

DEEP HOLE DRILLER

AN ATLAS COPCO PUBLICATION FOR THE DRILLING PROFESSIONAL — NO. 2 / 2011

Nature's building blocks



Bit of good sense for geothermal drilling

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Atlas Copco

EDITORIAL



The forecast for deep-hole drilling is strong despite low gas prices and increased environmental regulation. I am happy to participate in the development of new cutting edge technology that helps drillers meet these challenges with faster and more cost-effective ways to go deep for resources.

I am especially proud of Atlas Copco's partnership with Sandia National Laboratories. Together, we have earned a \$3.4 million, three-year research and development project for the U.S. Department of Energy. The goal of the research is to design a down-the-hole hammer capable of low-cost, high production drilling in the high temperatures of deep geothermal wells.

This U.S. Dept. of Energy project will directly benefit the DTH drilling industry, especially in deep-hole applications. You'll also read in this issue about the technological successes of our new EDGE drill monitoring system. EDGE has been saving one company tens of thousands of dollars each month in bits.

Economic recovery has been slow in coming for drillers, but these technological advancements keep the future bright for deep-hole drilling. Whether it's going deep for geothermal or oil and gas, maybe you'll see a new opportunity for you.

Ron Boyd
Atlas Copco Secoroc LLC
Project Manager, Oil & Gas and Edge

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Atlas Copco



More than a gas

Carbon dioxide is the gas form of dry ice. The solid dry ice is created when carbon dioxide is cooled under high pressure, forming a liquid. It is then allowed to expand under reduced pressure to produce "snow." The snow is compressed into dry ice blocks, slices or pellets as the end product. The temperature of dry ice is -109 degrees Fahrenheit.

Dry ice isn't carbon dioxide's only use. Although it has been known as a coolant and for its uses in the oil and gas industry for years, new developments include using CO₂ in agriculture. Reliant Exploration & Production has customers who pipe CO₂ into greenhouses to speed up growth. Plants grow three to four times faster in a controlled environment fortified with CO₂.

Nature's building blocks

From fracking to carbonated beverages, drilling company finds markets for CO₂ »

(on magazine cover) Three generations of Vanderburgs are onsite to help rig up the new RD20. Freddie is on right with his son Vance in the middle and his son Dalton on the left. Freddie's other son Scott had to spend the day in the office.

» **W**hen carbon dioxide (CO₂) reserves were found in New Mexico's north-east corner in the 1940s, the market for the gas was uncertain. Today CO₂ is sought after because of its use in everything from refrigerated food shipments to manufacturing to enhanced oil recovery (EOR).

Reliant Exploration & Production, a division of Reliant Holdings, Ltd. out of Midland, Texas, is one of the companies developing the Bravo Dome formation near Bueyeros, New Mexico. Reliant's new Atlas Copco RD20 is the perfect drill rig, offering mobility and performance to reach the gas formation.

Breaking from his family's business in the mid-1970s, Freddie Vanderburg, currently chairman of the board for Reliant and an animal science graduate from Oklahoma

State University, went into cattle ranching. Vanderburg is the grandson of the late J.O. Vance, known in western Texas as a conventional oil rig manufacturer under the OIME brand.

When EOR technology using CO₂ became better defined, Vanderburg followed his roots and got back into the petroleum business. Although he still runs cattle, Vanderburg likes the possibilities of a business based on drilling rather than on livestock, which are vulnerable to the Texas climate. "It can be dry out here with a drought year about one in every seven years."

CO₂ was initially found here in wells as shallow as 600 to 800 feet (182 to 244 meters). Today the Bravo Dome gas is found at depths between 1,900 and 2,950 feet (579 to 900 meters) from surface in the Tubb





(top) The site layout includes both mud and air drilling options. Shown here the mud boxes are between the compressor trailer and pits.

(above) CO₂ is stored in large insulated tanks to keep it in a gaseous form.

(previous page) Chairman of the board Freddie Vanderburg takes close interest as Atlas Copco Regional Manager Derek Anderson goes through the operation of the RD20 Drill Rig.

Sandstone formation. Vanderburg said the gas zone is about 80 feet thick. The gas is trapped in the formation by a salt seal 30 to 40 feet (9 to 12 meters) thick. He said experts attribute the gas

to previous volcanic activity and believe the Bravo Dome may be a regenerating field, at least to some extent.

Reliant leases the center of the formation where the gas is found at around 2,300 feet (700 meters) below surface. The area covers about 34 square miles (55 kilometers).

Supporting the oil and gas industry

Reliant Holdings operates many businesses that revolve around the production of CO₂. Its petroleum transfer business operates under the name FloCO₂, and the food business operates under the name Reliant Gases. FloCO₂ supplies CO₂ to the oil and gas industry for EOR including well stimulation and fracking as well as pressure control treatment.

To get the gas to market, a pipeline runs from multiple locations in the west, including the Bravo Dome, to the Permian Basin CO₂ hub in Denver City north of Odessa. Today the oil fields of western Texas are using CO₂ to boost production because the price of crude is so high that maximizing recovery pays off.

CO₂ makes good sense for fracking enhancement, said Vanderburg. “For opening up a well, CO₂ offers many benefits.” The best new opportunity is the reduced amount of water necessary. “With CO₂ 70 percent less water is used versus a conventional frack,” Vanderburg said.

He also added that no swabbing unit is needed and the caustic nature of CO₂ assists in some formations by etching the formation. This eliminates the need for additional acids. Also, it’s cleaner because it reduces the risk of swelling clay formations. The fact that there is less waste water to dispose of means there is a reduction of contamination risk and a cost savings.

Vanderburg said recent research has found CO₂ to be important in the development of new fuels. For example, off-shore oil is the result of decayed biomass, specifically algae. Because algae eats CO₂, scientists have taken this knowledge to make synthetic oil from algae, without the millions of years it takes naturally.

Food grade

The Bravo Dome gas is a good resource for the food industry because of its purity. “The gas here is nearly perfect at 99.99 percent pure,” said Vanderburg. CO₂ can »

“There’s a good chance that if you got a Coke at a convenience store today, it was carbonated by us.”

Freddie Vanderburg
Chairman, Reliant Exploration & Production



(above) After the first well, driller Josh Wheeler III was comfortable at the controls.

(left) Threaded fiberglass casing is necessary because steel would rust away in just a few years.



» be stripped from other processes including ethanol production and other gas formations, but pure CO₂ is extremely rare.

Dry ice is often used for transporting food. Reliant Gases, a Reliant Holdings company, supplies food industry giants such as Cargill and Tyson with dry ice. It also supports convenience stores that serve carbonated fountain beverages.

“We supply retail stores with 250 gallon tanks and drive route trucks to fill the tanks. There’s a good chance that if you got a Coke at a convenience store today, it was carbonated by us,” said Vanderburg.

CO₂ is transported in a liquid form by decreasing its temperature to between -53 and -20 degrees Fahrenheit (-47 and -29 degrees Celsius). It takes 17,000 standard cubic feet (scf) of CO₂ gas to make 1 ton of liquid CO₂ and 2.8 tons of liquid CO₂ to make 1 ton of dry ice.

Vanderburg said, “Some wells can produce a million scf a day, but 500,000 scf is more common.” He added that wells can have a long life. For instance, some have been producing since the 1970s.

RD20 advantage

Vanderburg bought his RD20 as a low-hour used rig in good condition, but having a common rig with available parts was

an important benefit when selecting it. Atlas Copco salesman Derek Anderson said it best: “The oil patch is a tough place. Things break.”

Vanderburg had looked for a hardy rig. “You can’t just get parts down the street out here, so I needed a good package,” he said.

“We purchased the rig with 7,700 hours in good shape. It needed some work on the table area and main valve, otherwise that’s it.” They took just over six months rigging up the necessary equipment and adding catwalks and a dog house.

“I like the safety factor with this rig,” said Vanderburg, comparing the RD20 to conventional drills used in the region. “We don’t have people slinging chains or climbing up the derrick.”

The rig has also been a quick learn for the crew. Driller Josh Wheeler III said getting up to speed was “no more than grabbing the handles and watching the gauges—8,000 pounds on a conventional rig’s string is the same as 8,000 pounds of pull-down on an RD20.” He also compared the RD20’s functionality to an automatic driller added to a conventional rig.

Drilling process

The rig has been set up to run on mud and air. The company wanted it to be versa-

tile for the formation, combining the speed of air and down-the-hole hammer drilling with the control that comes from mud drilling, although CO₂ is not combustible.

To start off the well the crew began drilling with a 12-inch hammer and a 17-inch button bit. “We ran into heavy water at 15 feet (5 meters) with a sandstone bottom at 40 feet that was trapping the fresh water. We were seeing 100 gallons (378 liters) per minute,” said Vanderburg.

Conductor pipe is set at 40 feet on this project. The surface casing is set to 700 feet (213 meters) and then the hole is drilled to depth. The production hole is drilled at 7 7/8-inch diameter.

Casing the well is a bit different than normal because of the caustic nature of a CO₂ well. “We use 5 1/2-inch fiberglass casing cemented to 2,000 feet (610 meters) with steel at the bottom 200 to 300 feet (61 to 91 meters). Steel alone would rust out in three years,” said Vanderburg.

Ultimately Reliant will drill an estimated 150 wells with one well per 160-acre quarter section of land. Vanderburg said the demand for CO₂ is increasing because of its many uses, adding, “We are excited about the future and our RD20.”

Vanderburg said, “The secrets of nature are discovered once in a while, and CO₂ has opened a door of discovery.”

Bit of good sense

Geothermal pioneer finds the right bit for bad stone

Mid-State Construction Company in Livingston, Tennessee, is a geothermal pioneer, having entered the market back in the early 1990s. Mid-State CEO and founder Johnny Coleman had grasped geothermal's significance early on to become an outspoken proponent of the technology. However, Coleman said geothermal today no longer needs a spokesperson. This energy-saving strategy for cooling and heating is now sought after both in new construction and in retrofitting.

Mid-State's geothermal reputation keeps its drilling division almost continuously in the field on large-scale installation projects, often on multiple sites simultaneously throughout its five-state area of operation. The jobs include high schools and colleges, federal, state and municipal buildings, and even Ft. Knox, where they have completed several projects. »



(left) An early proponent of geothermal technology, Johnny F. Coleman (seated) is seeing his vision come true as more and more construction designs specify the green energy in their engineering plans. Jimmie Webb and J. Kelly Coleman, standing, are co-owners of the company.

A large photograph of a construction site. In the foreground, a yellow Atlas Copco T4 drilling rig is parked on a dirt area. In the background, another yellow Atlas Copco T3 drilling rig is visible, along with other construction equipment and a building under construction. The sky is blue with some clouds.

An Atlas Copco T4 and its partnering T3 in the background have just enough room to work between Belmont University's buildings and the excavation for the new facility. Together the rigs drilled a hundred 500-foot holes with Atlas Copco 5 3/4-inch carbide button bit to create the geothermal loop field for this project.



The geothermal loop field was installed alongside the 60-foot (18-meter) excavation for the College of Law's new facility. Incidentally, the perfectly parallel bores on the excavation's walls represent the signature line drilling also done by Mid-State with an Atlas Copco T4W but with a 6 1/2-inch bit.

» The company has exactly the right equipment to maintain uninterrupted production at each of its concurrent projects. Of its 125-piece fleet, 30 units are drilling rigs. Among the larger machines are 12 Atlas Copco T4W rigs and a T3W.

Powerful as these rigs are, their production capability relies heavily on the bit at the bottom of the drill string. In the difficult conditions at the Southeastern Tennessee State Regional Correctional Facility near Pikeville, Tennessee, only one bit proved cost effective: an Atlas Copco 5 3/4-inch bit with conical carbide buttons on an Atlas Copco Secoroc QL 50 DTH Hammer.

Hard time

The correctional facility is a close security prison capable of housing 971 inmates. Operating since 1980, the prison is undergoing an expansion that will allow it to house another 1,444 inmates. Mid-State was contracted to create a geothermal loop field consisting of 580, 5 3/4-inch vertical holes to 500 feet (152 meters).

At this site, the crews encountered extremely abrasive sandstone within only a few feet of the surface, continuing to 480 feet (146 meters). Jason Gentry, project manager for Mid-State, said the complex formation was “a mix of every color of sandstone in the book—red, pink, white—with three water seams.” The water seams were found to run consistently throughout the field. The sandstone ate up most bits so quickly that competitor brands could not complete the holes they started.

Gary Brown, project superintendent, said the company did have success with diamond bits. While the diamond bits could each manage two holes before they were exhausted, they were not cost-effective compared to the Atlas Copco carbides in these conditions. Mid-State purchased 600 of the bits for this project.

Bit by bit

Atlas Copco T4 rigs started each hole with a new bit, drilling to total depth. Then drillers retrieved the bit, sharpened it and set it aside for later use in projects with less difficult conditions.

Up to five T4 rigs were in use at a time during the year-long contract. As the T4 rigs were drilling, their electronics simultaneously logged the seams and water voids found in each bore. This precise in-

DTH BIT FOR SANDSTONE

Made in Ft. Loudon, Pennsylvania, Atlas Copco Secoroc's unique materials and design make the difference

A bit can only cut through rock if it's tougher than the rock. In difficult sandstone conditions the bit's body also has to endure the energy transfer of hammer blows into unrelenting stone, as well as the continuous abrasion of stone cuttings as they are blasted from the bottom of the hole.

Short of more costly diamond bits, only Atlas Copco Secoroc's 5 3/4-inch convex bits with hemispherical BH66-grade carbide inserts proved capable of making it to total depth in the geothermal project at Southeastern Tennessee State Regional Correctional Facility near Pikeville, Tennessee. Here's why:

- These bits are manufactured from proprietary materials in a unique process perfected by Atlas Copco Secoroc, including the BH66-grade carbide for the inserts.
- Atlas Copco leaves nothing to chance, controlling every step of the process during the manufacturing process, from the milling of the raw materials, to sintering, pressing and quality assurance inspection.
- No bit body can maintain its original dimensions in sandstone for long. However, Atlas Copco Secoroc bits not only competently finished the hole they started but could be used again in future applications elsewhere.



The 5 3/4-inch bit features Atlas Copco's own BH66 hemispherical carbide buttons. The bit proved more cost-effective than diamond bits, which were the only other bit Mid-State Drilling's trials found capable of drilling to 500 feet total depth in difficult sandstone conditions.

formation allowed grouter Jacob Collins to stop exactly at the voids to pack them with gravel. Otherwise, Collins said, he'd lose his grout. This would waste untold amounts of the thermally-enhanced mix used for this application, since the seams ran throughout the breadth and width of the loop field.

The loops were connected by 8-foot (2.4-meter) trenches and then run to an exchange house. Two large pipes exiting the rear of the exchange house will permit auxiliary air conditioning or heating if ever the geothermal loops need to be turned off.

To give an idea of how much energy relief the geothermal system can provide, an auxiliary unit would need up to 6 tons of refrigerant to match this system's air conditioning capacity BTU for BTU.

Bit better

Mid-State was engaged in several large geothermal projects during the prison expansion work. On-site at Belmont University in Nashville, the company was using the same Atlas Copco 5 3/4-inch carbide bits. This project was

for the College of Law's Randall and Sadie Baskin Center, a 71,000 square foot (21,640 square meter) facility with a five-level, 500-space underground parking garage.

Brown said the project plans called for 100 bores. These were also drilled to 500 feet with T4 and T3 rigs. These conditions provided a strong contrast for comparison.

"This was better drilling than the prison job," Brown said. "All limestone, no sandstone. Very little water and no voids. We could get 9,000 to 11,000 feet (2,743 to 3,352 meters) from each bit."

Extended use

Though the bits at the correctional facility have only 500 feet on them so far, Brown said the resharpened bits will see additional duty in Mid-State's quarry projects.

At first glance, such frugality over a bit may seem excessive, considering the

size of the projects and the expense of the rig and hammer. In the increasingly competitive geothermal market, however, these two projects prove Mid-State's tooling choice to be ... a bit of good sense. ☺

“The formation was a mix of every color of sandstone in the book—red, pink, white—with three water seams.”

Jason Gentry
Project manager for Mid-State



GARY BROWN
Project Superintendent



JASON GENTRY
Project Manager

(below) Cody Winton, Jeremy Anderson, Jacob Collins, Justin Roberson, Tracy Horton, Ronald Gunnels, Jason Gentry, Ron Cravens, Joshua Phillips, Gary Brown, Jim Oakley.



EDGE

on the market

Stay on top by seeing the bit at the bottom

Technology is a strange thing. We talk about it, and the world benefits from it most of the time, but personal acceptance doesn't always move at the same speed. We often want to wait and see the benefits of something, or someone else's failures, before we jump aboard. EDGE is the new down-the-hole monitoring system that will change the way people drill. One company has chosen to make that jump into new technology and has found success in the process.

Noah Horn Drilling Company is a multi-rig gas drilling company operating in the Appalachian Mountains of the eastern United States. They are headquartered out of Vansant, Virginia. For nearly 30 years they have been focused on hard-rock, coal bed methane and conventional gas drilling.

Vice President of Field Operations, Leon Boyd said in the mid-1980s they were drilling CBM wells to flare off the gas to make coal mining safer. Now CBM is a major and growing industry globally.

Horn Drilling put the first Atlas Copco

RD20 to work and was the driving force to make it a Range III class rig. The company continues to follow the philosophy of its founder, Noah Horn, who died in 2006: Don't shy away from new technology that could make you more successful.

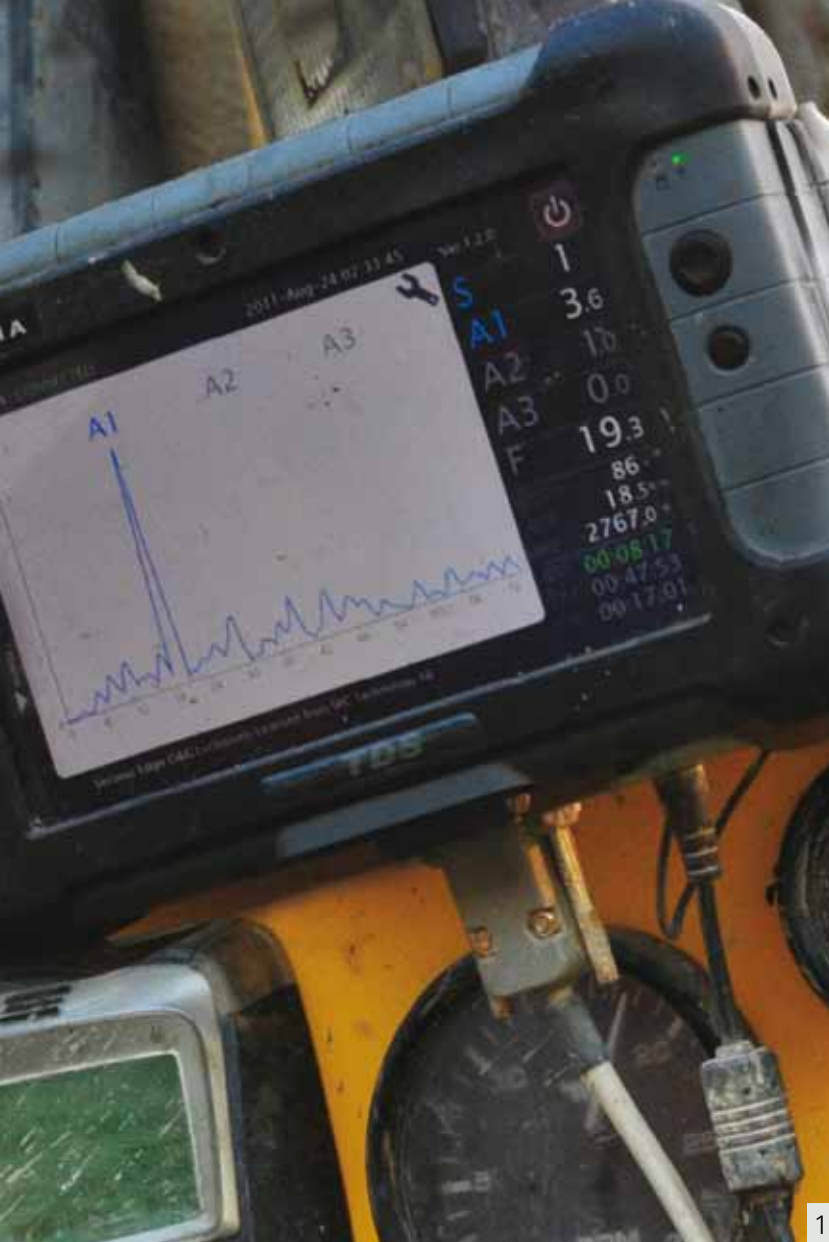
After three months of using the new Atlas Copco Secoroc EDGE system for precision down-the-hole hammer drilling, Horn's drillers are giving it high praise.

What is EDGE?

EDGE's functionality for drillers is compared to that of aviation's flight instru-

ment navigation technology. Just as pilots can precisely navigate their planes in the clouds, drillers can precisely adjust weight on bit and rotation by watching graphic and numeric portrayals of conditions affecting the hammer at the bottom of the hole.

EDGE is available as a rental package from Atlas Copco Customer Centers and authorized dealers and is relatively easy to install. In total, it takes just a couple hours away from production and involves mounting a sensor on the rotary head that collects vibration signals generated by the



1. The driller's display is easy to understand. A1 represents impact energy from the hammer used to break rock while A2 and A3 show wasted energy. The object is to keep A1 strong or dominant over A2 and A3. The drillers use weight on bit (WOB), rpm and common sense to control and optimize this pattern.
2. Driller Jerry Stiltner glances at the EDGE screen to ensure proper drilling parameters. Stiltner has been with Horn for 19 years, as a driller for the last 14.
3. Driller Mike Street has been drilling for Horn Drilling since 2003.

hammer that are transmitted through the drill pipe. The sensor is connected to a processor unit, which is then connected to a 7-inch computer display mounted at the operator's console.

The display portrays the EDGE program's interpretation of the bit/hammer vibrations, which travel up the string. The resulting signal is the equivalent of having eyes right at the bottom of the hole, seeing the effects on the hammer caused by different geological formations, the presence of water, or flushing problems. The built-in signal filters recognize and eliminate

unwanted noise from other sources before displaying the information for the driller.

In practice

On this job, Horn is installing surface casing to 3,000 feet (914 meters). A conventional rig will follow them, drilling to a kick point at about 8,000 feet (2,438 meters). They start with 17-inch bore for 16-inch conductor casing to 350 feet (106 meter). Then they set 13 $\frac{3}{8}$ -inch casing in a 15 $\frac{3}{8}$ -inch bore to 1,000 feet (304 meters). Finally, they'll set 7-inch casing in an 8 $\frac{3}{8}$ -inch hole to 3,000 feet. They cement and

then re-drill through it to 3,100 feet with a 6 $\frac{1}{2}$ -inch bit, which ensures a smooth start when the conventional rig sets up.

Driller Jerry Stiltner said the difficulty of the formation here in Tennessee is a new experience for some of the crew. Stiltner said, "Back home we set up on a hole; three days later we're done with it. But this is really hard stuff here."

For an example, driller Michael Street said, "There's a spot 120 to 140 foot thick of pure sandstone. Looks like regular play sand when it's coming out." The rest of the drilling alternates quickly »



The Noah Horn crew is tripping pipe from 2,400 feet. Once the roughneck begins to pull the pipe, the winch man can make the roughneck's job easier by lowering the pipe, which allows gravity to push the base of the pipe away from the rig. Extending bit life by using EDGE can minimize the number of trips while improving safety.

» from shale to sandstone, sometimes within a matter of inches, in a highly fractured formation.

Street said, "EDGE helps you a whole lot on a new formation. You can watch it. Put a little adjustment on it. If you hit a hard spot or go from hard to soft, you speed up, slow down. You get into the soft stuff with so much air going, you'll about blow right through the shale, so you have to put a little weight on it. EDGE tells you when.

"Even when I'm starting out and am not watching it, I'll see or hear something different and make adjustments, like always. But now I look up at EDGE to make sure I'm right."

Street said it used to take a half a rod, minimum, to dial in his drill. "Now it takes less than five feet to get it right." With EDGE, drillers don't need years of experience and a built-up sixth sense to drill right and troubleshoot. When Street let a new hand working with him drill, the novice used the EDGE. "The new kid's already getting it right, tuning it good within seven, eight, maybe nine feet."

Better than they've ever been

Boyd's drillers praise the system and what it has done for their drilling ability. "If it had been new guys," he said, "I wouldn't have thought so much about it. But these are my older guys who are converting. It's changing the way they drill." Boyd added that traditional drillers "have to learn all this electronic over hydraulic anyway. EDGE is just another tool to help them."

Boyd agreed that no two drillers are the same: "The hammer is not going to act any different. But drillers judge by air pressure or feel, which varies. Plus, today's hammers have advanced so much, drillers can't keep up with them. With EDGE everyone can see the exact same thing. When you tell them, here's what's happening, there is no argument."

Boyd said he was aware that there are some drillers in the industry who describe EDGE as "tattletale technology." He said these are usually weak drillers to begin with, afraid this technology will prove they are not using the equipment well.

"But I have good guys, and they like it. It only makes them better than they've ever been."

Bit life

Boyd said, "Everyone is tightening their belts, looking for better ways to do things." That's when Tony Funk of Keystone Drill Services brought down the EDGE.

Funk said he did initial testing on the EDGE with three different rigs in Tennessee, Virginia and Kentucky to determine its value to his customers.

"All of the drillers on the rigs we tested the EDGE with were able to look at the display and understand it immediately," Funk said. "This allowed the drillers to dial in the hammers to their maxi-



Noah Horn staff on this drill site included (from left) Chad Estep, winchman; Shannon Dotson, roughneck; Jerry Stiltner, driller; Lance Baldwin, pusher.

mum performance levels by adjusting the weight on bit (WOB) and rpm within a few seconds of tagging bottom. After the drillers were able to adjust their drilling by using the EDGE, the drillers were able to see much smoother drilling with less variance in their torque."

When Funk became convinced of the EDGE advantages, he brought it to Noah Horn. "We wanted to get it on someone's rig where we knew they covered a good range of varied geography and had a productive mindset. Noah Horn Drilling Company had both. This company keeps some of the best equipment and people in the southern region and are well known for doing top-rated work."

Funk added, "In my opinion, the EDGE is a tool that we have needed for a long time and should be on every rig that is drilling with DTH hammers."

Boyd said, "The biggest thing that attracted us was that we were losing bits, constantly losing bits. We weren't able



Leon Boyd
Vice President of
Field Operations



Josh Marcus
DTH Product Specialist



Tim Burton
Support Specialist

Tony Funk of Keystone Drill Services introduced the EDGE to Noah Horn drillers. Funk said a sort of motto for the industry should be, "Rotate with weight and lubricate and this will let you penetrate."

Funk is confident the EDGE will be a positive change in drilling. He said, "We see so much damage to DTH hammers and bits that is directly related to over-rotating and too little or incorrect weight on bit and lack of good lubrication. These all equate to lost drilling time, but could be corrected by using the EDGE."

to continue holes on just one bit. Tony thought this would help us."

Stiltner said, "When we started this project down here, we couldn't get more than six, eight hundred feet out of a bit. Then we'd put another one in. Get maybe the same from it. Finally, we'd wind up using rotary bits to finish the hole."

With EDGE they are now consistently getting 2,500 feet (762 meters) on a single bit, allowing them to finish a hole without tripping out to change bits.

"Our last hole that we finished up, the bit had 2,700 feet on the bit, and I wouldn't be scared to put it in another hole. The bit looked new."

Boyd spoke about what finishing a hole on one bit means for their bottom line. "Look at just what we save on those two to three bits per hole. Those bits cost up to \$10,000 apiece. A rig drills 30, 40 holes a year. That's a lot of the savings."

Time is money

There are several ways Noah Drilling saves time and its associated costs. "Before, we were getting 30 feet (9 meters) in 30 minutes," Stiltner said. They were using the QL 80 with an 8⁷/₈-inch bit. "With EDGE we cut that by half, by at least half." Stiltner said he likes all Atlas

Copco hammers, "They've always done a fine job."

There are fewer trips, which saves time. Changing out the bit after each trip in itself consumed what would have been valuable time in the hole.

Hazard reduction

Today's drilling contractors are also looking for increased safety. Boyd said EDGE gives them this, too, indirectly. "Not tripping out of the hole as often, that's where EDGE has made drilling safer. Hazards occur where you have drill steel and casings moving around your crew. Keeping the steel in the hole drilling makes us safer."

Then Boyd summed it up: "You take that extra trip time out of the way, you're saving trip time, you're saving money on bits, and you're increasing your safety factor."

"You know, Noah formed a really good company. We have a lot of really good competitors here. Once they see this system, they're going to want EDGE as well. Some of them have already tried it and are liking it."

Chances are they won't be able to remain good competitors if they don't. EDGE is making that big a difference for companies who use it. ☉

Drill companies who use EDGE in the eastern U.S. will likely see Atlas Copco Product Specialist Josh Marcus and Support Specialist Tim Burton. Marcus spent 10 days on Noah Horn drill sites to make sure operators were comfortable with the new equipment.

"I probably spent two full days on the rig with them," Marcus said. "It depends on the driller, but one with experience will pick it up real quick like these guys did. It's a common sense tool. Drillers who I consider to be fine drillers are able to fine-tune what they do and get at least 10 to 15 percent gains in performance."

He said potential EDGE customers shouldn't feel they have to be tech-savvy to easily adapt to the new tool. Marcus is a former DTH operator himself and said, "I was resistant at first like many of them are. But once I could see that it actually makes a job easier, I was convinced, and so were they once they tried it."

Marcus works between product engineers and the end users, utilizing his own experience in the field to help educate customers and get the best product developed.

Burton sets up the system and helps operators use it throughout their use of EDGE. He spent a few days on two daily shifts on-site with Noah Horn, making sure they didn't have any technical problems.

"It seemed to answer the questions on its own for the drillers," Burton said. "They definitely came in knowing what they were doing but it was a good enhancement tool for them, just like it would be for most drillers."

Burton, who didn't grow up in the computer age and who spent 17 years as a driller himself, said he looks forward to working with more customers with the EDGE.

Part of why Burton likes helping customers use EDGE is because it is a basic system. He said, "It is self-contained. Once it is set up and has the basic information entered into it, it regulates itself. The graphs can be changed a little but the first basic settings are all you have to deal with."

He stays on hand through shifts over a few days just in case he's needed, but typically, Burton said, new users of EDGE are able to work with it right away.



TH60 GETS A BOOST

Large diameter hole challenges overcome with high pressure air

A U.S. government agency that focuses on environmental sciences was recently drilling an exploratory pilot hole in the Nevada desert in order to observe the water table near Lake Mead. Located over a mile away, well below the elevation of the test well, the lake is receding because of a lack of rainfall, reduced snow melt runoff and increased consumption by the residents of Las Vegas and its surrounding communities.

The well was instrumented with a water level sensor that will collect and relay real-time data via satellite to the organization's office. The information will allow them to monitor water levels, water quality and yield for several decades.

The crew started drilling with air from the 1070/350 compressor on their Atlas Copco TH60. This rig is outfitted with 70,000 pounds of pullback for deeper boreholes. The organization also has an Atlas Copco XRVS 1000 compressor and Hurricane B4-41/1000 booster to support deep well drilling. With all that air power, the crew began at the surface with a 12-inch hammer to drill a 20-inch hole. The plan was to case with 16-inch casing toward the surface, reducing the diameter to 6 inches as the well got deeper.

As happens with many good plans, the formation didn't want to cooperate. Because of a sandy formation, the versatility of the TH60 drill rig proved useful, converting to mud drilling at about 80 feet (24 meters), continuing to 120 feet (37 meters). The crew converted to a 14¾-inch tricone bit to do this. The rig has a 3-inch by 4-inch Mission centrifugal mud pump with flow and pressure of 150 gpm at 310 psi. Once they got into competent rock, 12-inch surface casing was set in place.

The formation was described as "red clays and chalky near the surface with carbonates going deeper." From that point drilling continued with air, supported solely by the rig's compressor. It worked well for the crew to drill a 6½-inch pilot hole and then ream the hole with an 11-inch bit. For the 6½-inch hole the crew tried out



The site is laid out for easy access to plumbing and for observation of gauges by the driller.

the Atlas Copco Secoroc Aqua 60 down-the-hole hammer with success. The water table was first encountered at 360 feet (109 meters) below the surface.

At this point, drilling remained well above the elevation of the lake in the distance. To continue drilling the 6½-inch pilot hole, it was necessary to engage the booster at 600 feet (183 meters), where they encountered too much water to penetrate without the booster. Ultimately, the hole was completed without full capacity of the 1,000 psi booster, requiring just 600 psi.

Blake Gearhart, Atlas Copco large compressor business development manager said, "The booster can be used in harsher circumstances and worse conditions, but it also performed well in its lower range for this job."

Through the monitoring process made possible with the TH60 and high pressure air, the amount and quality of groundwater for one of the world's most recognized cities, which happens to be in the vast desert of Nevada, will continue to be tracked for future generations. 🌐

The Atlas Copco XRVS compressor is a two-stage, high pressure unit that the customer used from the deck. The Hurricane B4-41 is an open-style booster with a small footprint that's useful for getting high pressure in a tight space.



CLEAN

During a normal working day, operators of Atlas Copco water well rigs might not have time to reflect on the fact they are driving the world's cleanest trucks. It is no exaggeration: in some of America's larger municipalities, Atlas Copco engines are actually cleaning the city air as they drive through town.

These engineering marvels have been designed to meet the 2010 U.S. Environmental Protection Agency (EPA 2010) over-the-road diesel exhaust emission standards. And if they happen to be driving the newest generation Atlas Copco T2W, they might not notice anything different at all. It was purposely designed so that operators would not experience anything different than in a pre-EPA 2010 rig: the T2W features Advanced Exhaust Gas Recirculation (EGR) technology.

Both Advanced EGR and the more common Selective Catalyst Reduction (SCR) are effective methods for meeting the new standards. Atlas Copco is offering water well rigs in both technologies because contractors have a wide range of needs that can be better met by one or the other. It just so happens that one of their long-time mobility partners, International Trucks, is the only manufacturer who has 100 percent EGR-based diesel engine designs. The first new generation T2Ws off the line feature International carriers with Maxxforce EPA 2010-compliant EGR diesel engines.

Case for EGR

Several other manufacturers had attempted EGR before announcing SCR as their EPA 2010 solution. International focused on EGR, believing it to be a permanent solution, one that was user-friendly. Lyn-dell Pannell, a sales representative of Texas-based Southwest International Trucks, said, "Our goal was to build an engine no

different to operate than pre-EPA 2010 rigs."

He noted that among the most significant values of owning a solely EGR-based rig are that it meets the EPA 2010 standard without requiring additional operator training or action and that it allows companies to travel to remote areas without having concerns for diesel exhaust fluid (DEF) sources. Liberation from DEF also means no concerns about performance derating as the DEF tank runs low, or restart concerns if it has run out.

Additional benefits are that there is no mixture to monitor and no additional fluid to maintain records for. Nor is there any additional equipment to maintain, such as a DEF doser and DEF container. There simply are no externally visible clues that an EGR rig is meeting EPA 2010 standards.



Atlas Copco partners with only the most trusted manufacturers. Performance is guaranteed by either system. To know whether to choose a rig built on an SCR engine, such as a Peterbuilt, or an EGR-based International, you will want to know more about how the systems differ.

Much of the information on the Web is conflicting, though, and most of it seems biased in preference of one system or the other. Atlas Copco does not manufacture diesel engines and provides information only for the benefit of customers making a choice based on their unique requirements.

DRIVING DRILLS

Atlas Copco Exhaust Gas Recirculation exceeds EPA 2010 regulations

“Our goal was to build an engine no different to operate than pre-EPA 2010 rigs.”

Lyndell Pannell
Sales Representative, Texas-based
Southwest International Trucks

Keith Estes, the Atlas Copco product marketing engineer for water well rigs, said that although Atlas Copco has chosen International for its newest T2W and offers an International T3W, customers may request either rig be installed on a Peterbuilt carrier as well. Atlas Copco has some Peterbuilts currently in stock.

Cleaner diesel

As of June 1, 2006, Pannell said, the U.S. EPA has required that all highway diesel fuel be Ultra Low Sulfur Diesel (ULSD). ULSD's sulfur content is 15 parts per million (ppm) or less. This was one step toward meeting the EPA's Clean Air Act target.

American diesel engine manufacturers took it from there, designing engines that would burn ULSD and emit no more than 0.01 grams of particulate matter per brake horsepower from their exhaust. Brake horsepower is the total horsepower before subtracting the loss in power consumed by things such as the alternator, power steering pump, and part friction.

To do this they had to overcome the problem of nitrogen oxides (NOx) and particulate matter, or soot, that are produced during combustion at high temperatures. Engineers chose between two effective solutions.

External vs. internal treatment

Selective Catalytic Reduction (SCR) reduces NOx externally, post-combustion, by introducing a Diesel Exhaust Fluid (DEF) into the exhaust system. DEF consists of about 30 percent synthetic urea or ammonia and is commonly purchased under the name Ad-Blue. It combines with NOx in the exhaust, converting it to harmless by-products, such as water and carbon dioxide.

The technique requires the purchase and continuous onboard storage of DEF, with requisite maintenance of associated DEF storage and mixing equipment. In normal conditions, the rate of DEF consumption means operators only need to refill the DEF container about every other time they fill their fuel tanks. The fluid is widely available for purchase at dealerships and many diesel refueling stations. »

» International's Exhaust Gas Recirculation (EGR) systems treat NOx internally, "in-cylinder," two ways. First, combustion takes place at lower temperatures, so less NOx is produced. Second, exhaust is re-circulated back to the cylinders, where it replaces excess oxygen in the mixture. Drivers operate an EGR rigs no differently than they drive pre-EPA 2010 rigs. All of the technology is built into the engine with no need for additional operator action.

In addition to these NOx-reducing systems, both methods also incorporate catalytic converters and diesel particulate filters and to deal with soot and other particulate contamination. The particulate filters require a periodic regeneration cycle that raises exhaust temperatures to burn off any accumulated matter.

International's advanced EGR

While some early EGR competitors were unable to avoid horsepower loss due to lower combustion temperatures, International completely re-designed their EGR engines to increase performance while lowering the overall cost of operation specifically for the EPA 2010 standard. International diesel engines for the U.S. market feature new injectors and a high-pressure, common-rail fuel system that increases injection pressure to effectively atomize diesel for combustion at the lower temperatures. They also have matched dual turbochargers for low-end and high-end boost and an optimized piston bowl design.

Pannell said ultimately it's the customer who pays for the cost manufacturers invested in designing EPA 2010-compliant engines over the past few years. An EGR system means the customer does not continue paying for that investment with the additional operating costs of the urea aftertreatment.

Pannell commended Atlas Copco for offering water well rigs in such a complete array of 2010 compliant packages for customers to choose from. ☉



HIGH SULFUR DIESEL

While it is illegal to sell anything but Ultra Low Sulfur Diesel (ULSD) for on-highway use in the United States, it is not available worldwide. Some foreign governments who do have a fuel standard do not require diesel to be less than 5,000 ppm sulfur. ULSD can have just 15 ppm sulfur.

Southwest International Trucks salesman Lyndell Pannell explained that running any of the newer, EPA 2010-compliant diesel engines on high sulfur fuels can cause them to fail. Poor quality diesel can damage emission controls, particulate filters would fill rapidly with soot,

DEF in an SCR system would be rendered useless. As the U.S. inventory of pre-EPA 2010 used equipment rapidly progresses to its depletion, manufacturers who export to other countries must make more than one kind of engine.

Pannell said International will meet the requirements of all its customers by continuing to make three kinds of engines. In addition to the EGR rigs for the United States and Canada, they make 2004–2010 engines for markets like Mexico, whose diesel standard is 500 ppm, and pre-2002 engines for markets with little or no diesel quality regulations.

Balancing act

Australian family started drilling as a support business to farming operation

For the Serra family, having a versatile drill rig is necessary for the region and the type of work they do. The multi-generation family business is located on the fertile Atherton Tablelands of northern Queensland, Australia, and the T4W is its work horse, drilling bore holes for agriculture, residential and mining customers.

Before his family started the business in the late 1960s, Joe Serra said if you needed a well drilled, you'd put your name on a list with a drilling company that would come around occasionally. Joe's father saw a business opportunity. He was right.

Joe admits that when his father started the business he bought the wrong rig. It was a mud rotary rig that didn't work in the varying formations of the Tablelands.

In 1981 they bought their first used T4W and that gave them the hard rock power they needed, and they've stuck with the T4W ever since

After 30 years of running T4Ws the family recently purchased its newest rig. "The old rig was running great, but with the incentives offered by the government it didn't make sense not to buy now," said Joe. The Australian government offered tax incentives to make capital expenditures at the time.

Today the family business drills water wells for irrigation and drinking water while also doing work for mines in the region. Joe likes the versatility of the T4W that allows

him the finesse to drill 620 feet (190 meter) water wells—including running 118 feet (36 meters) of slotted PVC casing at the bottom—yet the strength to drill 950 feet (290 meters) of steel casing in the coal mine region.

The distance the family drilling business will travel has grown over the years. Population and farming development has leveled off. So, Australia's mining industry has developed into a »



Joe Serra can point out the area where ancient volcanic flows formed the table lands and created the variations in formations.





*A family operation:
(from left) Georgie,
Mark, Peter, Anne,
Joseph (Joe), Mel
and David Serra.*

» good base for the Serra business. Within a day's drive coal fields and metals mines offer an alternative source of revenue drilling for ground monitoring, dewatering and chip sampling.

In the Tablelands near the family farm where the Serra family got its start, the ground is rich with volcanic surface soils that make the region perfect for everything from bananas to potatoes. The land was once a tropical jungle that was cleared in the first half of the last century. Below the surface is honeycombed basalt rock that holds a large amount of water. Below that is solid granite.

Joe gives an example of the formation: 2 feet (0.6 meters) of surface soils, 20 feet (6 meters) of sub-soils, 200 feet (61 meters) of clays, 80 to 90 feet (27

meters) of decomposed or 50 to 60 feet (18 meters) of honeycombed igneous rock.

"When going through the decomposed formation, it's important to slow down," Joe cautioned. Although it's fast drilling, the ground can swell behind the hammer causing it to become trapped below the expanded ground. Joe said going slow allows the formation to move with the hammer and not swell after penetrating the formation.

At times they also encounter sandstone below the volcanic rock, but once the tight granite is reached, there will be a low water yield.

The hammer that works best for the family business is Atlas Copco Secoroc's COP 64 Gold. In the past Joe went with

“When going through the decomposed formation, it's important to slow down.”

Joe Serra

Owner, Serra Drilling Contractors



another brand, but he said it couldn't hold up. In the toughest blasthole drilling situations Joe said he can get 25,000 hours on a hammer.

Joe talks about one situation that other drillers might encounter. On a mine property he said they were getting half the life out of the hammer. After looking at all possibilities, he said it came down to the water they were injecting. The minerals in the water were caustic, reducing the piston life. The solution was to bring water from off-site to fill the tank.

After so long on the job, troubleshooting has become second nature to Joe and the rest of the family, similar to most drillers. Unlike some, however, the Serra family has been at it for three generations. ☉

WORKING THE EARTH AS FARMERS AND DRILLERS

Drilling began as a sideline to farming, so the family potato farm is still very important. Like most family businesses, everyone has a role.

Older brothers David and Mark do most of the drilling, leaving Peter to work the farm.

Patriarch Joe Serra works between the farm and drill rig, helping both operations where necessary. Matriarch of the clan, Anne Serra is also a key part of the business, working in the office and holding everything together.

David and Mark's wives share management duties in the packing warehouse and office for the farming operation. The gourmet Kipfler potato that the family grows is sold under the Atherton Gold Produce brand and is the primary crop, with corn and peanuts as rotation plantings. The family produces 1,000 tons a year in their Australian operation.

Kipfler potatoes (or German finger potatoes) have an elongated shape with waxy, cream-colored flesh. They are popular for salads or as a boiled side dish. The next time you eat a Kipfler potato it may have been grown by a water well family.



The irrigation system keeps the Serra's Kipfler potatoes well nourished. Also shown are boxes of the potatoes ready to be distributed.

New site focuses on water well drilling



Atlas Copco Drilling Solutions has also created a water well microsite to help ease users in to the new product pages. They can visit the microsite at the same domain as before: www.atlascopco.com/wwdrills. Here, they will find a list of all water well products Atlas Copco has to offer and be directed to the product pages for more detailed information. Users will be able to download product brochures, be given a link to visit DeepHoleDriller.com and also be given the opportunity to view Atlas Copco's marketplace for used equipment.

If you'd like to visit Atlas Copco's oil and gas product pages the addresses are as follows: www.atlascopco.com/Predator and www.atlascopco.com/RD20.

Ray Kranzusch appointed Product Manager

Ray Kranzusch has been appointed to the position of Product Manager, Oil and Gas Drills, for Atlas Copco Construction & Mining effective immediately. In his new role, Kranzusch will report directly to Scott Slater, Business Line Manager for Geotechnical Drilling and Exploration and Atlas Copco Drilling Solutions – Oil and Gas.

Most recently, Kranzusch served Atlas Copco's Western Region in technical support for water well and oil and gas products. He brings 27 years' experience working in the drilling industry to his new position.

Slater commented, "The contacts and relationships in the oil and gas industry that Ray has built over the years, in addition to his wide product knowledge, make him the ideal person to contribute to our continued oil and gas growth."

Kranzusch's primary focus will be the RD20, RD20 XC and Predator rigs, and related Atlas Copco drilling consumables in the U.S. oil and gas industry. He will be involved in sales support, technical training, the product development and engineering process, and new product launches.

In addition, Kranzusch will assist in sales efforts in the Western territory until a salesperson is permanently assigned to that area. He will be based out of Sacramento, California.



Atlas Copco announces changes in U.S. sales team

Dolezal now area salesperson



Jeff Dolezal is Area Salesperson for specific product lines for Atlas Copco Construction Mining Technique USA LLC in South Florida and parts of the Caribbean. He will be based out of Atlas Copco's new Miami store, effective immediately. In his new role, Dolezal will report directly to Andrew Andre, Southeast Region Manager.

For the past five years, Dolezal has been selling and renting equipment, including heavy road machinery, on behalf of a south Florida AED distributor.

In his new role, Dolezal will be responsible for developing sales and rental opportunities in the south Florida market, as well as specific parts of the Caribbean market for several Atlas Copco product lines. His portfolio will extend to geotechnical and exploration drilling equipment.

Beloso covering sales in west



Drillers in northern California and Nevada will see a familiar face representing Atlas Copco in Joe Beloso. Beloso is responsible for water well and exploration drilling equipment in the territory.

He is known in the same area after spending 32 years working in the industry. Beloso was a water well and mineral exploration drill salesman and worked at the Ingersoll-Rand rock drill factory in Virginia before managing the Sacramento branch of Ingersoll-Rand, which served well drillers and construction contractors. Atlas Copco has since purchased the Ingersoll-Rand drill line.

He is busy making new sales contacts and has run into some former ones too. "I'm seeing old customers and even their children who are now involved in the business," Beloso said.

AtlasCopcoMarketplace.com PRE-OWNED DRILLS



REDUCED PRICE!

Atlas Copco TH60/2003 sn:6840
Location: Milwaukee, WI
Tower: 38 ft
PTO Engine: CAT C15, 565 hp
Drill Hours: 7,063
Compressor: 900 cfm / 350 psi



Atlas Copco T3W/2007 sn:21203
Location: Tahlequa, OK
Tower: 36 ft
Drill Engine: CAT C15, 565 hp
Drill Hours: 906
Compressor: 1,070 cfm / 350 psi



Atlas Copco T3WDH/2008 sn:21228
Location: Milwaukee, WI
Tower: 36 ft.
Drill Engine: CAT C15, 580 hp
Drill Hours: 1,120
Compressor: 1,070 cfm / 350 psi



Atlas Copco RD20 III/2001 sn:6660
Location: Denver, CO
Tower: 61 ft.
Drill Engine: CAT 3412, 735 hp
Drill Hours: 13,950
Compressor: 1,250 cfm / 350 psi



Atlas Copco RD20 II/1998 sn:6389
Location: Denver, CO
Tower: 51 ft.
Drill Engine: Cummins QSK 19C, 755 hp
Drill Hours: 7,972
Compressor: 1,250 cfm / 350 psi



Atlas Copco T3W/2002 sn:6753
Location: Milwaukee, WI
Tower: 32 ft.
Drill Engine: CAT C15, 565 hp
Drill Hours: 6,562
Compressor: 900 cfm / 350 psi



REDUCED PRICE!

Versa Drill V2000/2003 sn:1120
Location: Milwaukee, WI
Tower: 35 ft. 6 in.
Drill Engine: CAT C16, 600 hp
Drill Hours: 4,443
Compressor: 1,070 cfm / 350 psi



Atlas Copco TH60/1992 sn:3640
Location: Milwaukee, WI
Tower: 38 ft.
Drill Engine: Cummins N14, 410 hp
Drill Hours: 9,207
Compressor: 750 cfm / 300 psi

Atlas Copco Construction & Mining USA LLC
888-456-6017
www.atlascopcomarketplace.com

WHERE TO FIND US

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Canada	Mississauga	+1 (0)289-5620100
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