March 29, 2017

For Reference of NECA Now 2017 San Antonio Attendees Only

Latest Trends in Firestopping, Personal Safety, and Underground Cable Locating

Phil Redding, George Yoshida and Ed Scott

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– Attend 90% of this presentation
– Fill out the online evaluation for this session

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Construction Safety & Health

Key Topics and Trends in Construction Safety

- Facts from OSHA
- Falls remain the #1 cause of death in Construction
  - Fall Protection
  - Dropped Objects Prevention
- OSHA Silica Rule – June 23, 2017
- Noise in Construction – Growing Awareness
Facts from OSHA:

The Construction Industry

- 90% of Construction Employers have 20 or less employees
- The industry typically has very high employment turnover rates
- Most are multi-employer worksites
- 50.5% of OSHA compliance inspections are construction (three year average, FY13-15)


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Facts from OSHA:

Number & rate of fatal occupational injuries

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Number of Fatal Injuries</th>
<th>Rate per 100,000 Full-Time Equivalent Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>990</td>
<td>3.8</td>
</tr>
<tr>
<td>Transportation and warehousing</td>
<td>700</td>
<td>1.4</td>
</tr>
<tr>
<td>Agriculture, forestry, fishing and hunting</td>
<td>435</td>
<td>1.8</td>
</tr>
<tr>
<td>Professional and business services</td>
<td>422</td>
<td>1.3</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>215</td>
<td>0.9</td>
</tr>
<tr>
<td>Retail trade</td>
<td>193</td>
<td>0.9</td>
</tr>
<tr>
<td>Leisure and hospitality</td>
<td>185</td>
<td>0.8</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>153</td>
<td>0.8</td>
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<tr>
<td>Information and financial activities</td>
<td>117</td>
<td>1.2</td>
</tr>
<tr>
<td>Retail trade</td>
<td>105</td>
<td>1.7</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>94</td>
<td>1.7</td>
</tr>
<tr>
<td>Agriculture, forestry, fishing and hunting</td>
<td>80</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Private construction had the highest count of fatal injuries in 2014, but the private agriculture, forestry, fishing and hunting sector had the highest fatal work injury rate.

Facts from OSHA:

### Top Ten Most Frequently Cited Construction Violations - 2015

1. Duty to have fall protection  
2. Scaffolding  
3. Ladders  
4. Fall protection training  
5. Eye and face protection  
6. Head protection  
7. General safety/health  
8. Aerial lifts  
9. Excavations  
10. Fall protection systems criteria and practices  

- Many are related to Height Hazards and Fall Protection -


Falls remain the #1 Cause of Death in Construction

**2015 in Construction**  
(Source: Bureau of Labor Statistics)  

**#1 Cause of Death:**  
- Falling from Height  
- 364 out of 937 deaths were from Falls (39%)  
- 12% of them from <6 feet (2014 data)  
- Over 50% of them from <20 feet (2014 data)  

**#2 Cause of Death:**  
- Struck by Object  
- 90 out of 937 deaths (10%)  
- Some of which were falling objects
Fall Protection Basics - ABCD

**OSHA:**
- Tells you when and where Fall Protection is required
- Reference: ANSI Z359 Fall Protection Code
- Ensure you are using ANSI compliant equipment

**ANSI Requirements for the Equipment:**
- 3600 lb. gated hooks, impact indicators, robust labeling/instructions, etc.
- Third party testing and verification

**Key Elements of a Good Fall Protection Program**

**Beyond Just the ABC's...there are D, E and F!**
- **D** = Descent & Rescue (relatively new to Fall Pro program protocol)
- Not good enough to just stop the fall. Need a prompt rescue plan.
- **E** = Education & Training
- **F** = Fall Protection for Tools – Dropped Object Prevention Program

**Resources:**
- [www.OSHA.gov](http://www.OSHA.gov)
- [www.ASSE.org](http://www.ASSE.org)
- [3M.com/fallprotection](http://3M.com/fallprotection)
Dropped Objects Prevention – Fall Protection For Tools

The Solution:
- Dropped Object Prevention Program
- Competent Person Training
- Tie off tools and equipment at height
- Drive continued awareness

Resources:
- [3m.com/fallprotection](http://3m.com/fallprotection)

Silica in Construction - 2017

- Major regulation for the Construction Industry – less so for General Industry

- 2.8 million workers affected
  - 2 million in construction
  - 800k in general industry

- Regulations for both sectors – similar but with significant differences

- [https://goto.webcasts.com/viewer/event.jsp?ei=1124592](https://goto.webcasts.com/viewer/event.jsp?ei=1124592)
Construction vs. General Industry

**Common Requirements**

- Engineering controls first
- Housekeeping
- Written program
- Medical surveillance
- Worker training
- Very similar to other chemical regulations – lead, cadmium, hex chrome
- No special silica respirator:
  - 100 efficiency not required
  - Disposables OK as long as they can be used per respirator regulations

**Differences in Requirements**

- Construction has “Table 1” – General Industry does not
  - Exempts construction from PEL and exposure assessment for 18 tasks if OSHA procedures implemented
  - Can also do traditional exposure assessment
  - General industry does not have Table 1

- Construction requires silica competent person – general industry does not

- Construction medical surveillance triggered by silica respirator use. General industry triggered by exposure level
Silica in Construction – Key Dates

- Construction – 23 June 2017
- General Industry/Shipbuilding – 23 June 2018
  - This includes oil and gas
  - Only hydraulic fracturing - All parts enforced on 23 June 2018 – except
    - Medical surveillance - 2018 above the PEL, 2020 above the AL
    - Engineering controls June 2021
- Depending on the project, contractor may come under general industry if they are doing what would be considered routine maintenance

Silica Rule – More Information

- OSHA Website: www.osha.gov/silica
- CPWR Website: www.silica-safe.org
  (The Center for Construction Research & Training)
- 3M Website: www.3m.com/oshasilica
Noise in the Construction Industry

• One study 1300 samples - depending on trade:
  ▪ 10% had full shift TWA greater than OSHA PEL of 90 dBA
  ▪ 70% full shift TWA greater than NIOSH REL of 85 dBA

• Typical noise levels on construction sites range:
  ▪ 88 dBA for circular saw
  ▪ 96 dBA for chipping gun
  ▪ 102 dBA for jackhammer

Sources:
ANSI/ASSE A-19.46-2013
CPWR Construction Chart Book 2013
Noise in the Construction Industry

Workers Compensation
Washington State:
- Construction: 7% of work force
- Construction: 21% of accepted hearing loss claims
  - Source: Construction Industry Noise Exposures School of Public Health, University of Washington 2004

Pennsylvania’s Workers’ Compensation Act:
- Hearing loss of 10% or more in both ears is covered by workers’ compensation.
- Permanent hearing loss - 66.66% of wages for 260 weeks for each 10 percent of hearing loss.
- 20 percent hearing loss = compensation for up to 520 weeks.
- ($35,000/52) x 0.6666 x 520 = $233,000

Noise in the Construction Industry

Hearing Protection Devices (HPD’s):
- Used only 20-40% of time when noise >85 dBA
  Why?
  - Transient workforce.
  - Abstract, painless nature of NIHL – If only ears would bleed
  - Lack of comfort – studies show this should be given greater emphasis during selection than NRR.
  - Over attenuation.
  - Lack of training on proper insertion.

Sources:
Noise in the Construction Industry

How can we protect workers?
• **Fit-Testing** of HPD may address some of the problems:
  ▪ HPD selected on both comfort and adequate protection
  ▪ Avoidance of overprotection
  ▪ Training and motivation of wearer and trainer
  ▪ Inventory control – may need more – or less
  ▪ Prioritize retraining
• 29 CFR 1926.101(b) Ear protective devices inserted in the ear shall be fitted or determined individually by competent persons.
• Engineering controls
  ▪ Engineer the noise out
  ▪ "Buy Quiet" NIOSH Program – purchase quieter tools and equipment
• Administrative controls – Perform noisy tasks in isolated areas when possible

Thank you
Latest Trends In Fire Protection

George Yoshida, Business Development Manager, 3M Company

Biography-George Yoshida

- 3M Fire Protection 18 years
- Business Development Manager
  - Fire Protection for Electrical Applications in Nuclear, Oil/Gas, Commercial Construction
- Past Vice-President International Firestop Council
- University of Minnesota Carlson School of Business
Firestopping Electrical Penetrations

• Who Knows About Firestopping Conduit, Cables, Cable Trays, Penetrating Electrical Conduit, Cables, Cable Trays Penetrating Fire-Rated Walls, Floor/Ceiling Assemblies?

Fire Protection of Critical Electrical Circuits

• Who Knows About Fire Protecting Critical Electrical Circuits for Redundant Systems?
Fire Protection of Distributed Antenna Systems

• Who Knows About Fire Protecting Distributed Antenna Systems?

WE ARE TALKING ABOUT THIS TODAY

Fire protection of public safety Distributed Antenna Systems (DAS) is the hottest topic in fire protection today
Distributed Antenna Systems
Series of antennas connected by cables

What is driving the fire protection of public safety DAS?

First responders need to communicate
9/11 Drove Changes in the Building Codes

• National Association of State Fire Marshals
• International Association of Fire Chiefs
• Both concerned about sending their men into burning buildings
• As a result, both Nat’l Fire Protection Assc and Int’l Fire Code significantly changed

What is driving fire protection of public safety DAS?
International Fire Code Section 510

SECTION 510
EMERGENCY RESPONDER RADIO COVERAGE

510.1 Emergency responder radio coverage in new buildings. All new buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.
National Fire Protection Association (NFPA) 72, Chapter 12 – “Pathway Survivability”

12.4 Monitoring for integrity shall not be required for a maintenance loop circuit provided that a fault circuit condition on the alarm circuit wiring results only in the loss of the noninterfering feature of operation.

12.5 Monitoring for integrity shall not be required for connections to and between supplementary system components, provided that a single open, ground fault, or short circuit condition of the supplementary equipment or interconnecting means, or both, do not affect the required operation of the fire alarm and/or signaling system.

12.6 Monitoring for integrity shall not be required for the circuits of an alarm notification appliance installed in the same room with the control circuit equipment, provided that the notification appliance circuit conductors are installed in conduit or are equivalently protected against mechanical injury.

12.7 Monitoring for integrity shall not be required for a trouble notification appliance circuit.

12.8 Monitoring for integrity shall not be required for the interconnection between listed equipment within a common enclosure.

12.9 Monitoring for integrity shall not be required for the interconnection between enclosures containing control equipment located within 25 ft (7.6 m) of each other where the

The Problem

- Understanding the code – when, where, what to do with regards to fire protecting “Public Safety” DAS
- Buildings are constructed and then the Authority Having Jurisdiction informs the contractor that 2-Hour fire protection is needed
How to meet the code

- 2 Hr Fire-Rated Cable
- Sprinkler System
- 2 Hr Fire-Rated Enclosure (Drywall Box)
- AHJ Approved Alternative System
- 2 Hr Fire-Rated “System”

What is a 2 Hour Fire-Rated System?

- Must Be A Tested AND Listed System at UL, Intertek or other approved 3rd Party Agency

For Reference of NECA Now 2017 San Antonio Attendees Only
**Typical UL System**

**3M™ Interam ™ Endothermic Mat**

- Color: White
- Roll Width: 24.5 in. (622 mm)
- Roll Length: 20 ft. (6.09 m)
- Mat Area/Roll: 40.8 ft.² (3.79 m²)
- Mat Laminations: 3 mil. Aluminum Facing
- Mat Thickness: 0.408 in. (10.3 mm)
- Roll Weight: 74.6 lbs. (33.8 kg)
- Weight/Unit Area: 1.83 lbs./ft.² (8.93 kg/m²)
- Bulk Density: 54 lbs./ft.³ (865 kg/m³)
3M UL Tested AND Listed Systems

What is it made of?

Latex
+ Alumina Tri-Hydrate
+ Fibers

= E-Mat
How does it work? Endothermic Technology

- Endothermic Reaction
  - Heat Energy Absorption
  - Releases Chemically Bound Water at 600°F (316°C)
  - Creates a Cooling Effect

Endothermic process absorbs heat energy through the release of chemically bound water. This slows down heat transfer and helps protect items that have been wrapped with 3M™ Interam™ Endothermic Mat.

How Is E-Mat Applied? What Are The Applications?

- E-Mat is wrapped around conduit, cable tray, structural steel, vessel skirts and placed inside of junction boxes
Installation Video

What exactly are we protecting?

Orange lines show areas needing protection
E-Mat Application Before/After

E-Mat Application Before/After
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3M E-Mat for DAS/RF Cable
Miami Surf Club/Power Design Inc

- Miami Dade County Fire Marshall has mandated that all new construction/renovations involving DAS/RF (Distributed Antenna System/Radio Frequency) cable have 2 hour fire rating for the communications cable.
- Power Design Inc. had Miami Surf Club renovation and contacted 3M for 2 hour solution to cover 900 linear feet of cable and several wire troughs.
- Brought opportunity to Graybar Clearwater. 103 rolls installed

Importance of Marking Critical Assets

Ed Scott, Business Development Manager, 3M
The challenges for utilities globally are three fold:

- Where are my assets?
- How do I know they are mine?
- How do I prevent damage to my facilities?

Customer Pain Points

**Environment**
- Utility Congestion
- Common Trenches
- Facility access limitations
- Above ground interference
- Abandoned utilities
- Corroded or cut tracer wire

**Documentation**
- Inaccurate, incomplete records
- No maps for guidance
- Unmapped Facilities
The Real Cost of Accidents

Consequential Costs
- Damage
- Prevention is Critical for All Utilities
- Repair Cost
- Consequential Costs
- Death/Injuries
- Property Damages
- Emergency Services
- Repair Cost
- Lost Time
- Lost Material
- Lost Sales
- Lost Production
- Machinery Damages
- Secondary Emergency
- Spoilage
- Legal Cost

Electrical Utilities and Conduits
Many Ways to Find Power Lines

- Pothole $ 😃
- Find it Accidentally $$ 😃
Real World Encounters in EM Locating

Breakage, Corrosion, Exposure, Installation Errors

Congestion of Utilities in ROW

US Nationwide Damage Causes

Source: CGA 2014 DIRT Report
Facts and Figures

38%
Out of all utilities, 38% of the damages were attributed to gas

90%
Of all locates are done by contract locators

180 Million locates in the US every year

Source: DIRT report 2014.
http://commongroundalliance.com/sites/default/files/publications/DIRT%20REPORT%202014%20FINAL.pdf

Plastic Pipes Increase Locating Challenges

• Growing use of plastic for utility pipelines
  – Over four billion feet placed underground worldwide, every year (all utilities)
  – PVC and polyethylene – low cost, increased durability and strength
  – Estimate 45-50% of new water mains (up to 10") in US will be plastic*

• Plastic is not electrically conductive
  – Cannot be traced the same way as traditional metal pipes

• Solutions for finding plastic pipes today have limited success

*Source: AWWA “Buried No Longer” study, 2011
Marking Key Features w/EMS Technology

• Tees
• Crosses
• Fittings
• Valves
• Crossings
• Casing Ends
• Bends
• Clean Out's
• Path of Pipe
• Depth Changes

Secondary Fault Finding

11 Steps to Fault Finding

1. Isolate the faulted section
2. Connect the leads. Red = faulted conductor; Black = ground rod.
3. Measure the resistance of the fault to ground (OHM mode)
4. Select fault mode on transmitter
5. Plug a-frame into receiver and set receiver to fault mode
6. Place a-frame in the ground @ ground rod & save the reference reading.
7. Move forward, probing the ground with the a-frame until the arrows reverse
8. Center the a-frame over the fault, by moving the a-frame forward and backwards in small
9. Turn the a-frame 90 degrees and pinpoint left and right.
10. Turn the a-frame 90 degrees again. Center the a-frame over the fault once more
11. 360 circle to verify fault location
Electromagnetic Locating - Basic Concept

The facility must radiate an electrical signal so it can be located and traced by a Signal Receiver.

Transmitter → Copper Wire/Cable → Far-End Ground

Decaying Signal

The Locator Receiver assumes an Ideal Magnetic Field

They find the magnetic field fields generated by the current flowing through:

- Copper Wire/Cable
- Aluminum Wire/Cable
- Steel Pipes
- Tracer Wire
- Traditional locating uses a transmitter to transmit a signal and a receiver to detect the signal.
Causes of Signal Distortion

- Use of high frequencies couples to adjacent lines
- High power output from transmitter
- Return current crossing path of other utilities
- Common grounding
- Congestion of utilities
- Above ground interference

Challenge to Industry

What if?

- Tracer wire were not required for non-metallic facilities
  - No need for access points, bonding, grounding
- The means to locate the facility doesn’t require continuity to function
- The risks of corroded or cut tracer wire were eliminated
- No issues associated with electromagnetic locating failure modes:
  - Congestion of utilities, Bleed over
  - Chain link fences, guardrails, cars/vehicles, above ground objects
  - ‘Art’ of locating becomes a simple repeatable science
- No issues with installation errors or neglect of a wireline network
- No issues with metallic wires that could attract lightning
- Designed for long life with a field proven technology
- A simple method of locating and identifying buried cables
Making Pipe Locatable

Locating Tape & Rope

- Addresses a critical pain point for water and other industry
  - Significant improvement to accuracy of locating
  - Provides path direction at each marker
  - Life expectancy lasting that of facility
  - Does not provide a path for lightning

Robust
- Continuity not required for functionality
- Corrosion resistant, maintenance-free

Simple
- Replaces tracer wire,
- Access points not required
- Reduced complexity of locator
- Easy to learn
- Exact even in harsh field conditions

EMS Locate Tape

EMS Rope

All in One Locator

- New locator designed for accurate location of EMS Locate Tape / Pipe
- New to the world antenna array, calibration not required
- All in One unit to locate both new and legacy facilities in a single instrument

Plastic Pipe

Resonant electronic markers, 2 m spacing

Benefits of EMS Technology

Electronic Marking Systems provide positive identification of buried plant for safe and efficient asset management.

The highest standard of Positive Identification

- Precision of facility position in harshest field conditions
- RFID identifies facility attributes
- Tolerant to congestion
- Designed for the life of the facility
- Ease of use, simple
- Exceptionally cost effective
- Field proven over decades of use in over 60 countries

- 50+ Million Markers in the Ground Today!
The Future of Asset Management

GIS Adoption Curve for Electric Utilities

GIS foundation (digitized paper maps)
Utilities rely on GIS for maintaining, mapping, and reporting on utility infrastructure and millions of miles of pipes and conduits.

GIS linked to GPS coordinates
GIS systems may not be tied to real-world GPS coordinates, but GPS linkage is needed for more sophisticated applications.

GIS-based workflows
The base GIS system integrates with applications for specific tasks, such as automating the leak survey with GPS tracking.

UTILITY GIS ADOPTION CURVE

Industry Solution: Location data in the cloud

Drivers
- Damage prevention focus in US gaining priority in OUS markets
- Trend for new facilities to be buried
- Leaner work forces drive productivity
- Breakthrough in GPS price/performance
- Vertical market GIS solution availability
- Mobile applications widely deployed

Detect Buried Assets

Transmit To GPS

Map Server

Base Office Util

Excavation Safety

Field Support

Workforce & Asset Mgmt

Industry Solutions
- Mapping services
- Field mapping hardware and software
- Back office GIS and map view systems
- Web-based viewing tools and 3rd party-hosted portals
- Smart phone & PDA applications
- Mapping integration with workforce mgmt. systems
- Integration of mapping with excavation machine control
- Upload data to GIS Mgmt system
Data mapping App - RFID Marker, Path, Cable points

**Marker installation**
- Create Template
- Send to Locator (BT)
- Program RFID marker
- Log Data Point (Cloud)

**Facility survey / mapping**
- Locate & read RFID marker
- Send to App (BT)
- Log Data Point (Cloud)

**Log Data Point**
- Path, Marker, Cable Depth
- Send to App (BT)
- Log Data Point (Cloud)

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**3M RFID Marker – GIS system overview**

- Maps (Bing/Google/Baidu)
- Cloud based data storage
- GPS based on smartphone or external device
- Log data records along with GPS data for GIS
3M Locating & Marking Solutions

Provides solutions for locating, fault finding, and accurate marking of buried utilities for companies committed to ensuring safety, quickly restoring outages, minimizing operating costs and efficiently managing assets.

- Telephone
- Gas
- CATV
- Power
- Water
- Wastewater
- GP/Rec Wtr

Customer Benefits From the Ball Marking

**TODAY**
- Pinpointing from visible power grid & GPS while the trench is open

**TOMORROW**
- Land surveyor pinpoint mapping from marker & GPS

Marking Solution |
Cost Benefits for ENEDIS with innovative Trench Management
- Immediate backfilling, Reduce excavation costs
- Network immediately repowered
- Mapping after backfilling, no need to wait for the land surveyor
- Improve the effectiveness of street works
- Compliant with Health & Safety Guidelines
- Minimize Traffic Management
Questions

Up Next: Lunch on Event Lawn 1

Plenary Session at 1:45 in Grand G-J

Hill Country Hoedown at 8:00 PM at the Knibbe Ranch

Don't forget to fill out the online evaluation at www.necanet.org/NNSurvey2017

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