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# Precision Excavating: The What and Whys of Vacuum Excavation

Ben Schmitt & Ron Spoerl  
Session #T35

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## Why are We Here?

### 1 dead, several severely burned after Shelby County gas line explosion

However, at 10:45 p.m., pipeline operator Colonial reported that five were injured and one fatality was discovered at the scene of the accident. Pipeline operator Colonial said the contractors experienced an incident when the trackhoe it was using hit the line.

"Typically we don't see external damage to a pipeline from ground-level activity, whether it's human or weather-related, except for some third party striking the pipeline with a piece of excavation equipment." Brigham McCown, former administrator of the federal Pipeline and Hazardous Materials Safety Administration told AL.com last month.

**That's now the leading cause of pipeline spills and accidents.**



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## Introduction

- Ben Schmitt
  - Vactor Manufacturing Product Manager
- Ron Spoerl
  - Hawk Construction LLC



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## What is Vacuum Excavation?

- Non-Mechanical
- Non-Destructive
- Safely Visually Locate
- Precise Excavation
- Minimally Disruptive



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## Why are We Here?

*In Walnut Creek, California on November 9, 2004, a petroleum pipeline carrying gasoline to San Jose, California, owned and operated by Kinder Morgan, struck by a Cascade Inc. construction Bay Municipal gasoline spill resulting in a the deaths of supervisor and the severe injury of five others. A Kinder Morgan worker had misread an as-built map, and had incorrectly marked the pipeline's route before the accident.*

**\$90,000,000 IN FINES AND  
LAWSUIT SETTLEMENT**



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## Is Vacuum Excavation New?



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### Vacuum Excavation History

- 1960's Vactor ExcaVACTor
- Sewer Cleaners Adapted in 70's – 80's
- First Dedicated Machines in 80's for Canadian Oilfields
- Mainstream in the late 1990's



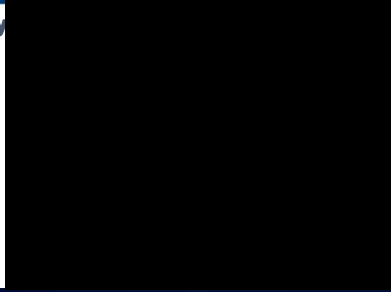
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### Why



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### Why Vacuum Excavate?

part of a settlement. But the explosion should've never happened, and could've been prevented had Romeoville officials investigated the case. What made the case particularly egregious, to id-09, en, le, ew ith- v. The Illinois Commerce Commission concluded in 2009 that Globe Construction, the contractor in the case, "willfully violated" state safety law during the project. Globe was fined \$1.25 million.

Chicago Tribune | Section 1 | Thursday, April 8, 2010

### Romeoville house explosion



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### Why Vacuum Excavate?

**FIRE ERUPTS AFTER BACKHOE STRIKES GAS LINE IN WOODLAND HILLS, HOMES EVACUATED**



A fire erupts in Woodland Hills after a backhoe struck a gas line and ignited it on Wednesday, Aug. 3, 2016.

WOODLAND HILLS, CALIF. (AP) — Homes in Woodland Hills were evacuated after a backhoe struck a gas line and ignited it on Wednesday. Fire officials said the backhoe struck a 4-inch gas main in the 1000 block of N. Chicago Avenue shortly after 7 p.m.

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### Why Vacuum Excavate?

**Las Vegas natural gas line catches fire after backhoe accident**

By Sam Staff (contact)

Published Tuesday, July 26, 2016 | 12:27 p.m.

Updated Tuesday, July 26, 2016 | 3:56 p.m.

A backhoe hit a natural gas line in a residential neighborhood today, sparking an intense blaze that firefighters allowed to burn until the gas could be shut off, according to Las Vegas Fire & Rescue officials.

Fire department spokesman Tim Kivimaki said the fire was "extremely intense," and the fire company was the first to arrive. Firefighters opened water on the burner to keep them from catching fire, he said.

The fire was reported about 11:43 a.m. on Acacia Tree Drive at Anasazi Drive, said fireman John W. Brown.

Eleven people were evacuated, officials said.

No homes were involved, and nobody was injured, officials said.

The backhoe was digging on the street when it ruptured a gas main, officials said. Details of who was operating the machinery was not immediately released.

Gas was shut off to the area by about 1:30 p.m., and firefighters stood by as the remainder of the gas in the line burned off, officials said.

More police and officers assisted with traffic control and evacuation. Streets in the area were closed.

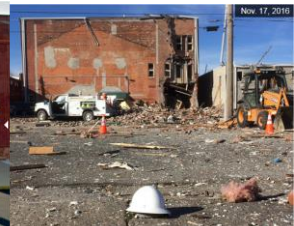
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### Why Vacuum Excavate?



The explosion took place shortly before 6 p.m. The American workers arrived on the scene about 7 p.m. and started digging for a gas service line, according to utility spokesman Tucker Kennedy.

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### Not All Hits Result in a Fireball



Hollywood, Nov. 16, 2015

**HOLLYWOOD, LOS ANGELES (KABC) —**A Los Angeles Department of Water and Power crew punctured a gas line in the 7000 block of PCH, California Boulevard in Hollywood Saturday, prompting precautionary evacuations of more than 100 people from nearby buildings.

Construction crew LADWP were in the process of installing a water service on a water main when their backhoe punctured the cracked six-inch gas line at about 11:30 a.m.

We were prospecting over that mark and what we did is excavate three and a half feet away from it to locate the gas line. We were not supposed to dig there, and it is the gas line that was hit. It is a different location, and it is the gas line that was hit with their gas main. It's a different type of LADWP work.

More than 100 homes and 10 cars were evacuated from six buildings, Los Angeles Fire Department officials said. About 10 people were told to shelter in place.

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### Not All Hits Result in a Fireball



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### Not All Hits Result in a Fireball

Official: Construction crews break water line in Gilbert

The Republic, 4/15/2015, 4:37 PM - 4:57 PM

Construction crews in Gilbert for a water line at Eastview Elementary, according to a city official. Reclaimer water from the broken line gushed into eastbound Wilcox Road between Gilbert Road and Civic Center Drive, backing traffic there to one lane, said Jennifer Alvarez, a city spokeswoman.

Alvarez said city water employees have stopped the flow and are working to assess the damage and necessary repairs.

Photo: City of Gilbert



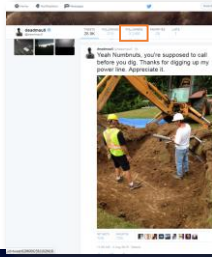
Gilbert, Arizona  
@GilbertAZ  
#GilbertAZ  
A mistaken water line break is being fixed near Gilbert and Wilcox Rd. Please #ConcureCity  
4:37 PM - 18 Aug 2016

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### News Travels Fast!



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### Not All Hits Result in a Fireball

4/15/2015 2:56:00 PM

UPDATE: Peru school evacuated after contractor ruptures gas line

Lauren Blough

NewsTribune Reporter

Share With Friend

Students were able to get out of school early after a contractor working at the construction site of the new addition at Northview School in Peru struck a gas line.

Peru police chief Doug Bernabel spelled out a whirlwind string of events, starting with the first 911 call logged at 2:45 p.m. Police were on scene two minutes later and the first fire crew was in place at 2:52 p.m. The school was evacuated at 2:55 p.m. — preschoolers were dismissed earlier in the school day — and the gas was shut off at 3:09 p.m.

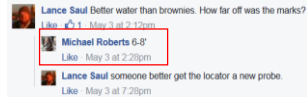
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### Why Do They Happen?

• Electronic Locates are Often Inaccurate

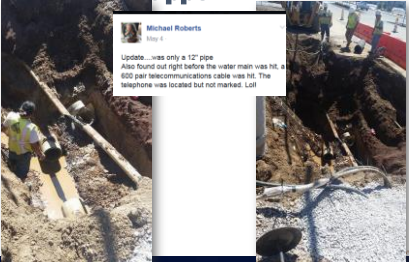


Michael Roberts  
Blue State was way off... All those baseball size rocks were launched in the air about 60'. Rocks sand blasted at the point off the back of the digger.



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## Why Do They Happen?



**Michael Roberts**  
May 4

Update...was only a 12" pipe  
Also found out right before the water main was hit, a 800 pair telecommunications cable was hit. The telephone was located but not marked. Lol!


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## Why Do They Happen?

**WEIRD NEWS**

### Cards Against Humanity Threw \$100,000 Into A Giant Hole Over Thanksgiving Weekend



*Is the hole bad for the environment?*  
*No, this was just a bunch of empty land. Now there's a hole there.*



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## Why Do They Happen?

**Hydrovac Nation = HYDROVAC NATION**

Had I member write me!!!

Just a fun note: I was thinking of you hydrovac operators and those who locate buried lines for ya. We had a contractor doing line locates out in our neighborhood again ... he was carrying the locator on his right and just whipping those marker flags down on his left anywhere he could. Didn't even look like he was using the locator. Then he put the locator down and continued up the street with the flags throwing them down. I thought maybe he painted it first, nope, he didn't. He did the painting after throwing down the flags. Hate to be the guy who has to go digging in there! I see my cable line getting out again...

Then today he wrote me again!

Well it happened yesterday. They started digging where they had located and poof! Gas line cut. Wonderful time last night being kicked out of the house and the neighborhood while they had to stop the leak.

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## Why Do They Happen?

North American Pipeline, Inc. PHMSA: <http://opsweb.phmsa.dot.gov/pipelineforum/faq/>



**> 2.5 MILLION MILES IN US!**

Map Composition:  
William Huston / Shaleshock Media  
WilliamAHuston@gmail.com

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## Why Do They Happen?

### Traffic Signal Innovations

How is it doing the best thing?

With the increasing demand of reliability and efficiency on the SDOT Signal system, the SDOT Signal Group has created an experience with some construction professionals and equipment that can make our system more robust and resilient.

We've begun using steel over our signal poles which can double the life expectancy of our signal equipment as well as decrease the amount of maintenance calls like things like road works. They are also much more readily opening than signs over cones.



How do you install? You don't need any special jobs required for the old signal poles or that and University Street.

How is it doing the best thing?

As the downtown area, it can often be very difficult to install traditional for those who go beyond from an easy, efficient, minimal equipment, for instance. One of the biggest construction problems we have created using a traffic structure which can help prevent work to ensure that the road's resources to improve the ability of digging with a large repair job. That only show the scale of construction and change the way we control how it is strictly designed to provide forward side view of the

How is it doing the best thing?

We've also started updating our communication systems from copper to fiber and connecting signals that are currently not part of the system. Fiber communication allows us to use our central systems to talk directly to devices in a redundant network rather than point to point. This means that if one part of the system goes down it doesn't take the whole network down. Smaller tin like going from the old incandescent Christmas lights to save LEDs.

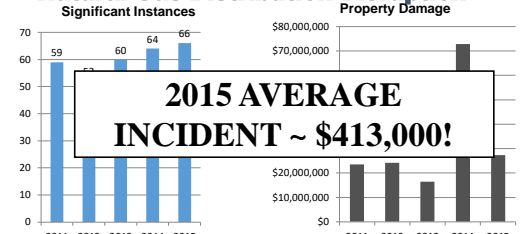
Moving forward, we have started exploring new technologies like advanced and thermal protection detection, real-time data collection, wireless communication between signals, solar power and materials with a smaller footprint to assist with more protection and like literally urban designs.

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## Natural Gas Distribution Disruption

Significant Instances | Property Damage



Year	Significant Instances	Property Damage
2011	59	\$20,000,000
2012	60	\$20,000,000
2013	64	\$15,000,000
2014	66	\$25,000,000
2015	66	\$75,000,000

**2015 AVERAGE INCIDENT ~ \$413,000!**

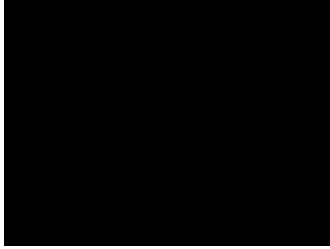
Source: <http://phmsa.dot.gov/pipeline/library/data-stats/pipelineincidenttrends>

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## Google Fiber Video



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## Root Cause Analysis

(220 ILCS 50/4)  
 Sec. 4. Required activities. Every person who engages in nonemergency excavation or demolition shall:  
 (a) take reasonable action to inform himself of the location of any underground utility facilities in and near the area for which such operation is to be conducted;  
 (b) plan the excavation or demolition to avoid or minimize interference with underground utility facilities within the tolerance zone by utilizing such precautions that include, but are not limited to, **hand excavation, vacuum excavation methods,** and visually inspecting the excavation while in progress until clear of the existing marked facility.  
 Source: www.jllinois1call.com



States Requiring Hand Dig or Soft Dig in Tolerance Zone



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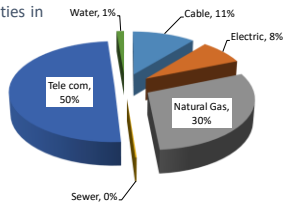
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## Affected Utilities

- Over 19 million miles of buried utilities in the United States
- 288,346 known strikes in 2015!
  - That's one every 2 minutes!
  - 5% increase from 2014



Source: 2015 CGA DIRT Report

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## What They Think...



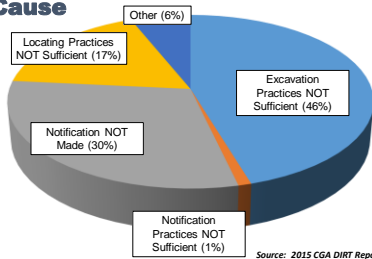
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## Root Cause



Source: 2015 CGA DIRT Report



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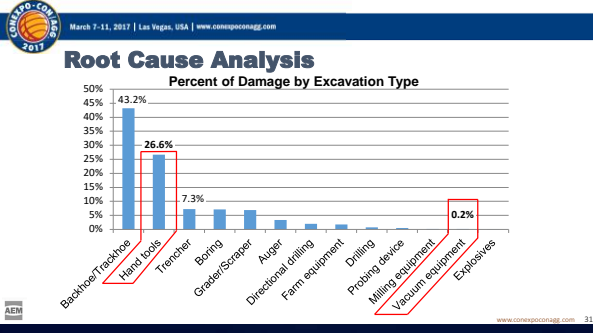
## What We Do



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### Advantages of Hydro Excavation

- Can Dig in Virtually All Soils
- Can Dig in Frozen and Hard Soils
- Water is a Lubricant
- Eliminates Sandblasting Effect
- Eliminates Fugitive Silica Dusts
- Reduces Static Hazard
- Varied Water Pressure and Flow
- Can be used for Alternate Applications
- Highly Productive in Virtually all Soil Conditions

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### Root Cause Analysis

Shovel Damage

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### Advantages of Air Excavation

- Air is Limitless
- On-Demand Generation
- Non-Conductive
- Lighter Weight Unit
- Faster Excavation in Loose Soil
- Dry Spoils for Backfill
- Drought Proof

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### Root Cause Analysis

**UPGRADES**

- **Air/Water Digger** - The use of air or air/water jet combination is very effective for interrogating in hard compacted soil. The stream will penetrate soil with compaction values of over 20 tons/ft<sup>3</sup> creating a trench 5" deep and 10" long. Using the air to blast away debris to expose pressure sensitive explosives allows for a much safer interrogation process.

**VEHICLE MOUNTED INTERROGATION ARM**

DETECT. INVESTIGATE. REMOVE.

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### Advantages of Vacuum Excavation

- Jobsite Safety – 100% Verification of Utility
- Non-Visual Utility Locating Methods are Often Inaccurate
- Much Faster than Manual Excavating Methods (Hand Digging)
- Versatile – Equipment can be used for many Applications
- Easily Reach Hard to Reach Areas
- Reduces Landscape Reconstruction
- Improves Public Perception
- Reduces Risk with Non-Destructive Methods
- Safety as a Value Proposition
- Reduces Job-Site Congestion
- Reduces Operator Fatigue

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## Competitive Advantage

### ALA Benefits for the Excavator

- Reduces the wait time for a locate providing the ability to expedite Customer requests
- Reduces the administrative burden related to managing locate requests (e.g. relocates for project work).
- Competitive advantage
- Improved response time on locates that do not fall under the ALA



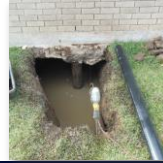
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## Excavate in Hard to Reach Areas

- Easily Access Remote Locations
- Minimal Disruptions
- Does Not Damage Surrounding Area



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## What Can You Do With A Vacuum Excavator

- Light Pole Installation
- Directional Drilling Mud Recovery
- Potholing/Daylighting
- Safe Excavation around Utilities
- Water Main Repair
- Pit Cleaning (Car Wash, Elevator, etc.)
- Electrical Fault Repair
- Fence Installation
- Telephone Pole Installation and Removal
- Anode Replacement
- Large Excavations
- Water Valve Exercising
- Water Valve Replacement
- Gas Line Repair/Shutoff
- Fire Hydrant Maintenance
- Excavation around Tree Roots
- Spill Cleanup
- Fiber Optic Repair
- Sand Filtration System Cleanout
- Vacuum Roof Rock
- Valve Box Cleanup
- Catch Basin Cleaning
- Portable Toilet Cleanup
- Recovery of Material
- Cleaning of Lateral Lines
- Lift Station Cleaning
- Culvert Cleanout
- Utilize as a Water Truck
- Natural Gas Extraction
- Cathodic Protection
- Service Cut-Off
- Connecting Service Tee or Lateral
- Pipeline Inspection
- Pressure Testing
- Slot Trenching
- Frozen Ground Excavation
- Telephone Line Repair
- Vault/Hole Digging
- Window Well Installation
- And More!



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## Excavate in Hard to Reach Areas



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## Water Mains

- Minimal Ground
- Can Dig in Mudd
- Water Mains are Utilities
- Repair without S
- Reduced Traffic

Anthony White @anthonywhite  
 Seriously? Acton Municipal Utility District employees are dedicated.  
 #employeeofthemonth Photo cred: Andrea Adams



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## Excavation Around Tree Roots

- Fast and Efficient
- Non-Destructive to Tree Roots
- Mandated by some Cities



### TREE PROTECTION POLICY AND SPECIFICATIONS FOR CONSTRUCTION NEAR TREES

#### Within a TPZ, there must be:

- no construction;
- no altering of grade by adding fill, excavating, trenching, scraping, dumping or disturbance of any kind;
- no storage of construction materials, equipment, soil, construction waste or debris;
- no disposal of any fluids (e.g. concrete slurry, gas, oil, paint);
- no movement of vehicles, equipment or pedestrians;
- no parking of vehicles or machinery;
- directional micro-tunneling and boring may be permitted within the limits of a TPZ subject to approval by Urban Forestry;
- open face cuts outside a TPZ that are consistent with an approved plan and that require root pruning, require the services of a qualified arborist or approved tree professional. An exploratory dig, either by hand or using a low water pressure probe (air method) must be completed prior to commencing with open face cuts outside the TPZ.



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### Excavation Around Tree Roots

Translating Cal Theobald to Tree's Health  
March 10, 2014 by Kenneth G. Brackley, Inc.

By: Steve Rosen

The fact that Cal Theobald is a tree doctor is not surprising. He has spent his career in the field of arboriculture, and his expertise is well known. He has been a member of the International Society of Arboriculture (ISA) since 1980, and has served on the board of directors of the ISA's California Chapter since 1998. He is also a member of the ISA's National Council of Fellows.

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### Surface Preparation



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### Prevent Cross Bores



Source: People's Gas

#### Methods Used for Cross Bore Elimination and Prevention

1. Records review
2. Inspection mains and lateral sewers from sewer main with robotic CCTV cameras
3. Inspection of lateral with push rod CCTV cameras
4. Pot holing using vacuum excavation
5. Combining 1, 2, 3 or 4 with GPS/GIS sub foot accuracy mapping saved into permanent data base – accessible to multiple users with aerial photo overlay.

Source: Cross Bore Safety Association

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### Contain and Transport Material



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### Utility Pole Installation/Removal

- Not All Utility Poles are Clear



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### Vacuum Roof Rock



Source: Great Lakes Power Vac



Source: Dunn Service Group

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## Fish Line through Conduit



Source: Done-Rite Daylighting  
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## Best Practices

- Electrical Safety Authority – Technical Standards & Safety Authority
  - Guideline for Excavation in Vicinity of Utility Lines
  - TSSA is an Ontario based, not-for-profit, self-funded organization dedicated to enhancing public safety in Ontario
- ESA guideline specifies pressure for hydro excavation
  - Max pressure with a straight tip nozzle – 2,500 PSI
  - 1,500 PSI max pressure when below 18” of the road surface.
  - Max pressure with a spinner (orbital) nozzle – 3,000 PSI
  - An 8” distance shall be maintained between the end of the pressure wand nozzle and soil.



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## Trench Collapse Rescue

Person identified after being pulled from collapsed trench in Washington Twp.



Fire crews trying to recover body from collapsed trench in Washington Township  
WASHINGTON TOWNSHIP (NBC7) – Fire officials on the scene of a trench collapse say they are looking for a male victim.  
Washington Township Fire Chief Bill Gaul said they have multiple resources at the scene of the accident and the township has exhausted all its resources, except for one engine and one medic in case of another call.  
**Gaul said they also are using a remote tool from the Fire Department to retrieve the body** from the hole, however, crew still don't know the exact location of the man's body.  
Gaul said the weather could become a factor for rescue crews, with the heat and especially if it begins to rain.



## Rescuing 'Randy': Alton firefighters, Public Works employees practice trench rescue scenarios Tuesday

By Linda K. Walker | walker@altonnews.com



ALTON — A simulated, step-by-step exercise was conducted for Alton firefighters and Public Works employees Tuesday to practice trench rescue scenarios. The exercise was held at the Alton Fire Station and was led by Alton Fire Chief Brian Smith. The exercise was designed to help firefighters and Public Works employees practice trench rescue scenarios. The exercise was held at the Alton Fire Station and was led by Alton Fire Chief Brian Smith. The exercise was designed to help firefighters and Public Works employees practice trench rescue scenarios.



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## Best Practices

- Gas Technology Institute (GTI)
  - Vacuum Excavation Best Practices & Guidelines
- GTI guideline specifies pressure for hydro excavation
  - Same as TSSA
  - Max pressure with a straight tip nozzle – 2,500 PSI
  - 1,500 PSI max pressure when below 18” of the road surface.
  - Max pressure with a spinner (orbital) nozzle – 3,000 PSI
  - An 8” distance shall be maintained between the end of the pressure wand nozzle and soil.



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## Swine Transport Cleaning

Hydrovac Based Swine Transport Cleaning Expected Soon

17 August 2016

CANADA - A Professor with the University of Saskatchewan hopes to have a manual hydrovac system for cleaning and disinfecting swine transport equipment operational by the end of 2016, writes Bruce Cochrane.

As part of research being conducted on behalf of Swine Innovation Farm, scientists are working to automate the washing and disinfection of swine transport vehicles to reduce the risk of spreading disease.

The Prairie Agricultural Machinery Institute is developing a hydrovac based system for washing the equipment. VICO-Innovex is examining methods to ensure the pathogens are deactivated, and the Prairie Swine Centre is evaluating the design of the trailers.

Dr Terry Forstad, a Professor in the College of Engineering at the University of Saskatchewan, says the goal is to reduce the time it takes to clean swine transportation equipment and ensure all organisms capable of causing disease have been killed.



Dr Terry Forstad-University of Saskatchewan

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## Hawk Construction Intro



- Ron Spoerl
  - Owner – Hawk Construction
  - An opportunity in vacuum excavation led to utility market analysis with the help of the American Indian Chamber of Commerce and the Small Business Administration.
- Developed Business Plan and Formed Hawk Construction in 2003
  - The name “Hawk” comes from Ron’s native name “ThunderHawk”
  - Created relationship with Michel’s Corporation for potholing on utility locates
  - With the support of Vector, leased and took delivery of first Vector HXX truck in the spring of 2004
  - Added additional Vector HXX in 2005

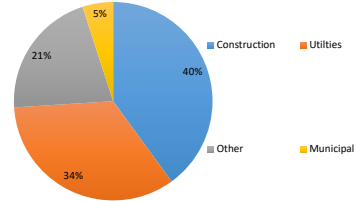
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## Revenue by Customer Segment



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## Hawk Construction Intro (cont.)

- Past Construction Mgt and Project Mgt Background
  - Managed over 1000 employees
  - Accountable for over \$100 million in revenue

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## Key Customers



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## Current Geographies



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## Engineering Companies

- Utility Locates for Sub-Surface Engineering (SUE)
  - Documentation
  - Surveying
  - Mapping
  - Backfilling



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### Utility Applications

- Gas, Power, Fiber, Water/Waste Water
  - Utility Poles
  - Trenching
  - Fast Paths
  - Transformers
  - Splice Pits
  - Fault Repair
  - Valve Box Repairs



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### Building Applications

- Building Contractors
  - Excavate Elevator Shafts
  - Expose Footings
  - Trench in Basements
  - Excavate Crawl Spaces
  - Remove Roof Rock



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### Rail Applications

- Rail Roads
  - Expose Railroad Ties
  - Replace Railroad ties
  - Utility Trenching
  - Utility Locating
  - Switch Cleaning
  - Spill Clean-up



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### Environmental/Industrial Applications

- Environmental and Industrial
  - Power Plants
  - Catch Basins
  - Grading and Excavating
  - Culverts – Bridge Cleanouts
  - Department of Transportation



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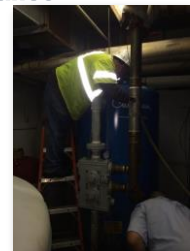
### Plumbing Applications

- Plumbing Contractors
  - Vacuum Salt in Water Softeners
  - Expose Sanitary and Water Laterals
  - Exterior Trenching
  - Interior Trenching



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### Water Softener Maintenance





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## Foundation Footings



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## Hawk's Accomplishments

- 2007 WISDOT New and up and coming DBE Firm
  - Wisconsin Department of Transportation
- 2007 WUCA Safety Award for outstanding performance
  - Wisconsin Underground Contractors Association
- 2006 WISDOT The Secretary's Golden Shovel Award
- 2006 WUCA Safety Award for outstanding performance
- 2005 Business of the Year Award – American Indian Chamber of Commerce
- 2005 WUCA Safety Award for outstanding performance
- 2004 WUCA Safety Award for outstanding performance

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## Crock Installation



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## Hydro Future Expansion

- New Hawk Centers:
  - Zion, IL – Completed in 2016
  - Manteno, IL – Completed in 2016
  - Joliet, IL – Completed in 2017
  - Madison, WI – Coming in 2018
  - Fox Valley, IL – Coming in 2018
  - West Coast – Target Fall 2018
    - Looking for New Partners
  - East Coast – Target Fall 2019
    - Looking for New Partners

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## Hawk's Reputation

- Quality Employees
  - Extensive training through "Hawk University"
    - Quarterly, ongoing education
  - Astute understanding of Customer Needs
  - Employment Longevity
  - Superior Quality of Work
  - Impressive Work Ethic
  - Topnotch Customer Service
  - Quick Thinking Problem solving

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## Questions?

Please complete the session evaluation on the CONEXPO – CON/AGG Mobile App

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