

# WORKtoZERO

an **nsc** program

## 2020 Work to Zero Summit -- Hazardous Situation Breakout Summaries

February 13  
Hyatt Regency Coconut Point Resort & Spa  
Bonita Springs, FL

### Confined Spaces

Moderator: Marty Cohen, University of Washington

### Construction and Installation

Moderator: Scott Knowlen, Cianbro

### Electrical Work

Moderator: Kevin Harris, Exelon

### Heavy Equipment Operation

Moderator: Carl Heinlein, ACIG

### Work at Heights

Moderator: Steve Davis, Day & Zimmermann

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### Confined Spaces

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#### Specific situational risks discussed:

O <sub>2</sub> deprivation	O <sub>2</sub> deprivation-material	Drowning	Trench collapse
Gases/Solids	Medical emergency	Entrapped	Mechanical hazards
Explosion	Electrical	Falls	Environment conditions
Fire			

#### Specific systemic risks discussed:

Leadership failure	Lack of workplace awareness	Faulty equipment
Training	PPE	Rescue plan (team/equipment)
Planning failures	Lack of resources	Safety systems approval
Fatigue	Design	Declassifying to soon
Atmosphere	Competency	Extend permit too long
Procedures	Do not foresee all hazards	

First, we need to consider how we can “design out the problem.” When confined space cannot be designed out—or until it can be designed out—what technology is available to assist confined space safety concerns?

Gas monitors	Fire/smoke detection	Unmanned vehicle robots
Supply air respirators	Rescue retrieval	Lone worker monitor
Remote detection	Environmental monitors	VR training
Mock-up training	Access monitoring	
Human sensing wearables (skin temperature, audio, perspiration, oxygen levels, motion)		

General notes from open conversation:

- Leadership needs to review its threshold of risk – leadership is key to the whole thing. Companies need to vertically communicate the message. Virtual reality could be a strong way to educate all levels of the safety chain – leaders should “see” where they are sending their people.
- Work to Zero should tap into the mining industry for learnings about confined space.
- Are the technologies creating other safety hazards? Test the tools you are using to ensure that they are intrinsically safe.

The group considered the Hierarchy of Controls:

- 1) Eliminate
  - a. Design out the risk
- 2) Substitution
  - a. Remote
  - b. Unmanned vehicle robots/drones
- 3) Engineering controls
  - a. Addressing barriers
- 4) Administrative controls
  - a. Fire/smoke detectors
  - b. Gas monitors
  - c. VR training
  - d. Mock-up training
  - e. Human sensing
  - f. Lone-working monitoring
  - g. Remote sensing
- 5) PPE
  - a. Gas monitors

## **Construction and Installation**

Moderator: Scott Knowlen, Cianbro

What are the specific risks and hazards you see, and where are the greatest numbers of fatalities?

- Dismantling, erecting, etc.
- Looking at serious injuries and fatalities, not just where occurring but what the potential is

- Hazardous energy – not just electrical, whole bunch of other things – incorrect lockout/tagout or no lockout/tagout
  - Also looking at air, hazardous waste, etc. – things to think about when doing remediation projects
- Welding on giant pipe – bladders inside pipe wouldn't hold (using argon in inert atmosphere) – asphyxiation
- Biggest risk in small construction, not large construction – home renovation
  - Not a lot of tech solutions, but lots of basic solutions (e.g., how to do fall protection better in roofing – basic tech out there that's not being used)
- Biggest systematic risk is turnover of workforce (40%) – can't keep them trained
  - Lack of skilled available workers, bringing in people with less experience
  - Outsourced vs. in-house
    - Don't even have people in house who know how to do construction supervision
  - Can't put in enough technology to deal with that
  - Hierarchy of controls – maybe new solutions to get people up to speed
    - Augmented reality/virtual reality (AR/VR) for training?
      - Construction vendors – should be doing AR/VR training on their particular specialty, not the owner companies – futile to go after it
      - Low down on the hierarchy, but still necessary
- Another area of high risk – startups – turning over systems and starting systems back up
  - Communication during handover – someone saying it's locked out from the client
    - Also unplanned work – happens frequently during startups/handovers
- Demo work – had building fall on top an excavator
  - Fortunately the design of the machine protected him, backed out
  - Potential to do unmanned controls – engineering the hazard out
  - Never know quite what's under it, lots of heavy equipment, often working at height, energy control, electrocution, crush/struck by vehicle risk
- Trenching
  - Lots of fatality potential
  - Often seen in utilities projects – also environmental projects – for digging, “soft digging” – bore a hole, create a vacuum and water blast the soil out vs. getting someone outside in a heavy piece of equipment in the heat
    - Give and take of doing work different ways to get rid of one risk and add more
    - When implement a new technology, do a hazard analysis to understand what new things have been introduced into the work environment
  - Digging in electrical substations – ton of risk
  - Prefabrication on the ground and then bring it in and erect it vs. erecting it in the field
    - Doing work on the ground vs. at height or in trench, etc.
    - Fabricating and then bringing into the trench
    - Moving the shop to the site to reduce traffic on the site – eliminate the traffic on the road back and forth
- Crosswork and coordination of trades involved
  - Concrete pour that lead to a collapse but no one had been informed work was taking place above/no one informed workers on floor below to know to leave area
  - Work density mapping – understand where there's a lot of work going on and dig into the hot spots to engage in coordination and communication

- New construction is all modeled, much safer, but when things get outside of the plan is when things happen
- Work crews moving throughout the day
- Proximity sensors
  - For moving equipment – forklift, etc. – how close they are, position relative to the vehicle
  - Helps for analytics proactively – was person supposed to be there
  - Alerts driver and it vibrates for the pedestrian
  - Have seen reductions in injuries and saw problem areas with lots of close calls that allowed for making work design/space design changes
  - To separate pedestrians from moving equipment, put rails/roof on pedestrian paths
- VR/AR – is there data proving out effectiveness or how fast it is?
  - Abandoned by one company – too slow/expensive – was also too rudimentary
  - But has gotten better fast
  - But useful in understanding experience of a fall or fire without actually experiencing it
  - Is it too clunky?
  - Simulation training
  - HoloLens/AR – for digging, seeing where power, air, gas are in the facility or on the project
- 360 camera video tied to plans of a project. Can do overlays of progress
  - Have used drones to do similar sorts of surveillance/help create models/drawings/3D mapping for planning
  - Or determining where to setup equipment
- Drone uses
  - Doing surveillance/inspection at height, reduced number of work at height tasks by 90%
  - Installation in-air, painting, etc. – all sorts of tasks
- Electric current sensing wristbands, etc.
  - Can be worn at wrist – not necessarily perfect but useful

Where are you learning about these technologies? What are the sources?

- Just googling it. There are a few tech magazines but not much out there
- Feel 20 years behind the actual technology in the consumer space
- Starting with the issue – person in a lift who was crushed
  - Went to vendor of lift and said “we need an anti-crush protection technology, what do you have?”
    - Need to do that together – need hands-free hydroblasters
- Just like the legal/regulatory push – need to decide together as a group
- Insurance carrier as a source – trying things out to incentivize risk reduction
  - Need to share when it works and when it doesn’t with their insurer
    - Won’t affect rates – if company is actively trying to solve a problem, that will be a bump up
- Exhibit floors/expos – at Congress, other trade shows, Grainger
  - Reps asking what issues are, helping to identify technologies
- NIOSH – could they create an issues bank? Help startups understand what they are?
  - Lloyd’s is doing something similar with tech accelerator

Any technologies actively looking to implement?

- Cameras to enforce PPE – video vision for compliance monitoring
  - Machine learning trained to recognize PPE
  - These will cause trust issues with workers – need to communicate this with workforce – and reward compliance not go negative on observations

#### Issues implementing wearables/computer vision tech?

- Computer vision vs. RFID technology – were looking at the new, cool solution of computer vision vs. RFID
  - Person making decision in office needs to understand what the work environment really looks like and visualize the issues
- People felt safer – generally accepted even though were being tracked
  - It wasn't brought in top down from management, it was brought in by a pilot/tech team that made it feel more like a goodwill solution
  - Had the people being asked to use it involved in the development of the solution
- Haven't gone wide, but would anticipate other sorts of challenges
  - Scalability can be difficult

#### Vehicle monitoring technology

- At NIOSH – even a safety organization – lots of pushback
- Need to proactively communicate and address concerns
- Similarly at Dow – had the CEO make a proactive video – just the idea of it made the habits better – now 65% implemented
  - Placebo effect
  - Personal statement
- Lack of feedback loop – fear of what is the manager going to say or do?
  - People who would have a “bad driving week” to test out system to test boundaries of what was acceptable?

#### What would be helpful in this research area?

- Information on spread and adoption – how do we get that spread and adoption?
- Culture shift from big brother aspect to safety benefit – support not chase – trust factor
  - Understanding what rollout looks like, distressing workforce, communication – research on the soft side of implementation
    - Distinction b/t wearables monitoring individuals vs site – not talking about the people behavior but the systemic change – story sharing
- Relative investment in technology for planning a project vs. investment in putting a bunch of stuff on the worker to more proximally prevent an incident
  - Which is more cost effective?
- Use of technology to redesign job (e.g. ergonomic, etc.) – wearables study out of U of W – finding the right technique and then removing the technology
- Noise camera
  - Shows where the sound is – heatmaps for hearing protection – scanning large areas for noise

### **Electrical Work**

Moderator: Kevin Harris, Exelon

What are the specific risks/hazards?

- Arc flash 13+ KB
- Inadequate barriers
- Third party contact with electrical power (e.g., gardener service)
- Skilled worker qualifications (skill loss)
- Not following protocol in emergency/unique situations
- Lockout/tagout failures
- Not wearing the right PPE
- Flash with home meter installation
- Lack of workplace awareness/observation of general conditions
- Not knowing/over confidence with safe procedures

Possible technology applications?

- PPE sensing
- Electrical safety by design (better barrier design)
- Remote robotic handling
- Barcode for tags
- VR training/qualifications
- Remote technicians (via cameras, phones, holo lenses, glasses)
- DC readiness emergency response
- Geofencing

Greatest successes?

- Drones
- Data synthesis → big data → artificial intelligence
- Operational analytics extrapolate to safety failure predictions
- DC electrical tech due to batteries
- Vtech
- Micro-learning

What could Work to Zero provide?

- Formalize facilitation of continued dialogue throughout the year

## **Heavy Equipment Operation**

Moderator: Carl Heinlein, American Contractors Insurance Group

What are the specific risks and hazards that you see in your work areas? What are your exposures?

What are things that you're doing about this risk?

- Familiarity with equipment or lack thereof. Understanding how to operate the equipment and following manufacturers' signs/warnings/instructions for use. Use of technology (telematics) to track performance of equipment.
- Use of heavy equipment within a facility. Implementation of back-up cameras and noise alerts.
- Forklifts equipped with lights in front, back, and sides when in motion.

- Sensors on equipment and on pedestrians/workers (proximity detectors). Pager style, or on helmets/vests, in pockets.
- Work with forklift manufacturers to govern the speed of forklifts or even bring forklifts to a complete stop.
- Engulfment
- Technology doesn't always have to be so complicated. We can do a lot with spotting and flagging. We can pair technology with some basics.

How to reduce exposure for lone workers?

- Something to warn excavators, especially if they're working alone, if they are getting too far into a pile and are at risk for engulfment.
- Motion activity trackers. Outfitting lone workers with alarms if movement hasn't been detected.

Technology success and barriers:

- Types of signal use (low level magnetic, RFID) are not always approved for use in other countries or regions of the world.
- Establishing a defined process to review and approve of technology. Many times, the request for technology will come from sites. What they think will help them do their jobs better and safer.
- Roadblocks with procurement in obtaining and implementing new technology. Need to build the process for implementing new technology that includes procurement so that there's more communication and collaboration. Prevents roadblocks.
- Bluetooth binders had a short life and couldn't sustain much wear and tear. Didn't end up meeting the proof of concept because of the cost.
- Strayed too far from worker center of design principles when trying to implement proximity detectors. Worked in one segment of a business, but not others. But humans tend to want monolithic, silver bullet solutions.
- What is the role of insurance in adopting technology for EHS? Insurance companies are interested in cybersecurity and how the technology impacts risks for security. Especially with IT and integrated processes, data in the cloud, IoT – what risks do those things open your organization to?
- Work with OEMs to get heavy construction equipment outfitted with the same technology as personal vehicles.
- Technology and support from trade organizations
- Involvement of workers in process
- Use of VR training/education so that equipment doesn't have to be taken out of service for training purposes, areas don't have to be shut down temporarily for training. Allows workers who don't operate that equipment better understand exposures.
- Being an investor in technology so that we can capitalize on a process/technology that is potentially beneficial to us.

## **Work at Heights**

Moderator: Steve Davis, Day & Zimmermann

What are the hazards/challenges that you are facing in this area?

- One problem is using ladders. Are people really going to tie off when using ladders. People are using both hands to do inspections. Where can we eliminate ladders? We use scissor lifts and

one-person lifts but that's difficult with terrain. We're also looking at installing work platforms with handrails and now you don't need the fall arrest.

- Stairs instead of ladders, especially on scaffolding.
- Active fall protection does not prevent all of the fatalities because it still relies on humans.
- At the end of the day that fall protection is PPE which is at the bottom of the hierarchy but it's what we use the most. It's viewed as being the most flexible solution.
- Not using PPE correctly, allowing harness to be loose, not calculating the fall distance for heights less than 20 feet.
- A lot of companies have irregularly scheduled contractors that come in to do the work at height. There is a reluctance to intervene because those are contractors.
- Not only PPE but human performance. Everyone who has not fallen yet does not think that they are going to fall. Getting inside their head is a worthwhile venture.
- Start with new equipment and engineer to put at a lower level where you don't have to climb. But most companies cannot order all new equipment and start over again.
- We've sold execution identification so that as it costs more we can convince that we can eliminate risk by building platforms instead of building scaffolds. We are not as good in the US as we are everywhere else in the world. Scaffold standards are weaker in the US. You'll never eliminate all ladders. We had a fatality yesterday, individual was on scaffold ladder, slipped, not tied off to yo-yo that existed, helmet came off as part of the fall. Fall protection was available but wasn't used. Not sure why.
- Starts by flushing out all of the tasks that you're doing above 6 feet and work way down hierarchy of controls. We have a standard for it but whether we're good at it or not is a different story.
- We had a fall from a truck that opened our eyes on some gaps that we found. Especially with infrequent tasks. But this trucking company that they have a rule that they can't climb on top of the truck but they also have a rule that it has to be empty, so there is a conflict there.
- We have suppliers and customers that are getting on their trucks. We might have a good standard and implement it well we don't have a lot of control once they pull off our property.
- Often times we have rules set in place signed in blood. Why don't we identify rules from the end user and get technologies from there?
- We're talking to end users who are climbing ladders and ask them, "what's going to protect you WHEN you fall." They don't have a good answer and then they get ideas about how they can do the job without working at height. It's been impactful.
- We're putting yo-yo's and SRLs with roadblock. Different types of technology. But they all still rely on a harness and someone clicking in.

Is there technology that won't let you work unless you hook in?

- There is for single-lift devices but none of that is out there in a plant. Technology exists but it's the implementation that is more difficult.
- At Exelon we are piloting with some of that technology so we can't operate booms without clicking in.
- The technology is out there but it's subject to human failure. You see it used in manufacturing but not really in construction. I would challenge the construction industry to think about how you do design for safety and focus on effectiveness with the hierarchy of controls. Require aerial lifts instead of ladders. Fatalities are on the rise and more money is spent so we're not getting there.
- We required self-closing gates on platforms that can help address some of the human element.

- We did a policy change of ‘no fall protection allowed unless it is mission critical’. If it’s done more than once a year you have to comply. But if it’s an infrequent thing then you can use fall protection. I’m not having trouble with operations. But I do have trouble with inflated estimates. How do I teach ourselves to not design a submarine when we’re building a platform. We swept our jobs and looked at everything over 4 feet and most fatalities were people coming back from break who forgot to clip back in. We had to rework over 25,000 job tasks that had to be reworked. And we’re planning on using design to keep new ones from occurring.
- Sometimes we do a root cause analysis and figure out that someone didn’t clip in but that’s where a lot of the analysis stops. It is important to figure out how to get to the default of going up the hierarchy.

In construction, we are not going to improve anything by writing a better standard procedure. If you look at residential construction, you are not going to be happy with what you see despite these technologies being available. What are we going to achieve tomorrow in fall protection?

- I work with small A&E firm and my guys would just go to Lowe’s and get a harness and put it on. What we do now is use drones to do inspections of construction areas. Drones has helped us eliminate that but mainly it’s been education.
- It’s constant education too. The dynamic changes on the worksite all of the time and we have to aware of that and educate and train on that.
- We are looking at incidents based on potential. Some of our clients are looking at evaluating hierarchy of controls against incidents to see which interventions are using top of hierarchy and they use that to benchmark against themselves. That way your standard can increase slowly over time. It starts to turn the thinking around in the organization to think about how to address in the high end of hierarchy.
- How to balance customer demands with policy procedures. Once worker sees that management is in agreement with safety policies workers will be less likely to take risks because they know that management supports the decision (e.g., we aren’t going to use a bucket if wind is >30 mph and stick to it).

Who has a fall protection problem they can’t solve? Where are we not matching tech up with problems?

- Building a work platform where you can’t fit a scissor lift. Is there a type of scaffold that you can build on the ground and then raise it? So we don’t have to get off the ground?
- There can be a challenge with roof access too. Getting up there safely. One thing we did is locking all access points and having a permit system to get on the roof. Treat it like a confined space and require a permit to go on the roof.
- Tarping trucks or loading and unloading trucks.
- We have roof inspectors and owners who don’t want anchor points put in their house. Inspectors say it’s a much larger hazard to be potentially tripping over lines. We tried drones but the job requires feel and touch that drones can’t do. Even if we have fall protection it has to be portable and light weight.
- Utilities. Placing a ladder can be challenge. Transitions from ladder on to some other platform.
- Scaffolding is usually designed for the 1<sup>st</sup> craft, not 2<sup>nd</sup> and 3<sup>rd</sup> craft/crews
- Non-routine work and modification in the field. Many fatalities in construction space are around ambiguity in process in the field.
- Anchor points are big issue. What about portable anchors?
- Our biggest problem is getting people to use at the moment of execution. It takes longer to put the equipment on than to do the job they need to do.

What struggles have you all had with rescue?

- Communications, lone-worker issues. Everybody assumes the fire department will show up soon.
- If you can reach someone with a firetruck then you should not have done the job the way you did it. If the rescue plan involves building a scaffold, do that as your job plan instead. But we hardly ever rescue people from a suspended line because they usually end up on the ground.
- You need to make sure that first responders or whoever have the ability to rescue someone where they end up needing rescued from. And make them write it and prove it.
- With confined spaces we found out that we were as diligent and effective as we should be. We now have people on site who are only there to rescue people. Rescue specialty contractors. It's also not that expensive.

Who's seen some cool stuff to combat gravity?

- We have several different wind facilities that we inspect the blades on wind facilities. It takes about a day to inspect an entire blade. We instituted drones now and it takes 45 minutes to do the same job. We have ClearSight, which is our actual drone subsidiary in Exelon which works with our sites. We use them to inspect the top of nuclear towers to inspect concrete. We are now using submergible drones to measure intake of our water in our plants.
- We're looking at one way to not have to exit the bucket. Using a pen system to build out railing on the workspace area and then be able to return to the bucket.
- A lot of us get involved with community relations projects. Please reach out and help those organizations with fall protection plans (Habitat for Humanity). Helping volunteers who have never been on a roof.