When I attended my first 40-hour New Miner Training (more years ago than I care to admit), the instructor had a poster in the classroom entitled “Carelessness.” The poster chronicled the serious injuries and deaths attributed to lack of focus on the job; even stating that job-related injuries and loss of life vastly exceed those attributed to both world wars.

The term “carelessness”, however, carries a connotation of being an intentional or willful action. Not to attempt a tie between safety and citations, it should be noted that during 2014, OSHA states that only 5% of serious violations were classified as intentional. Perhaps a more appropriate term to apply would be “complacency.”

On a personal level we tend to act from a basis of routine. When our activities remain incident free, our safety behaviors can become “programmed” through repetition. It’s through this process that complacency occurs. There is not an intent to shortcut established procedures or willfully display a disregard for our personal safety. Failure to recognize or correct hazardous conditions becomes a product of accepted deviance, as our safety awareness has become automatic.

Everyone knows that factors like rushing, frustration, worry, and failure to keep focused on the task at-hand can contribute to the occurrence of an incident. Unfortunately, having strong safety programs and a good safety record can create a false sense of security. Most of us know of facilities with great safety records that ended in a major incident.

Steps to Prevent Complacency

• Take an active role in safety meetings and work planning efforts such as JHA’s.
• Perform work area hazard assessments at the start of a shift, and throughout the day. Remember- it’s stop and correct, not stop and report.
• Good safety records do not indicate a lack of hazards. Stay engaged.
• Avoid comments such as “work safe,” “where is your PPE?”, or “be careful.” Such statements do not address the root cause of the behavior or practice.

Challenge yourself. Are you actively protecting yourself, or living on luck?

“Safety First, Last, and Always”
George W. Zugel, CMSP
Safety Director
In 1972, the newly incorporated Frontier-Kemper Constructors, Inc. (previously Frontier Constructors and Kemper Construction had operated independently and also as joint venture partners before merging the two companies) obtained their first project. It consisted of a small size tunnel, 6 ft. nominal in size and 4,500 ft. in length, built for the Army Corps of Engineers. I think of it as an example of how the more things change, the more they stay the same. Over the last two years we have been fortunate to successfully construct a number of small tunnels (microtunnels to use the common vernacular) and we feature this new but old line of business in this issue of the Crosscut. Much credit goes to the efforts of Bob Marshall in successfully heading up these projects with the support of our Engineering and Evansville Shop groups.

Over the last few years we have witnessed relatively stagnant to slow growth in worldwide mining production. Despite record low interest rates, and aggressive intervention by central bankers, the world economy has been slow to respond after the financial meltdown of 2008 and 2009. Nevertheless, FKCI has managed to maintain a steady backlog of mine development projects through the doldrums, by providing clients with innovative and cost efficient solutions to their infrastructure needs. A perfect example is the record setting vertical belt system for Fresnillo PLC that will more efficiently hoist their ore to the surface. With commodity production picking back up as economies continue to recover, we are positioned to meet the demand as evidenced by the successful projects detailed within. Our Mine Development, Engineering and Lake Shore groups are excited for coming years and look forward to meeting the expected challenges ahead.

Dave Rogstad
President & CEO
Frontier-Kemper is extending its reach into smaller-diameter, shorter-length Utility Tunnels in the trenchless construction market. This method, known as Microtunneling, is under the guidance of VP of Operations, Robert Marshall. Robert joined Frontier-Kemper’s Heavy Civil Division in 2012. In 2013, Frontier-Kemper was awarded its first Utility Tunnel contract; three (3) tunnels for a new sewer installation in Brighton, Colorado totaling over 3,700 LF. Frontier-Kemper was later awarded two (2), new Sewer Tunnel contracts: the Paradise-Whitney Interceptor (PWI) Projects 669 and 668 in Las Vegas, Nevada. The PWI 668 and 669 contracts include more than 25,000 LF of trenchless construction; making the combined contracts one of the most significant new installation projects, in terms of trenchless footage, installed in the United States.

Winning two contracts, with work being undertaken for two different prime contractors, required multiple crews to maintain production and keep ahead of both project schedules. In order to tackle the work, Frontier-Kemper formed a joint venture with Pipe Jacking Unlimited, a well-established and highly respected trenchless contractor out of San Bernardino, California with 20 years of underground experience.

Frontier-Kemper provided:
- (1) Slurry Microtunnel Tunnel Boring Machine (MTBM)
- (2) crews
- performed all on-site project management duties

Pipe Jacking Unlimited provided:
- (4) tunnel boring machines (TBM)
- (2) crews

TBM diameters included (all systems were Pipe Jacking systems):
- 60” open-face, man-entry, conveyor belt TBM
- 60” closed-face, man-entry, screw auger EPB TBM
- 66” closed-face, man-entry, screw auger EPB TBM
- 72” closed-face, man-entry, screw auger EPB TBM
- 60” closed-face, remote operated, Slurry MTBM
**What is Pipe Jacking?**

Pipe Jacking is a method of tunnel excavation that utilizes a stationary set of hydraulic cylinders to advance a pipe string (connected to the back of the TBM) through the ground. The pipe serves as the structure to transfer the thrust force to the TBM, as well as to provide continuous ground support for the excavated tunnel. Like all underground excavation methods FKCI is familiar with, Pipe Jacking is a repetitive work sequence. A pipe is lowered into the jacking pit and engaged with the back of the TBM. The back of the pipe is engaged by an adapter yoke fabricated to mate with the pipe-end to not damage the bell or spigot-end depending on orientation. The adapter yoke is connected to the thrust cylinders, and this assembly sets on the jacking rail. The jacking rail has notches, or “dogs” as they’re called in the field, that the cylinders react against as they advance the pipe and TBM through the ground. At the end of the cylinder stroke, the jacking yoke is secured to the rail and the cylinders are retracted until they catch the next set of dogs. The process is repeated until a pipe reaches the end of the jacking rail. For economy of shipping and construction of the jacking shafts, pipes are supplied in 20’ lengths.

For the majority of the PWI project, the pipe used to jack the TBM’s also served as the final lining; requiring no other operations other than contact grouting of the pipe after the bore was complete. This single-pass method, also called Direct Jack Pipe Jacking, is far more economical than a two-pass system where a tunnel is bored, and the final liner pipe is installed within the bore at a later date.

The Direct Jack method is one of the main reasons the Frontier-Kemper/Pipe Jacking Unlimited JV was able to meet the tight project schedules for both contracts concurrently.

**New Equipment!**

When one thinks of Las Vegas, aside from the bright lights and commotion associated with the Strip, they think hot, dusty desert. When you think desert, you think dry, hard ground. Surprisingly, over 50% of the tunnel bores required between the two Paradise Whitney contracts were to be bored below the water table with pipe installation depth ranging from 20'-45'. Within that 50%, approximately 10,200 LF of the bores were in very soft soils. So soft that pre-excavation ground improvement operations were required along the entire length of each drive to ensure the TBMs would not sink and the filament wound fiberglass-mortar jacking pipe would not float out of design tolerance. Because of the poor soil conditions and the fact that boring would occur well below the water table, the operating conditions called for the use of a Slurry TBM.

As the saying goes: when buying any tool or piece of machinery, buy once, cry once. Having worked with inferior equipment (as well as good equipment that was just too far beyond service life to be productive) in previous roles at various underground companies, Robert Marshall and newly hired Slurry TBM Operator and Superintendent, Mike Abbott set out to put together a slurry tunneling program that was second to none. To start, an Akkerman SL60 MTBM pipe jacking system was purchased. A micro-tunneling system utilizes computer controls to allow the TBM operator to drive the TBM from a climate-controlled office on the surface. To assist the operator, a laser mounted in the jacking pit shines through the tunnel at the design line and grade. This
laser hits an optical eye in the bulkhead of the MTBM, the control computer shows the location of the laser with respect to the center of the machine, and the machine is steered in a direction to maintain line and grade. Along with the laser data, the computer projects deviation from line and grade if you are to maintain the current steering cylinders positions, reports of the steering head and body of the machine, and reports roll of the TBM to help the operator decide which direction to operate the cutter head. In addition to the TBM controls, the operator is responsible for controlling the slurry pumps and flow diversion valves at the head of the machine, as well as the extension and retraction of the hydraulic jacks that thrust the pipe and TBM through the ground.

The Akkerman equipment is not only at the top of its class when it comes to quality and technology, it is designed and manufactured on American soil and supported very well through highly trained field technicians and a very well-stocked aftermarket support program. The MTBM for the PWI contracts was ordered with a 250hp drive, as opposed to the standard 150hp drive. The additional horsepower gave us great flexibility when it came to adapting the TBM to future works, allowing cutter heads to be designed more aggressively for higher excavation rates or in larger diameters in conjunction with a body skin to allow the installation of pipe diameters ranging from 60” to 74”.

Because a Slurry TBM relies on a plant on the surface to remove the cuttings and suspended solids from the slurry and return a clean cutting fluid to the face, it can only advance as fast as the slurry is cleaned. To handle slurry cleaning duties, a Derrick Corporation slurry separation plant piggy backed by a Derrick Corporation DE-7200 VFD centrifuge provides more than enough processing capacity for the diameter range possible with this MTBM. The slurry is pumped from the head of the MTBM back to the jacking shaft where a booster pump provides the head required to take the slurry out of the pit and up to the top of the slurry plant. The slurry flows through two parallel primary shakers where the large particles (a crusher cone in the plenum of the MTBM reduces all materials to a size of 1” diameter or less) are caught and dumped into a muck bay while the slurry flows through the shaker screens into a large tank. The slurry is then pumped up to an array of de-silter cones where the sand particles are removed, with the de-silted slurry dumping through a secondary shaker screen which catches the remaining clay particles and larger suspended solids. The slurry is now clean enough to return to the cutting chamber to collect more excavated material.

As the slurry begins to thicken throughout the day with fine suspended solids that cannot be removed by the slurry plant, it will be pumped through the centrifuge to drop out all remaining suspended solids. To facilitate removal of these suspended solids, a flocculating polymer is added to the slurry prior to entering the centrifuge. The polymer causes the small particles to clump up and the increased mass of the particles as they clump allow them to be dropped out of suspension through centrifugal force, producing clear water to be dumped back into the slurry tank to dilute the thick slurry.

What the Future Holds
The Las Vegas team is wrapping-up all tunneling operations at PWI. When the project is complete, the Akkerman SL60 MTBM will be shipped directly to Campbell River for the Raw Water Lake Intake project to complete Frontier Kemper’s first wet retrieval. In late June part of the PWI crew headed to Los Angeles, CA for the City Trunk Line South Unit 4 Phase 2 project for the Los Angeles Department of Water and Power to construct an oval-shaped SEM/NATM excavated tunnel under the Tujunga Wash.
People, Projects, & Ingenuity

FKCI WELCOMES
Engineering Manager, Christine Linden

In January, Frontier-Kemper welcomed new Engineering Manager, Christine Linden. With more than 20 years experience in mining engineering, mine development, heavy civil/structural construction, and related activities, Christine comes to FKCI with a wealth of experience that has allowed her to hit the ground running. Christine has worked at several underground mines throughout the US and Canada, where she has held various leadership positions. Additionally, Christine has worked on large EPCM projects including the development of a repository for spent nuclear fuel and high-level nuclear waste. She most recently served as Chief Engineer and Manager of Technical Services at Thyssen Mining. Christine is a licensed Professional Engineer in Alaska and Nevada, as well as the Canadian provinces of British Columbia, Ontario, Saskatchewan, Northwest Territories/Nunavut, and Manitoba. Please join us in extending a warm welcome to Christine as she embarks on this exciting new experience.

MINING DIVISION
15.05 Buchanan Vent Shaft #16

Frontier-Kemper continues its historical presence in Southwest Virginia with the construction of Vent Shaft #16 for the Buchanan #1 Mine Complex in Whitewood, Virginia. This long-standing customer saw a change in ownership during the first quarter of 2016. Coronado Coal of Wilton, Connecticut acquired the Buchanan #1 Mine from CONSOL Energy and is now operating the mine as Buchanan Minerals, LLC. Despite the change in ownership, it has been business as usual for the FKCI project team at Vent Shaft #16.

Vent Shaft #16 is a concrete-lined Shaft measuring 18 ft. in diameter and approximately 1,215 ft. deep. The project also includes two Water Rings and a three-way Mine Level Station with concrete invert. The shaft was excavated using Conventional Drill and Blast methods.
People, Projects, & Ingenuity

One specific challenge at Vent Shaft #16 was to stop the water inflow within the initial few hundred feet of the shaft. Pre-sinking grouting and in-shaft grouting were both utilized to reduce the water. To collect the remaining water entering the shaft, FKCI elected to install a Water Ring below the inflows. The Water Ring was then connected to a 12-in. diameter hole drilled parallel to the shaft from the shaft interior. A deep well pump was installed in the adjacent hole to remove the surrounding ground water and the water from the shaft Water Ring. This created substantial savings for Buchanan #1 due to the water prevented from entering the mine dewatering system.

With the water removed from the shaft sinking environment, FKCI was able to efficiently mine the shaft through hard shale and sandstone formations. Construction was completed in mid September 2016.

**CIVIL DIVISION**

**13.20 John Hart GSR Project**

The John Hart Generating Station Replacement (GSR) Project sits in the temperate rainforest of Campbell River, British Columbia. BC Hydro, is replacing an antiquated, surface hydroelectric power plant built in 1947 with a safer, more resilient plant underground. Frontier-Kemper ULC formed a joint venture with Aecon/SNC-Lavalin JV to complete a 36-month tunneling and shaft-sinking schedule to create the underground powerhouse cavern where the new turbines will reside.

The Frontier-Kemper site management team studied the final excavation means and methods while benching neared completion on Bench 3 and began on Bench 4 with hopes of identifying opportunities to improve schedule. This exercise yielded a unique innovation for the project. During the excavation of the 64,000m Power House, where three hydroelectric turbines will eventually operate, an estimated one month was shaved off of the project schedule. The Power House, which is nearly the size of an underground football field, had been slated for excavation in eight lifts (benches) below the crown level. Instead of continuing to excavate benches in a linear fashion, Frontier-Kemper made use of a crown pillar in order to excavate multiple benches concurrently, making use of draft tubes at the lowest elevations we had recently completed.
People, Projects, & Ingenuity

FKC-LAKE SHORE DIVISION

16.02 Fresnillo Record-Setting Vertical Belt

Since publication of the last issue of the Crosscut, FKC-Lake Shore has completed successful projects with Webster County Coal LLC, Warrior Coal LLC, and Votorantim Metals; and is in the process of delivering exciting material handling projects for customers throughout North and South America. In February, FKC-Lake Shore landed its next big project in the heartland of our neighbors to the south. Fresnillo PLC has contracted FKC-Lake Shore to provide a new Vertical Conveyor System for the San Diego Shaft at their Fresnillo Mine. The Fresnillo Mine, located in Zacatecas in central México, specializes in the extraction of precious metals namely silver. The Vertical Belt is a FLEXOWELL® S-shape system measuring 830m in length. The Vertical Conveyor System will handle 200 metric tons per hour at 400m of lift; the seventh world record for FKC-Lake Shore and partner, Continental Contitech, in the deep shaft, underground mining industry.

The project will extend FKC-Lake Shore’s market share within Central America and further solidify the case for using Vertical Conveyor technology in deep, underground mines. With record-low commodity prices and oversupply in the mining industry as of late, the Fresnillo Vertical Belt is a prime example of FKC-Lake Shore’s ability to win work in a cyclically difficult period; all while shifting focus and putting down roots in new markets.

The Vertical Conveyor System is currently in the testing stage of the project life cycle. Early phases of installation are expected to begin in December 2016. Install completion and commission of the entire system, including a significant change order for the Underground and Surface Ore Handling Systems is expected to take place in March/April 2017.

SHOP & YARD

CNC Machines

In November 2015, Frontier-Kemper took delivery of two, new Haas CNC machines at the Main Shop in Evansville, IN. Both the VF-6 Vertical Machining Center and the ST-35 (a 2-axis lathe) were purchased to provide higher levels of service to all Frontier-Kemper divisions. The goals for this investment were to reduce outsourced machine work, maintain more control through the process of design-build components for the Lake Shore Division, and provide a wider array of custom equipment solutions – all while showing a significant reduction in cost.

Within days of receiving, installing, and commissioning the new machines, the EVV Shop tackled a large project with an aggressive schedule for FKC-Lake Shore; eight (8) spherically seated Safety Glands for Agnico Eagle and Sierra Metals. Coordinating machine-operator training along with construction of the glands went well; the entire Machine Shop stepped-up and completed the job accurately and on time.

With nearly a year of experience and many projects completed, the value these CNC Machines bring to the table is more than expected. However, this value is only realized through the hard work and dedication of the people involved. With more competitive costs and increased capabilities, throughput in the Machine Shop has increased tenfold with these additions.
Years of Service

40 YEARS
Tony Wargel Shop & Yard 9/22/2016

35 YEARS
Dennis Morrison Engineering 12/21/2016
Cheryl Hughes FKC-Lake Shore 11/30/2016
George Foster EVV Shop & Yard 10/26/2016

30 YEARS
John Branson EVV Shop & Yard 7/1/2015

25 YEARS
Bill Dean NEDO 7/22/2016
Peter Hanke Estimating 7/23/2015

20 YEARS
Don O'Brien NEDO 12/2/2016
Doug Dye Buchanan VS #16 3/6/2016
Dave Rogstad President & CEO 12/4/2015
Lonnie Jacobs NEDO 2/20/2015
Anne Mamone NEDO 1/11/2015

15 YEARS
Brian Scott Engineering 12/3/2016
Kerry Wolfe EVV Shop & Yard 8/6/2016
Thomas Wheeler Jr. Buchanan VS #16 9/14/2016
Jim McMahon FKC-Lake Shore 9/5/2015
Dana Markee Accounting 6/26/2015

10 YEARS
Michael Odle Solvay VS #4 12/7/2016
Denver Sizemore Mine Development 11/22/2016
Dan Rathmann EVV Shop & Yard 11/13/2016
Matt Willhite FKC-Lake Shore 9/25/2016
Stephen Horning Accounting 9/18/2016
Marci Ranes Accounting 9/11/2016
Anthony Hays Solvay VS #4 8/7/2016
Gary Muhs Engineering 6/5/2016
Brannon Cater EVV Shop & Yard 10/31/2016
Erin Doyle John Hart CSR Project 4/18/2015

5 YEARS
Doug Buckman EVV Shop & Yard 12/9/2016
Lori Haley Accounting 12/12/2016
Tom Herford Solvay VS #4 8/25/2016
Mike Evans FKC-Lake Shore 8/22/2016
Brent Hunt Solvay VS #4 8/11/2016
David Schreiber EVV Shop & Yard 7/5/2016
Nestor Garavelli Frontier-Kemper ULC 4/10/2016
Adam Cannon Solvay VS #4 3/21/2016
Jeremy Davis Engineering 3/14/2016
Bob Lancaster EVV Shop & Yard 3/7/2016
Derek Hazelip EVV Shop & Yard 2/23/2016
John Woodward FKC-Lake Shore 2/7/2016
Paul Cannon Solvay VS #4 2/1/2016
Michael Lang CMo06 1/17/2016
Ricky Lickey EVV Shop & Yard 1/3/2016
Rohit Shetty Chinatown Station 12/20/2015
Rick Meyer Engineering 11/22/2015
Jimmy Poole FKC-Lake Shore 9/7/2015
Chris Robinson Solvay VS #4 5/24/2015
Ashok Stanley Engineering 5/3/2015
Derrick Bearden EVV Shop & Yard 5/3/2015
Kevin Dartt FKC-Lake Shore 4/5/2015
**FKCI Bids Farewell to 100+ Years of Experience**

**Albert Macke Retires**

Congratulations to Albert Macke on his retirement from Frontier-Kemper after 42 years of service. We’ve all enjoyed his presence in the office and considered him a valuable asset to the Frontier-Kemper team. While his hard work and diligence will be greatly missed, his retirement is most deserving. Our hope is that he will find the same success and happiness in retirement that he’s experienced during his time at FKCI. We wish Albert the best of luck in his your future endeavors. Here’s to a fun and rewarding retirement! Congratulations.

**John Batchelor Retires**

John Batchelor retired from his position as Electrical Supervisor on August 31, 2016 after 36 years of service at Frontier-Kemper. John’s experience has been invaluable. He could always be counted on to set up a project’s electrical equipment safely, efficiently, and under budget. He knew the length and type of every cable that was on hand in our Evansville equipment yard. John’s ability to troubleshoot equipment issues, often over the phone, was second to none. His trips to jobsites to inspect equipment created a peace of mind for everyone involved. John has been an integral part of Frontier-Kemper’s success over the years. His loyalty and dedication will truly be missed.

This fall, John will surely enjoy a peaceful deer season in the woods of Southern Illinois without the worry of a jobsite calling. Good luck! We wish you a long and enjoyable retirement.

**Clyde Purdue Retires**

After 20+ years working for Frontier-Kemper, Clyde Purdue has retired from the industry. Clyde worked for Frontier-Kemper’s Northeast Division since 1995 on NYC-DEP Shaft 26B, NY-NJ Port Authority JFK Bridge Rehabilitation, NYC-DEP Bowery Bay Project, New Croton Aqueduct Rehabilitation, MTA East Side Access – Manhattan Structures North, NYC-DEP Third Water Tunnel Raise Bores, various Joint Ventures and numerous other Raise Bore Projects in New York.

During the 1970’s Clyde worked on Perini’s Upper Westside Sewer Tunnel (the first use of a tunnel boring machine in New York) and the 63rd Street NYCTA Tunnel. Clyde retired while working on the Eastside Access Project, which utilizes the 63rd street tunnel he originally constructed.
Crosscut is FKCI’s semi-annual newsletter. Just as a crosscut in a mine or tunnel provides a connection between one area and another, this newsletter serves to connect the various parts of our organization. The Crosscut’s aim is to celebrate accomplishments, provide explanations and information, and promote communication. To help maintain the standard of our publication, your comments and suggestions are appreciated and welcome. Write to FKCI Crosscut, P.O. Box 6690, Evansville, IN 47719-0690.