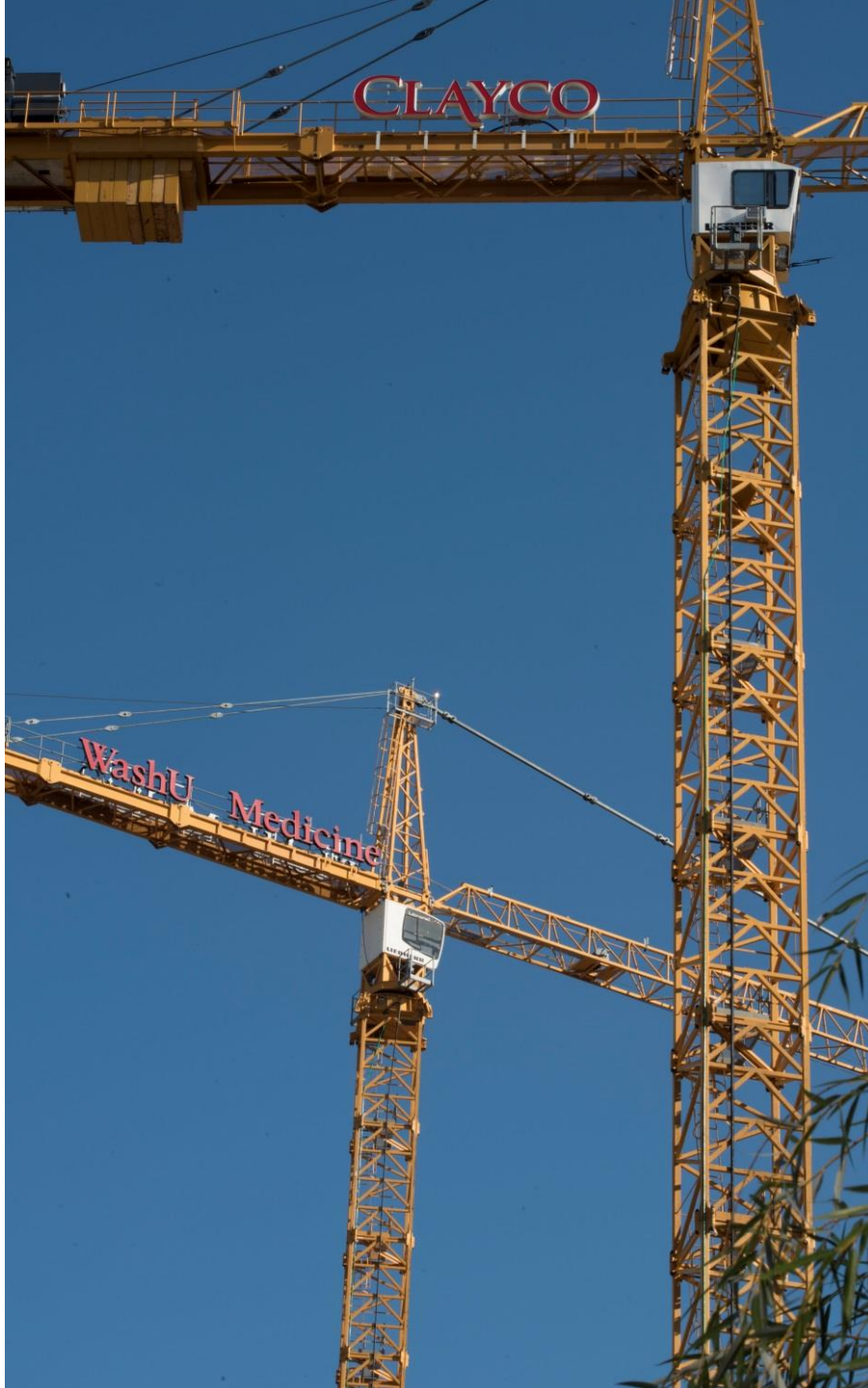
Enhancing MSD Prevention Efforts within a Construction Safety Management Program

AM Dale and B Evanoff

Washington University School of Medicine-General Medical Sciences

NIOSH Grant #2U60OH009762-06/-IISCE



Background

- Non-fatal injuries are 16% higher among construction workers than all industries (BLS 2013)
- Overexertion injuries exceeded $13 billion and are the leading cause of all injuries (Liberty Mutual Workplace Safety Index 2017)
- Injuries are trending down but suffer from under-reporting for various reasons (Lipscomb 2015; Schoenfisch 2014)
- Yet construction workers suffer from disability causing early exit from the workforce (Welch, 2016)

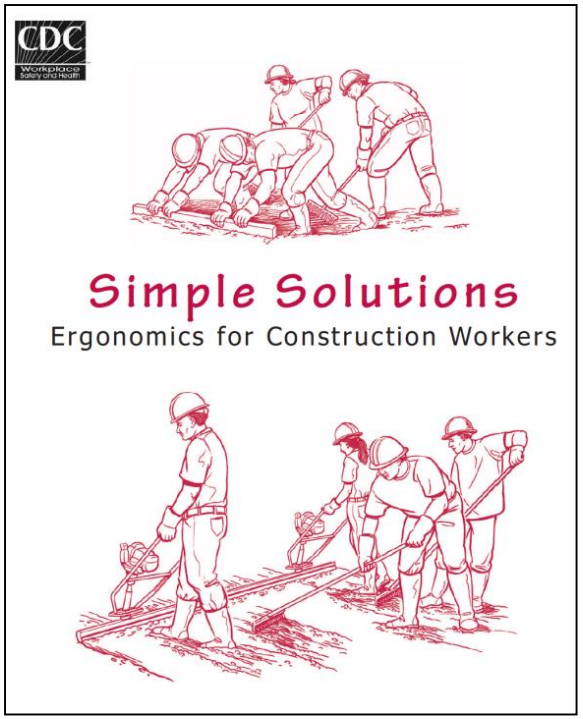
Background

- High physical exposures in many construction tasks contribute to risk of musculoskeletal disorders (MSDs)
- Manual material handling is a common high exposure task in most trades

- Poor working position
  - Reaching overhead
  - Forward bent at waist to work at floor level
  - Prolonged kneeling

Ergonomics

- Science to reduce/eliminate physical exposures to prevent MSDs
- Many ergonomic solutions available for use (Choi 2012, CPWR 2016, NIOSH 2014)



Solutions do not reach the worker

- Challenges in construction
  - rapidly changing work tasks
  - limited work area and tight schedules
  - multiple employers

- Multi-level organization
  - General contractor controls environment and schedule; oversees safety of the project
  - Subcontractor provides skilled workers and equipment
  - Workers perform tasks using available tools/equipment

- All levels are responsible for safety and health

Safety Management Program

- Intended to control risks and eliminate injuries
- Often lack management support and commitment necessary to bring about effective and safe work behaviors (OSHA Recommended Practice for Safety and Health Programs in Construction (October 2016)

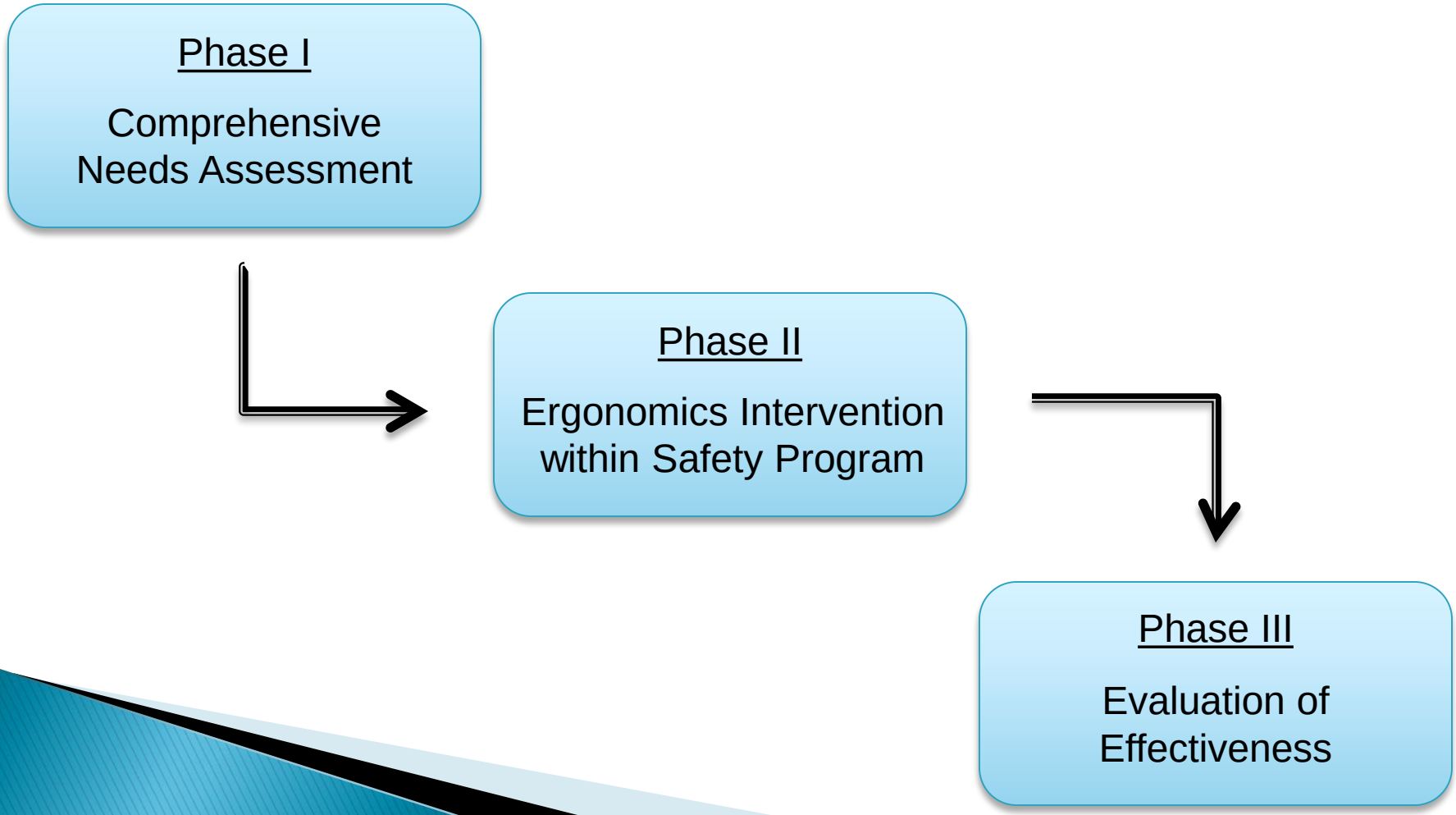
- OSHA Focus 4: Falls, Electrocutions, Struck by, Caught between
- Ergonomic information is an “add-on” to safety programs (Yazdani and Wells 2012)

Ergonomics in Construction

PURPOSE: To present development of an intervention designed to address MSD prevention by systematically incorporating ergonomics within an existing safety management program

Ergonomics Program:

Integrating ergonomics into an existing safety management program

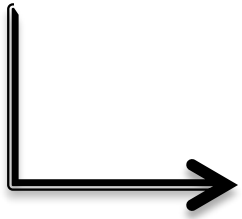


Methods–Phase I

Phase I

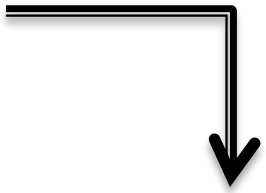
Comprehensive Needs Assessment

- Identify ergonomics in safety program
  - 3 commercial construction projects; 6–9 months duration
  - Observations, surveys, interviews/focus groups



Phase II

Ergonomics Intervention within Safety Program



Phase III

Evaluation of Effectiveness

Phase I- What did we find?

- Contractor has a well-developed safety management program
  - Safety integrated into each construction activity
    - Preconstruction meetings
    - Training
    - Meetings
    - Hazard ID/controls
  - Recognition program
  - Enforcement and accountability
- Contractor program covers all recommended elements of OSHA's safety and health program (OSHA, 2016)

Phase I- Review for ergonomics

- Preconstruction meetings with subcontractors
  - ergonomics not listed
- Training:
  - Worker orientation- reviewed proper lifting technique
  - Weekly Toolbox talks (GC)-3% ergonomics; 18% falls; 7% electricity
- Meetings
  - Foreman meetings- ergonomics not listed; some discussions by superintendent or foreman
- Hazard ID/control
  - Worker PTSA- listed MMH hazard (45%); Control- proper lift (71%), mechanical assist use (19%)
  - Contractor audits-topic listed, rarely comments (1% Ergo, 25% falls, 12% electricity)
  - Upper management site audits-ergonomics not listed

Phase I- Review of injuries (annual)

- Sprains and Strains: 25% of all injuries
  - Overexertion involving manual lifting: 47%
  - Location of work below knee: 27%
  - Location of work above shoulder: 17%

Phase 1 – Worker Survey

Training:

- Most received training on ergonomic topics
  - 78%: Manual material handling techniques
  - 70%: Choosing tools to reduce strain on the body
  - 69%: Healthy work postures

- Baseline Survey (n=270)

Phase 1 – Worker Survey

Reported behaviors of coworkers:

Proportion of coworkers who (often or always)

- 34%: Work in a kneeling position without knee pads
- 31%: Carry 50# loads without assistance or assistive devices
- 18%: Work with arms overhead when there is a better way to work
- 17%: Working in awkward or twisted postures when posture improvements can be made

Baseline survey (n=270)

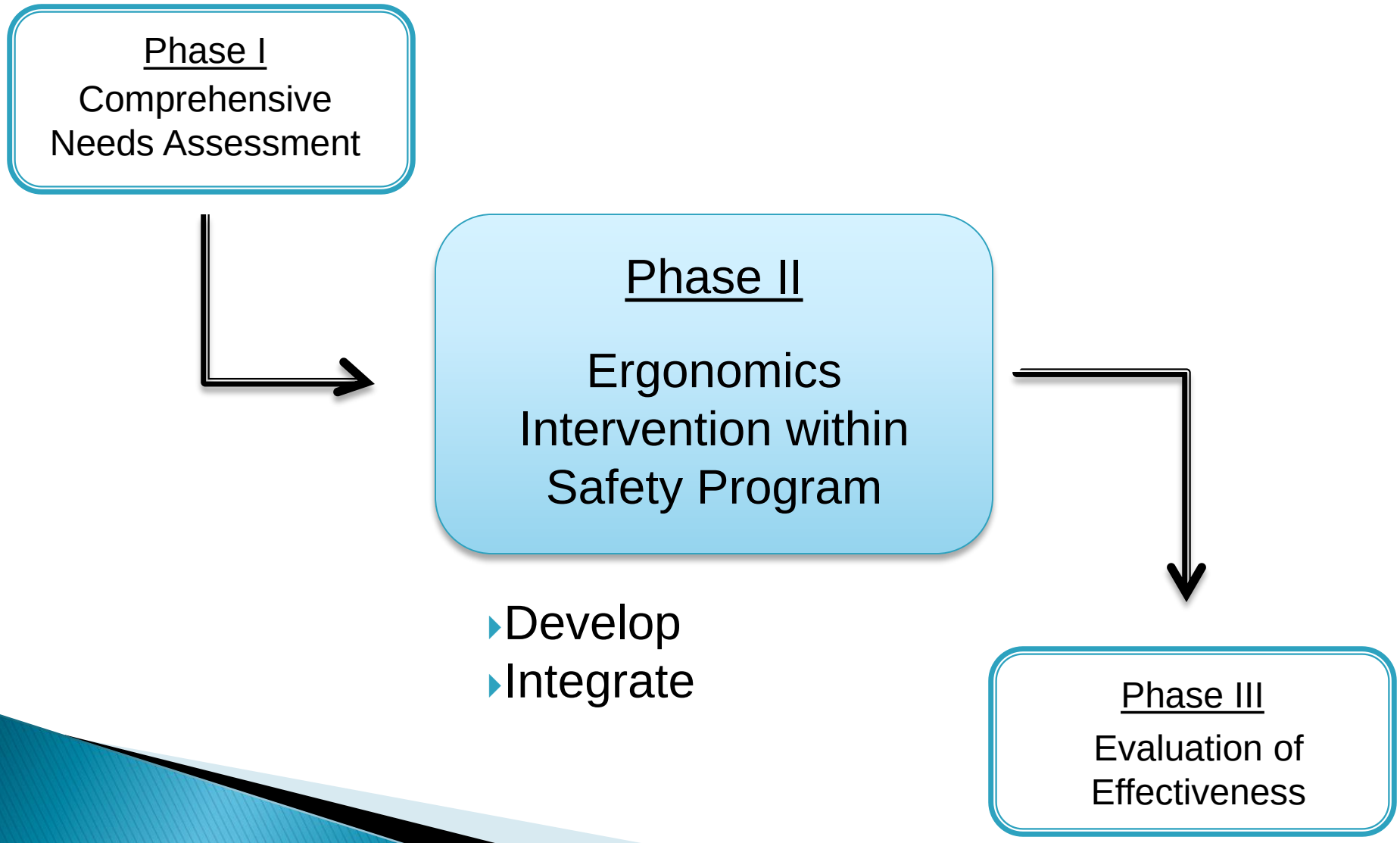
Phase 1 – Worker and Foreman feedback Ergonomics

- Worker focus groups (3):
  - Subs and workers must figure out best method themselves
  - GC sometimes helped: kept the job clean; helped when asked; one site built crates to lift equipment to higher floors before buck hoist installed
  - Barriers: can't find carts when needed, 95% of time materials stored on ground; before buck hoist had to carry up stairs
- Foreman interviews (11):
  - GC did not bring up ergonomic topic at meetings but facilitated discussion between trades if brought up by others
  - Few references to ergonomics in daily interactions
  - GC stopped guys from carrying an object that was too heavy

Phase 1–Summary results

- General Contractor has a well developed safety program but little reference to ergonomics on documents and in meetings.
- Workers seemed knowledgeable but report inconsistent behaviors of coworkers
- Barriers due to lack of equipment, schedule issues, staging, manpower; coordination/planning about ergonomic issues between GC, subs, workers

Methods–Phase II



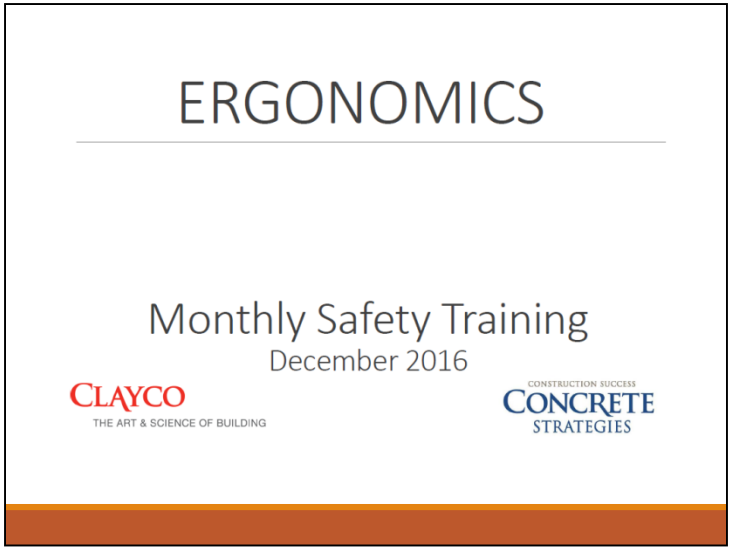
Intervention

- Develop plan
  - Simple education intervention (identify and control)
    - Workers handling heavy objects
    - Work above shoulder
    - Work below knee
  - Incorporate into written materials
- Role out plan to organization
  - Approval by Safety Committee of GC
  - Educate all employees on ergonomic intervention

Intervention

- Role out plan on construction project
  - Before work onsite
    - Subcontractors plan for ergonomics in site specific safety plan
    - Discuss during preconstruction meeting
  - Start of work
    - Worker orientation- review ergonomic principles
    - Discuss expectations for ergonomics
  - During project
    - Review of daily PTSA
    - Discuss in weekly foreman meetings and daily interactions

Intervention
General Contractor Training & Audits



- Management Quarterly Audit: Observe safe material handling techniques and Ergonomics

Focus Five: Ergonomics

CLAYCO TBT

REGULATIONS

- *Clayco Work Rules Book*

- Clayco's "Focus Five" causes of injury: Struck By; Slip/Trip/Fall; Ergonomics; Caught In/Between; Contact with Electricity
  - These are the main causes of injury on Clayco jobsites. These hazards are to be eliminated whenever possible.

STATISTICS

- In 2015, Ergonomics was Clayco's #3 cause for injuries (18%) - *Clayco 2015 Pareto Analysis of Injuries*
- Ergonomics is not part of OSHA's Fatal Four, but overexertion injuries are very common in the workplace across the US.
  - Half of workplace fatalities could be avoided by eliminating the Fatal Four Hazards (508 total "Fatal Four" fatalities in 2014)

Intervention
Subcontractor Preconstruction Plan

Subcontractor Site-Specific Safety Plan Outline

ERGONOMICS/SOFT TISSUE INJURY * ***Management understands and agrees***

Describe the means and methods to be used by employees to reduce risk of soft tissue injuries (sprains, strains, contusions, etc). The work methods and available equipment should:

a) limit the weight of objects handled by workers

b) promote good body positions and minimize work done above head level and near floor level.

List heaviest objects to be lifted/moved manually by workers (and estimated weight):

_____

List mechanical equipment (carts, dollies, hoists, cranes, lifts, etc.) to assist in lifting and transporting heavy loads (to be readily available onsite):

_____

Does scope of work require performing tasks frequently or for long periods of time ***above worker's head?*** * **YES** * **NO**

If yes, what work methods are to be used to minimize work done above shoulder level?

(use of aerial lifts or ladders, preassembly on waist-height, preassembly in shop, etc)

_____

Does scope of work require performing tasks frequently or for long periods of time ***at/below knee-level?*** * **YES** * **NO**

If yes, what work methods are to be used to minimize this type of work and reduce stress in the back and legs? (wear knee pads/seated pads, preassembly at waist-height, preassembly in shop, extended handled tools, etc)

_____

Other controls or work methods to address soft tissue Injuries:

_____

Intervention
Subcontractor– foreman training
Daily task hazard identification and controls

CLAYCO PRE-TASK SAFETY ANALYSIS (PTSA)

Company: _____ ***Supervisor Name:*** _____ ***Project:*** _____ ***Date:*** _____

Craft(s): _____ ***Task/Job:*** _____ *Location:* _____

What activities could get someone seriously injured today? _____

DISCUSS IN DETAIL WITH CREW EACH DAY TO PROVIDE A SAFE WORK PLAN SO THAT EVERYONE GOES HOME SAFE EACH DAY!

CHECK THE BOX IF YOUR CREW IS AT RISK	HAZARD	CONTROL
☐ EYE INJURY	Working around flying debris (dust, metal, etc)? Working around power tools (nailers, saws, etc)?	Z87 Glasses, Minimum. Other ways to protect eyes: ☐ Face Shield ☐ Goggles ☐ Foam-lined Glasses
☐ HAND INJURY	Working with sharp objects, tools, chemicals, etc? Working around moving parts, pinch points, etc?	☐ ANSI Cut Lvl 3 Gloves ☐ Watch Hand Placement ☐ Gloves with greater protection level
☐ NOISE	Working around loud noises? (Generators, blowers, impact hammers, saw, etc)	☐ Ear Plugs ☐ Ear Muffs ☐ Plugs + Muffs ☐ Rotate Workers through out the shift
☐ STRUCK BY	Working around suspended loads, flying objects, overhead work? Strike self with tools?	☐ Controlled Access Zones ☐ Keep clear of overhead loads ☐ Body Parts out of Line of Fire ☐ Taglines
☐ SOFT TISSUE INJURY	Workers lifting, pulling, pushing loads repeatedly? Work done above shoulder or below knee?	☐ Stretch & Flex ☐ Mechanical means of lifting ☐ Alternative Tools ☐ Work between shoulder & knee
☐ SLIPS & FALLS	Working near 6' or higher? Slippery surface Working with ladders, scaffolds, aerial lifts?	☐ Guardrails ☐ 100% Fall Protection ☐ Secure Ladder ☐ Warning line on Roof ☐ Clear walk/work surface
☐ CONTACT WITH ELECTRICITY	Work around energized systems? Work with tools? Work around overhead or buried power lines?	☐ Inspect Cords & Tools ☐ Cord Protection ☐ LOTO ☐ Locate Utilities for Excavation ☐ GFCI
☐ CAUGHT IN OR BETWEEN	Working around equipment/structure, excavations? Working around moving parts, live equipment, etc?	☐ Backup Alarm ☐ Barricade Equipment ☐ Guarding ☐ LOTO Equipment ☐ Trench Box ☐ Slope/Bench

SAFE TASK BUILDER

1 *Identify Job/Task, Tools & Equipment* → 2 *Identify Hazards* → 3 *Identify Controls* → 4 *Communicate Plan with Crew*

1 *IDENTIFY JOB/TASK, TOOLS & EQUIPMENT*

2 *IDENTIFY HAZARDS*

- What activities can hurt me or the people I work with?
- Are there any special/unique activities today?
- Am I working with or around any tools, machines or equipment today?
- Am I needing to lift heavy loads?
- Is flying debris involved that could injure my eyes?
- Is there extreme weather heat, noise, or vibration that could hurt me or the people I work with?
- Is there a danger from falling objects?
- Are there any dust, fumes, mists or vapors in the air?

3 *IDENTIFY CONTROLS*

- Can anything be done to ELIMINATE or REMOVE the hazard?
- Are there any guarding, barricading or isolation methods that can be done to SEPARATE workers from the hazard?
- Are any permits required?
- Are all workers trained for the tasks they are to perform?
- Are all workers outfitted with appropriate PPE for the task?
- ***DESCRIBE WHAT ACTIONS ARE TO BE TAKEN AND HOW THE WORK IS TO BE PERFORMED SAFELY.***
- ***USE MORE THAN JUST "BE CAREFUL" & "USE CAUTION" - GIVE DETAILS!***

4 *COMMUNICATE PLAN WITH CREW*

- Review with crew - everyone signs before work starts
- Anyone that comes in late must review and sign
- Change the PTSA to reflect any changes with the task during the day
- Give the crew an opportunity to ask questions and make contributions
- Review the Four Basic Steps with the crew

CLAYCO
THE ART & SCIENCE OF BUILDING

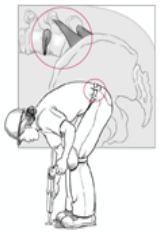
Intervention
Worker training

Worker Orientation

ERGONOMICS/SOFT TISSUE INJURY

- Caused by work tasks that are too much for the body, lead to sprains and strains
- Common problem tasks:
  - Manual material handling
  - Work above head
  - Work below knee
- Plan each task to use best practices
  - PTSA form
  - Team communication


Excessive force


Awkward Postures

CLAYCO

CONTROLS FOR SOFT TISSUE INJURY

Manual handling

- Stage deliveries near installation
- Use mechanical means

Engineering control is preferred

- Co-worker team lift
- Lift assist tools
- Stretch and Flex (as often as needed)
- Proper lifting technique

- GOOD HOUSEKEEPING

CLAYCO

PRE-TASK SAFETY ANALYSIS (PTSA)

CLAYCO TBT

The Pre-Task Safety Analysis (PTSA - Orange Sheet) is a safety tool to be used to help protect you and those who work with and around you. The idea of the PTSA is simple…

1. ***Prior to starting a task,*** bring the crew together and review the jobs to be done that day.
2. ***As a crew,*** identify the hazards you are going to be facing that day.
3. Identify what controls you will use to eliminate or reduce the risk created by those hazards.
4. Make sure that everyone understands the hazards associated with that task and what they are expected to do to protect themselves and others.
5. Everyone signs onto the PTSA and acknowledges the plan.
6. If any changes occur in the task through out the day, the PTSA must be updated.

Intervention
Weekly and Daily Safety meetings

- Foreman Meeting- Safety and ergonomics

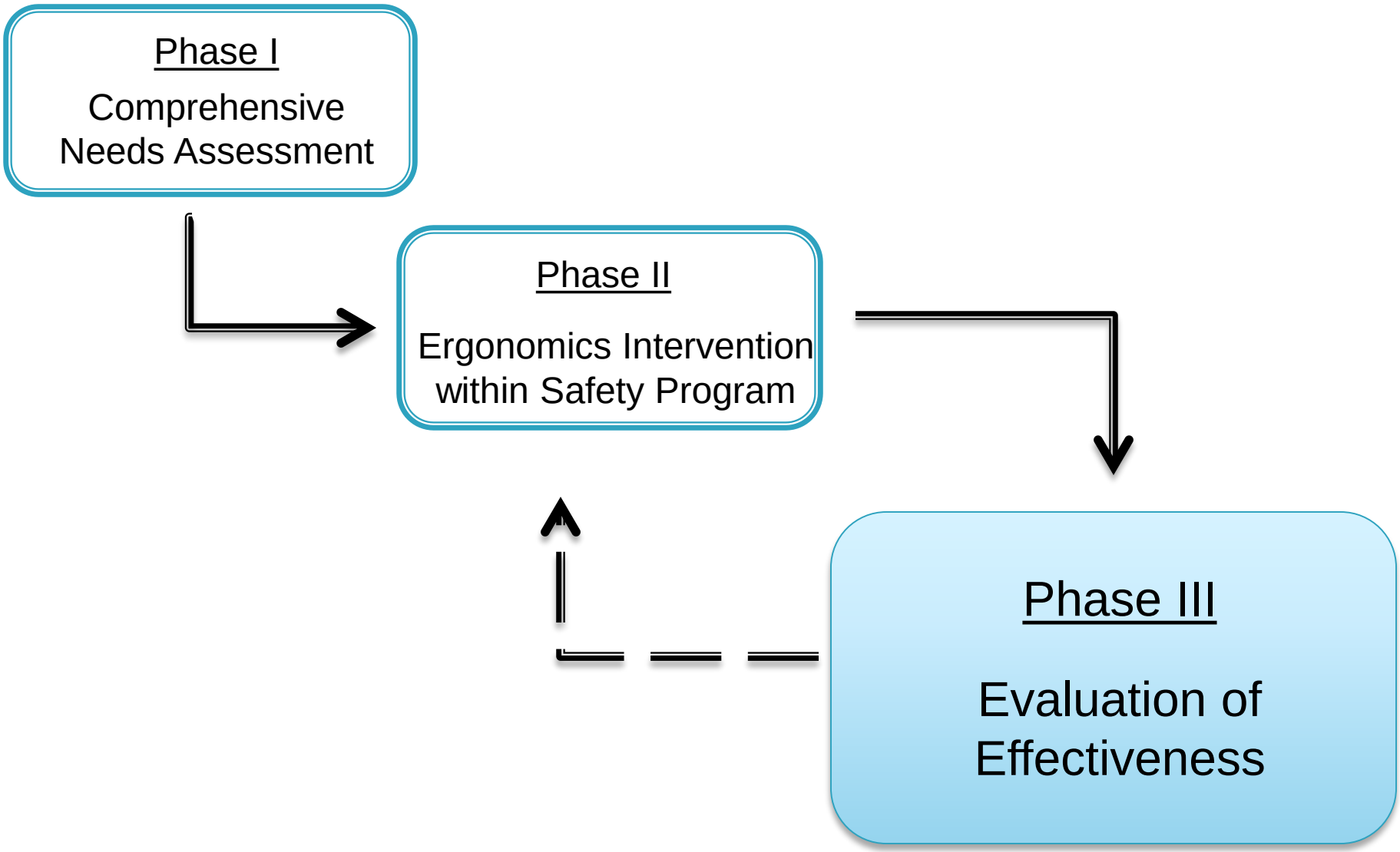
OBSERVATIONS

- Stretch & Flex; Safety Briefs; PTSA huddles

Conclusions

- Ergonomics is lacking even in well-developed safety programs
- There are many positive points to build on- knowledge among workers, solutions on the market, good safety program frameworks to incorporate ergonomics, motivation among workers and contractors
- Need for regular discussions on ergonomic issues from preconstruction throughout the build

Next Steps–Phase III



Questions?

Ann Marie Dale PhD, OTR/L
Office: (314) 454-8470
e-mail: amdale@wustl.edu
Website:
https://oshr.wustl.edu/

PARTNERING FOR HEARING LOSS PREVENTION IN CONSTRUCTION

Mary Kathryn (MK) Fletcher, CPWR

Eileen Betit, CPWR

G. Scott Earnest, NIOSH Office of Construction Safety and Health

Elizabeth Garza, NIOSH Office of Construction Safety and Health

Linda Goldenhar, CPWR

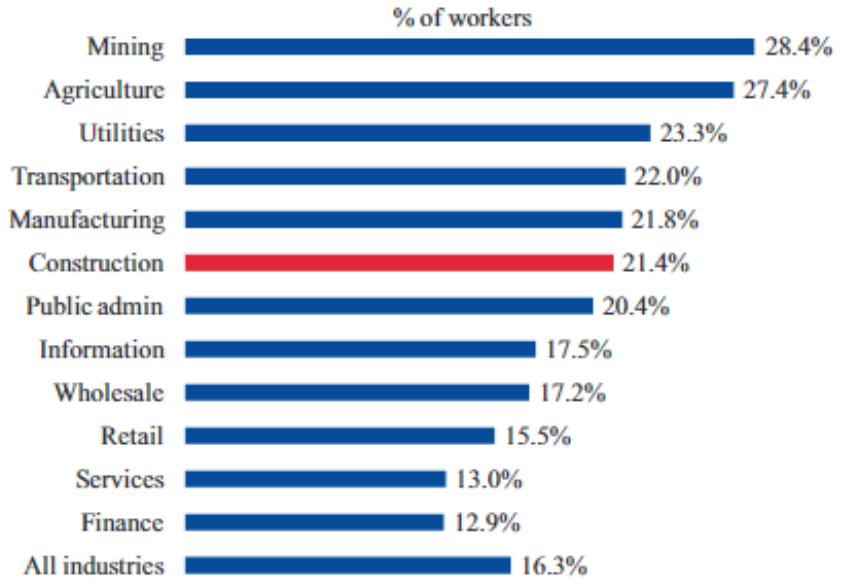
CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

June 21, 2017

NOISE IN CONSTRUCTION

- Estimated **73%** of construction workers are exposed to noise over 85 dBA 8-hr TWA – the NIOSH REL
- Construction workers are at high risk of suffering from hearing loss

49b. Percentage of workers with self-reported hearing trouble, by industry, 2010
(All employment)



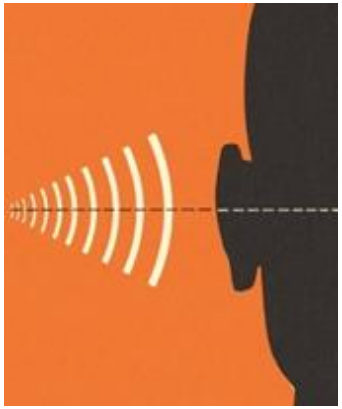
Source: National Center for Health Statistics. 2010 National Health Interview Survey. Calculations by CPWR Data Center.

OSHA-NIOSH-CPWR r2p WORKING GROUP

- **Work in partnership to advance r2p by:**
  - Translating research findings into practical materials and resources
  - Disseminating materials and resources to construction audiences
  - Facilitating exchange of information between researchers and construction stakeholders
  - Driving use of safety and health interventions and practices to eliminate construction worker fatalities and reduce injury and illness.
- **Identified hearing loss prevention as a priority**

HEARING LOSS PREVENTION

- **Conducted surveys of trainers and workers to identify:**
  - Awareness of noise hazards
  - Use of controls and hearing protection
  - Barriers to use of controls and hearing protection
  - Gaps in the types of training conducted & received



TRAINER PERSPECTIVE

- 9 unions out of 14 national unions participated
- 248 trainers – 21% response rate
- Question categories:

Demographics

Sources of Noise

Training

Hearing Loss

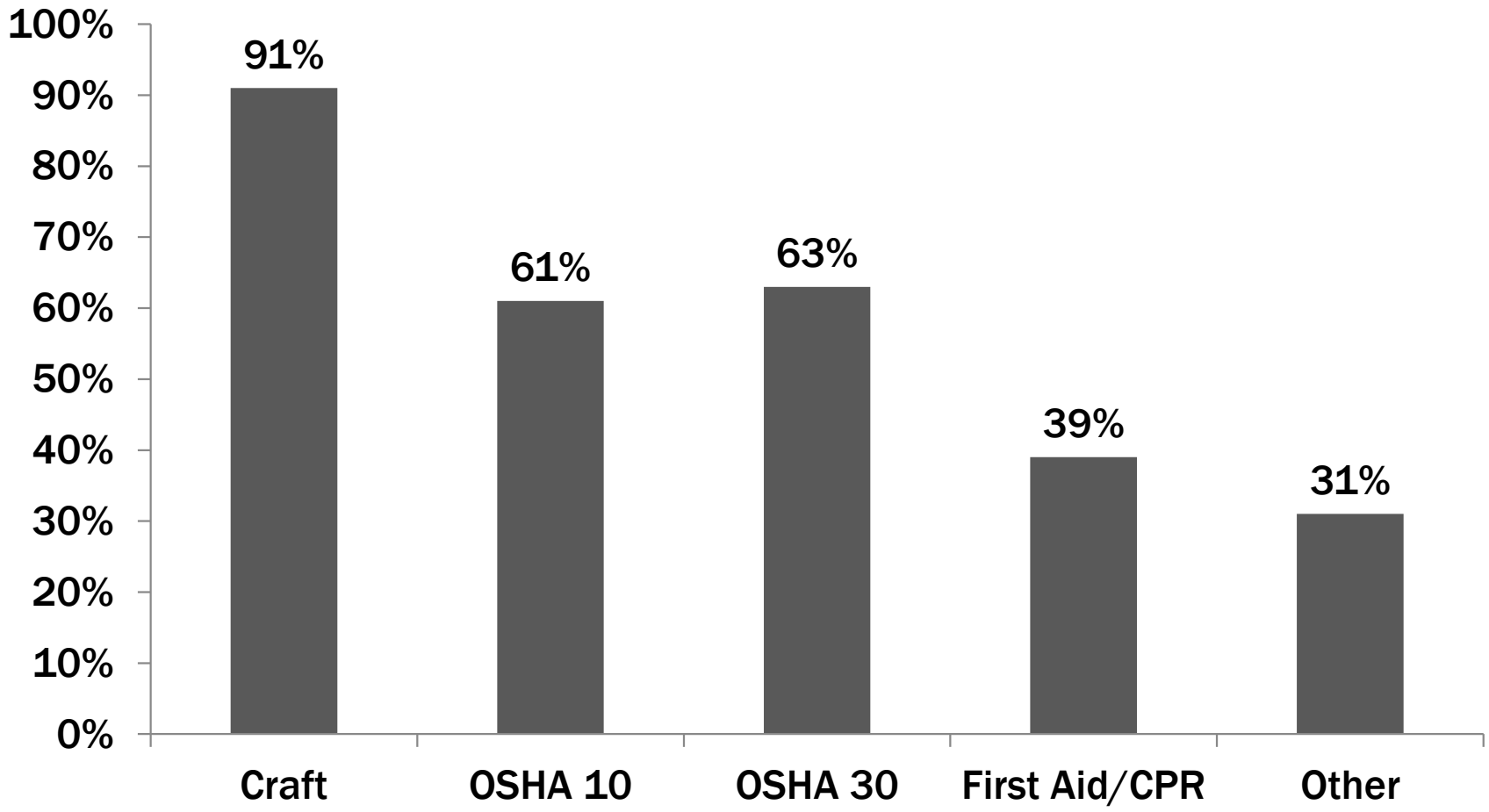
Challenges

TRAINER SURVEY RESULTS

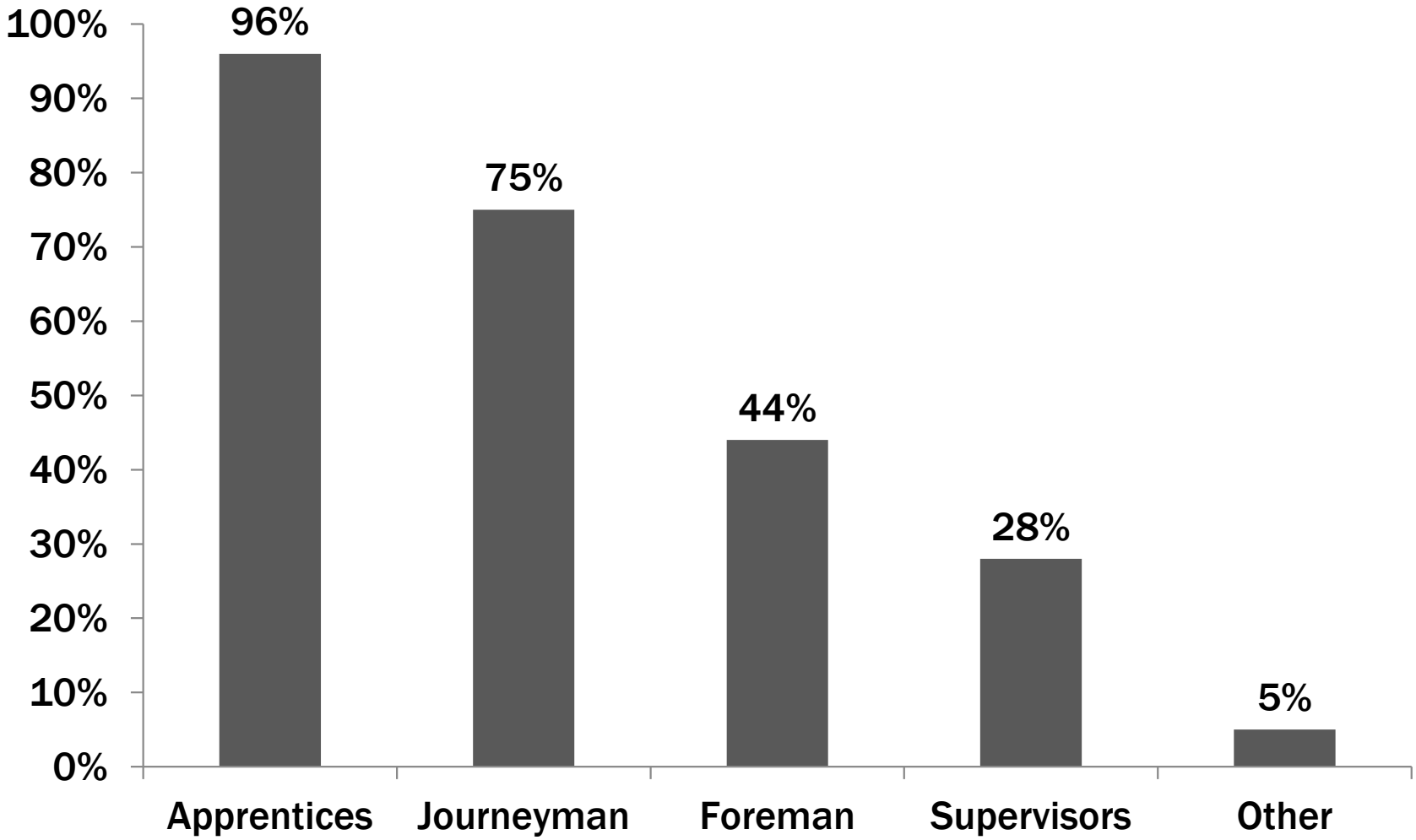
- Average experience levels of trainers:
  - **28.7 years** in construction
  - **11.9 years** as trainers

- **81%** of trainers provide training on how to prevent noise-induced hearing loss

TYPES OF TRAINING CONDUCTED



WHO RECEIVES NOISE TRAINING



NOISE-RELATED TOPICS COVERED

	Trainer Provided
OSHA standards & PEL	**86%**
How to wear hearing protection	**86%**
How to determine when needed	*77%*
How to select	*77%*
Limitations	*53%*
When to replace	*43%*
Sources of noise	**82%**
Risk & signs of hearing loss	*69%*
Engineering controls	**37%**
Administrative controls	**26%**

CHALLENGES

Reducing the risk of hearing loss

Training about hearing loss & prevention

1. Convincing workers of the hazard
2. Raising awareness of noise sources
3. Getting workers to apply what they learned

TRAINERS' RECOMMENDATIONS

- Results reviewed and discussed with a multi-trade group of 60 trainers.
- Specific actions recommended to address challenges:
  1. Add noise-related training materials to the OSHA 500, 502, 10, and 30 training packets that CPWR sends to the trainers.
  2. Send regular notices and reminders -- *"once is not enough."*
  3. Include regular reminders in the unions' magazines, newsletters, Facebook posts, and Twitter feeds.

WORKER PERSPECTIVE

- **49 trainers** administered the survey
- **4,195 union workers** responded from multiple trades -- **84%** response rate
- Question categories:

Demographics

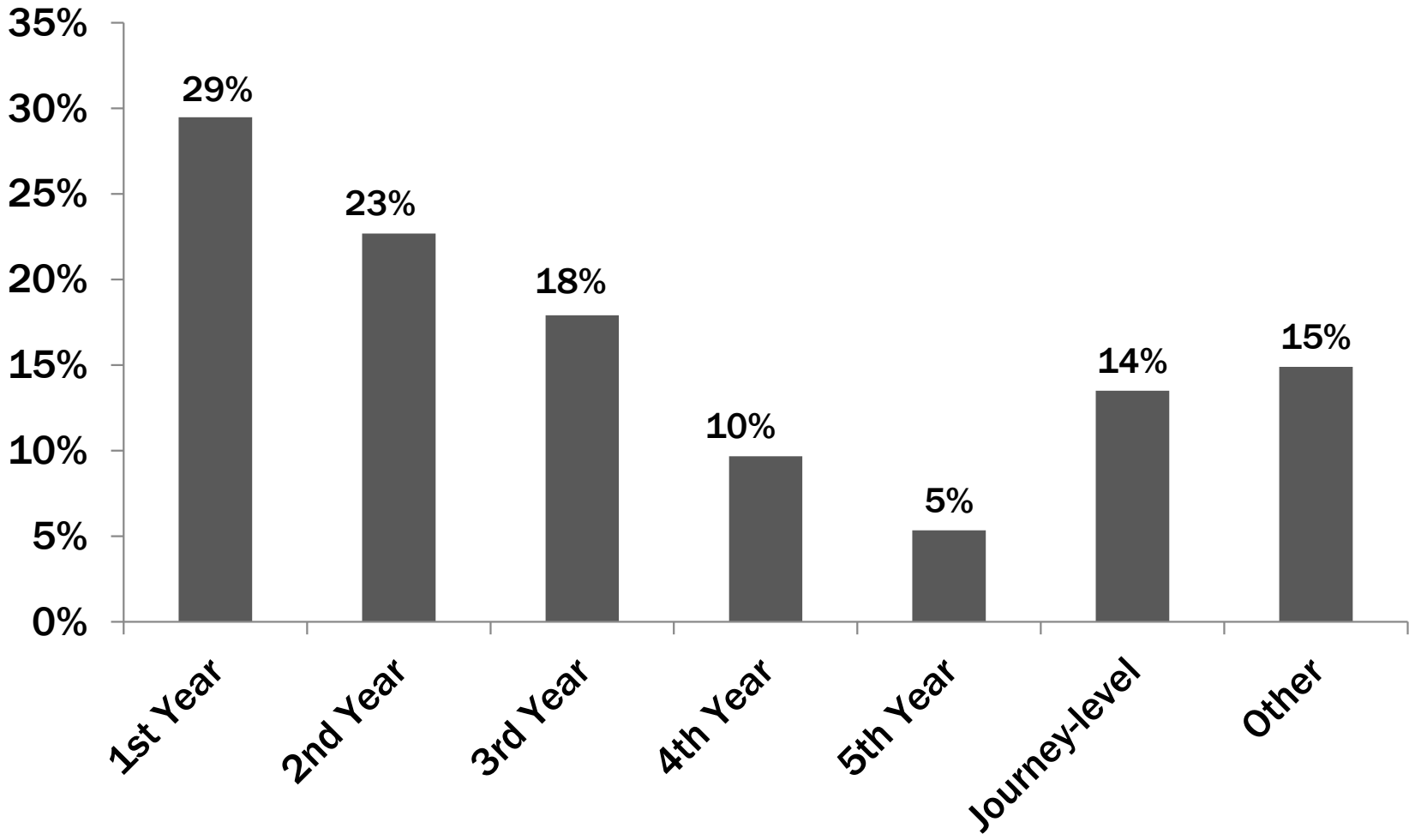
Noise Levels of Jobsites

Hearing Loss

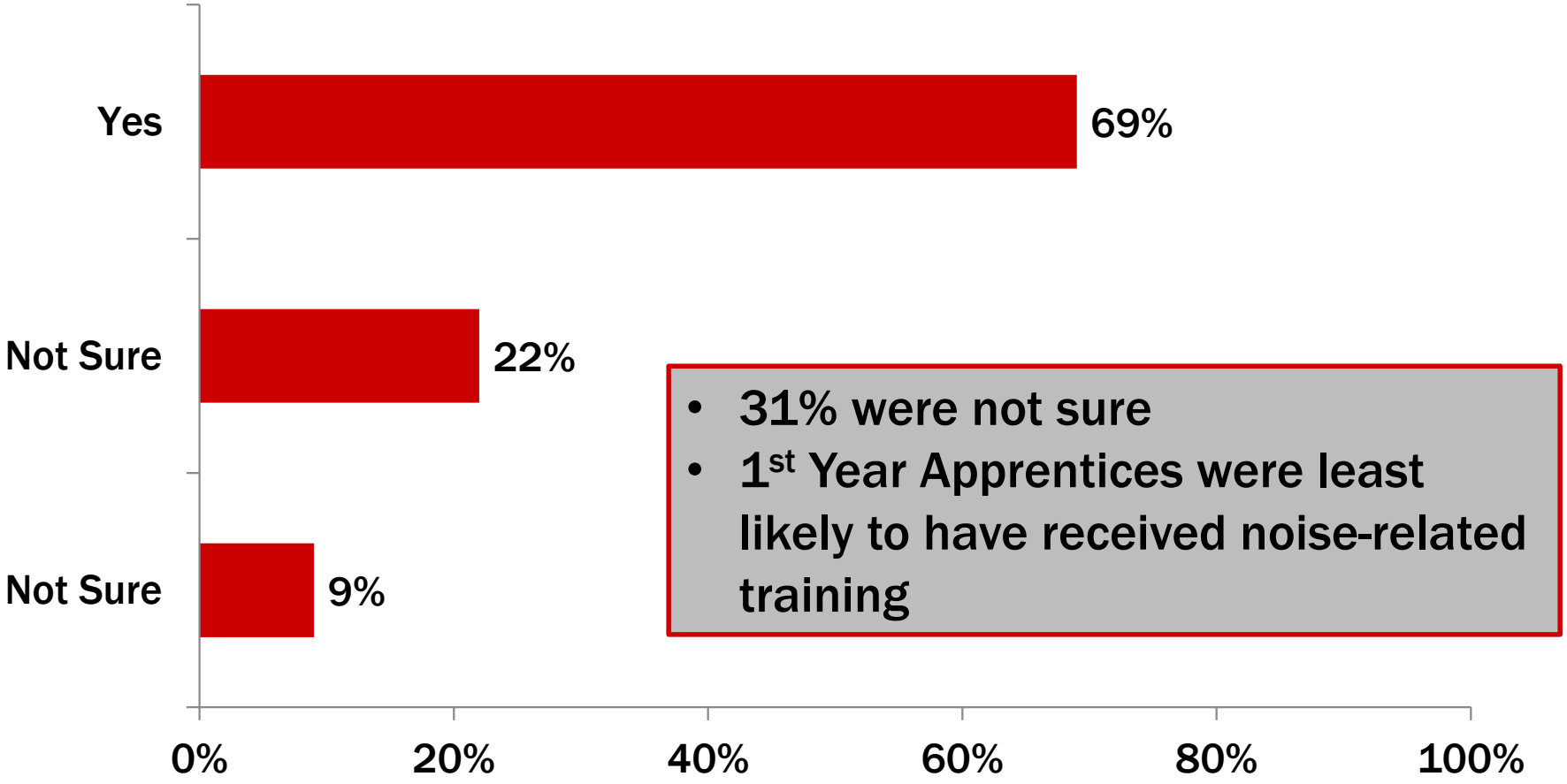
Training

Use of Hearing Protection

PARTICIPANTS - STATUS



RECEIVED TRAINING ON HOW TO PREVENT NOISE-INDUCED HEARING LOSS

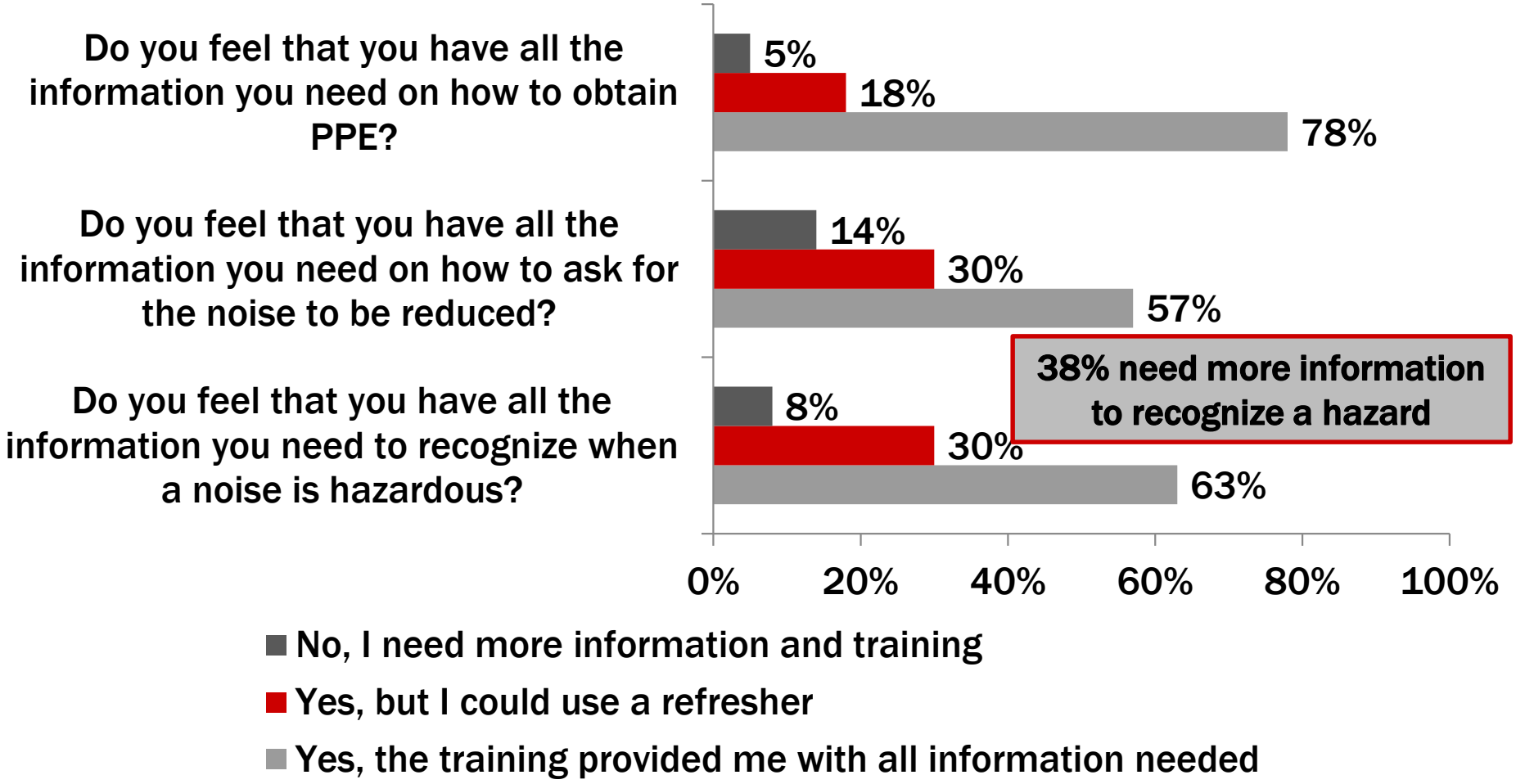


- 31% were not sure
- 1st Year Apprentices were least likely to have received noise-related training

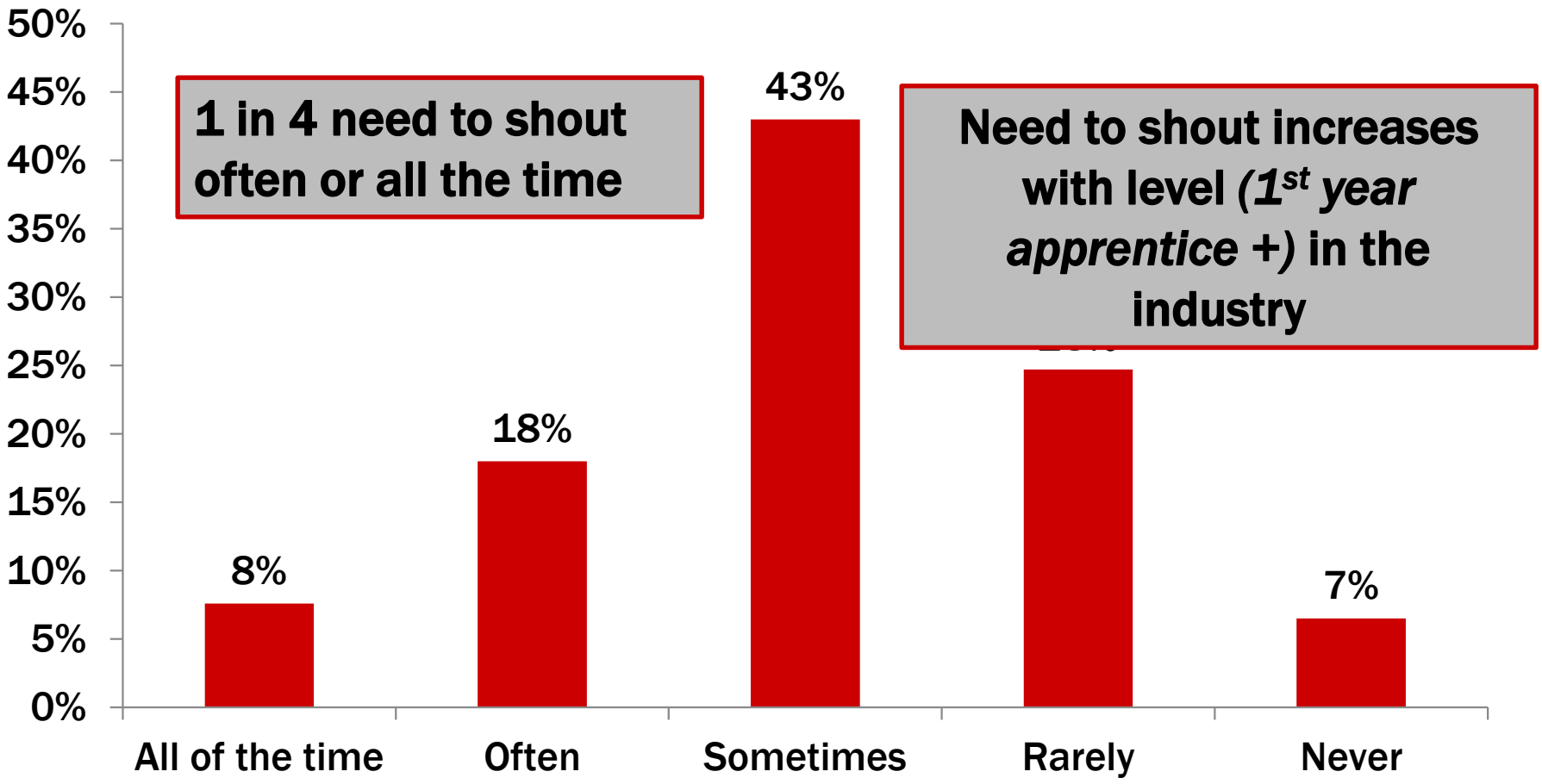
NOISE-RELATED TOPICS COVERED

	Trainer Provided	Worker Reported
OSHA standards & PEL	**86%**	**90%**
How to wear hearing protection	**86%**	**76%**
How to determine when needed	*77%*	*70%*
How to select	*77%*	*67%*
Limitations	*53%*	*43%*
When to replace	*43%*	*45%*
Sources of noise	**82%**	**66%**
Risk & signs of hearing loss	*69%*	*65%*
Engineering controls	**37%**	**24%**
Administrative controls	**26%**	**18%**

WORKER SURVEY RESULTS

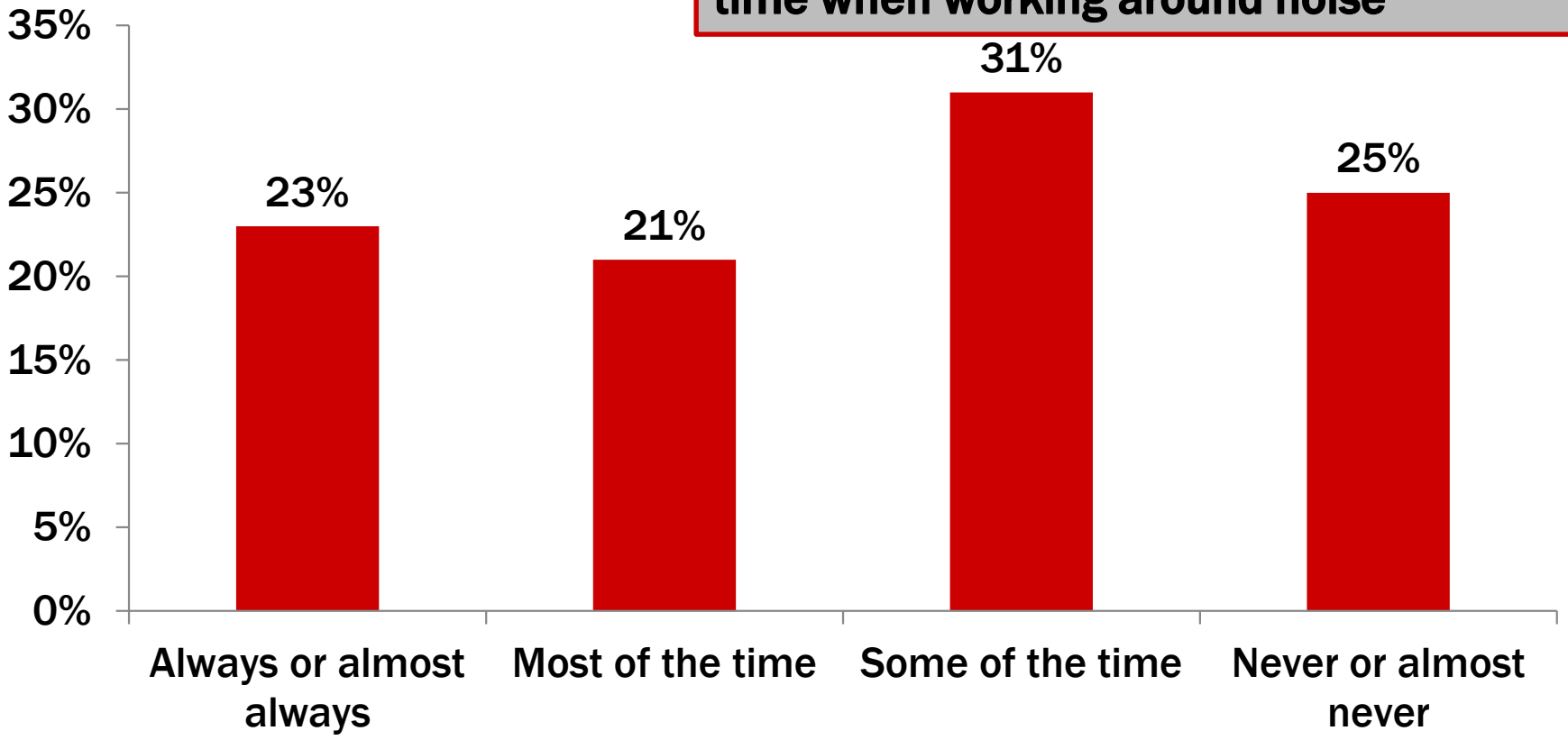


NOISE ON THE JOBSITE – HOW OFTEN WORKERS NEED TO SHOUT TO BE HEARD



USE OF HEARING PROTECTION

56% do not wear PPE most or all of the time when working around noise

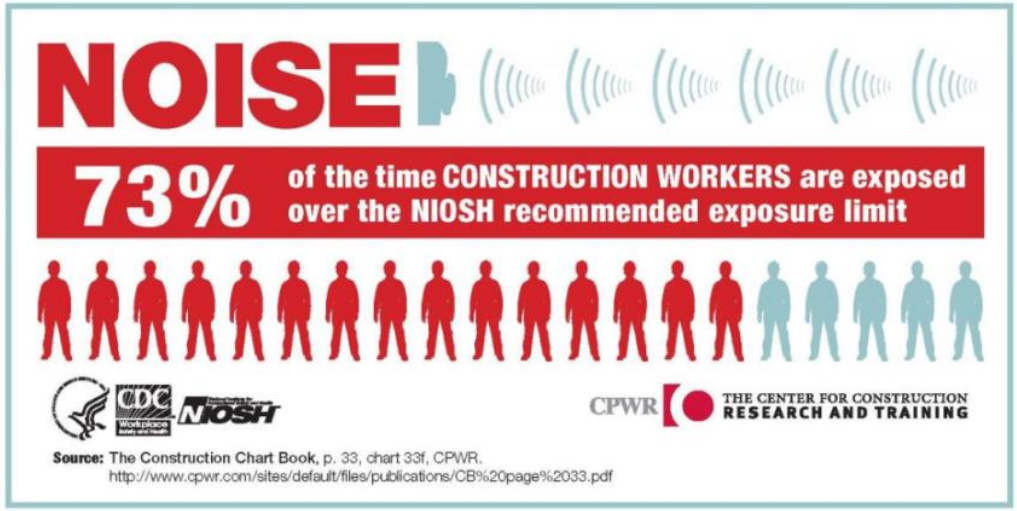


WORKER SURVEY RESULTS

Reasons why workers did not always wear hearing protection	Percentage (%)
I am not sure when I should wear hearing protection	15%
I can't hear things I need to hear when I wear hearing protection	49%
Hearing protection is not provided	27%
Hearing protection is uncomfortable	19%
No one else wears hearing protection	20%
I can't always find hearing protection	30%
Hearing protection gets in the way of other safety equipment/clothing	11%
I feel isolated when wearing hearing protection	18%
Other	14%

SURVEY CONCLUSIONS

- Workers benefit from noise training
- Workers are not always retaining what they learn
- Workers need ongoing & repetitive training and hearing loss
- Trainers need more noise training resources



IMPACTING RESEARCH 2 PRACTICE (R2P)

- New training materials are being developed
  - Noise hazards
  - Risks of hearing loss
  - Low noise equipment
  - Controls (engineering, administrative, and PPE)
- Retention strategy
  - Brief activities to reinforce noise training during safety and skills training
  - Hands-on & in-class training activities

IMPACTING PRACTICE 2 RESEARCH (P2R)

- **p2r potential research opportunities:**
  - Clinical studies of hearing loss & tinnitus
  - Equipment solutions:
    - Low noise equipment
    - Protections that allow workers to communicate & hear important sounds, and are compatible with other safety equipment

LESSONS LEARNED

- **The OSHA-NIOSH-CPWR r2p Working Group's partnership allowed them to:**
  - Leverage resources to efficiently collect data on noise hazards and hearing loss
  - Share knowledge
  - Identify training needed to prevent hearing loss and address gaps

THANK YOU

A special thanks to the trainers, workers, and union staff who participated in these surveys.

mfletcher@cpwr.com

CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

Use of video exposure monitoring to increase worker proactive dust control practices: Evaluation of five worksite interventions

Emily Haas, PhD

Pittsburgh Mining Research Division

Expanding Research Partnerships: State of the Science Meeting

Colorado School of Public Health

June 21, 2017

Agenda

- Worker perspective on health, impact on decision making
- Integrating technology into H&S interventions
  - Helmet-CAM
- Quick fixes and controls for workers and management
- Best practices for technology integration

Workers' have engrained attitudes and behaviors toward dust control.

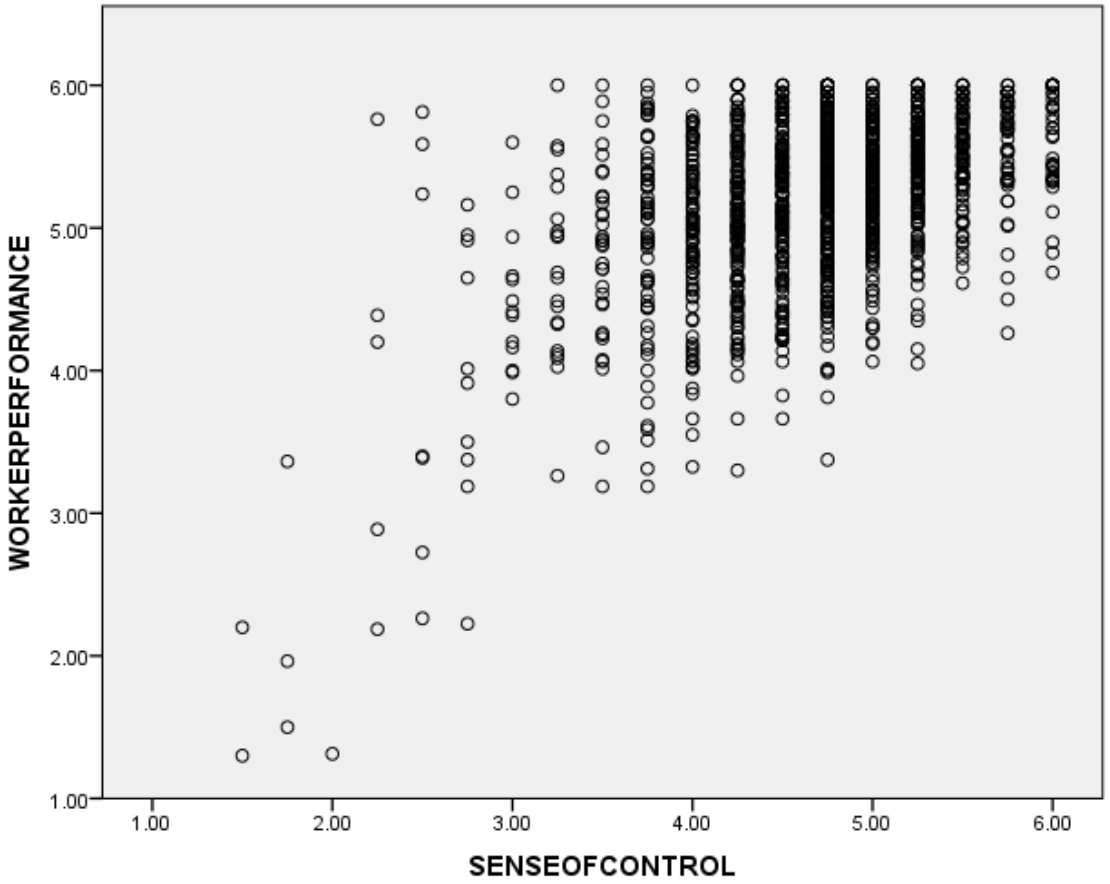
- Optimistic bias
  - "It's risky but not risky for me because…"
- High risk tolerance
  - "I don't feel unsafe while I'm doing…"
- Underestimating delayed outcomes
  - "It won't happen to me…"
- Complacency
  - "It's easy to get comfortable, fall back into old habits…"

Workers' have perceived knowledge and barriers about respirable dust exposure and prevention.

- Silica exposure primary health risk – but under control.
- Seeing dust increases awareness.
- Dust you can't see is more harmful.

- *Not much more we can do.*

When workers have more job control and are involved in task decisions, they experience higher levels of health and safety performance on the job.



Similar relationships:

- Job control and fatigue
- Job control and cognitive failure

Previous research shows that using technology within H&S interventions can increase job control.

- Technology and associated technology platforms have improved health behavior among various disease categories (88% - 151/170)*
  - **83%** of studies reported improvement in user engagement after using technology platforms.
    - 100% of intervention studies involving lung and airway issues.
  - **58%** of self-reported data showed a positive impact on health outcomes after using technology platforms within an intervention.

*Meta-analyses by Sawesi et al., 2016. *JMIR Medical Informatics*

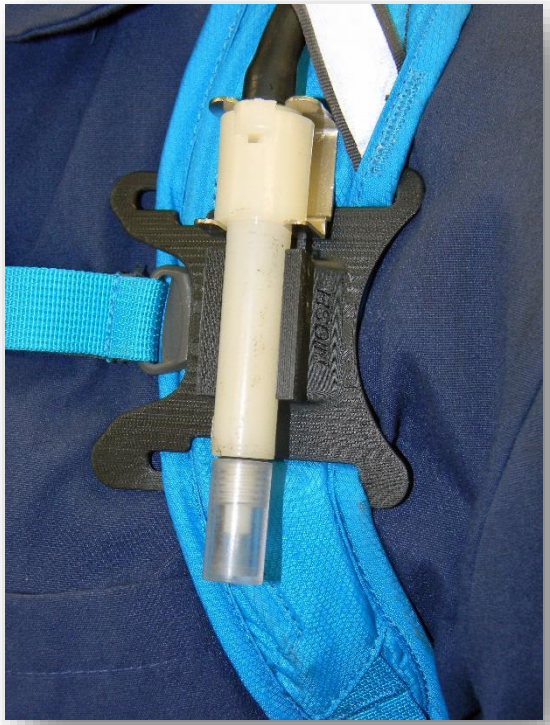
Overview of video exposure monitoring (Helmet-CAM) technology for dust control.

Video Exposure Monitoring *"Helmet-CAM"*
not regulated

Video of job tasks performed by mineworkers that are "dusty."	pDR-1500 to measure real-time respirable dust exposure.	Software "EVADE" merges video and dust data in easy to use synchronized format.

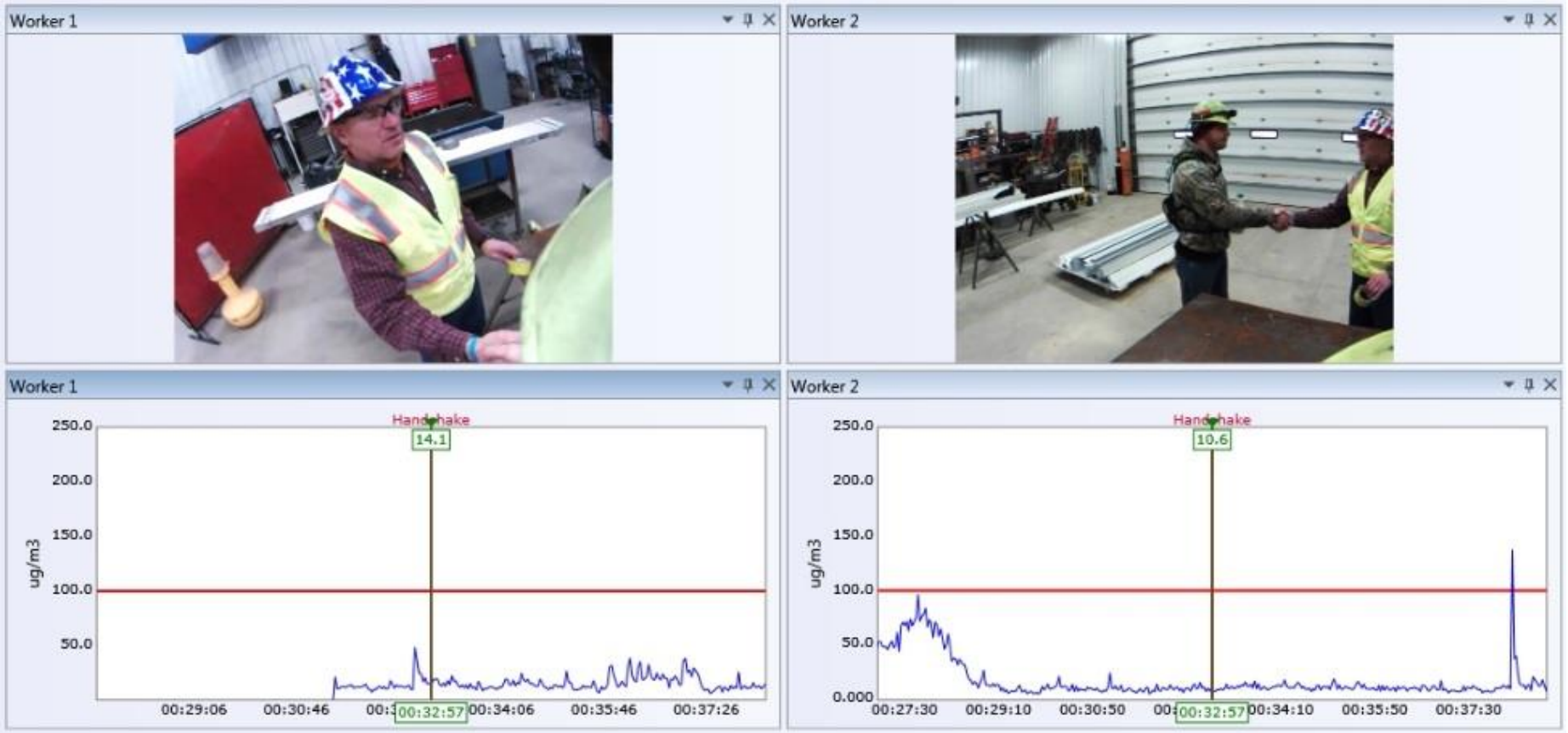
determines "sources of exposure" and "control technology effectiveness"


NIOSH
MINE SAFETY AND HEALTH RESEARCH
NIOSH



EVADE 2.0 Software

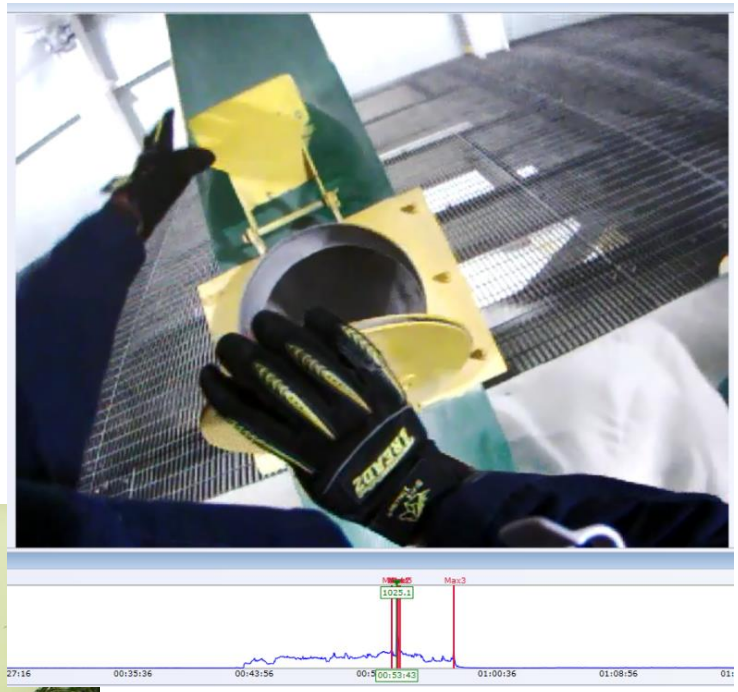
(Enhanced Video Analysis of Dust Exposure)



What can H&S technology tell us about the effectiveness of organization's risk management processes and impact on worker performance?

Pre and Post Surveys, Interviews, & Dust Assessments

Step 1



Step 2

Step 3

Identified exposure sources, behavioral practices, and organizational/engineering modifications. (*n* = 48, 5 mine sites)

Table 1

Helmet-CAM intervention participants.

Mined commodity	Number of participating workers	Job positions (as described by the workers)
Industrial minerals/ aggregates	11	Loader operator, rail loader, lab technician, dry maintenance, clean-up, mine operator
Metal	9	Assay lab technician, maintenance, blaster
Industrial minerals/ aggregates	9	Maintenance, electrician, utility/ process operator, load truck operator
Industrial minerals/ aggregates	12	Bagging operator–bulk and mini bags, clean-up, maintenance
Industrial minerals/ aggregates	7	Bagging operator–bulk and mini bags, lift truck operator, load truck operator

Folding the bulk or mini bag loading collars toward the worker resulted in brief, elevated exposures.

Quick Fix: Folding the bulk, mini-bag loading collar in a different direction from the worker resulted in up to a 92% reduction in exposure in comparison to folding the collar toward the worker while tying off the bag.

Know Your Dust Exposure
Tying Bulk/Mini-bags

Did you know?

Folding bulk/mini-bag loading collars away from your breathing zone can reduce peaks in respirable dust exposure up to 92%.

When tying, fold bag collars away from you.

CDC NIOSH

Findings based on NIOSH Helmet-CAM field studies during 2015 and 2016.
To learn more, visit https://go.usa.gov/xXCs9.

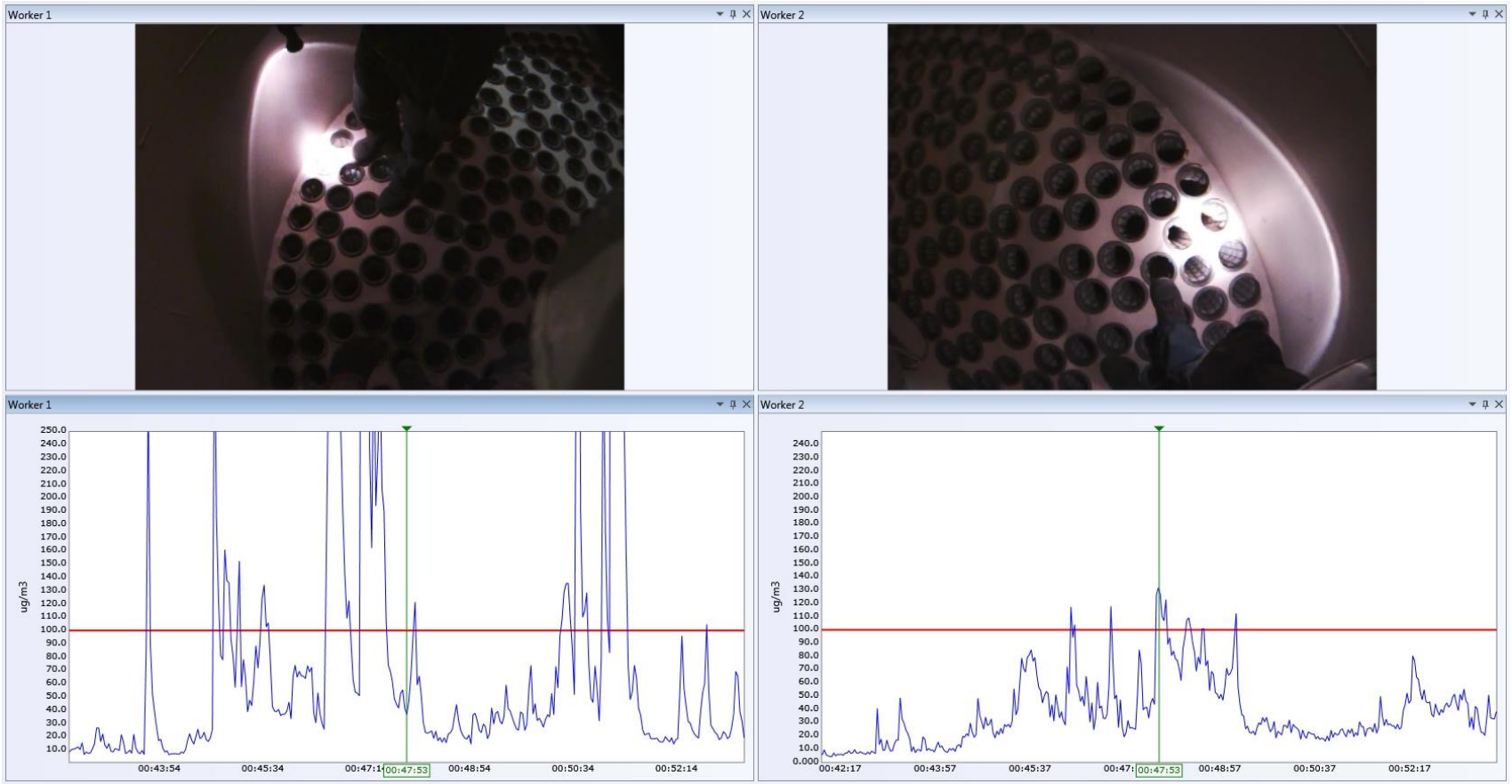
Dusty clothes worn by workers, dirty hands, and dust-laden cloth seats in operating equipment, light fleet vehicles, and office chairs are consistent dust exposure sources.

Quick Fixes

- Clothes cleaning techniques.
- Use of leather gloves.
- Vinyl seat cover over seats to help prevent dust absorption.
- General cleanliness inside cabs, trucks, office space.
- Alternative cleaning methods (e.g. vacuuming) rather than dry sweeping.

Effects of Contaminated Work Clothing

Working inside LEV system changing bags



Over a 12-minute time segment, worker 1 respirable dust exposure was 3 times higher than his co-worker.

Know Your Dust Exposure
Work Clothes

Did you know?

Using clothes cleaning technology throughout the workday can reduce your exposure to respirable dust by up to 88%.

Launder clothes post-shift, including sweatshirts and coats, and use leather (not cloth) gloves to avoid dust buildup.

CDC NIOSH

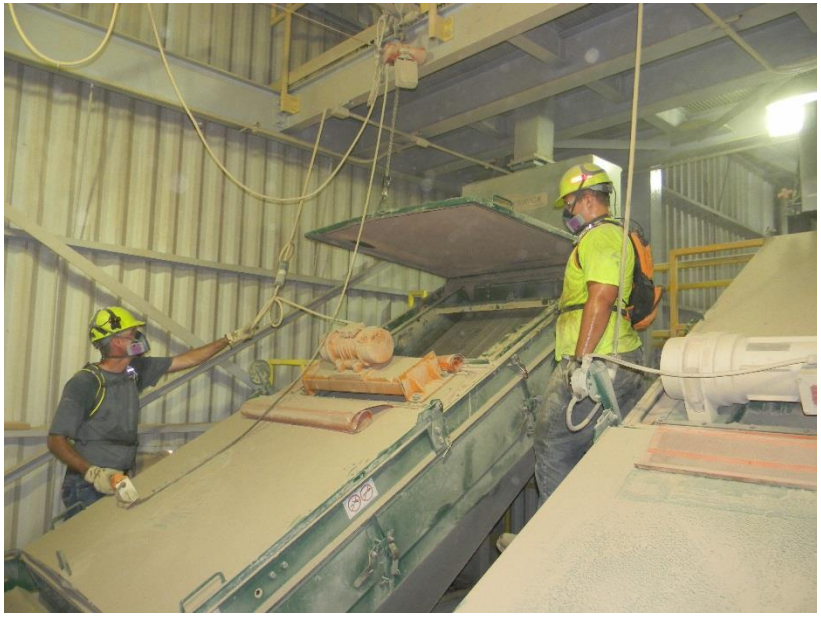
Findings based on NIOSH Helmet-CAM field studies during 2015 and 2016.
To learn more, visit https://go.usa.gov/xXCs9.

Fugitive dust while maneuvering dust-laden objects cause short exposure spikes.

Quick Fixes

- Housekeeping in dust-laden areas such as beltlines.
  - cleaning and maintaining the belt better than previous visits resulted in lower exposures.
- Water areas more frequently.
- Storage for screens and other objects (i.e. bags) to help prevent dust accumulation and liberations during installations, fills, and fixes.

Consistent exposures during screen cleaning & changes



Contributors to worker exposures

- Low LEV airflow volumes
- Low total structure ventilation air volume
- Improper storage of new and used screens
- Poor housekeeping practices
- Contaminated work clothing

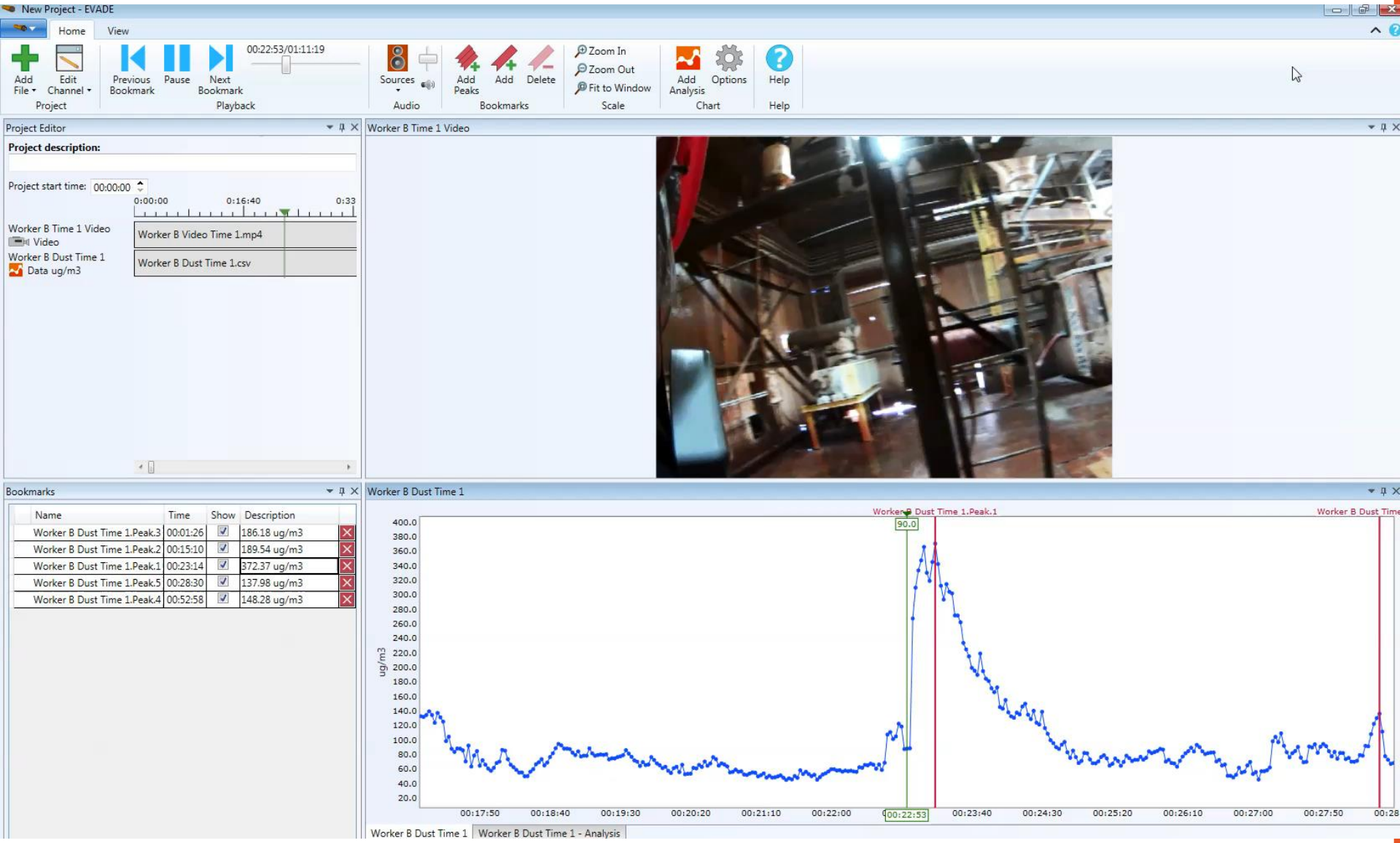
Improvements

- Significant increase in LEV airflow
- Increased total structure ventilation air volume
- Improved housekeeping and screen storage to eliminate dust buildup on new screen cardboard

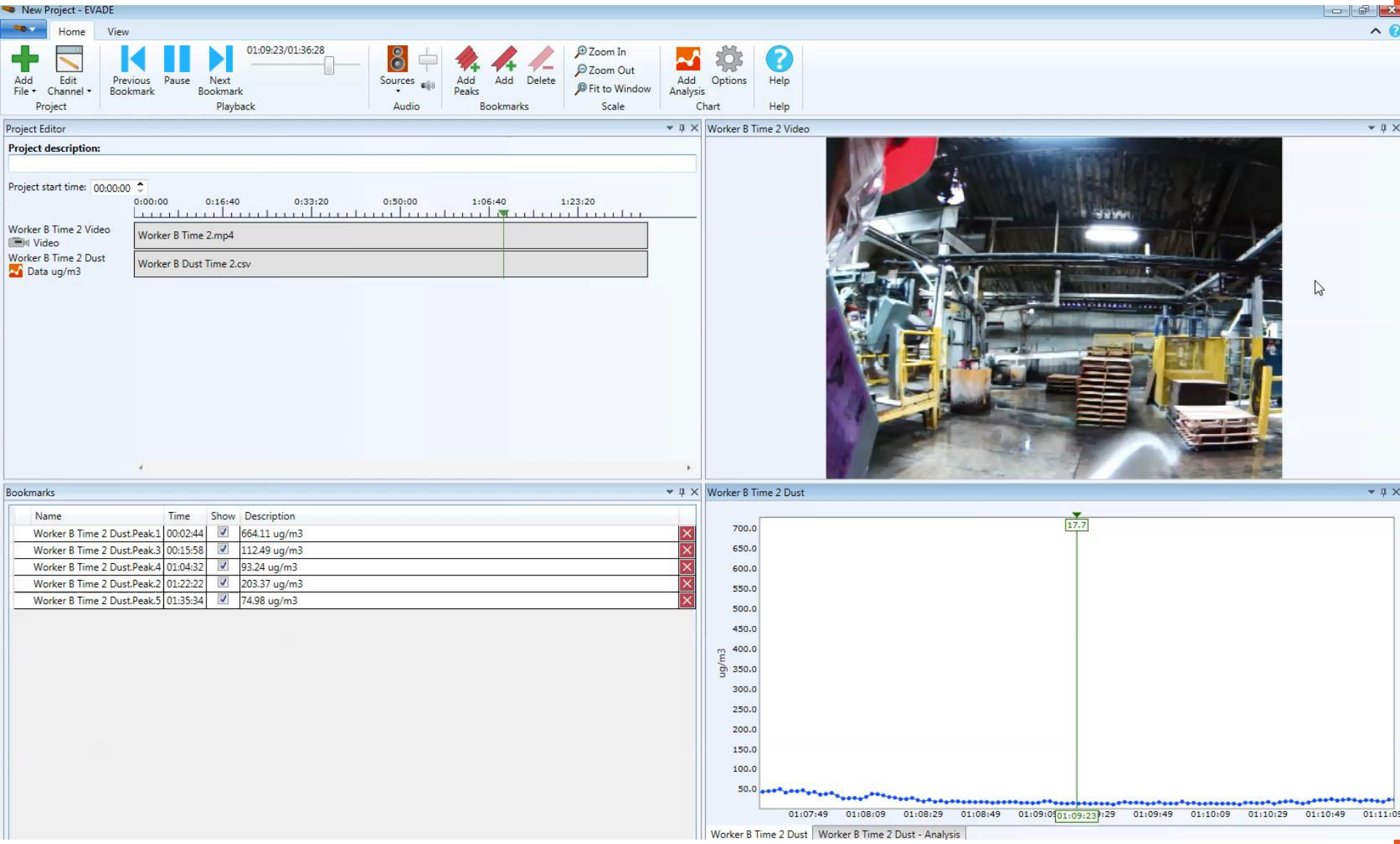
Testing performed following year:

- Mill operators' average exposure 50 µg/m^3
- 99 pct. reduction respirable dust exposure

Example – Spraying down mill areas /housekeeping tasks



Example – Experimenting with nozzles to reduce fugitive dust when spraying

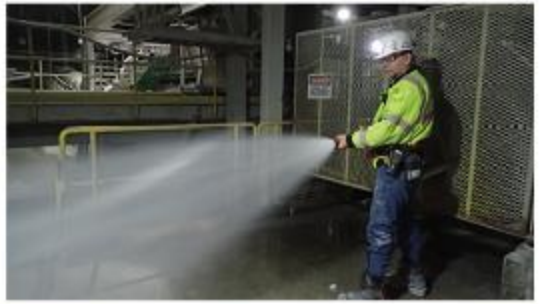


Know Your Dust Exposure
Spraying/Hosing

Did you know?

Starting with a forceful stream of water during housekeeping (e.g., hosing down equipment, walls, beams, and the floor) can elevate dust exposure.

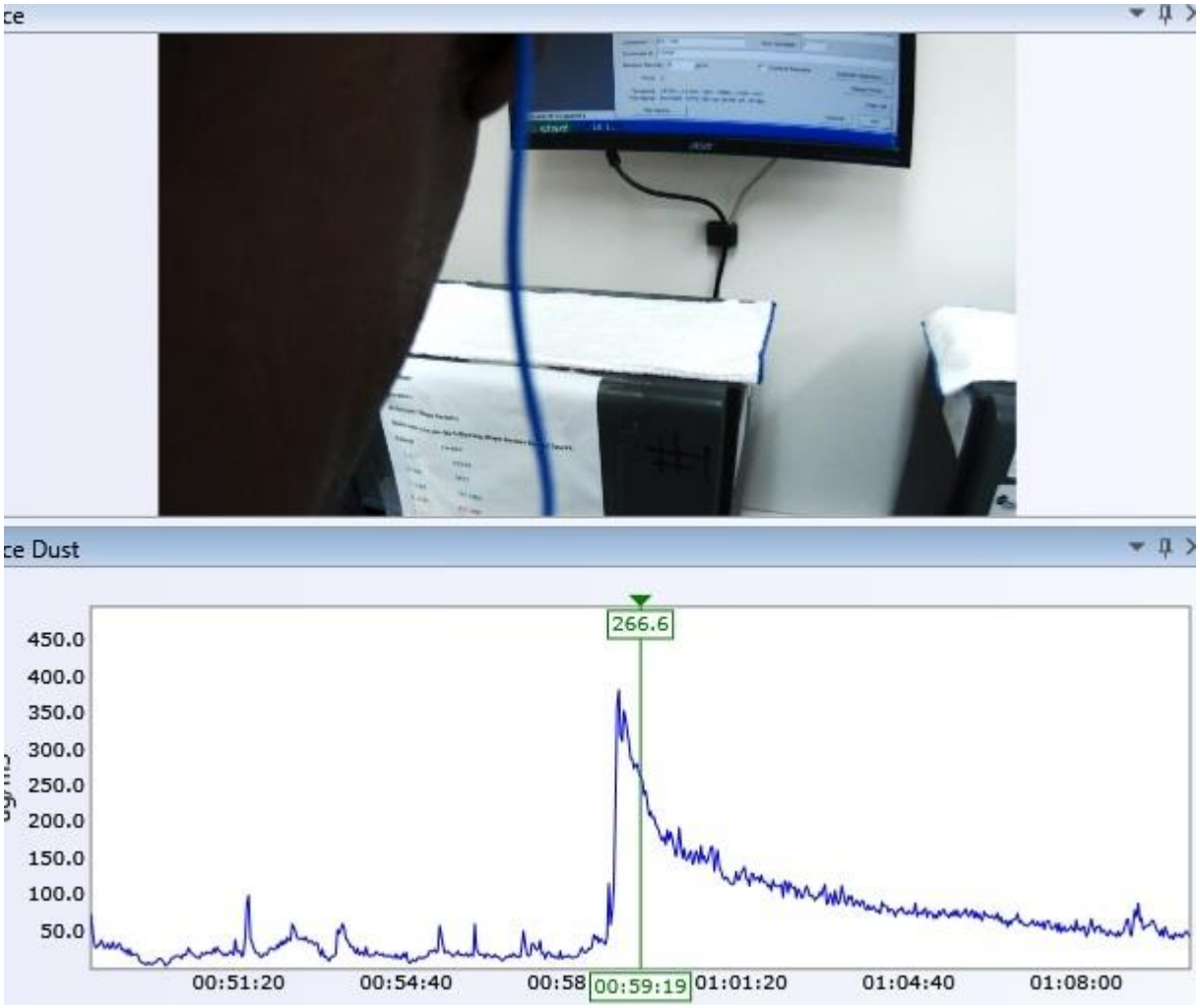
During housekeeping, begin with a wide spray to wet everything down, then use a narrow, forceful stream.



CDC NIOSH

Findings based on NIOSH Helmet-CAM field studies during 2015 and 2016.
To learn more, visit https://go.usa.gov/xXCs9.

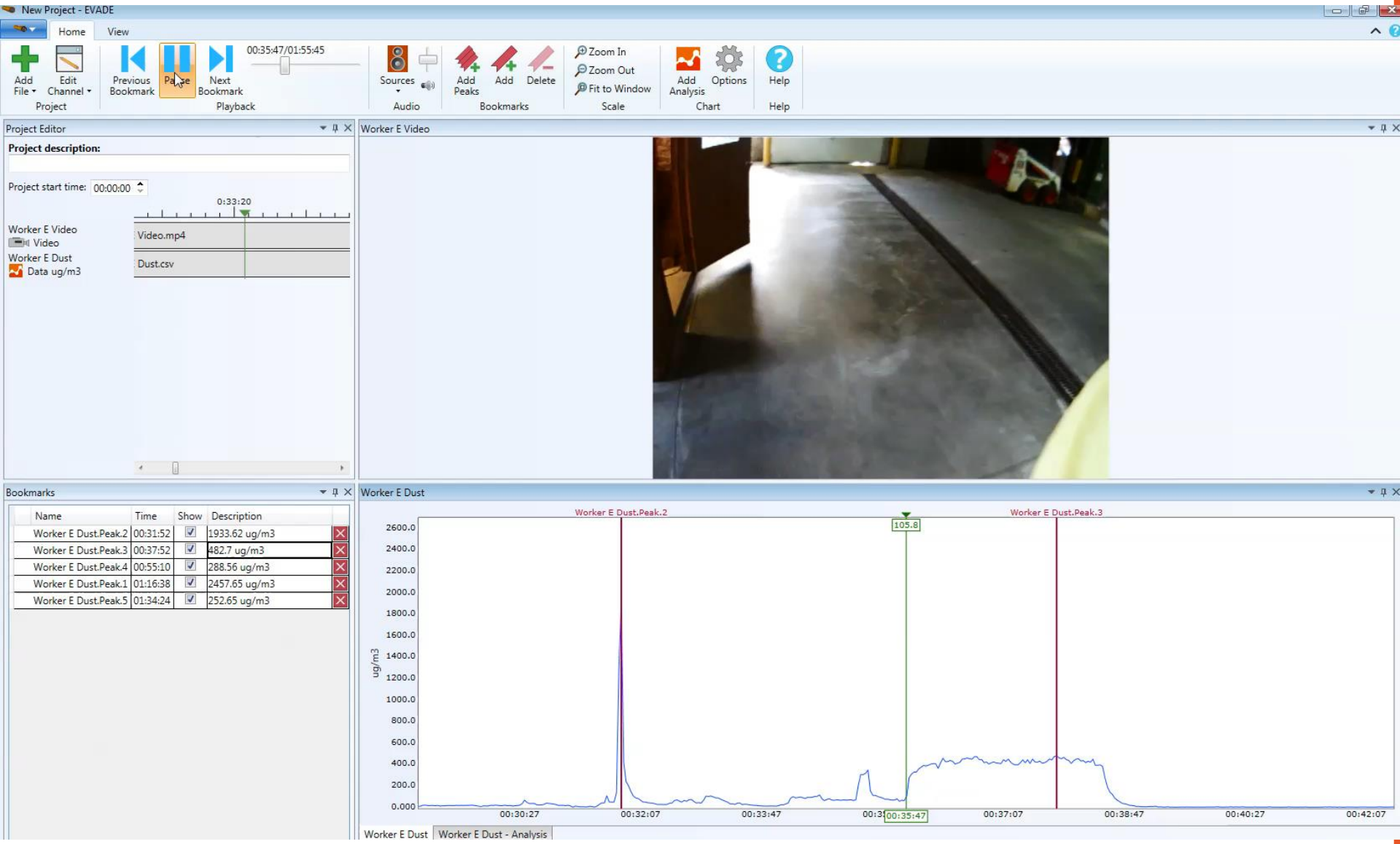
Workers and management have inaccurate perceptions of protection in enclosed rooms.



Exposures in some enclosed rooms showed exposures up to 300 mg/m^3

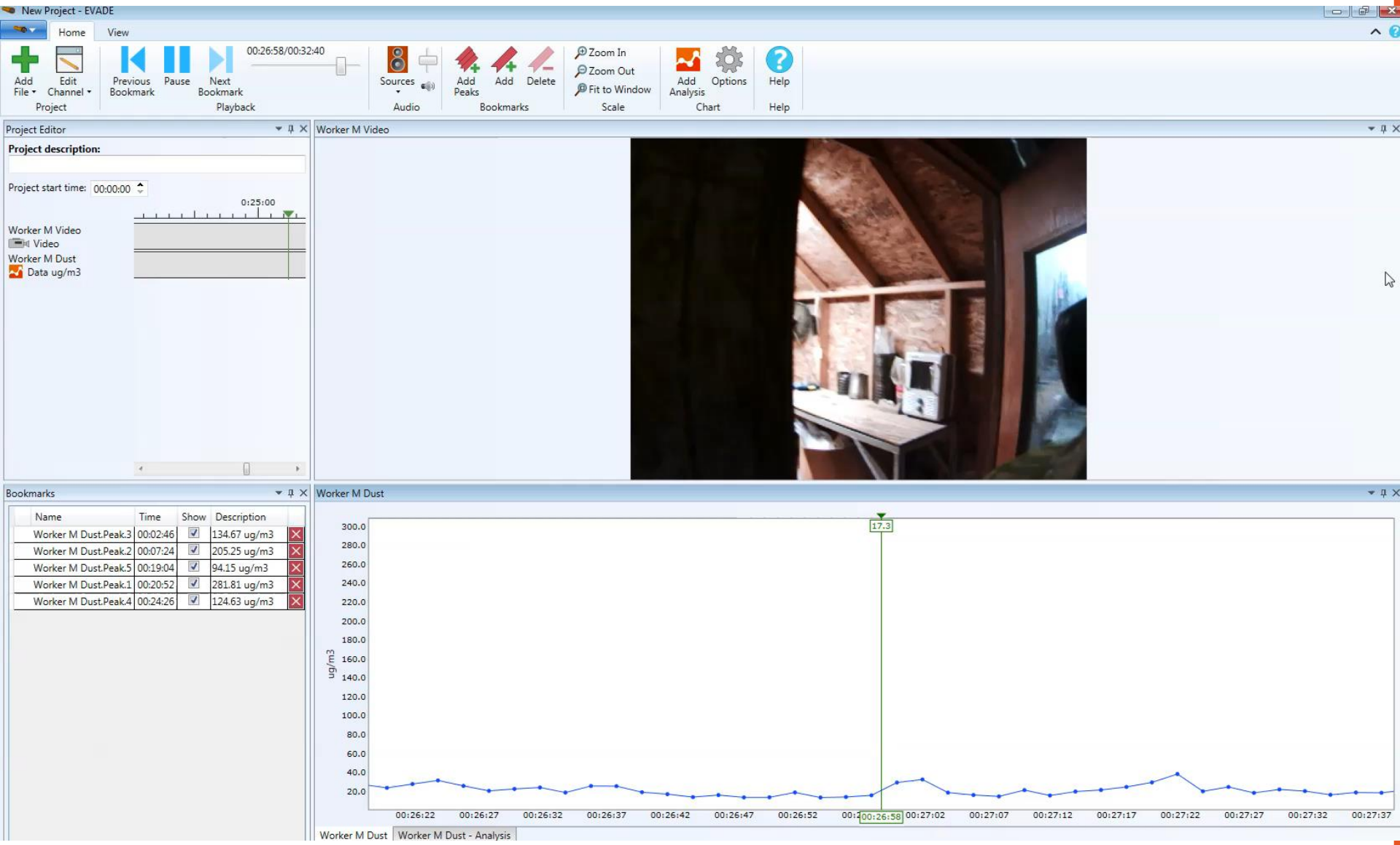
Improved filtration and pressurization systems for dry labs.

Example: elevated exposures in dry labs/splitter rooms *(without fan)*

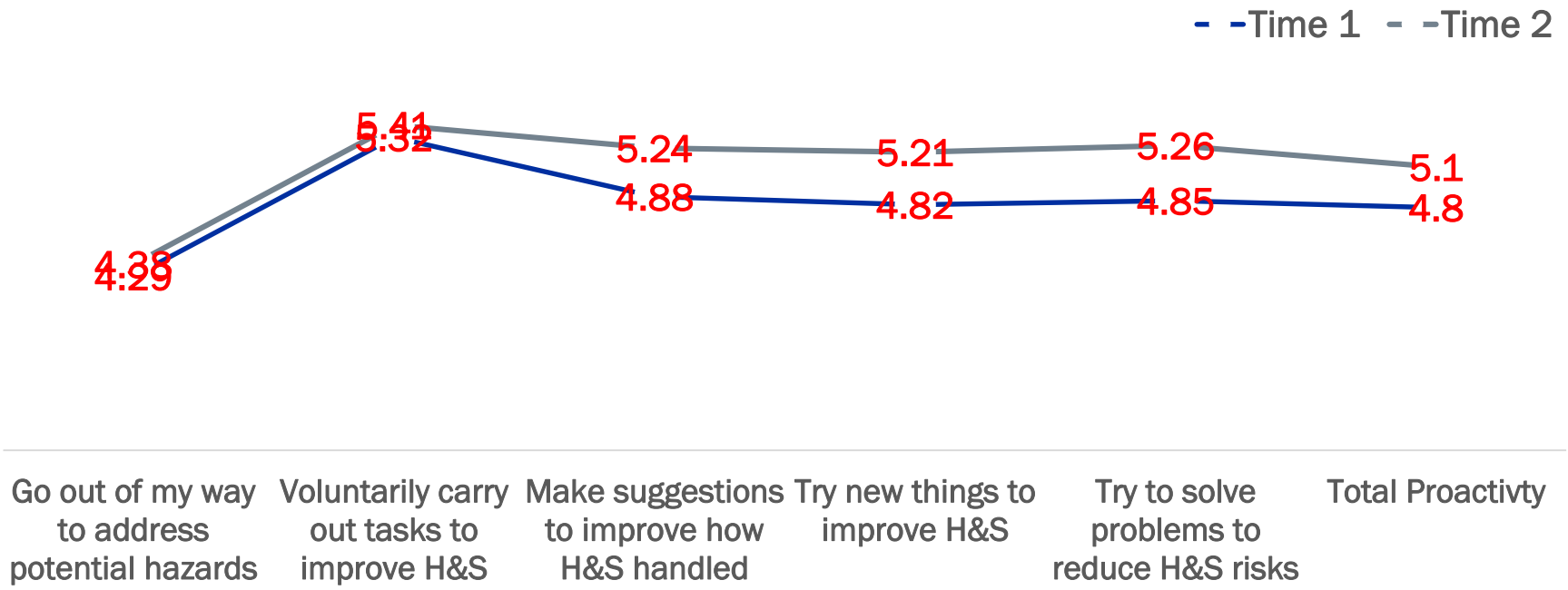


Example – Using splitter shack *(with fan)*

Increased awareness of proper ventilation



CHANGES IN WORKERS' PERSONAL HEALTH & SAFETY PROACTIVITY ON THE JOB



There was a statistically significant increase in workers' proactive behaviors from Time 1 (M = 4.84) to Time 2 (M = 5.10), t (33) = -2.545, p <.016 (two tailed).

The mean increase in proactivity scores was .268.
The eta squared statistic (.16) indicates a large effect size.

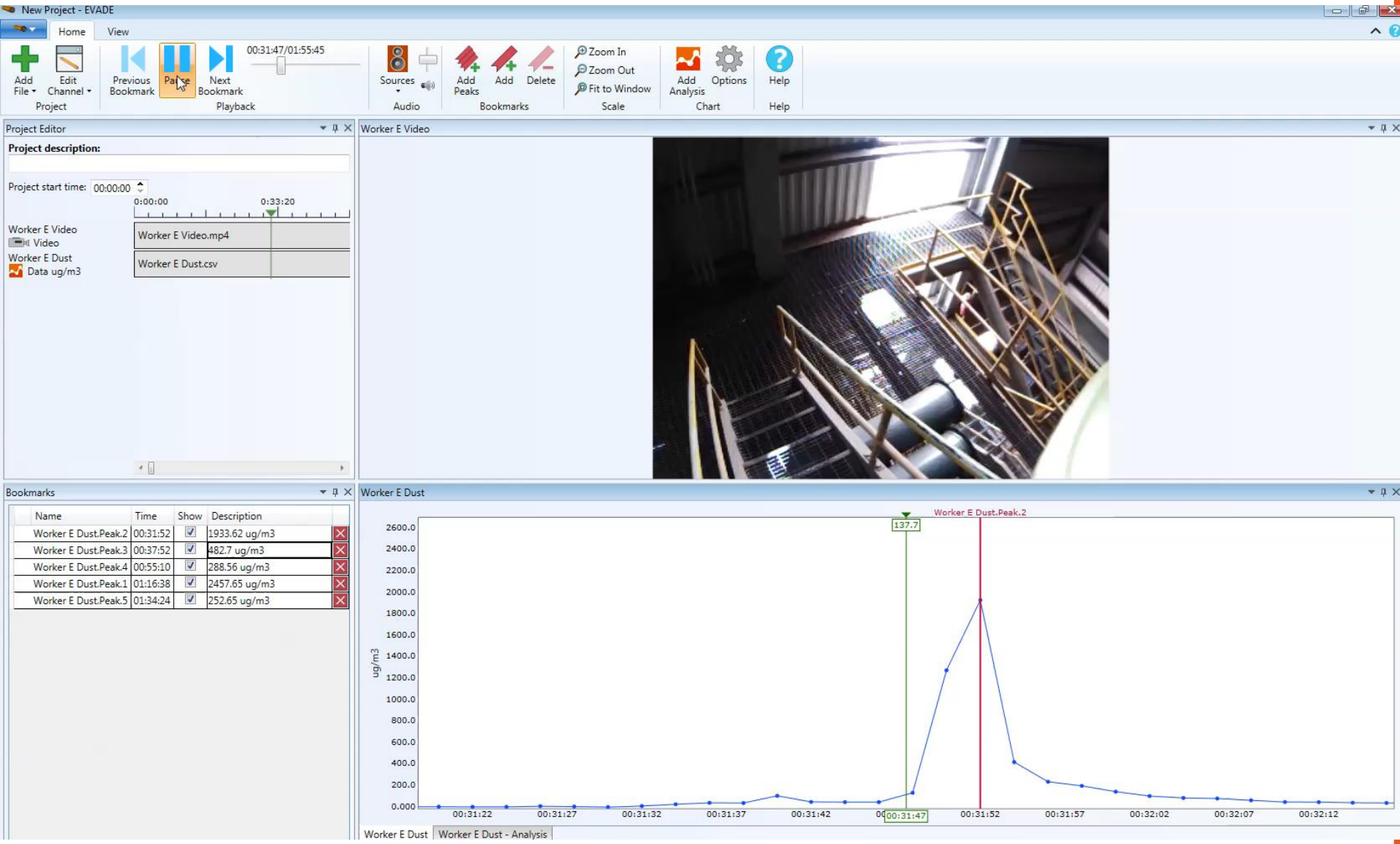
Understanding H&S motivations to determine how to use and talk about technology – Autonomy is desired among the workforce.

- Autonomous regulation
  (intrinsically motivated)
  - Improve skills
  - Part of job task
  - Helps identify dust sources
  - Protects health

- Controlled regulation
  (externally motivated)
  - Feel bad/guilty if don't comply
  - Does what is told
  - Others may look down on actions

i.e. leading (proactive) indicators that focus on H&S practices, risk management, employee communication, etc.

Example of increased worker awareness and subsequent behavior change

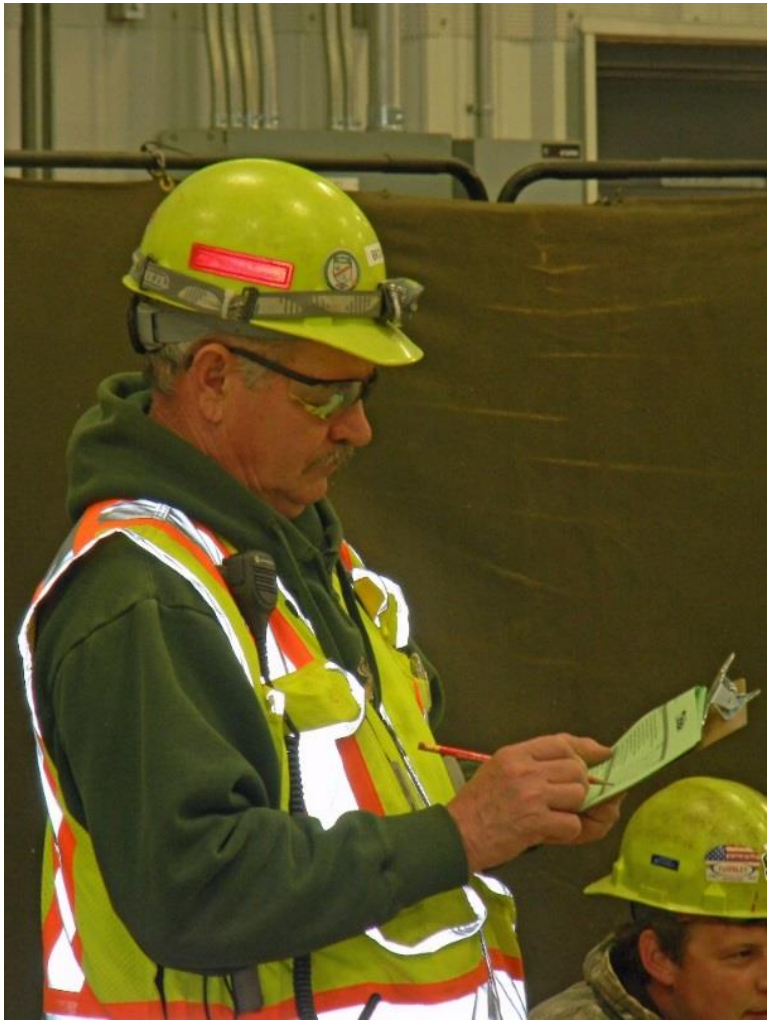


Management has a key role in improving how new technology is integrated into risk management processes.

Initial challenges

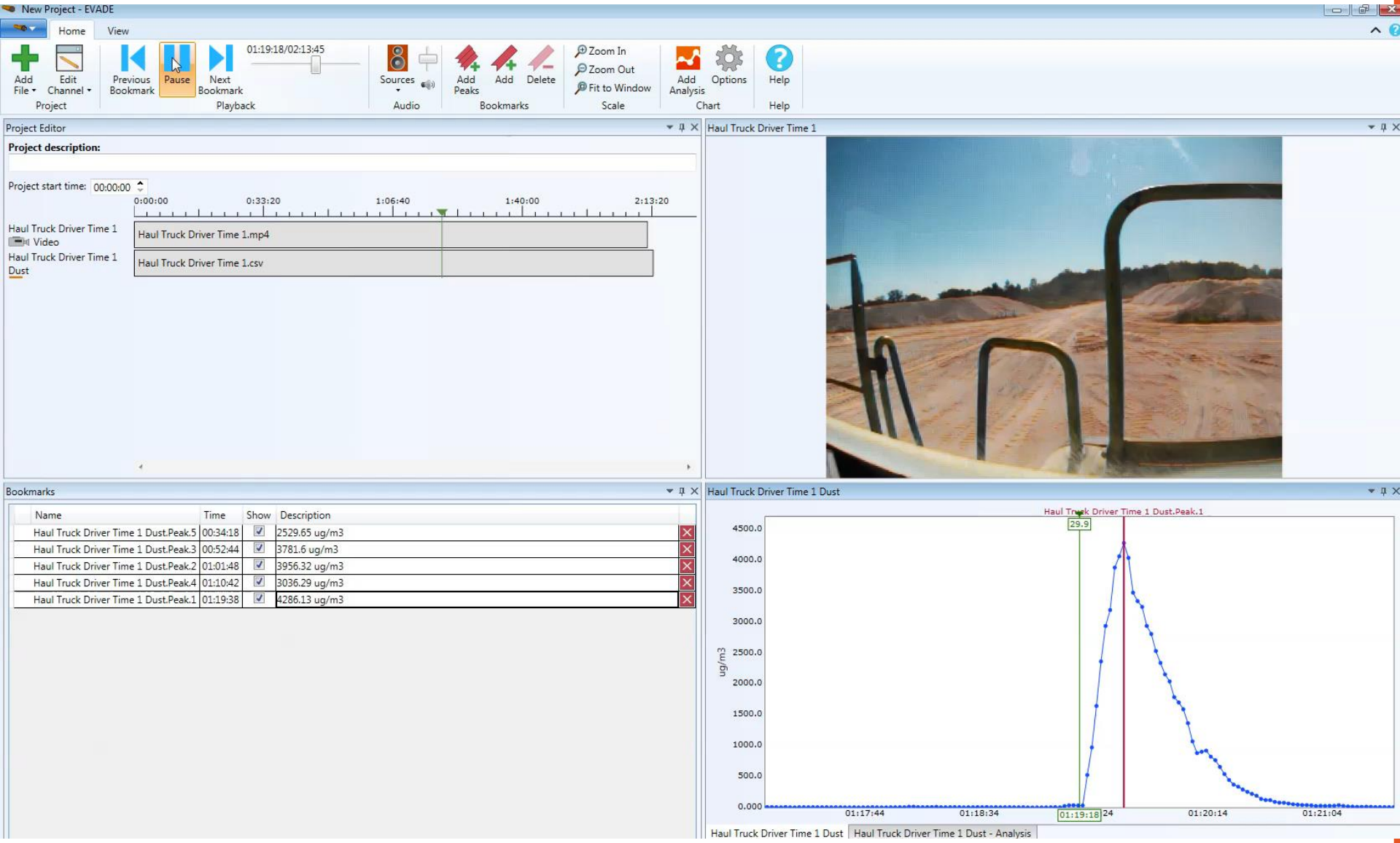
- Changing environmental and engineering controls.
- Distractions/safety concerns.
- Difficult to get initial buy-in from workforce.
- Time constraints to provide tailored communication.
- Lack of communication.
- Involving employees.

H&S is a spoken priority but not always a visible one – *always do what you say you will do.*



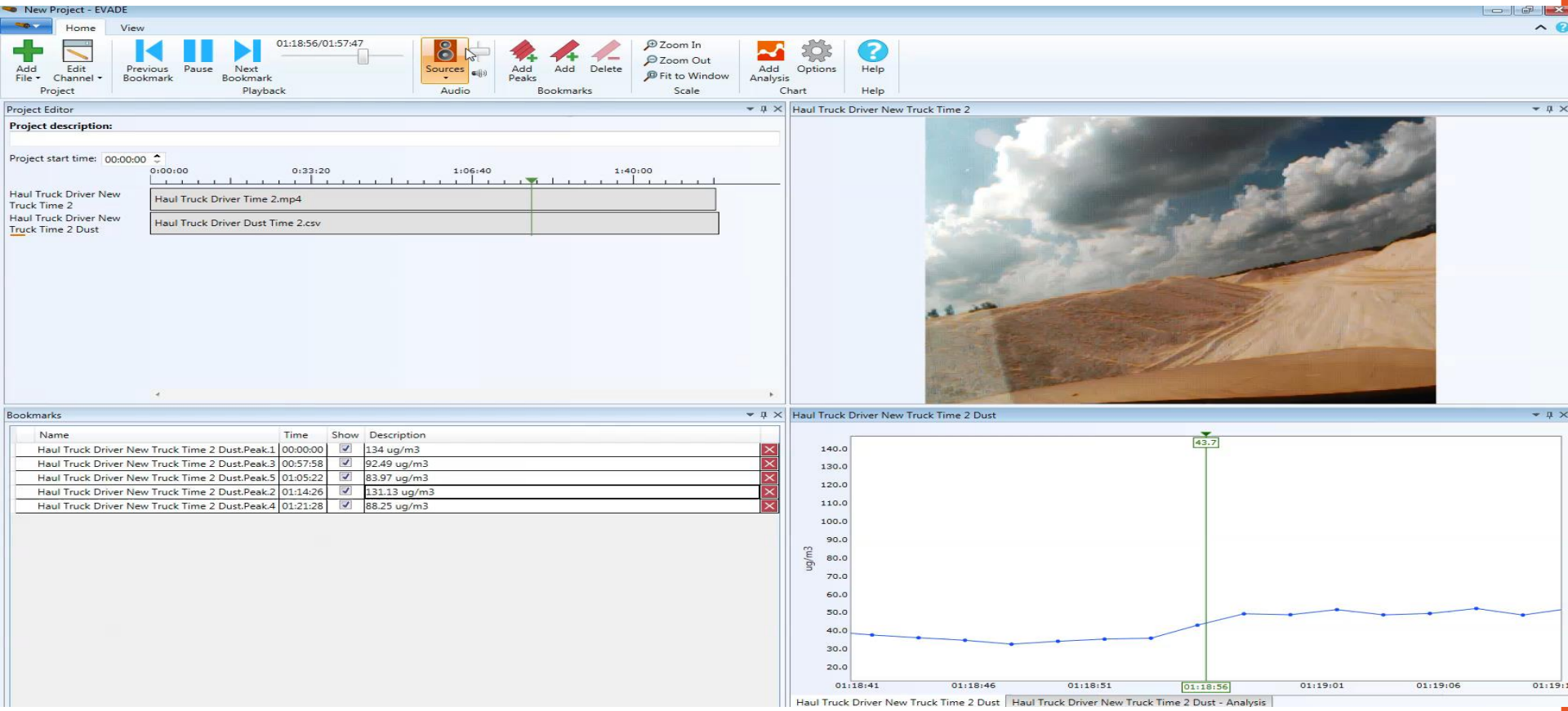
- Acting creates a sense of felt responsibility and accountability on behalf of workers
  - Case Example – Asking what concerns are – and addressing right away (respirators)
- Acting through positive reinforcements to enhance trust in work processes
  - Case Example – Autonomy to shut down a system (outcome is as promised)

Old haul trucks with little filtration/pressurization in cabs



Performance Metrics & Impact with Fairmount Minerals

From the first visit to our follow-up visit, Fairmount Mineral's Chardon Facility changed their haul trucks based upon the Helmet-CAM info.



The value of quality over quantity in daily communications is critical.

- Fostering good chemistry on site through specific, consistent actions
  - Case Example – everyone is given and abides by the same rules (supervisor written up for inadequate PPE)
- Making an effort to explain changes in processes and why
  - Case Example – doing more than the standard but explaining why (silica standard)

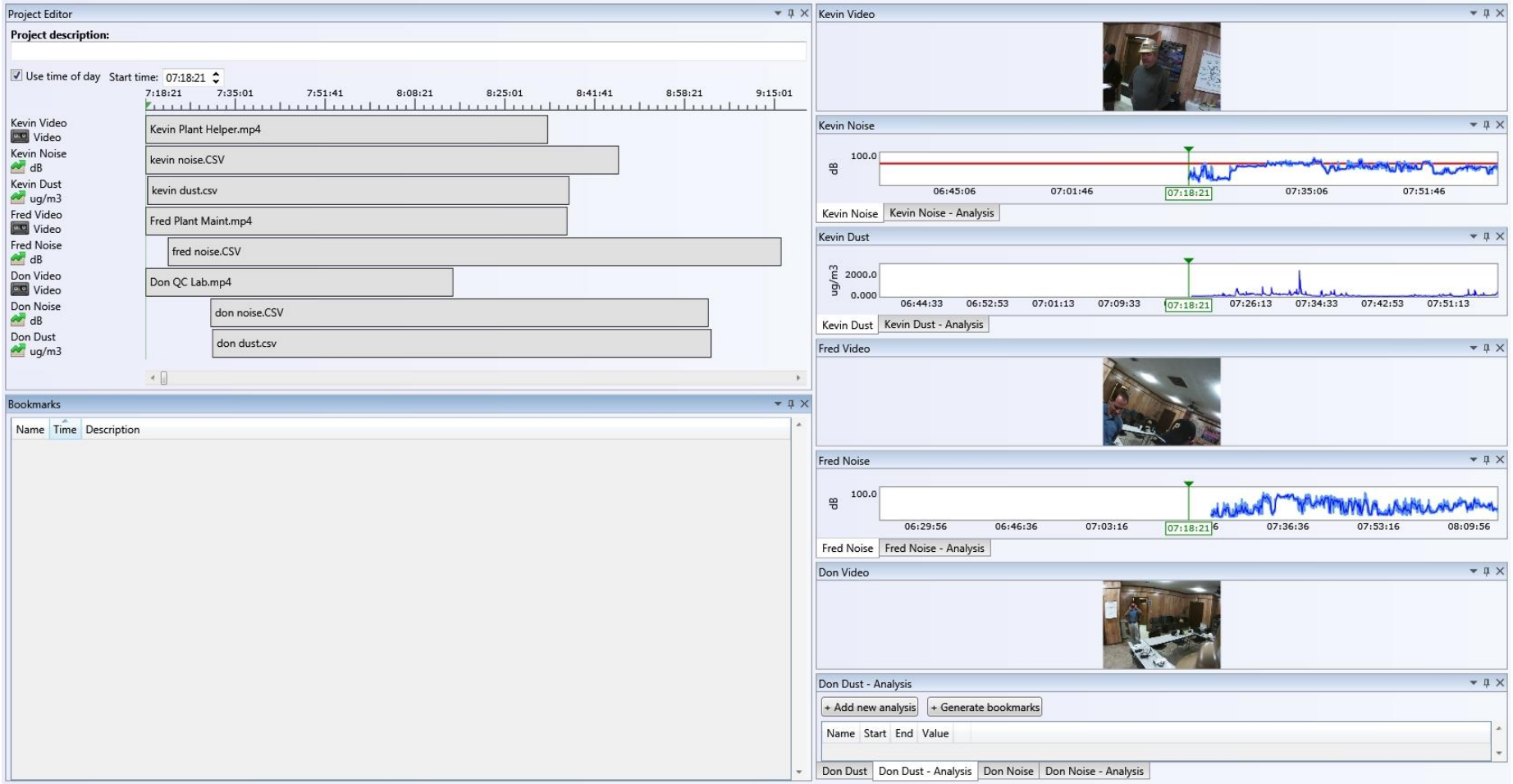
Performance Metrics & Impact

"On behalf of Unimin Corporation and the Tamms and Elco employees, we thank you for your work and professionalism in conducting the Helmet-CAM studies at the Tamms/Elco plants. The results of your study have already proven valuable in further reducing employee dust exposures, as already evidenced in the sampling results from your second visit. Your expert documentation, analysis and presentation of the study results to the employees has increased employee awareness and knowledge with respect to how their work habits can affect their dust exposure levels. This study will be useful for new employee and annual refresher training for years to come. Thank you."

Al Joiner, Plant Manager, Unimin
July 22, 2016.

EVADE v2.0

https://www.cdc.gov/niosh/mining/Works/coversheet1867.html



John Britton, Software Designer
NIOSH, Morgantown, WV

Thank You!

EJHaas@cdc.gov

412-386-4627