopy on ultrathin samples prepared with a diamond knife by Owen Mills, director of Michigan Tech's Applied Chemical & Morphological Analysis Laboratory.

The team decided to consult with a professor at the Università di Firenze in Italy, Luca Bindi, who is also an expert in solving complicated crystal structures. He helped run x-ray diffraction studies and the results revealed a complex structure made up of layers of molybdenum disulfide alternating at the atomic scale with layers of lead sulfide, along with other elements, including vanadium, antimony, bismuth, and selenium.

Although you aren't likely to see merelaniite in jewelry, it is appealing with its intricate, microscopic internal beauty. Additional studies on the crystal chemistry of this exotic mineral may eventually lead to useful applications.



Editor's Note: In between our print issues, the WWR Team prepares an electronic newsletter called E-News Flash. Based on readership, this was the most popular E-News Flash article of the month.

Get in on the action and subscribe today at: www.worldwidedrillingresource.com

Thank you for publishing the report on merelaniite in your *E-News Flash*.

Sincerely,
John Jaszczak
Michigan Technological University



CGA 2016 DEALMAKERS

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Wes and Ellis (2nd and 4th) with Powell Drilling of Paso Robles, California, were pleased to show the new GEFCO 30K at the California Groundwater Association event. Charlie and Jon with GEFCO / Astec Industries of Enid, Oklahoma, stand with them.

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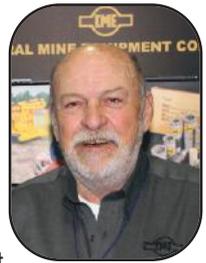
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In Memoriam

Roger Jay Eisler (1940~2016)



Central Mine Equipment Company had the sad task of reporting the passing of recent retiree, Roger Jay Eisler, on November 20, 2016.

Born in Somerset, Pennsylvania, Roger graduated high school in 1958, and joined the U.S. Navy. He then owned R.J. Eisler Drilling, a coal exploration business. Later, he worked for Central Mine Equipment Company until December 2015, nearly 37 years, traveling the northeast region of the U.S. The **WWD&R** Team snapped this photo of Roger at the New England Water Well Expo in 2015.

He enjoyed golf and playing cards at the Somerset Country Club where he was a past board member. He was also a member of F&AM Lodge 358, Grace United Methodist Church, and a former member of the Somerset Jaycees.

Roger is survived by sons Frank (Deenie) and Bryan (Amy); stepson John Bolek; three grandchildren; and five great-grandchildren. He was preceded in death by his wife Cynthia.

The management and staff of **WWD&R** extend their sincerest condolences to Roger's family, friends, and former colleagues.

William W. "Bill" Gregory (1943~2016)



The Michigan Ground Water Association gave the sorrowful news that William W. "Bill" Gregory passed away November 28, 2016, after a short battle with lymphoma.

Bill graduated with the class of 1961, then went on to earn a business administration degree from Ferris State University. After college, he enlisted in the Army, eventually serving as a tank unit commander.

Through his business of more than 40 years, WG Sales in Howell, Michigan, he not only provided plumbing supplies, he shared his wisdom of the trade. He considered the people he worked with as close friends. This photo, taken at the 2016 Michigan Ground Water Association Annual Convention and Trade Show by **WWD&R**, shows Bill's great smile. He will be best remembered for the love of his family and friends, his jokes, and his love of John Deere tractors.

Bill is survived by his wife of 50 years, Nancy; children Susan (Paul), Jill (Joe), Wyatt, Daniel (Kate); and 11 grandchildren. The management and staff of **WWD&R** express their sympathies to Bill's family, friends, and colleagues.

Lyle Elton Gordon (1926~2016)

The Michigan Ground Water Association also informed of the passing of Lyle Elton Gordon on November 18, 2016.

Born in Vandercook, Michigan, Lyle graduated from Addison High School, then served in the U.S. Navy during World War II. He was owner and operator of Lyle Gordon Water Well Drilling in Hillsdale, Michigan.

He was a member of the American Legion and Somerset Congregational Church, and enjoyed golfing.

Lyle is survived by his children Alan (Teresa) and Ronda (John); four grandchildren; two great-grandchildren; and extended family. He was preceded in death by his wife Mazel.

The management and staff of **WWD&R** send their condolences to Lyle's family, friends, and colleagues.



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Will Geothermal Energy Revitalize Alberta's Energy Sector?

Adapted from Information Provided by Rick Young, P.Geo. (ret.)

Canadian Geothermal Energy Association Member

Image courtesy of borealisgeopower.com

Could geothermal energy be the dark horse of Alberta's clean energy movement? At the recent Geothermal Tech Transfer Workshop held at the Southern Alberta Institute of Technology, nearly 80 engineers, geoscientists, bankers, lawyers, facility procurers, and other specialists were in attendance seeking to learn more about the emerging geothermal industry in western Canada. The workshop had numerous sponsors, but was organized primarily by the Canadian Geothermal Energy Association.

The introductory paragraph written to entice people to sign up for the workshop was revealing enough, reading "Geothermal energy is delivering clean, baseload and low-cost electricity in 24 countries around the world. Canada is still missing out on this opportunity. This workshop will target the question of how to transfer existing skills and expertise in oil/gas to geothermal project development. Low commodity prices and the economic downturn make this a hot topic."

Accessing and utilizing the energy trapped in hot, subsurface water systems is being successfully and economically exploited in several countries, including the U.S., Germany, and Turkey. This resource is huge in western and northern Canada, and ironically is quite well studied, analyzed, and mapped, thanks to countless tests conducted in oil and gas well operations over many decades on hundreds of thousands of wells. Another irony is the untapped knowledge, experience, and creativity of thousands of technical experts now out of work due to the economically dampened oil and gas industry - people who could be put to work developing new and better ways to extract the heat energy available in familiar areas of the conventional oil patch.

Aside from geothermal energy's recognition disconnect, another gap exists in policy. Few jurisdictions in Canada have regulations in place or tax incentives to allow a geothermal energy industry to grow. Several government agencies are currently reviewing various sources of power. For example, the Alberta Electric System Operator is seriously evaluating the potential of geothermal power generation.

Will Geothermal Energy cont'd on page 38.



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Your most valuable tool probably has three traits: reliability, predictability, dependability.

Valuable tools function as expected, when expected. A valuable tool not only helps you make money, it helps you keep your promises - to your customers, employees, your family. Valuable tools are useful tools, and how they are cared for is a direct reflection of the fella who operates them. Good, valuable tools well-maintained and cared for are something to be proud of indeed!

Now let's imagine you're looking to buy a rig. You're probably not looking for just any rig, you're looking to buy the "right rig". You know what I'm talking about. The right year, right size, the right systems, compressors, upgrades, etc. Maybe more important than what it is or how it's configured, are the right details - like the nuanced condition of the lubrication, wear points, and overall cleanliness. The details which matter and say boldly, "I've been handled right, I have what it takes, and I'll be dependable for you too." And when you find the "right rig" and get it outfitted to your liking, who exactly will you trust to run it for you? Just anybody with a drill operator's license? Someone who has seen one on a reality TV episode? Who exactly will work on your rig doing repairs and upgrades without fail? Just anyone handy who can turn a wrench? Maybe someone who . . .

Of course I'm kidding! But why do so many business owners treat insurance and workers' compensation (comp) any differently? Maybe because insurance tools cost money, not make money, right? Maybe there are a lot of reasons, but here is what I do know:

None of us would feel good about operating any sort of valuable machinery, let alone a drill rig, without the right setup, routine maintenance, and plenty of know-how. Disabling or not keeping necessary safety guards in place, even the small ones, is inviting serious consequences. Yet, the annual cycle of insurance policies somehow entices business owners and even competing agents to remove or omit many protections, details, and safety features within insurance policies - all to save premium dollars. This feels great and seems fine - until it isn't. In this, I'm not kidding. When a bad day happens to you, your insurance policy is either going to be worth infinitely more than what you paid for it, or it won't be worth the paper it's printed on. Exactly how insurance tools are setup, if the right details are in place, and who is operating it for you will matter. The choice is yours to either step over a dollar to pick up a dime, and maybe reverse engineer a disaster for yourself in doing so - or seize the moment and make the resolve in this New Year to treat your insurance and workers' comp as the valuable tools they are. These tools take care of your equipment, your people, your profit, your time.

All the best to you!

Kyle

Kyle Rehme may be contacted via e-mail to michele@worldwidedrillingresource.com

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Product Spotlight

Mills Machine Company, Inc. offers pipe alignment clamps with ratchet closures for speed and ease of aligning pipe ends. They are precision machined to facilitate a close tolerance alignment for welding, with heavier and larger cross-bars to assure straight alignment between the two joints of pipe. The wider stance of the roundabouts or sides of the clamp ensure a firmer and more secure hold on pipe ends. They are also available with arched crossbars to allow full-circle welding without removing the clamps.

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to see new sonic offerings for Geoprobe® Sonic Rigs and Tooling. Don't get left behind!

Geoprobe® 8150LS Rotary Sonic



"We chose the Geoprobe® 8150LS sonic rig because of the design and engineering of the rig, the quality and availability of the tooling, the knowledge and commitment of the Geoprobe® staff, the service department relationships, and the success we've had with the ten other Geoprobe® machines we've owned." ...Steve Taylor, Owner, Geologic Explorations, Statesville, NC

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A Real Game Changer for the Sonic Industry

Moving things forward. That's what the sonic weighted wireline tooling from Geoprobe Systems® does. Call it raising the bar. Innovation. Game changer. Or outside the box. This method of sampling moves things forward in the sonic industry.

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Those aspects? **Safety. Efficiency. Profitability.**

SAFETY. It's safer because it requires far less tool handling.

Tool handling has a direct correlation to safety. The more tooling is handled the more likely an injury may occur. The weighted wireline (WWL) system eliminates the need to trip rods in and out of the cased hole.

EFFICIENCY. It's more efficient because it's faster than all other methods. When using the WWL, the sample barrel and weight assembly are tripped in and out together with only the use of the winch, so the speed and efficiency of the system becomes more and more evident the deeper you go. Geoprobe® engineers completed a time study on trip in and trip out times (right). Mike Carlin, Geoprobe® Tools Group Leader, says check the numbers regarding efficiency. **"The use of the winch with WWL significantly reduces the time to trip samplers and core barrels in and out of the casing,"** he said. **"The numbers don't lie!"**

"I'm turning 58 years old and I can run our 8150LS sonic all day long! It's easy on me. And I love that the weighted wireline system takes care of the physical aspect and safety concerns."

Robert Keyes • President
Associated Environmental Industries • Norman, OK

PROFITABILITY. It increases profitability because it requires few parts to operate. Overall efficiency correlates nicely to profitability. So does a clean safety record. But the overall cost to tool up for and maintain a weighted wireline system is quite low compared to conventional systems such as 4x6 since it requires so few parts.

Both weighted wireline systems ... SDT45 and SDT60 (for 4.5- and 6.0-in. casing) ... are simple to use. Jed Davis, Tools Engineer, said, **"During a customer training session, it only took one core run for the drill crew to understand the weighted wireline system, and just a few more runs to have it completely mastered. We didn't hit a home run this time; we think it was a grand slam!!"**

Mike also said the weighted wireline system is not meant to replace conventional 4x6 or dual tube systems. "It has always been our recommendation that weighted wireline systems complement these other soil sampling systems," he said. "We don't suggest going to the field with one tool in your tool box, nor do we recommend that you limit yourself to one sampling system." There are formations where 4x6 works great. The same can be said for dual tube systems, **"But when you can incorporate a weighted wireline system into your project,"** Mike added, **"the benefits far outweigh any costs.** You can spend all day taking the back roads to Grandma's house, but why bother when the interstate will get you there twice as fast."

Probing Times articles on Geoprobe® Sonic Weighted Wireline are available at:

www.geoprobe.com/pt-spring2015 and www.geoprobe.com/pt-fall2015.



Rock core recovered using SDT60 Weighted Wireline Tooling.

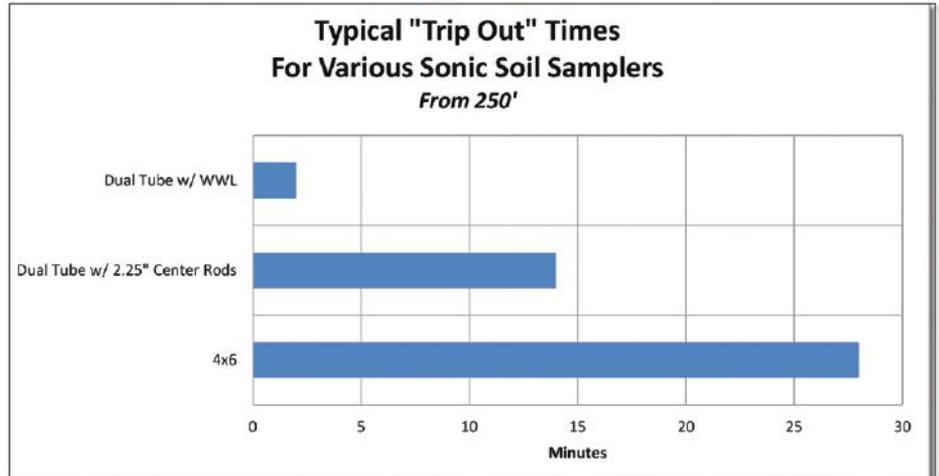


Sonic soil cores are examined in the field by an onsite geologist. The cores were retrieved by running SDT60 and an 8150LS.



Running sonic weighted wireline with SDT45 tooling. (above) Modular weight assembly, with the overshot 'spear' visible inside the weight head prior to being lowered downhole. The modular weight assembly consists of two, 150-lb. weight segments coupled together and a threaded head and overshot spear.

— Faster Tripping Times —



High-quality soil samples in less time! This graph was created by analyzing thousands of feet of various sonic drilling data collected by Geoprobe® engineers. At deeper depths, simple math indicates how much faster the sonic dual tube weighted wireline system can be.



An 8150LS Rotary Sonic, owned by Associated Environmental Industries in Norman, OK, is running SDT60 and a 6.0-in. Weighted Wireline system.

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The Un-Comfort Zone II

by Robert Evans Wilson, Jr.



Here's What You Need to Change the World ~
The tipping point is closer than you think.

I recall, back in 1995, trying to decide whether or not to get an Internet account. I only knew two or three people who had them. E-mail sounded like a cool idea, but you still needed to pick up the phone to get in touch with someone. (Remember when the question was: "Do you have an e-mail address?" instead of: "What is your e-mail address?") Getting on "The Net" seemed like a good idea for my writing business, especially for purposes of research. I just wasn't sure it was worth the money. Back then, you bought time on the World Wide Web by the hour, and it was deducted by the minute. If you downloaded a file that was too large, you might use up your entire monthly allotment. I really wanted it, but I needed to justify spending the money.

My justification arrived after a phone call with a new client. A magazine publisher in Texas wanted me to write some articles for him. During the conversation he said, "I only work with writers who are on e-mail." I made my decision in that moment. The publisher called me back the next day and said he forgot to ask for my e-mail address, by which time, I had one.

Not too long after, I went to see the movie *Braveheart*. When I got home I wanted to know more about William Wallace, so I went onto Netscape and searched the Web. I found an article about him on the website of a library in Scotland. I was so excited to be getting information from such a long distance away, I called my wife into my office to show her.

When I look back on it I wonder, if I had not had a business reason to be on the Internet, how long would it have taken me to do it? According to Everett Rogers, who created the diffusion of innovations theory, the tipping point for mass market acceptance of an idea occurs when 15-18% of the participants in a social network have tried it first. So, if we consider Dunbar's

Wilson cont'd on page 34.



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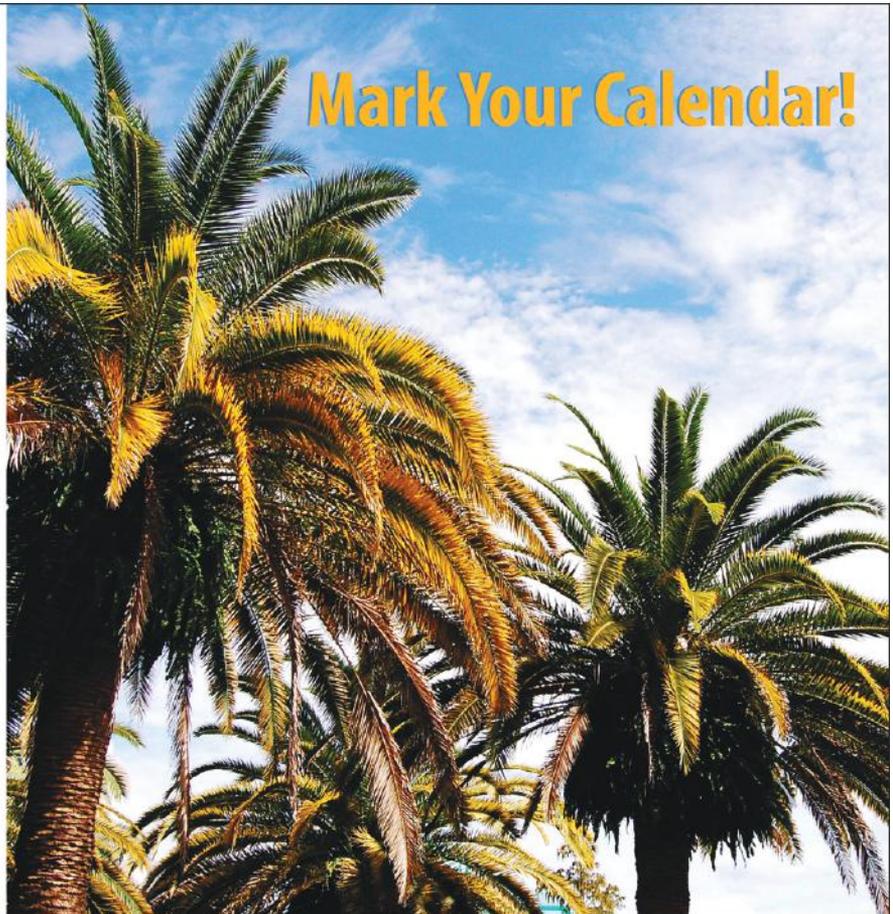
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TIPS FOR WORKING IN COLD WEATHER

Adapted from information by Vermeer Corporation's Navigator Nation

Drilling companies often have to make a tough call when winter hits and temperatures fall, deciding whether or not to send employees and equipment out into the elements. However, no matter how cold the weather gets, some projects and utility installations simply cannot be put off.

Most companies have procedures in place to determine when temperatures are too cold for man or beast (machine). Nevertheless, if a crew decides to brave winter conditions and get the job done, there are things you can do to help ensure the equipment stays functional and the integrity of the jobsite is maintained.

The main thing is to focus on fluids.

Water - Equipment maintenance in below-freezing weather centers on water and cleanliness. When temperatures fall below freezing, operators have a limited window of keeping water from freezing. Water is needed not only to maintain lubricity and remove cuttings from the borehole during the boring process, but also to help keep the equipment clean after the job.

Drilling Fluid - Drilling fluid is crucial to a successful bore. However, it can create issues if it's not removed after boring in the winter. Failing to clean the drill from top to bottom after each day of work can cause drilling fluid to freeze around the hydraulic hoses and drill components on the front of the rig, creating a nightmare the next morning.

Antifreeze - The third item on the winter fluid checklist is antifreeze. When the temperatures dip dangerously low, a mud pump can freeze and break quickly. Operators should flush the system with environmentally-friendly antifreeze when they are shutting down for a period of time or overnight.

Diesel Fuel - No. 2 ultra-low sulfur diesel (ULSD) fuel is ideal for a horizontal directional drill rig. However, once colder temperatures arrive, gelling can be a concern with No. 2 fuel. To prevent this, consider making a temporary switch to No. 1 diesel fuel when the temperatures drop. It's also important to note many Tier 4 final engines use diesel exhaust fluid (DEF), which is a blend of water and urea. Since DEF is a water-based solution it can freeze. DEF will begin to slush before it freezes and will reach a solid state when the fluid temperature reaches 12°F (11°C). DEF will also

expand when it freezes, so its important to make sure the DEF tank on the equipment is not completely full. During winter, once the engine is started, the DEF will thaw quickly and return to a useable state with no effect on its quality or performance.

Don't forget to protect your crew from the cold. The combination of personal protective equipment (PPE) and cold-weather gear is essential for operator comfort and safety during the winter months. Outdoor labor of any kind can lead to a heightened risk of frostbite. To help alleviate these concerns, crews should be equipped with warm and safe clothing. It's also important the crew takes adequate breaks to warm up and escape the cold temperatures. Often-times they are dealing with water and mud, and can run the risk of getting wet. They've got to have time to dry off or take a break.

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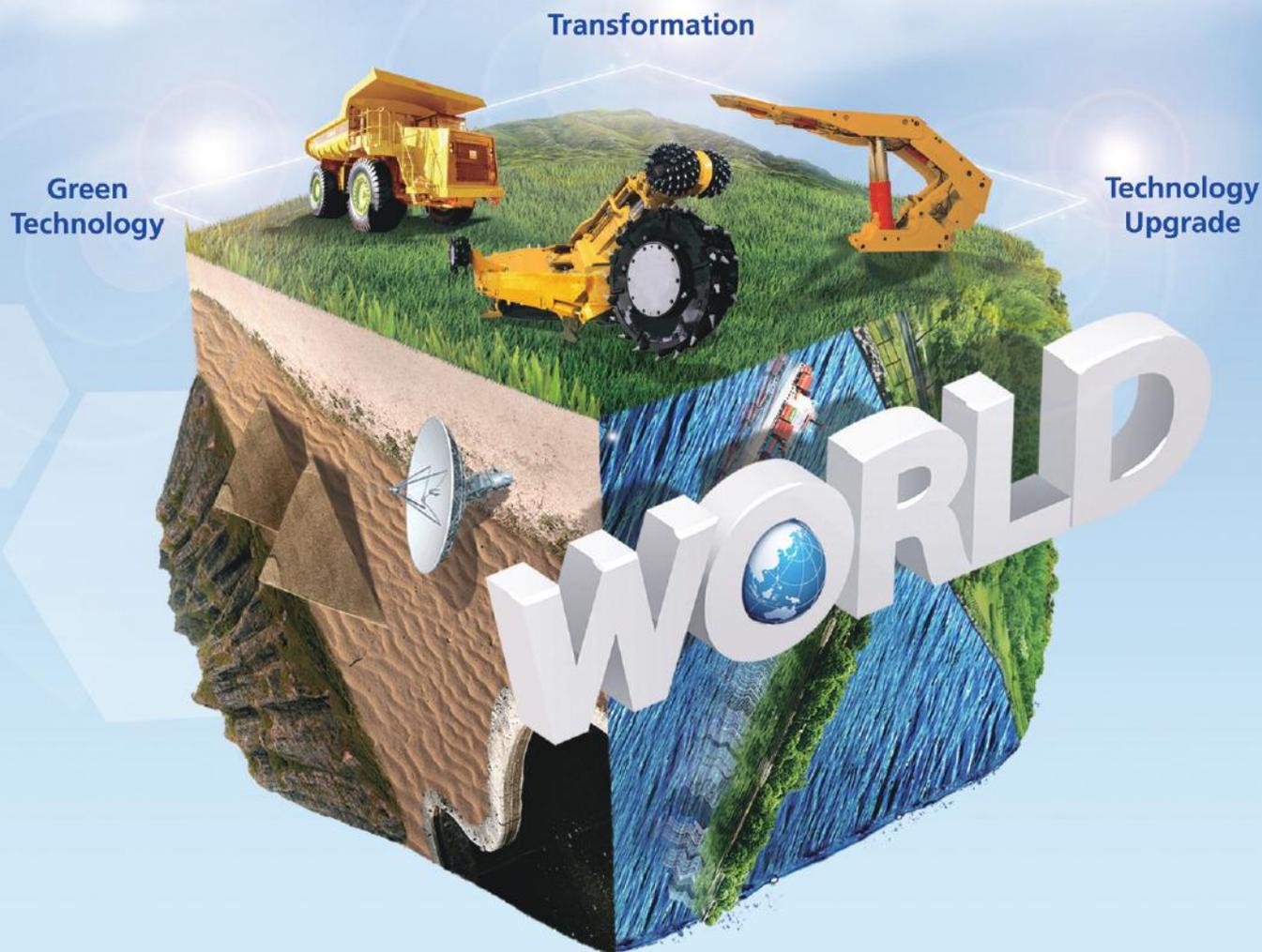
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Berta Verastegui, International Project Manager



New Down Hole Hammer for Geothermal Drilling!

Adapted from a Press Release by Sandia National Laboratories

Over the past three years, Sandia National Laboratories and Atlas Copco have worked to design a drilling tool capable of withstanding the high temperatures associated with geothermal drilling.

Down hole hammers are common in the oil and gas, as well as mining industries. They are attached to the end of a column of drill pipe and cut through rock using a rapid hammering action. Since the 1950s, down hole hammers have used oil-based lubricants and plastic/rubber O-rings, which don't work well when drilling into hotter temperatures.

"The technology behind the new hammer is fundamentally the same, but Sandia worked with Sweden-based Atlas Copco in material selection and dry lubricant technology that will work in the high-temperature environment," said Jiann Su, mechanical engineer and Sandia's principal investigator on the project with Atlas Copco.

The Department of Energy (DOE) Geothermal Technologies Office funded Atlas Copco as prime contractor on the project, and the company partnered with Sandia as the subcontractor. "Part of what the DOE's Geothermal Program is looking to do is help lower the cost of getting geothermal energy out to customers," said Su, a researcher in Sandia's geothermal research department. "Some of reducing the cost is lowering exploration and development costs, and that's one of the areas we're helping to tackle."

Su considers the project a success and said the team and Atlas Copco are looking for opportunities to deploy the tool. "We developed a tool that can be used in high-temperature environments that can help increase the drilling rates and the rate of penetration to maybe five to ten times that of conventional drilling operations, so that's a big plus for [drill operators]," he said. "It adds to the available options [they] have. This is not necessarily the final option for every drilling situation, but it does provide a good option for the right situation."

A critical piece of the project was developing coatings, which help reduce friction between parts, important in geothermal operations. As temperatures increase, the oils essentially cook, creating a sooty mess similar to running your car too long without changing the oil. Working with Sandia's Materials Science and Engineering Center, the team was able to develop a unique multilayer solid lubricant capable of operating at high temperatures.



Technologist Elton Wright assists as Jiann Su inspects a down hole hammer used at the HOT test facility. Photo by Randy Montoya.

New Down Hole Hammer cont'd on page 46.

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Ronnie's Real World



OMG! That is slang in today's world of weird things happening, for OH MY GOD! Here we are about to begin the year 2017. Are you ready? I am beginning to wonder about myself. LOL (That's another slang for Laughing Out Loud.) Go figure - we, shall I call us, elderly? (don't like that word) shall I call us "seniors" (don't like that word either) or shall I call us "mature"? (I like that one!), have to get in gear or this year will be the end of this year before we blink an eye. But thank goodness, those election commercials are all behind us - so there is something good to say about us starting 2017.

Always think positive thoughts - makes your life much happier.

I'm at the office on a Sunday, trying to work through these stacks of trade event folders, and marking the calendar, setting them up for the great **WWD** Team to cover for our drilling industry. We sure do enjoy attending and visiting with everyone - old friends and new friends both. But boy does it take a lot to get us to all of these in just 12 months!

But have no fear - neither snow, nor sleet, nor dead of night will keep us away from this wonderful world of drilling! And you can believe me on this one - this time of year takes these Florida **WWD** Team Members out of the chill down here up into some pretty **COLD** places - i.e., Minnesota and Montana, and even up into Canada!

Why am I doing it today, you ask?

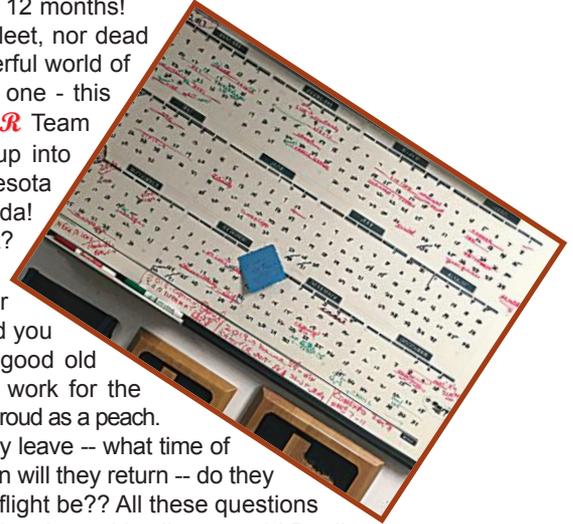
Well you see, the **WWD** Team had to leave for the Groundwater Week festivities in Vegas Tuesday, and you gotta get the work done, or else! Just wish good old

Doc Faison was here to see how hard these folks work for the industry he so loved. He surely would be grinning from ear to ear! Proud as a peach.

Now, let me think -- who should go where -- what day should they leave -- what time of flight -- where will they stay -- is there a shuttle, taxi, or do they need a car -- when will they return -- do they need a shuttle, taxi back, or did they rent a car -- what time should their return flight be?? All these questions have to be asked and answered before you can ever begin to get this all in motion. Love this all too much! Really.

Well, let me get back at it - but when you see us, don't frown because we may look a little bedraggled, just look at our **Solid Gold Smiles** and say - "They surely are everywhere."

And the **WWD** Team surely is - everywhere - for you,
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Where are you planning to go? How about including these shows:

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The 72nd Annual Montana Water Well Drillers (MWWDA) Association Convention and Trade Show will be held February 1-3, at the Radisson Colonial Hotel in Helena, Montana. The event starts Wednesday with an MWWDA-hosted hospitality room. The silent auction opens Thursday after registration. Then, earn continuing education credits (CEUs) by attending the Department of Transportation update and McElhiney Lecture. Also packed into Thursday, is the annual meeting, lunch, and trade show. This is followed by supper and a live auction. Friday's schedule includes more CEU opportunities, Past Presidents meeting, and Board of Directors meeting.



Visit www.mwwda.org



The Mountain States Groundwater Expo is held at the fabulous Aquarius Casino Resort in Laughlin, Nevada. Hosted by the water well and groundwater associations of Arizona, Colorado, Nevada, New Mexico, and Utah, this great event will take place February 9-10.

Registration opens with a continental breakfast on Thursday. Continuing education seminars run all day, followed at 4 p.m. by the exhibitor reception with the Buck Lively Scholarship Auction and Raffle. Friday's lineup includes more education opportunities and chances to view all the products on display in the trade show area.

See more information at www.mountainstatesgroundwater.com



The Virginia Water Well Association 2017 Winter Conference "Back to Basics" is set for February 15-17, at the Double Tree by Hilton - Koger Center in Midlothian/Richmond, Virginia. Concurrent classes for continuing education credits will be held both days, so there's plenty of time to sit in on them all. The trade show grand opening is Wednesday at 10:30 a.m., with the banquet and auction beginning at 6:30 p.m. The general meeting with breakfast is Thursday. Don't forget the annual jam session, which starts at 6:30 p.m. on Thursday.



Conference schedule is available at www.vawaterwellassociation.org



The heart of construction equipment pulses at SaMoTer in Verona, Italy. Dedicated to the construction industry for more than 50 years, it's the 30th International Earth-Moving and Building Machinery Exhibition, to be held February 22-25, at the Veronafiere complex. This edition will have a special focus on protection solutions for the environmental and hydrogeological risks. With special reference to intelligent machines - hybrid low-emission and high-efficiency machines - it's the smart place to be.

Go to www.samoter.it/en to register.

See more events online at www.worldwidedrillingresource.info/Planning2.pdf



Peak Performance Requires Fuel System Maintenance

by Brian Rogers, Geoprobe® Machine Service Specialist

We get calls every week saying, “The engine cranks, but will not start, or will not run well.” The number one cause is improper fuel system maintenance. No matter what kind of drill rig you use, it has at least one, if not two, fuel filters. Changing the filters every 200 hours is recommended, making sure to follow the engine priming instructions (see owner’s manual for engine manufacturer recommendations). **NEVER** prefill a fuel filter for your rig. If you prefill a filter, you’re putting unfiltered fuel on the downstream side of the filter element which will contaminate the fuel injection system - a costly mistake!

Fuel System Maintenance Summary:

- Service the fuel system at recommended intervals or sooner if conditions warrant
- Keep an extra set of fuel filters on hand (in-line and canister)
- Make sure the fuel source is reliable and clean (yellow cans, tender truck, or fuel farm)
- NEVER prefill a fuel filter
- Fill your rig’s fuel tank at the end of each day with clean diesel
- Use fuel additive in the winter even if using winter blend fuel

If you constantly source your fuel from a tender truck, out of portable fuel cans, or similar sources, expect to change your fuel filters more often. The cleanliness of these sources is marginal, at best. In the winter, it’s best to run a fuel additive as well.

If you have a contaminated fuel system, you’ll be changing fuel filters more often, and it’s advisable you keep an extra set of filters for the machine on hand. If you’re working in a remote area, keep a set of filters with the machine. Always fill your rig’s fuel tank at the end of the day. This will negate condensation collection inside the tank due to humidity/temperature swings which will lead to contamination issues.



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Taking Care of Your Generator is Worth the Extra Time

Adapted from Information by Doosan Portable Power

Not only does a well-maintained generator have a better chance at lasting a long time, it also has greater potential for providing the performance and productivity necessary for getting a job done on time and on budget.

Follow these five tips for generator maintenance:

Stick to a maintenance schedule - The best way to keep your generator maintained is to follow the manufacturer guidelines for scheduled maintenance. Recommended generator maintenance intervals typically start at 500 hours of use and focus on filters and fluids, including the engine oil, oil filter, fuel filter, and air filter. These intervals are generally repeated every 500-1000 hours.

Daily, weekly, and monthly generator maintenance should include checking machine components such as fluids, wiring, and hose connections, as well as looking for signs of trouble such as leaks, blocked air inlets, and parts susceptible to wear. A simple two-minute inspection could save one to two hours of downtime to replace a minor part. For example, a frayed or cracked fan drive belt is an opportunity for preventive maintenance instead of waiting for it to fail and cause a machine shutdown.

Adjust to your environment - Maintenance intervals should be scheduled more frequently for generators operating in harsh environments or challenging weather conditions. Dusty environments are particularly demanding on generators. Radiator fins should be checked for dust buildup and cleaned with a pressure washer to ensure optimal airflow through the machine, reducing the risk of overheating.

Ambient temperature also plays a role in proper generator maintenance. When a generator is operating in colder temperatures, a lightweight synthetic oil may be necessary to ensure adequate oil flow to vital engine components. A thicker oil grade may be recommended to provide better engine protection in hot climates.

Understand new Tier 4 maintenance requirements - Aftertreatment systems are now part of the generator maintenance checklist, so it's important to be familiar with those elements and the prescribed service intervals. This includes replacing the crankcase ventilation (CCV) filter at the 2000-hour interval. Tier 4-compliant engines utilizing diesel exhaust fluid (DEF) should also replace the DEF filter at that mark. The exhaust gas recirculation (EGR) system, diesel oxidation catalyst (DOC), or selective catalytic reduction (SCR) system should be inspected and maintained as recommended by the manufacturer.

Maintenance beyond the engine - Periodic inspection of the electrical system can go a long way toward preventing generator damage and downtime. Inspecting all wiring can often head off a major electrical problem with a simple fix such as tightening a loose wire, insulating a rubbing hazard, or bending a wire away from a sharp edge.

The trailer of a mobile generator is another area for maintenance. Check the tire pressure and rotate tires regularly, maintain the braking system, and ensure the trailer lighting is functioning properly. The trailer-to-vehicle lighting connector, tow hitch, and jack stand are often subjected to excessive wear and tear on jobsites and in transport, so they should be replaced as needed to avoid a safety hazard.

Use manufacturer filters and fluids - One of the best ways to ensure performance is to use genuine manufacturer aftermarket parts which have been tested during the development of the machine. Using off-brand filters and fluids introduces unknown variables which could not only affect machine performance, it could also void equipment warranty packages.



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Wilson cont'd from page 26.

Number of 150, which (as stated by anthropologist Robin Dunbar) is the number of stable relationships one person can have; I would've gotten on the Internet when about 25 of my friends had done it first.

Other research, however, says it might have taken fewer people. As reported by scientists at Rensselaer Polytechnic Institute, it only takes 10% of the population to create a shift in opinion. If those 10% hold an "unshakable belief," it will always be adopted by the majority of society.

"When the number of committed opinion holders is below 10%, there is no visible progress in the spread of ideas," said Professor Boleslaw Szymanski, director of the Social Cognitive Networks Academic Research Center at Rensselaer. "Once that number grows above 10%, the idea spreads like flame." As an example, Szymanski references the Arab Spring in Tunisia

and Egypt, "In those countries, dictators who were in power for decades were suddenly overthrown in just a few weeks."

As a rule, people do not like holding unpopular opinions. They feel more comfortable belonging to the majority. This is probably a throwback to our caveman days when acceptance by the clan or tribe meant the difference between surviving or not.

As few as two people can change the opinion of a third person. Sameet Sreenivasan, another researcher at Rensselaer, found if a test subject heard an opinion or belief from one person, he or she would not accept it, but if it was heard from two people, the subject would adopt it as his or her own.

Malcolm Gladwell, author of *The Tipping Point* says, "The tipping point is that magic moment when an idea, trend, or social behavior crosses a threshold, tips, and spreads like wildfire." He compares it to how a single sick person can start a disease epidemic like the flu.

A good example is the American Revolution which was far from a majority. At most, one-third of the colonists supported the revolution, but it was actually fewer than that. Only 3% actively fought the British; 10% provided material support to the soldiers; and another 20% preferred the revolutionaries, but did nothing to sustain them. At the same time, one-third of the colonists supported the crown; while another third were indifferent to either side. By the end of the war there were actually more American colonists fighting for the crown than for the revolution. And yet, the rebels succeeded.

The world is a marketplace of ideas, opinions, and beliefs. When the next new trend comes around, will you be an early adopter or will you wait for consensus? Perhaps it will be your idea that will spread like wildfire - so be careful with your next social media post - it may go viral!

Robert

Robert is an author, humorist, and innovation consultant. He works with companies that want to be more competitive and with people who want to think like innovators.

For more information on Robert, visit

www.jumpstartyourmeeting.com or contact him via e-mail to michele@worldwidedrillingresource.com



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Proximity Detection Systems Require Attention

Adapted from Information by the Mine Safety and Health Administration

The Mine Safety and Health Administration (MSHA) has required proximity detection systems (PDS) for continuous mining machines since March 2015. These systems use electronic sensors on both mining machines and miners to detect motion or the location of one object relative to another. The goal is to prevent miners from being struck or pinned by the equipment, by shutting down if a miner is too close.

These systems only prevent death and injury if they are properly installed and maintained. Last year, a scoop equipped with a PDS was tramming through a line curtain toward a miner located on the opposite side. The miner was wearing a miner wearable component (MWC) and was on his knees, the scoop bucket was in the raised position above the miner, who was able to roll out of the way without being contacted. The scoop operator heard the miner and stopped the scoop. The miner received a broken leg and was immediately transported to the hospital for treatment.

MSHA traveled to another mine where a similar PDS was installed on a continuous mining machine and observed the PDS was operating erratically. Shutdown zones were found to be set too close to the machine. The machine-mounted components would only indicate a warning zone infraction when the MWC was properly indicating it was within the shutdown zone. This allowed the machine to move.

In both of these instances, MSHA found the warning and shutdown zones were not set properly and preoperational checks of the PDS were not being conducted in the manner recommended by the manufacturer.

To prevent accidents, MSHA suggests following these best practices:

- Ensure PDS systems are installed and maintained in proper operating condition by a trained person.
- Conduct preoperational checks by following procedures provided by the PDS manufacturer.
- PDS software is updated periodically by manufacturers, make sure these updates are installed regularly.
- Verify the warning and shutdown zones are set as recommended by the manufacturer and according to company policy to stop the machine before a miner is contacted.
- Ensure both the MWC and the machine-mounted components indicate corresponding warning and shutdown zone status.
- MWCs should be checked for physical damage before use. Check for housing cracks or joint separation; broken charging ports or corrosion on the charging terminals; torn gaskets, seals, or membranes on the buttons; cracked or missing windows; broken or inoperable LEDs.

The system must include audible and visual warnings and cause machines to stop before contacting a miner. Additionally, operators must check the systems before they are used; records of the checks and any corrective actions are also required.



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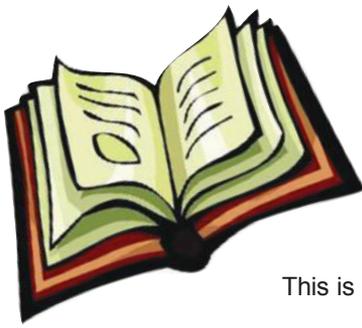


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Lessons to be Learned

Reprinted with permission - Mark Finch, District 1
Missouri Water Well Association, Inc.

Winter 2015 Edition

Veronica I. "Ronnie" Jones

Managing Publisher, *WorldWide Drilling Resource*®

This is a short story I had the pleasure of reading and found it quite on target and worth sharing.
Please indulge me.

"Well, the year is winding down and we're finishing up projects. The shop is filling up with equipment in need of repairs. That usually eats up most of the winter for us. All in all, it's been a good year work wise and hopefully, next year is no different.

I have two daughters enrolled at MU. The other day, the oldest got a lesson in business that she probably won't get at school. Her car was low on oil from a leak, she had just noticed. She called Jiffy Lube and the manger drove a short distance and put oil in her car. Then she drove to Jiffy Lube; they fixed the problem and wouldn't charge her for fixing it. The manager told her, he needs more business and would appreciate hers in the future. He'll get more advertising for the money it cost him, than if he paid for an ad in the paper! That kind of treatment is refreshing in this day and age.

Dear Madams and Sirs,

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Hereby, to thank you so much for this kind gift! . . .

I wish you a great day!

Serena Bini

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In contrast, I recently ordered parts from a rig manufacturer to the tune of \$7,000. The freight was \$175, which I paid, and two weeks later they called and said the freight cost them \$32 more than they had figured. On a \$7,200 purchase, they billed me for the \$32 dollars! I would be embarrassed to do that to a customer.

But it taught my girls something that they won't learn in business classes. And a simple gesture made someone smile.

Thanks for your time and make someone smile today."

This made me smile as it did Mark; and doesn't this sound just like you during the wintertime?

So now let's enjoy the rest of the year.

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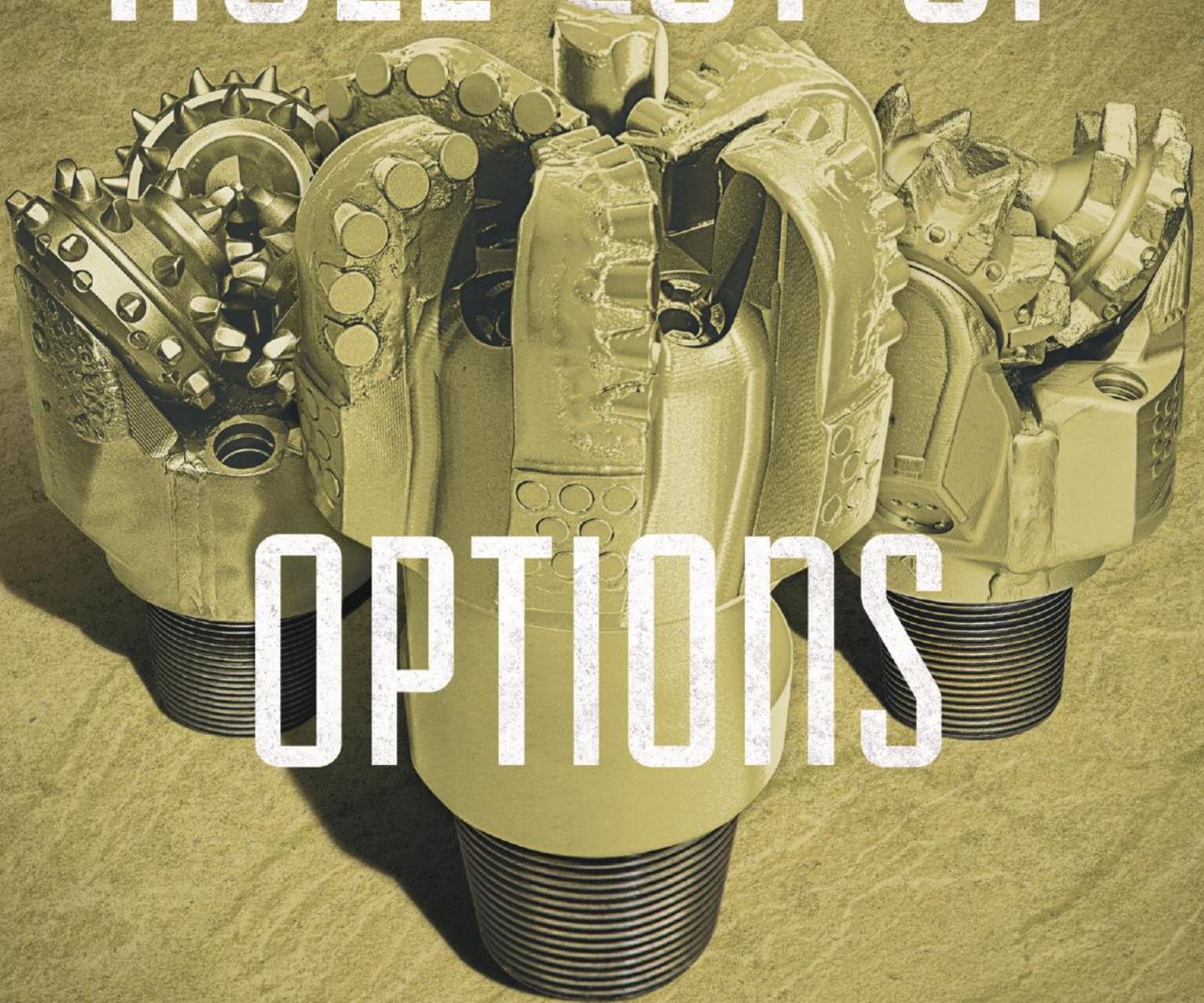
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Oil/Water Exploration

by Harold White



I like to write something of special interest to everyone, but this month has been uneventful - drilling in the rain, mud, water - stuck and wet. Tuajuana, the dog, and I are in the Springfield, Oregon, park near the bridge over the Willamette River. I took the dog for a walk along the river and he went swimming, then we walked around the park. Now we are all sitting in the car under the bridge, watching the river flow by, many thousands of gallons per minute to the ocean.

I was just told by a guy we drilled a well for, of the many rules our state has to try to save the water in the reserve. He was complaining about having to drill a well on every lot of his property he wants to sell.

He wanted to put up a holding tank and pump water to and from it, and with one good water well, the problem would be over. It should be, but he was told every lot has to be self-sufficient, meaning having its own well and septic system. This is causing more wells to be drilled, and the cost will raise the price of the property, so someone will pay taxes according to the cost of the property for many years to come.

The amount of water being used is not going to change if the next wells produce a good supply of water. The river is still running by. It is beautiful and a huge waste, and rules and regulations will not be able to stop it. The underground creeks and rivers are doing the same. If you don't use it, you lose it. Our wells are not in a lake or reserve. They are in a creek or river.

Water is said to move three to eight feet per year. It is a saturation speed. There are watershed systems underground the same as aboveground. You can sense it or see it underground, and I have taught people to do this.

*The statements and comments in this article are based on information and references believed to be true and factual. If you have any questions or comments, please forward them to me in care of **WWR**.*

Harold

Harold White may be contacted via e-mail to michele@worldwidedrillingresource.com

Will Geothermal Energy cont'd from page 21.

Alberta Innovates, via its subsidiary C-FER Technologies, also has a current research team looking into enhanced geothermal systems. These high-level agencies are expected to help lead the way to increased use of geothermal energy in Alberta.

In the past, Alberta engineers and scientists were very successful in developing technologies capable of extracting heavy oil from shallow depth formations and bitumen from near-surface sandstone. These techniques, including SAG-D, steam injection, and

oil sands mining have been exported and applied in many parts of the world. The new opportunity facing creative scientific minds is to find ways to exploit geothermal brine waters for heat and power extraction. Many of the standards and designs used in high-temperature, steam-assisted hydrocarbon extraction can also be used in geothermal water wells. Based on past experience in the unconventional oil and gas business, Alberta could become a leader, not a follower, in developing ways to harness the geothermal resource under its feet.

What seems to be missing is a government-sponsored pilot project or a commercial venture generating electricity and exploiting geothermal heat in western Canada. Several companies, including Borealis GeoPower and Raven Thermal Services, are developing small commercial projects. Several communities are also looking at geothermal resources to provide space heating and energy for new industries in their jurisdictions.

Are we on the cusp of recognizing and developing geothermal resources Alberta? Many indicators point to a definite Yes.

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JANNA IOM

U.S. Begins Exporting Ethane

Adapted from Information by the U.S. Energy Information Administration

Increased production of ethane in the United States has led to increased ethane exports, first by pipeline to Canada and more recently by tanker to overseas destinations.

The first U.S. ethane export terminal, located in Marcus Hook, Pennsylvania, has an export capacity of 35,000 barrels per day (b/d) and began shipping ethane cargos in March 2016. The second U.S. ethane export terminal, opened by Enterprise Products Partners in Morgan's Point, Texas, recently sent its first shipment to Norway. This 200,000 b/d-capacity facility, located on the Houston Ship Channel, is the first ethane terminal in the Gulf Coast region.

Ethane is typically extracted from unprocessed natural gas, along with other natural gas plant liquids (NGPL). Unlike heavier natural gas plant liquids such as propane, butanes, and natural gasoline, significant amounts of ethane can be left in natural gas transported on pipelines to natural gas customers, a practice known as ethane rejection. The relative tendency to either reject or recover ethane depends on prices and demand, as well as the ability of facilities to remove ethane from raw natural gas.

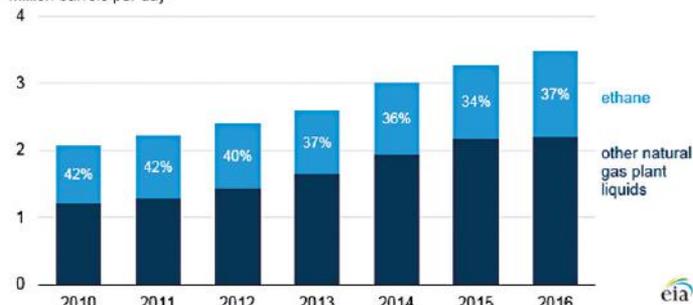
Since ethane has a higher heat content than methane, higher heat content of a natural gas stream often indicates ethane is being rejected, or left in the natural gas sold to natural gas users. EIA (Energy Information Administration) has collected monthly data on natural gas heat content by state since 2013. The heat content of

natural gas in states that receive shale gas produced from the Marcellus and Utica Formations, such as Ohio, Maryland, Delaware, and Pennsylvania, has been consistently reported at or above national average levels. Ohio, in particular, receives a higher portion of its natural gas from the Marcellus and Utica Formations. However, since early 2016, the natural gas heat content in these states has trended downward, indicating producers have increasingly been extracting ethane. The lower heat content has coincided with the start of ethane exports out of Marcus Hook, which sources all of its ethane from the Marcellus and Utica Formations.

From 2010 to 2015, the ethane share of total NGPL production dropped from 42% to 34%. Although other natural gas plant liquids have found ready markets close to key shale plays, such as the Marcellus and Utica Formations, the lack of pipelines and local markets for ethane in these areas has limited ethane recovery.

With more export capability and growth in domestic petrochemical demand, more ethane is expected to be recovered and brought to market.

Production of ethane and other natural gas plant liquids (2010-16)
million barrels per day

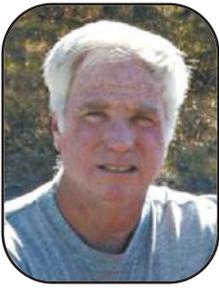


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Microprocessors are Really Simple

by Britt Storkson
Owner, P2FlowLLC

Even though the word “microprocessor” conjures up images of computer nerds working their magic in some darkened room somewhere, microprocessors, when one gets down to the basic operation, are very simple products. They use electricity (electrical voltages) to make decisions. All microprocessors do two things: detect and measure voltages. It’s all they do. Silicon, the material most microprocessors are made of, has the unique property of being able to retain (remember) voltage levels. Most microprocessors are able to detect and measure two different types of voltage levels: digital and analog voltages.

With digital voltages, a voltage greater than about 2.4 volts is defined as a “logic 1”. A voltage less than about 0.8 volts is defined as a “logic 0”. These voltage values are not tested or guaranteed by the manufacturer and they don’t have to be. All we’re concerned about with digital voltages is the voltage is above or below a certain point.

Analog voltages are variable voltages. These are measured just like the voltage on a battery, using a voltmeter. These voltages can be compared to another “reference” voltage to determine if one voltage is greater than another, or they can be converted into a digital “word” and used as data information.

Digital voltages can be compared to walking into a room and turning the light on. The light is either on or off. There is no in-between value. Analog voltages can be compared to the sun rising and setting. The sun has a variable “brightness value” depending on whether it is midday, morning, or evening. The sun is typically brighter midday, and its brightness varies depending on the time of day and other factors like cloud cover - just like voltages which are higher, lower, or in-between.

All microprocessors work exactly the same way. Microprocessors have a CPU (central processing unit) which executes instructions stored in a memory. The instructions are arithmetic operations, such as adding or subtracting two values (numbers); logical operations, such as comparing two values to see if they are equal; or test operations to see if a certain point has voltage present (logic 1) or voltage absent (logic 0).

What these instructions do and how many instructions are provided is defined by whoever makes the microprocessor. I use a Microchip brand microprocessor which makes many different microprocessor models. The model I use has 75 different instructions. Other microprocessor brands or models offer greater or fewer instructions, but they all do basically the same thing.

The instructions are very simple, yet execute very quickly. We’re talking about microseconds (millionths of a second), typically. What the instruction lacks in sophistication it makes up for in speed. A microprocessor costing less than \$1 can execute thousands of instructions per second. Today’s microprocessors also require very little power to do all of this, making them suitable for battery operation.

Microprocessor instructions listed in the correct order make what is called a computer program. A simple program would be to make a thermostat where the output turns on when measured temperature goes below a certain point and turns off when it goes above a certain point. To do this, one measures the voltage output from the temperature sensor and converts it to a digital value. Then we use instructions to determine if the measured temperature value is above or below a value we compare it to. If we want to maintain the temperature within a certain “window”, we turn off a heater if it goes above our “high level off” value and turn it on if it goes below the “low level on” value. For this application there’s usually a “deadband” in between where the microprocessor doesn’t do anything. The microprocessor doesn’t stop working, it just waits until the right moment to

respond. This is done for stability. An output switching off and on rapidly is something we don’t want. We want the heater (or anything else we control) to switch on or off in a controlled manner.

Microprocessors are simple and inexpensive, yet powerful and reliable. They are used almost everywhere, in thousands of applications. There’s a good reason microprocessors are so popular: Because they offer so much for so little. Almost everything we do is monitored and/or controlled by a microprocessor - and it’s a good thing.

Britt

Britt Storkson may be contacted via e-mail to michele@worldwidedrillingresource.com

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Frequently-Used Geological Terms Part 57

Glossary Adapted from the Dictionary of Geological Terms

O



Obsidian sample photo courtesy of the U.S. Geological Survey.

Octahedral Cleavage - Mineral cleavage parallel to the faces of the octahedron as in fluorite.

Octahedron - A crystal form consisting of eight triangular faces each having equal intercepts on all three crystallographic axes.

Oil Pool - A subsurface accumulation of petroleum which will yield crude oil in economic quantities. The oil occurs in the pores of the rock.

Oil Sand - Term applied to any porous stratum containing petroleum or impregnated with hydrocarbons; specifically a sandstone or unconsolidated sand.

Oil Shale - A kerogen-bearing, finely laminated brown or black sedimentary rock which will yield liquid or gaseous hydrocarbons when distilled.

Oil Trap - Any barrier to the upward movement of oil or gas, allowing either or both to accumulate. A trap includes a reservoir rock and an impermeable roof rock.

Oil Red Sandstone - A thick sequence of nonmarine, predominantly red sedimentary rocks (primarily sandstones, conglomerates, and shales) which represent the Devonian System in parts of Great Britain and elsewhere in Europe.

Oligoclase - A mineral of the plagioclase feldspar group. It is common in igneous rocks of intermediate to high silica content.

Olivine - A green or brown orthorhombic mineral. It is a common rock-forming mineral of basic, ultra basic, and low silica igneous rocks such as gabbro, basalt, peridotite, and dunite. It crystallizes early from a magma, weathers readily at the earth's surface, and changes into serpentine.

Look for more terms next month!



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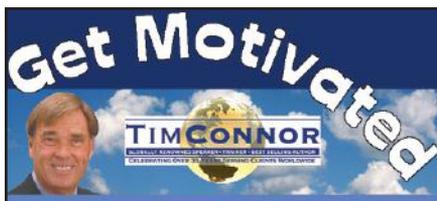


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Environmental Monitoring

by Thomas Kwader, Ph.D., P.G.



How Deep Should a Pump be Set?

My wife and I are currently on our annual fall trip to the Smoky Mountains. I can't help but notice a lot of pump trucks on the highway, and often after dark. It is an unusually dry fall and I suspect the groundwater levels are dropping and many wells are going dry.

The first sign of a well starting to go dry is when the pump is running for extended periods of time and air bubbles are appearing in the water. During droughts (extended periods of low rainfalls or lack of snow melt), groundwater levels may also drop due to low recharge from a lack of saturated ground and/or an increase in groundwater usage in the area. Also, new larger capacity wells or a new neighbor's well could affect an existing well's ability to supply water. Each well develops a cone of depression which can extend for hundreds of feet or yards, depending upon: the amount of water pumped per day; gallons per minute pumped; and the transmissivity of the aquifer (ability of the aquifer to transmit water both laterally and vertically). Also, if a well loses its ability to produce water (a plugged screen) or encrustation of the wellbore, the well will drawdown to lower depths when the pump is running.

If a well starts to pump air, one solution would be to lower the pump intake to a lower depth in the well. This can usually be performed with a pump truck fitted with a mast and spool of cable. In our area (North Florida), most wells are four inches in diameter and have nominal four-inch submersible pumps. The drop pipes are 21 feet in length. Usually, lowering the pump one joint (21 feet) is sufficient to take care of the problem. If the pump is already near the bottom, it may be necessary to deepen the well or redevelop the well to improve the efficiency of the well.

Another solution would be to reduce or lower the flow rate with a valve at the top of the well. Reducing the flow could help the pump keep up with the demand. However, the pump will need to run longer to supply the water needed.

Tom

Tom Kwader may be contacted via e-mail to michele@worldwidedrillingresource.com

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Drilling Into Money Not Boring

by Mark E. Battersby

Repair or Capitalize 2016 Style

Once again, every drilling business owner/operator faces the nagging question of when is a repair a capital expenditure. Properly classifying repair, maintenance, and improvement expenses is important because improvements to business property must usually be depreciated over many years - as many as 39 years for some business property. On the other hand, no matter how much they cost, repairs to business property are currently deductible in a single year.

If, for example, a company spends \$1000 to repair a business vehicle, it can deduct the entire amount in one year. However, if the \$1000 amount is to improve the vehicle, it must be deducted a little at a time over five years. Obviously, it is preferable for an expenditure to be classified as a repair rather than an improvement, so the entire amount can be deducted in one year.

Unfortunately, distinguishing between a repair and an improvement has not always been easy, even after the sweeping "final" guidelines governing the deductibility of repairs and improvements to business property went into effect on January 1, 2014. Recent changes to those repair regulations haven't helped.

The latest versions of the repair regulations are long and complex, and contain few clear "bright-line rules" which might explain exactly how much an asset must be altered to constitute an improvement. Instead, all of the "facts and circumstances" must be reviewed before making a judgment call. However, in their final revised form, the regulations do provide several benefits specially designed for small businesses. For example, under the new regulations:

- ➔ Items costing \$200 or less are considered supplies, and are currently deductible in a single year.
- ➔ There is a special "de minimis safe harbor" allowing businesses to immediately write off items costing \$500 or less. (Businesses with certified financial statements can write off items costing up to \$5000).
- ➔ Costs for "routine maintenance" are currently deductible.
- ➔ Business owners can deduct the unrecovered basis (cost) of business property replaced when performing improvements - for example, the unrecovered cost of an old roof can be deducted when a new roof is installed.

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The "Final" tangible property regulations were issued to provide guidance for every drilling business when distinguishing between a currently deductible repair and a capitalized expenditure. Obviously, professional guidance may be necessary to ensure repairs will remain repairs in the eyes of the ever-vigilant Internal Revenue Service.

Mark

Mark E. Battersby may be contacted via e-mail to michele@worldwidedrillingresource.com

March Issue Deadlines!

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January 25th

Display & Classified Ad Copy:

February 1st

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New Down Hole Hammer cont'd from page 29.

The project began by determining whether a high-temperature hammer was even possible. The Sandia team initially tested materials and coating combinations capable of surviving the expected environments, while Atlas Copco designed a

hammer without plastic parts.

The hammers proved successful. "We were able to reach our drilling rates, the materials held up, the coatings worked well," Su said. Sandia's new high operating temperature (HOT) facility was designed to test hammers under real-world operating conditions, including temperatures up to 572°F (300°C). Conventional drilling generally sees temperatures of less than 320°F (160°C). The facility, a three-sided open concrete structure, houses a 20-foot-tall drill rig, heating chamber, and process gas heater. Researchers are able to simulate conditions deep underground and the elevated temperatures affecting the hammer, and can drill into different types of rock, like the granite commonly found in geothermal-rich areas.

HOT was a large project itself. "We took a little more time in the development process, but when we put it all together, everything worked pretty much as we expected it to," Su said. The work required integrating multiple subsystems, including electrical, mechanical, pneumatic, and control systems. Sandia also worked with Atlas Copco on what instrumentation was required to collect the necessary data. The facility is also being used for other activities, such as developing drilling automation.

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Can you identify which ads in this issue these two photos came from?



A Priceless Gift for OSU

Compiled by Editorial Staff of
WorldWide Drilling Resource[®]

The Oregon Department of Geology and Mineral Industries (DOGAMI) was established in 1937. Since then, it has evolved from its early focus on mining into a critical source of information to help residents prepare for natural hazards such as earthquakes, tsunamis, landslides, and coastal erosion, in addition to regulating surface mining, and exploration for gas, oil, and geothermal resources.

Since 1972, Oregon mine regulations have required drill operators to submit well records including core cuttings. These materials are kept confidential for four years if they originate from oil and gas wells, and five years if they come from geothermal wells. As a result of these regulations, the state's core sample collection has grown steadily.

When DOGAMI made budget cuts they began looking for a new home for Oregon's expanding core collection. In the process, scientists with the agency took a decisive step to preserve geologic records for generations to come by donating nearly 20 pallets of rock and sediment from decades of mining and drilling throughout the state. Oregon State University (OSU) was the recipient of this rare gift.

The OSU Marine Geology Repository in Corvallis is funded by the National Science Foundation, and houses approximately 6000 cores. Historically, most of the library's samples have come from oceans and lakes. In fact, the lab contains core samples from every ocean on the planet. For scientists seeking answers to questions about the earth and its environment, the university core warehouse is a hotspot for learning. The lab has samples dating back to the 1960s still being requested for study. In a good year, researchers check out as many as 15,000 samples from OSU.

The cost to produce a core sample ranges from hundreds to millions of dollars, depending on the depth and setting of the drilled hole. The wealth of knowledge to be derived from these samples is priceless. Thanks in part to the generous donation from DOGAMI, the core laboratory at OSU now has well over 53,000 feet of core in-house, ready for a closer look.

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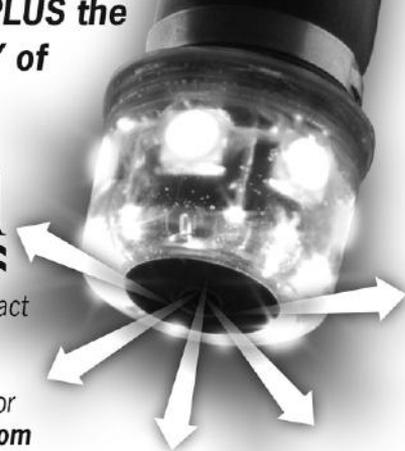
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Coal Production Drops to Levels Not Seen Since 1980s

Adapted from Information by the U.S. Energy Information Administration

According to recent U.S. Energy Information Administration data, coal production in the first three months of 2016 was 173 million short tons (MMst), the lowest quarterly level in the country since a major coal strike in the second quarter of 1981.

U.S. quarterly coal production (Q1 1978 - Q1 2016)
million short tons (MMst)



Production from the Powder River Basin (PRB) in Montana and Wyoming declined the most in tonnage and percentage.

Market conditions for coal production have been very poor due to increasing environmental regulations and the country's shift to renewable energy production. Although electricity generation accounts for more than 90% of domestic coal use, the recent natural gas boon has made natural gas-fired electricity generation more affordable, causing more competition for the industry.

The 17% decrease in coal production from the previous quarter marked the largest quarter-over-quarter downturn since the fourth quarter of 1984.

Another factor for decreased production was the unusually warm winter of 2015-16, which caused power plants to stockpile 34 MMst of unused coal, the highest fourth-quarter net increase on record. This ultimately resulted in lower coal orders for the first quarter of 2016, while plants merely consumed coal from their stockpiles.

Information from the American Association of Railroads reinforced the data by indicating coal carloads in the first three months of 2016 were about 20% lower than in the final three months of 2015.

Production from PRB witnessed the largest decrease with production of 69 MMst, which was its lowest level since the second quarter of 1995.

Coal demand has decreased across the nation. States such as Texas, Michigan, Illinois, and Oklahoma, accounted for an average quarterly demand of 37 MMst of PRB coal in 2015, which fell to 19 MMst in the first quarter of 2016.



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Sunday: Exhibitor Set-up, MWWA Board of Directors Meeting, and MWWA Hospitality.

Monday: Classes and McElhiney Lecture, Trade Show, Ladies Program, Awards, Banquet, and Casino Night.

Tuesday: Speakers and Classes, Annual Meeting, Past Presidents Meeting, Final Board Meeting, and Plumbing Class (Pt. 1).

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Friday, February 10

- 8 - 9 am** Continuing education seminars
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The "Idiots" Corner

by "Billy Bob Smith"

Do you know the number one contributor to death? I'll give you a hint - you deal with it every day and so does everyone else. Think you have it? Okay, read on.

Winning the lottery causes stress. Filing bankruptcy causes stress.

Getting married causes stress. Filing for divorce causes stress.

Going on vacation causes stress. Going to work causes stress.

Got it? Everything in life is a stressor, but here's the problem - some people are letting it kill them. Are you one of them?

Look friends, we are all going to die one day, but do we have to do it before our time here is not really over? Why are so many people letting this life circumstance kill them? 'Cause they're idiots, that's why.

I just had open heart surgery and, as I spent three weeks in rehab, I watched many of the other patients whining, complaining, and working themselves into a twit about trivial stuff. "The nurse took too long to get to my room." "The food is cold." "The people here are not very friendly." Trust me, all day every day I heard nothing but complaints - and these people are still alive.

Let me leave you with a simple concept. You were born. One day you are going to die. Believe me, everything in between is trivial. Why not start out the new year this time with a different mind-set? This year, you are not going to be an idiot, but you are going to live a little bit smarter with a little less impatience, and you are going to enjoy the time you have been given.

Happy New Year!

Billy Bob

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by Tim Rasmussen

One of the challenges Water For Life (WFL) faces is the dwindling number of cable tool drill operators. There are a limited number of men with experience in this technology and very few ways for interested persons to get experience in the technology. This is probably because cable tool drilling is a technology which has been overtaken and passed by modern hydraulic and digital technology.

We utilize cable tool drills because we can fix things that break and wear out with a welder and basic tools, and the more obvious reason is, it is all we have. We now have three 22-W drilling rigs in service in Guatemala. These rigs have been upgraded to diesel power, so they are not very expensive to run, and diesel fuel is more available than gasoline. If necessary, we have a fuel trailer we can fill and take to the field to refuel a drilling rig once it is set up.

Water For Life has a loyal cadre of men who have experience in cable drilling and are willing to donate some time to come and help the villagers in our area. WFL would not exist without them. Sometimes a drill operator or other volunteer comes and, for one reason or other, does not like or fit in with what is going on, they do not come back; but generally, if someone is willing to come and try it, they like it. We give operators room and board, tools, and a village to work in. They do the rest.

One of the ways of solving the problem would be to step up to rotary drilling. WFL wants to upgrade to a rotary drill. There are villages too far away for us to logistically handle supporting the rig for the two to three weeks it takes for a cable tool to drill the necessary depth. With a small rotary drill, we could go to a remote area and have the hole in the ground within two or three days. This is what we would like to do if we could.

WFL has 90 wells in operation at this time. We add about 12 per year. We would like to find someone who is willing to help us obtain or make a medium trailer-mounted air rotary drill. We do not have the funds to do it now, but are hoping someone will help us make this quantum leap forward in our ability to provide more water to the folks in these rural villages. If the Good Lord has placed it in your heart to help people, we have a good way you can do it. Come and join WFL in this good work. If you cannot come yourself, please help us by donating money or equipment.

If you would like to help, contact Gary Bartholomew at 509-466-5075 or 509-939-1941

Tim

Tim Rasmussen may be contacted via e-mail to michele@worldwidedrillingresource.com

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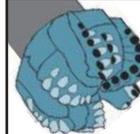
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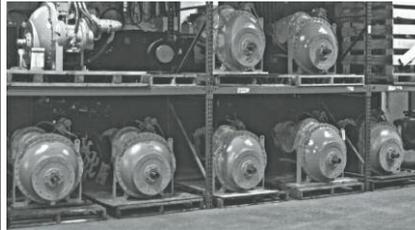
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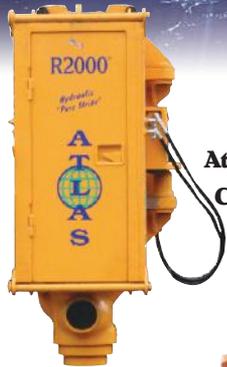
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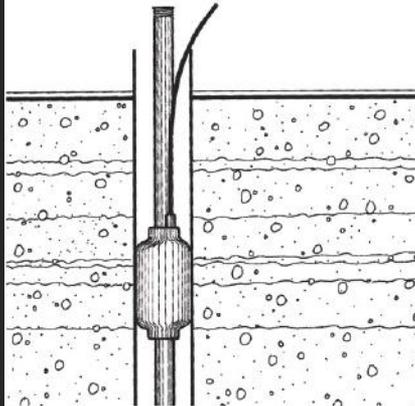
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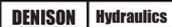
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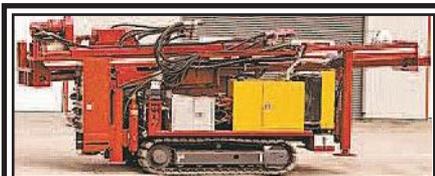
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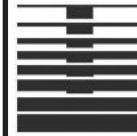
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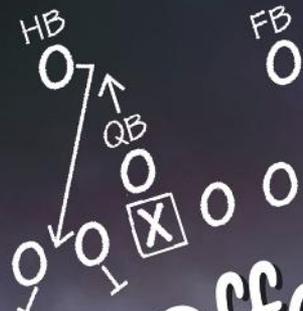
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