

Workplace Examinations with the NIOSH EXAMiner Software



Presenter:

Jonathan Hrica

EXAMiner Software Team:

Brianna Eiter, Jonathan Hrica, Jennica Bellanca, William Helfrich, Gregory Cole, Jonathan Fritz, Jason Navoyski, Timothy Orr, & John Britton

National Institute for Occupational Safety and Health

Pittsburgh Mining Research Division

Joseph A. Holmes Safety Association

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NIOSH Mining Program

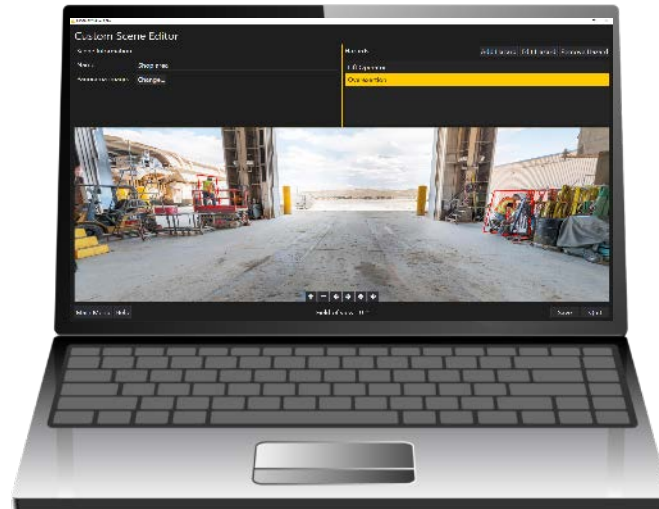
Topics:



EXAMiner Research to Practice



EXAMiner Demonstration



Tips for Creating Custom Scenes in EXAMiner

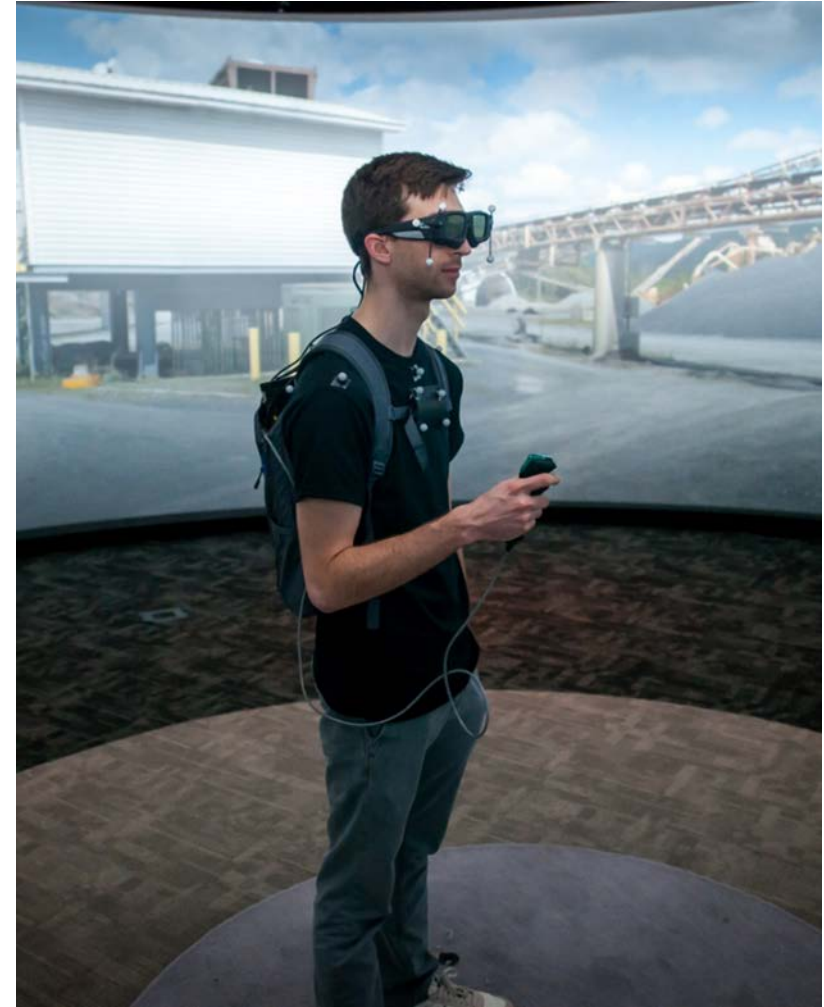
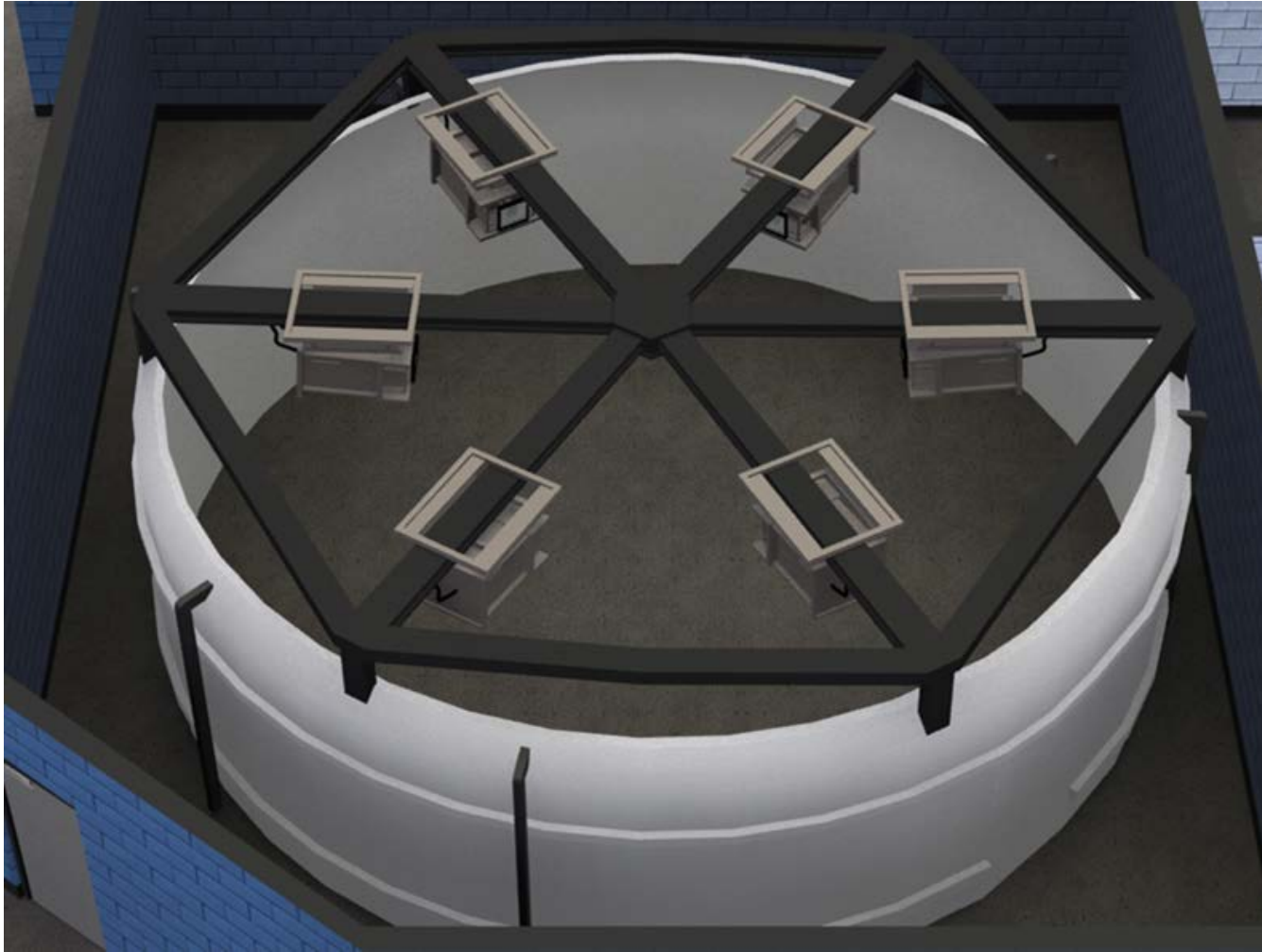
Background

- Metal/nonmetal mining experienced an increase in fatal injuries between 2013 and 2015.
- To address this increase, the Mine Safety and Health Administration (MSHA) updated the Workplace Examination Rule (30 CFR Parts 56 and 57):
 - Workplace Examinations must be done before work begins or as mineworkers begin work in a location.
 - Examination records must include a description of the adverse conditions that are not immediately corrected.
 - Examination records must include the date on which an adverse condition was corrected.

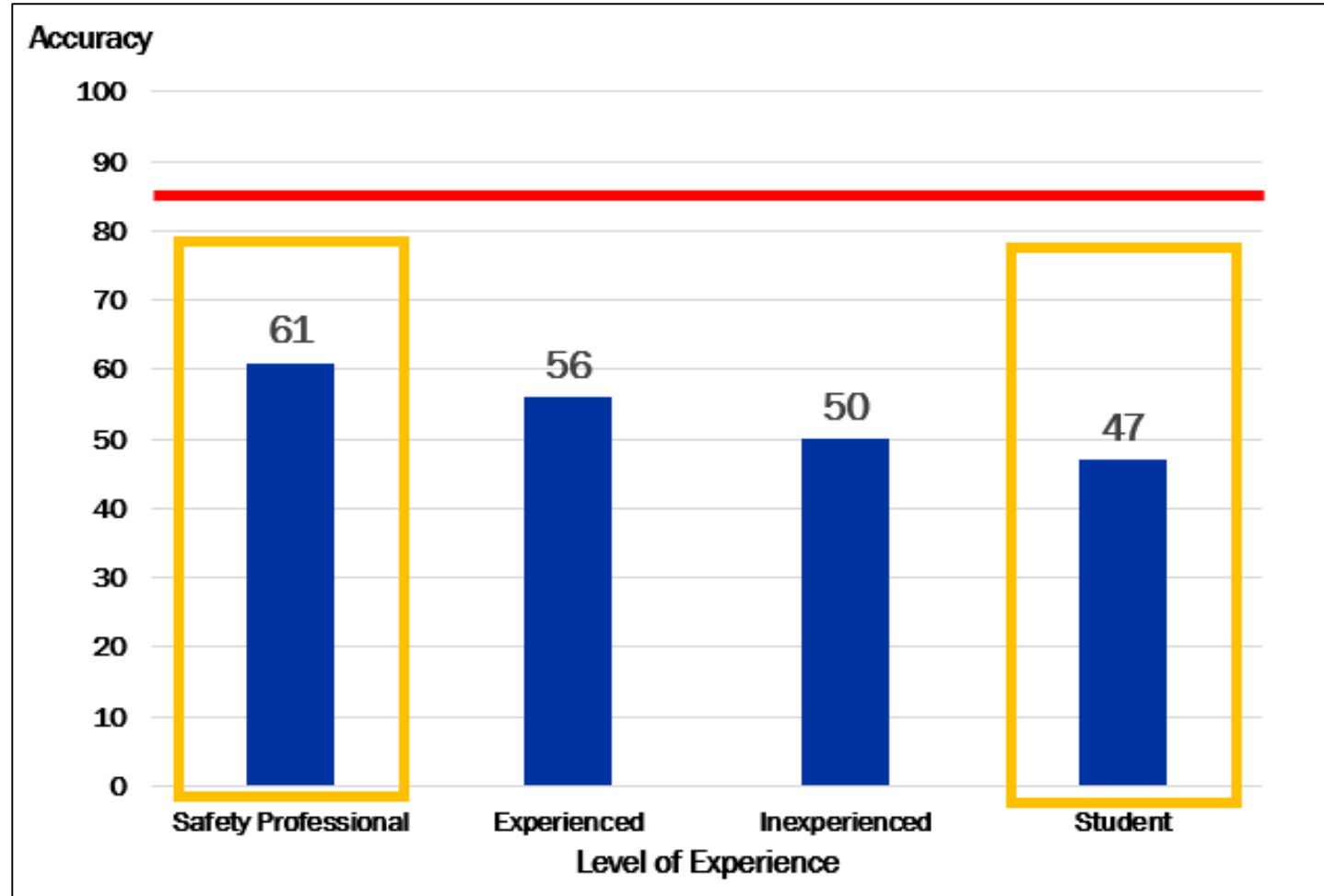


Recognizing worksite hazards is critical to the workplace examination.

Recent NIOSH research identified differences in hazard recognition accuracy based on mineworker experience



Participants with safety-specific experience identify significantly more hazards than other participant groups



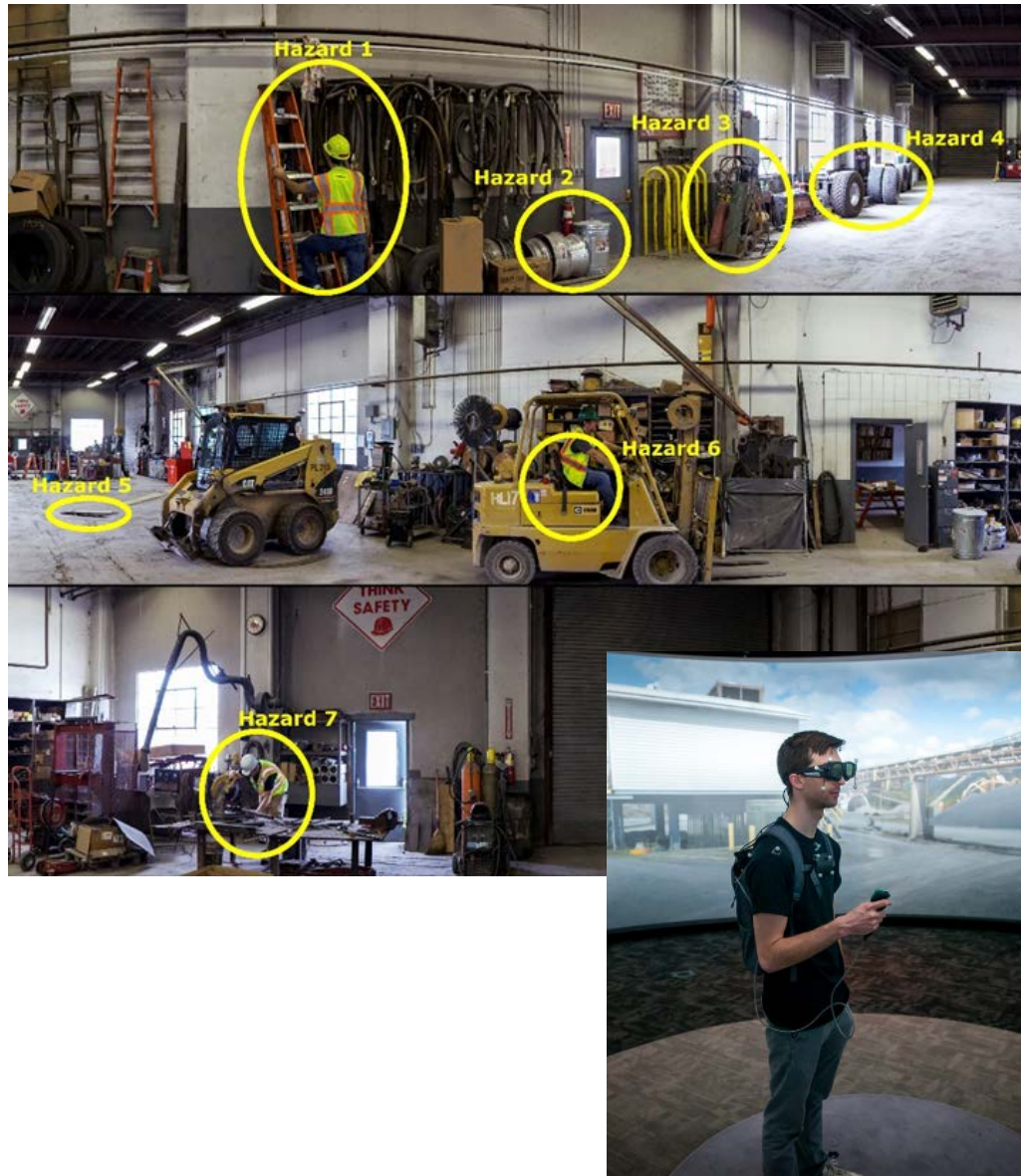
To address this deficiency, NIOSH created EXAMiner—a portable workplace examination simulation.

EXAMiner is available for download on the NIOSH website

The screenshot shows the NIOSH website interface. At the top left is the CDC logo and the text "Centers for Disease Control and Prevention CDC 24/7: Saving Lives. Protecting People™". To the right is a search bar with the text "Search Mining only" and a "SEARCH" button. Below the search bar is a navigation menu with the following items: "The National Institute for Occupational Safety and Health", "Mining", "Site Browser", "Safety and Health Topics", "Data & Statistics", "Tools & Publications", "Tools You Can Use", "Publications", "Mining Product: EXAMiner", "News & Articles", "Research Program", "Mining Links", and "About Us". Below the navigation menu is a sidebar with the following items: "NIOSH Homepage", "NIOSH A-Z", "Workplace Safety & Health Topics", "Publications and Products", and "Programs". The main content area features a large image of a mine with the text "EXAMiner BETA" overlaid. Below the image is a menu with the following items: "Select Scenario", "Debrief Session", "For the Instructor", and "Help". At the bottom of the page is a footer with the text "National Institute for Occupational Safety and Health, 2019 Jan: PC software." and a button labeled "Installer".

ing website:
net2050.html

EXAMiner uses materials developed for the NIOSH lab study



EXAMiner includes:

- 31 panoramic pictures at 4 mine locations (pit, plant, shop, roadway)
- 106 hazards
- Workplace EXAMination search task
- Debrief session

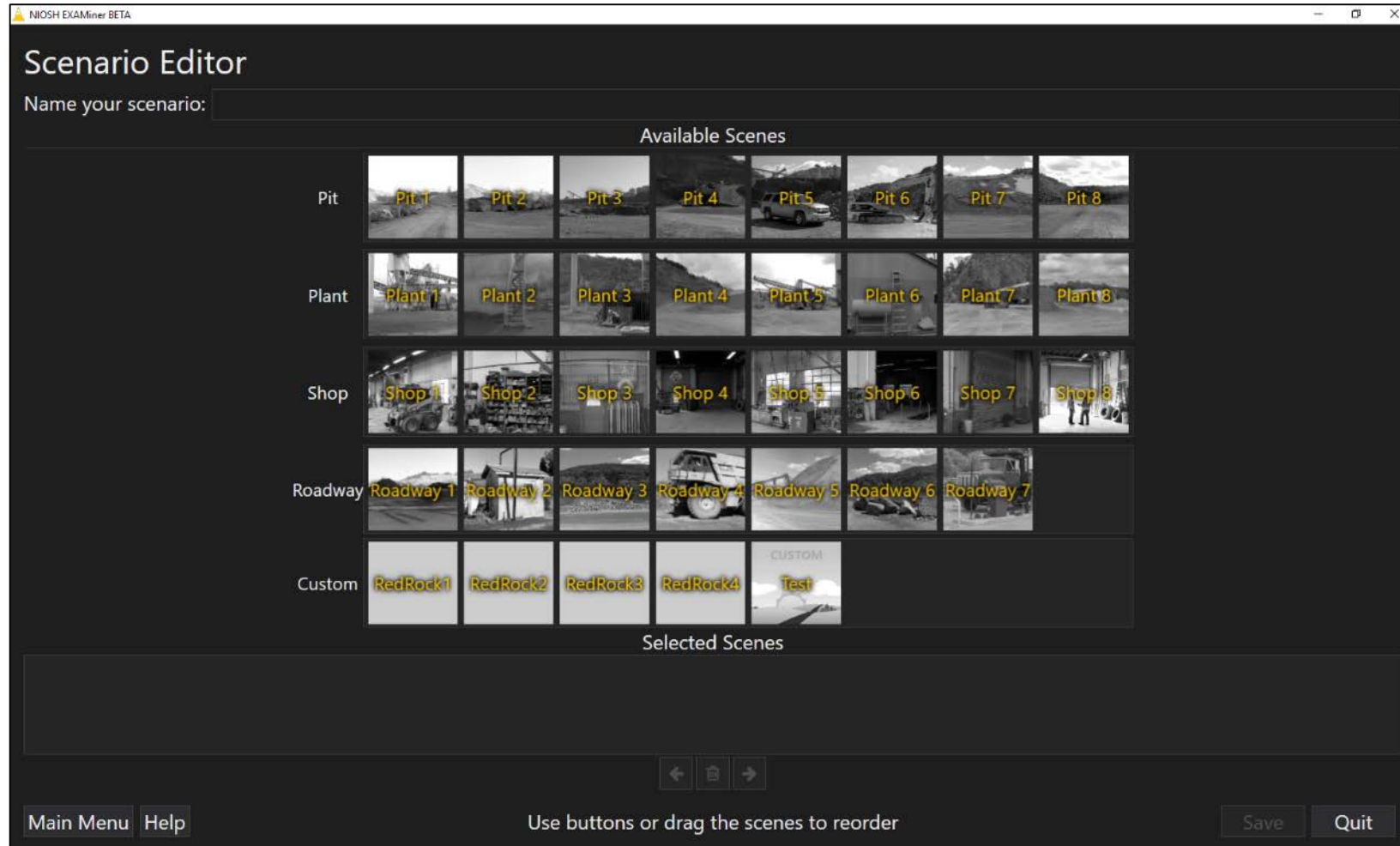
NIOSH designed EXAMiner for an instructor to use in a classroom setting



Who is the user?

- Metal/nonmetal mining sector
- Part 46 training: required by law
- Safety trainers during Instructor-led training
- Classroom setting with a projector and screen
- Customized material

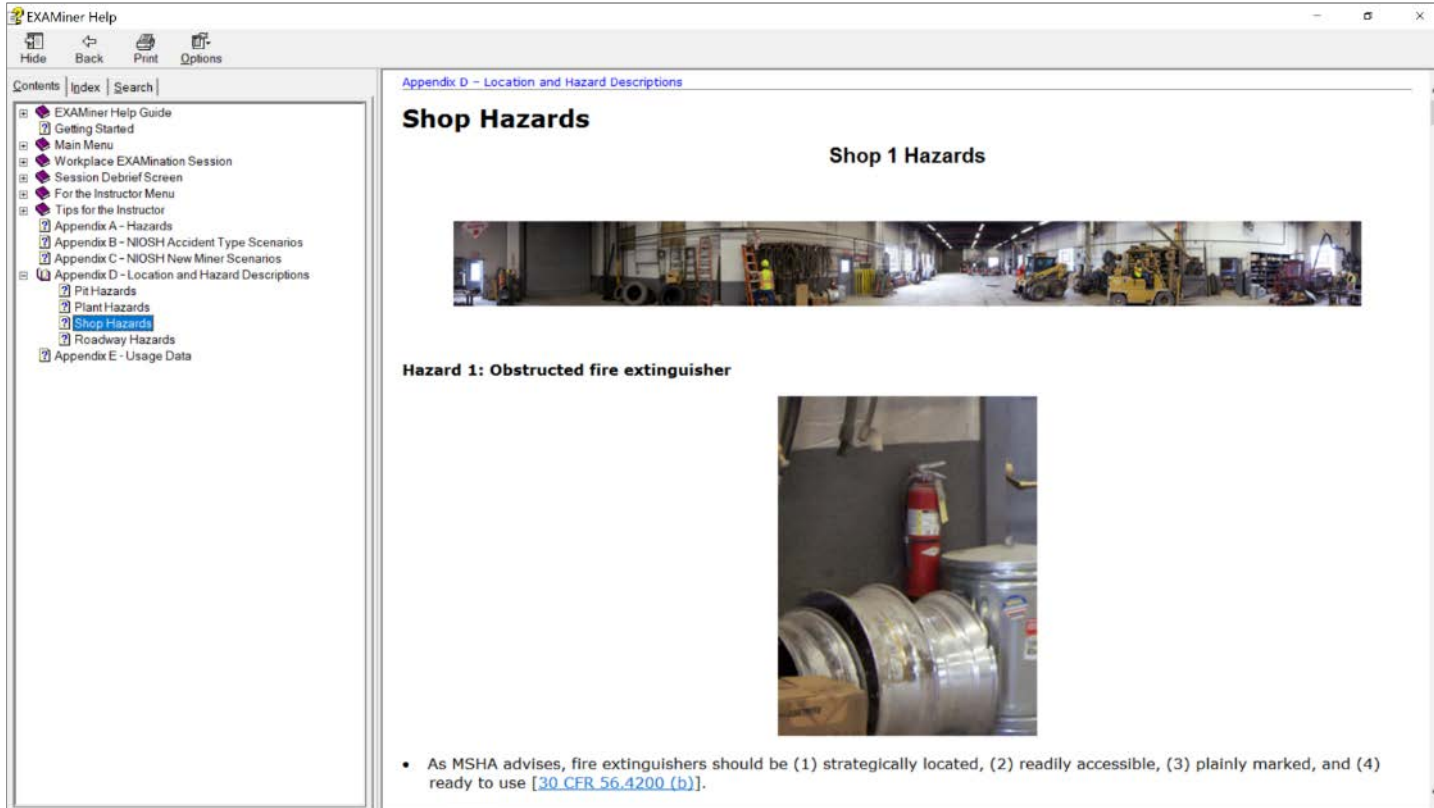
Instructors can create custom training scenarios to address specific hazards or highlight specific mine locations



A *session* includes the virtual workplace examination search task.

A *scenario* is a sequence of images or *scenes* the trainees search during the workplace examination search task.

EXAMiner includes guidance documentation to facilitate use

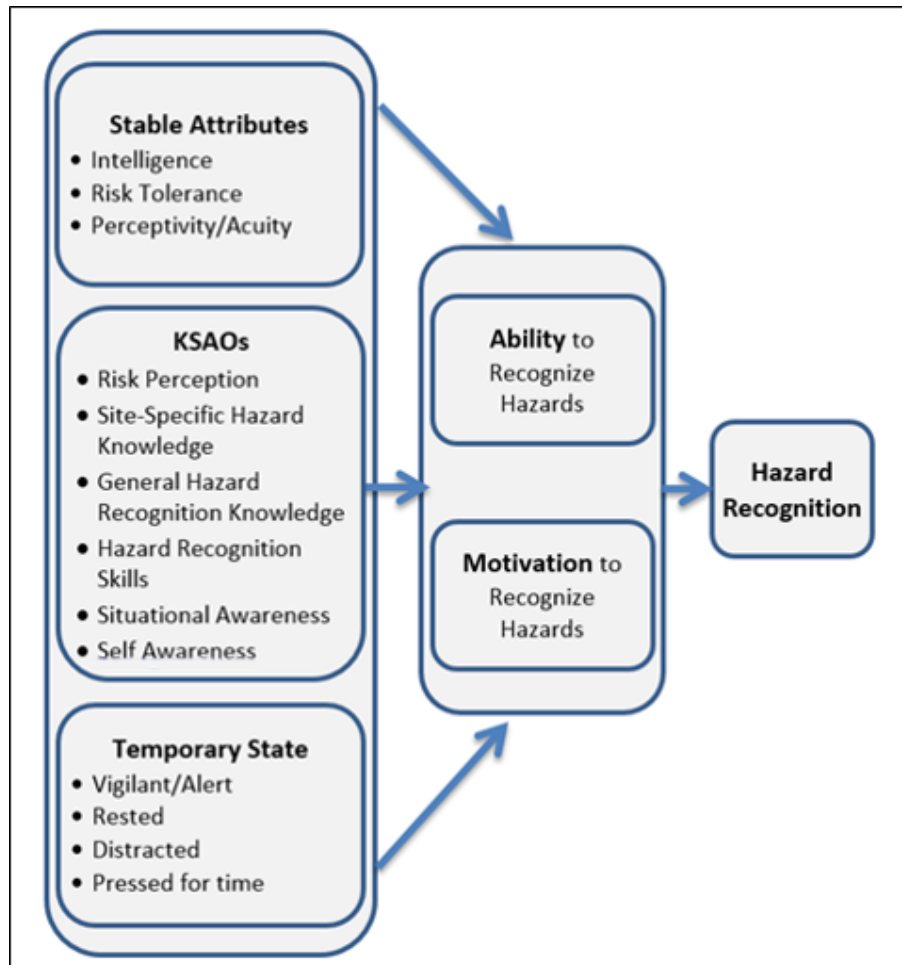


EXAMiner includes:

- Help guide
 - User instructions
 - Descriptions of software functionality
- Tips for the instructor
 - Suggestions for use during classes
- Appendices with all hazard information
- 9 NIOSH scenarios

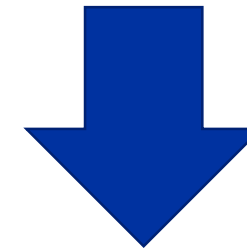
EXAMiner addresses critical hazard recognition competencies using scientifically based training strategies

Hazard Recognition Competencies Theoretical Framework



Competencies

- General hazard knowledge
- Site-specific hazard knowledge
- Visual search
- Pattern recognition



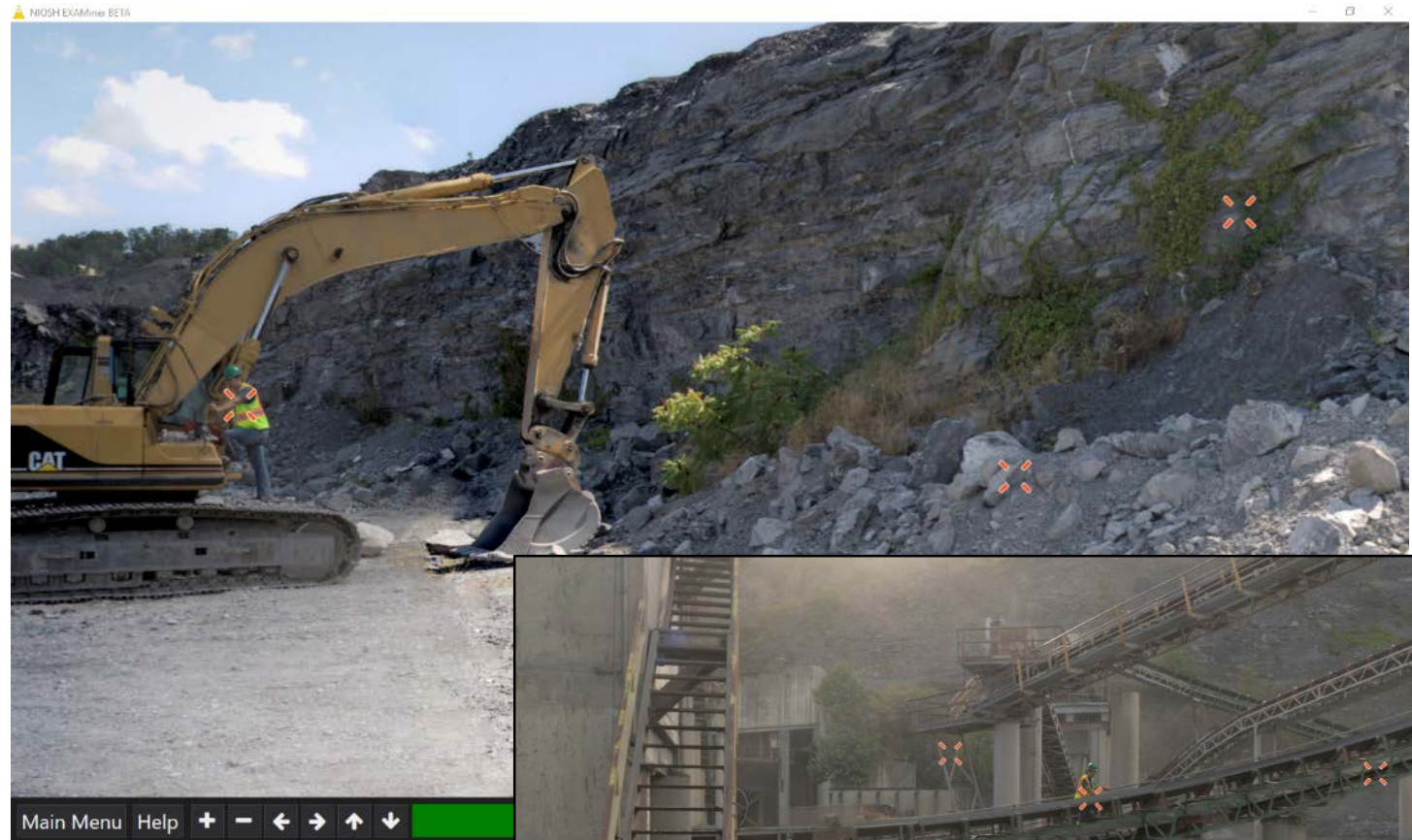
Training Strategies

- Information
- Demonstration
- Practice
- Feedback

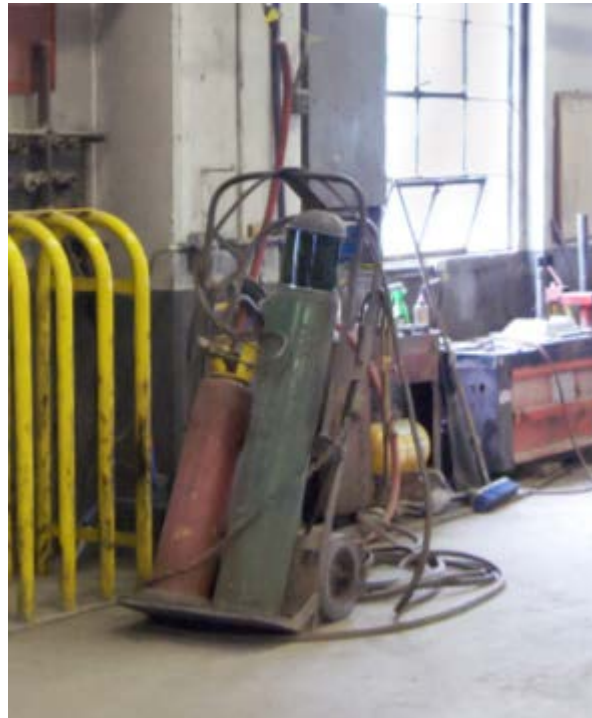
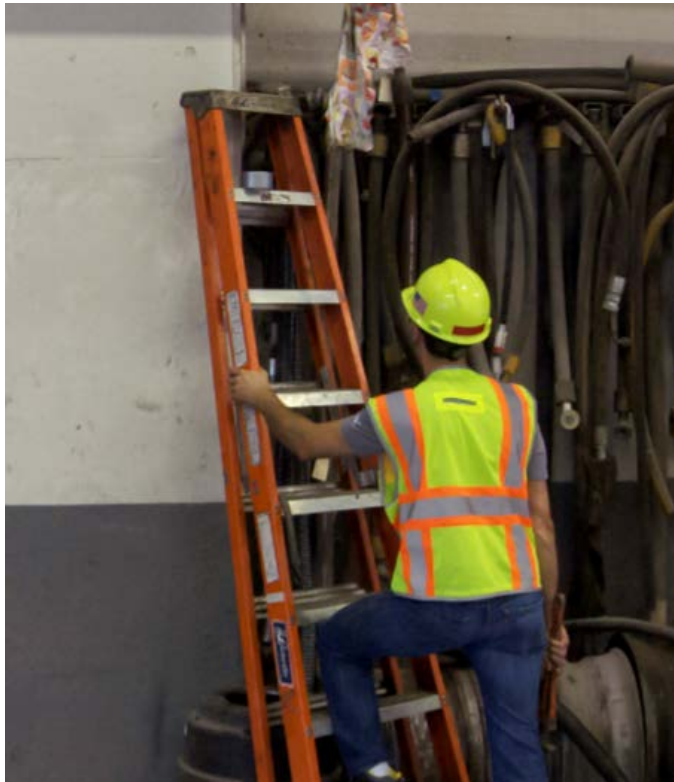
NIOSH designed the workplace examination search task to improve trainees' ability to search for and find hazards

Workplace EXAMination Search Task

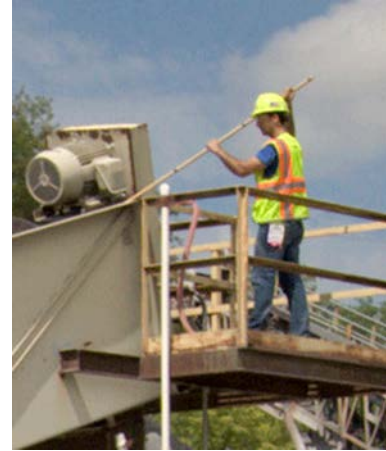
- Used to demonstrate hazard recognition.
- Provides opportunity to practice visual search.
- Instructions: Please search as if you were performing a workplace examination at your work location.



Trainees perform a simulated workplace examination by searching high-fidelity panoramic scenes for hazards



Trainees are able to search for variations of the same types of hazards to strengthen pattern matching skills



The session debrief gives trainers the opportunity to review and discuss trainees' performance during the search task

Session Debrief

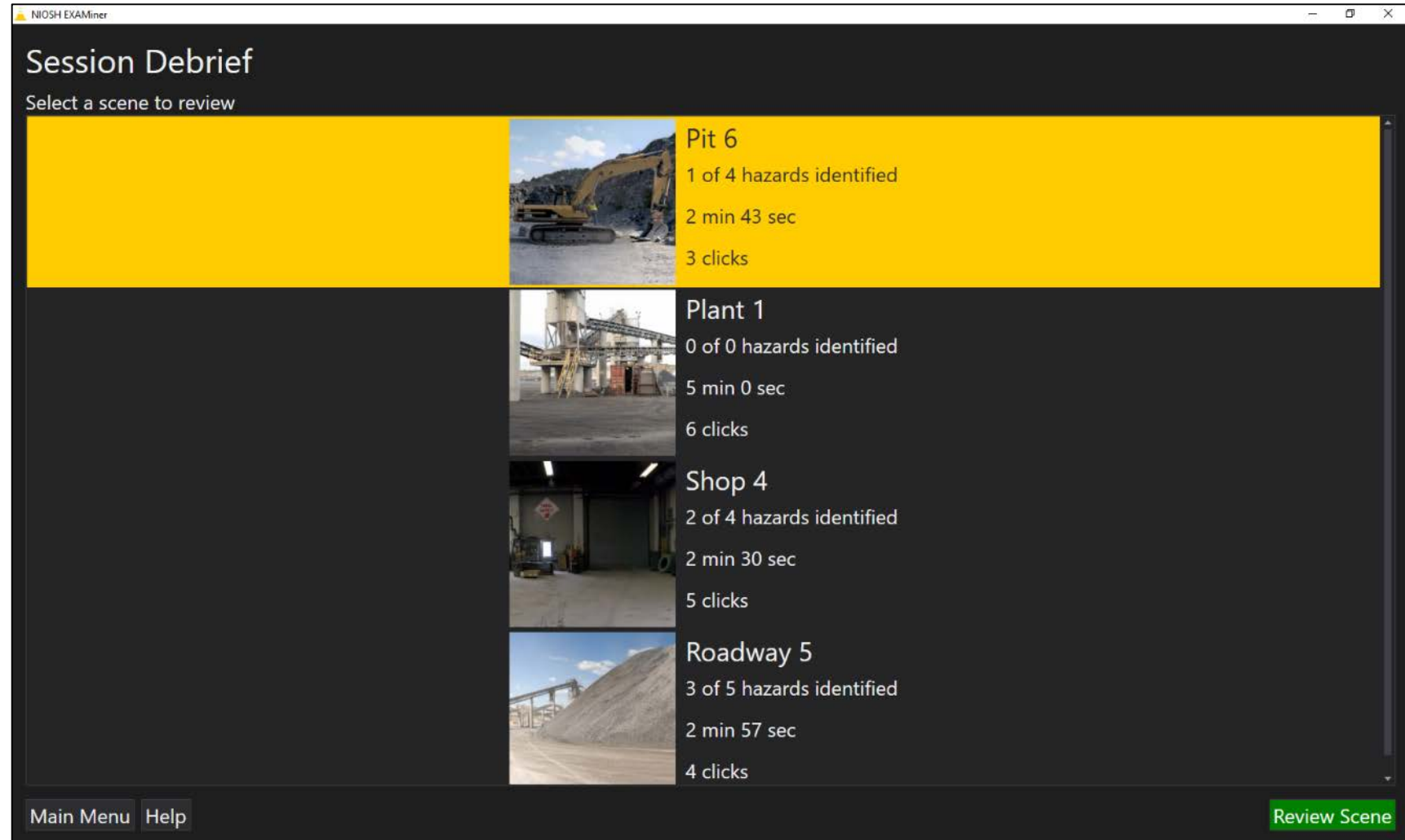
- Critical for learning and retention.
- Opportunity to review searched scenes.
- Discuss hazards that were identified.
- Discuss hazards that were missed.
- Provide explanation for hazards.
- Discuss site-specific policies.



The session debrief provides feedback for all scenes searched in a scenario

Feedback

- Accuracy
- Search time
- Number of clicks



The screenshot displays the 'Session Debrief' window in the NIOSH EXAMiner application. The window title is 'NIOSH EXAMiner' and the main heading is 'Session Debrief'. Below the heading, it says 'Select a scene to review'. The interface lists four scenes, each with a small image, a title, and performance metrics. The 'Pit 6' scene is highlighted with a yellow background. At the bottom left, there are buttons for 'Main Menu' and 'Help'. At the bottom right, there is a green button labeled 'Review Scene'.

Scene	Hazards Identified	Search Time	Clicks
Pit 6	1 of 4	2 min 43 sec	3
Plant 1	0 of 0	5 min 0 sec	6
Shop 4	2 of 4	2 min 30 sec	5
Roadway 5	3 of 5	2 min 57 sec	4

To reinforce hazard knowledge, NIOSH researchers provide additional information during the scene review

NIOSH EXAMiner


Pit 6

2 out of 4 hazards identified

- ✗ 1) Area Where Possible Rockfall Could Occur is not Bermed Off
- ✓ 2) Worker Climbing on Equipment Tracks, There is Build-up of Material on the Tracks
- ✗ 3) Smaller Vehicle Following too Closely and in the Blind Spot of a Haul Truck
- ✓ 4) Mineworker is Outside Vehicle. in Close Proximity to

Mineworkers should clean equipment access points to prevent slips, trips, or falls. The mineworker is in danger of falling off the equipment due to the excessive debris on the tracks and stairs [30 CFR 56.11001].

Proper housekeeping extends to all areas of the worksite, including operating vehicles. In 2013, the NSSGA reported that 23 percent of all aggregates injuries were the results of slips, trips, or falls.



Navigation controls: + - ← → ↑ ↓

Main Menu Help Back to Session Debrief

Accuracy Information

- Hazards that were accurately identified
- Hazards that were missed
- Additional clicks

Hazard Information

- Brief description
- Injury statistics
- Mitigation strategies

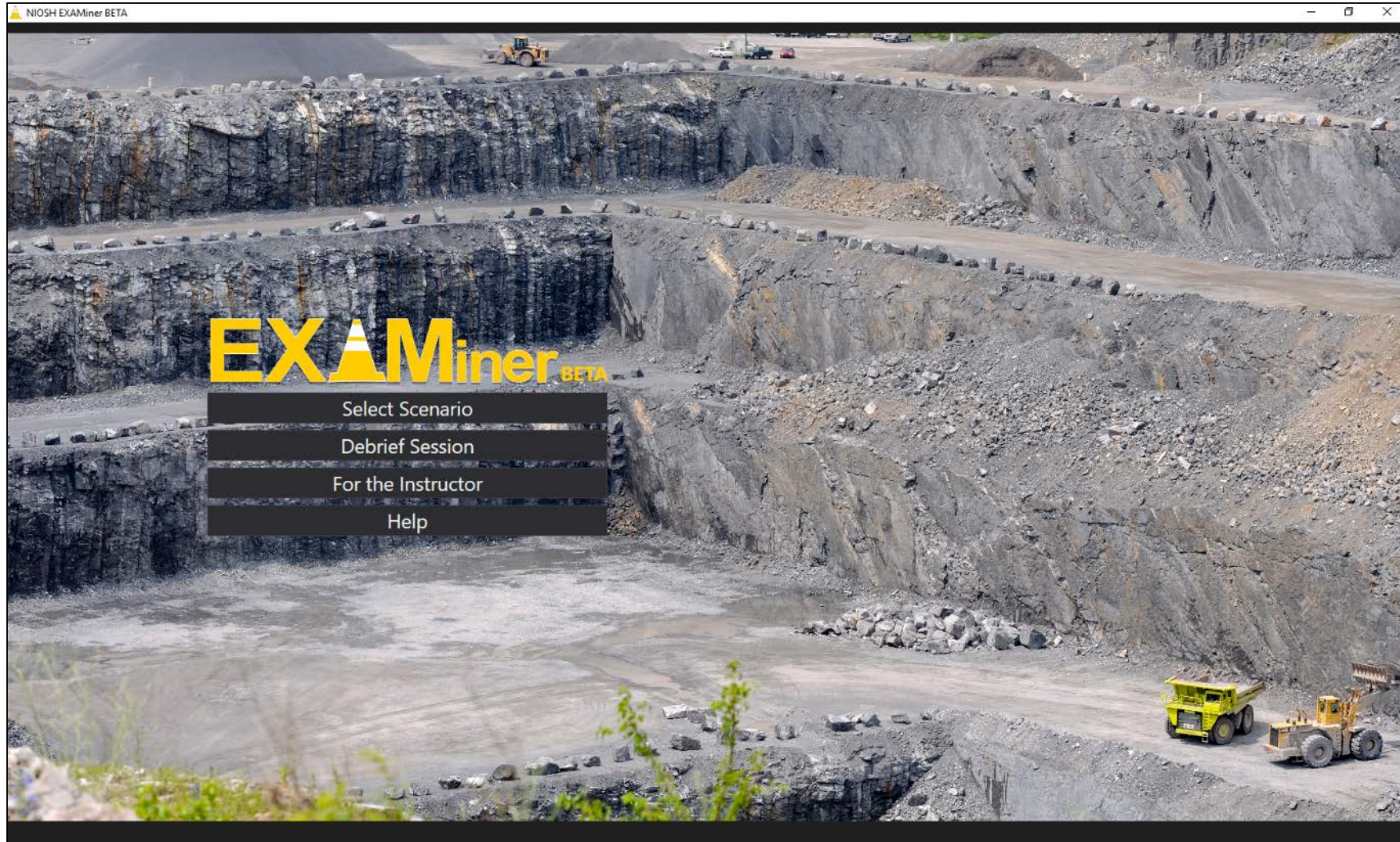
The mining community is currently using EXAMiner



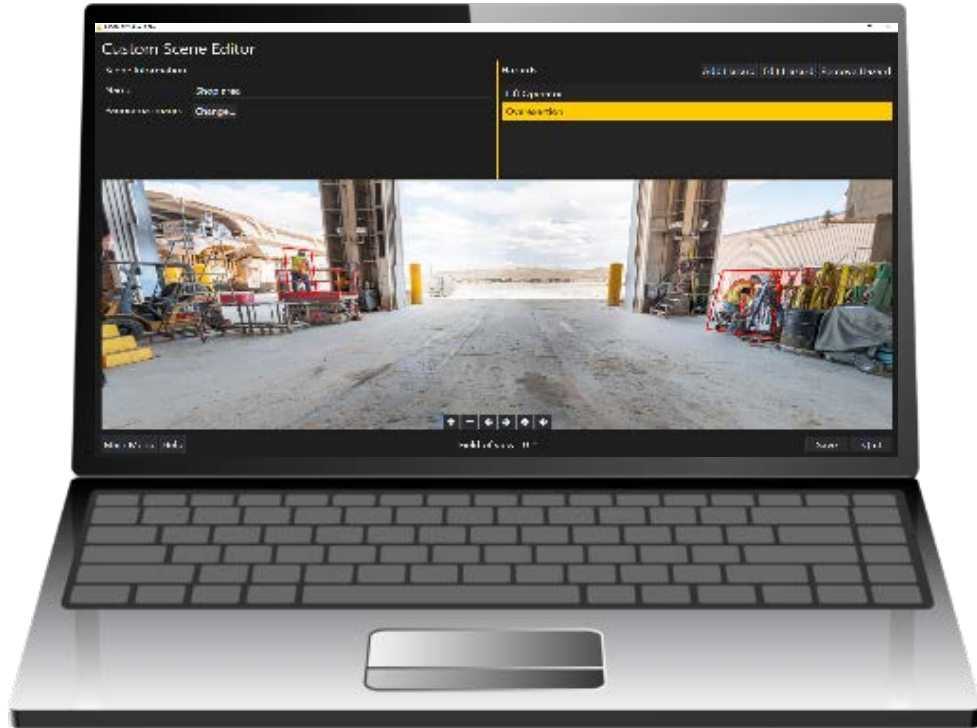
Field Observations

- NIOSH researchers observed 6 safety trainers using a beta version of the EXAMiner software.
- Safety trainers are using EXAMiner as an interactive training tool. The software:
 - Encourages active participation.
 - Can be used to evaluate trainees knowledge.

EXAMiner Demonstration



Tips for creating custom scenes



1. Look at the data.
2. Talk to people.
3. Inspect your sites.
4. Can you create a panoramic image to visually represent hazards or a specific hazardous situation?

Identify critical hazards or hazardous situations your mineworkers are exposed to at your mine site(s)

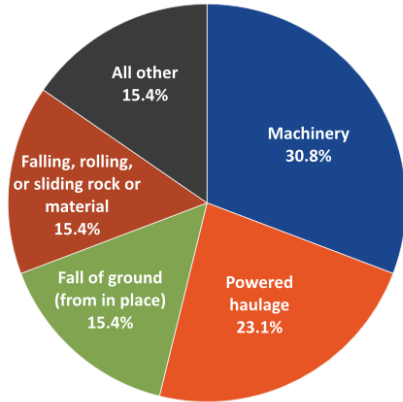
Location: Shop



Accident Type	Examples	Necessary Tools/Equipment
Ignition or Explosion of gas accident	Flame (sparks) near flammable materials	Drum; Flammable material storage; Oxygen cylinder; Acetylene cylinders
	Unmarked containers	Drum
Fall from ladder	Damaged ladder: missing wrung, broken foot	
	Incorrectly used ladder	
	Propped in wrong place	Righ inside/outside of door Under closing door
	Angle of prop is too steep or shallow 3 points of contact	Person; Tool/bucket
Fall to same level	Trip hazard	Tool/bar/hose
	Debris	Accumulation
	Moving equipment over debris	
	Contaminant	Oil; Water; Slick material

Look to the data

Distribution of Occupational Fatalities by Accident Class, 2015 (N=26)



Daily Shift Inspection	Location	Date															
Quarry -	Insert <input checked="" type="checkbox"/> if Examined Insert <input checked="" type="checkbox"/> if a Hazard is Found	Competent Person															
Area	Loose rock	Overhangs	Undercuts	Cracks	Bumps	Barbed wire	CS	Muddy (slush)	Excessive water	Spillage	Slips	Trips	Speed limits	Other Control Devices	Overhead hazards	Do Not Travel/Examine	Corrective Action (Corrected/Baricaded)
Highwalls Level one																	
Highwall Level two																	
Scales																	
Haulroad Condition																	
Stockpiles / Dumpsites																	
Ponds																	
Storage Areas																	
Comments																	
Supervisor Signature																	

Mine Citation/Order U.S. Department of Labor Mine Safety and Health Administration

Section Enclosure Info

1. Date: Mo Da Yr 08/26/2008 2. Time (24 Hr. Clock) 1230 3. Citation/Order Number 6437838

4. Served To [Redacted] 5. Operator [Redacted]

6. Mine [Redacted] Mine ID 26-00500 (Contractor)

7. Condition of Practice No. Written Notice (0-99) [Redacted]

Safety lines (lanyards) were not worn/attached when mine personnel traveled the rooftop of the Assay lab building for repair and maintenance of fans/motors and winterizing. A fixed ladder was attached perpendicular to the roof on the north/east side of the building and was provided with a backguard and landing. The roof was elevated 14 feet above ground level and had an approx 11 1/2 pitch. The landing was 1 ft 11 inches from the roof edge that was not structurally sound. This area lacked railing or tie-off points and safe footing. This condition exposed employees to the possibility of injury from slip-trip and/or fall hazards.

Safety belts and lines shall be worn when persons work where there is danger of falling; a second person shall tend the lifeline when bins.

9. Violation A. Health Safety Other B. Section of Act C. Part/Sections of Title 90 CFR 56.15005 See Continuation Form (MSHA Form 7000a)

10. Gravity: A. Injury or illness (yes) (no) No Laceration Lacerate Reasonably Likely Highly Likely Occurred B. Injury or Health Effect (yes) (no) No Lost Workdays Lost Workdays Or Restricted Duty Permanently Damaged Fatal C. Significant and Substantial: Yes No D. Number of Persons Affected: (0)1

11. Negligence (check one) A. None B. Low C. Moderate D. High E. Reckless/Disregard

12. Type of Action: 10da A. Citation B. Order C. Backlog D. Written Notice E. Citation/Order Number [Redacted] F. Dated No Da Yr

13. Type of Issuance (check one) Citation Order Subsequent Written Notice

14. Initial Action A. Citation B. Order C. Backlog D. Written Notice E. Citation/Order Number [Redacted] F. Dated No Da Yr

15. Area or Equipment

16. Termination Date A. Date: Mo Da Yr 08/26/2008 B. Time (24 Hr. Clock): 1430

Letter: B - Termination Action

17. Action to be taken

18. Terminated A. Date: Mo Da Yr B. Time (24 Hr. Clock) MAY 05 2009

Section IV - Automated System Data

19. Type of Inspection (selectly code) E16 20. Event Number: 1141405 21. Primary or MHI: P [Redacted] HSLP DEP: [Redacted]

22. Signature [Redacted] 23. AR Number: 1273

NO RECORD

NSSGA

NATIONAL STONE, SAND & GRAVEL ASSOCIATION

Talk to people



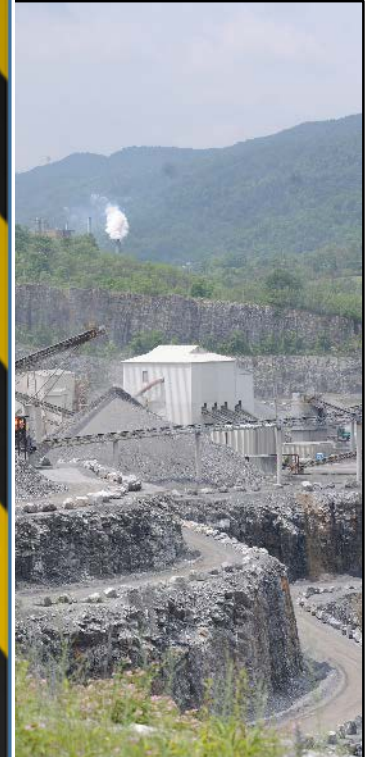
Inspect your worksites



Barriers to Hazard Recognition

Many factors such as experience, complexity of the work environment, and change in the work environment can affect hazard recognition. When thinking about potential barriers in your work environment, remember:

- **Experience** affects the number of hazards that mineworkers recognize. Think about:
 - ✓ How many years have my employee(s) worked in the mining industry?
 - ✓ Are my employee(s) knowledgeable of hazards in the work environment?
 - ✓ Are my employee(s) focused on safety?
 - ✓ Will my employee(s) be exposed to a new or unfamiliar location in the mine?
- **Complexity** affects the number of hazards a mineworker is able to find. Think about:
 - ✓ Are my employee(s) working in cluttered work environments?
 - ✓ Are my employee(s) working in busy (high traffic, divided attention) locations?
 - ✓ Are my employee(s) working in areas where multiple hazards may be present?
 - ✓ Are my employee(s) performing tasks that require multiple safety procedures?
- **Change** in the work environment can affect hazard recognition. Think about:
 - ✓ What conditions are my employee(s) exposed to? (e.g., weather, time of day, etc.)
 - ✓ What changes may be made to the mine plan? (e.g., traffic pattern, location of roads, etc.)
 - ✓ What changes may be made to tools, equipment, and structures?
 - ✓ Are my employee(s) fit for duty? (e.g., fatigue, illness, distraction)



Tips for Taking Panoramic Pictures for Use in EXAMiner



Take panoramic pictures for EXAMiner – *it's EASY!*



Phone

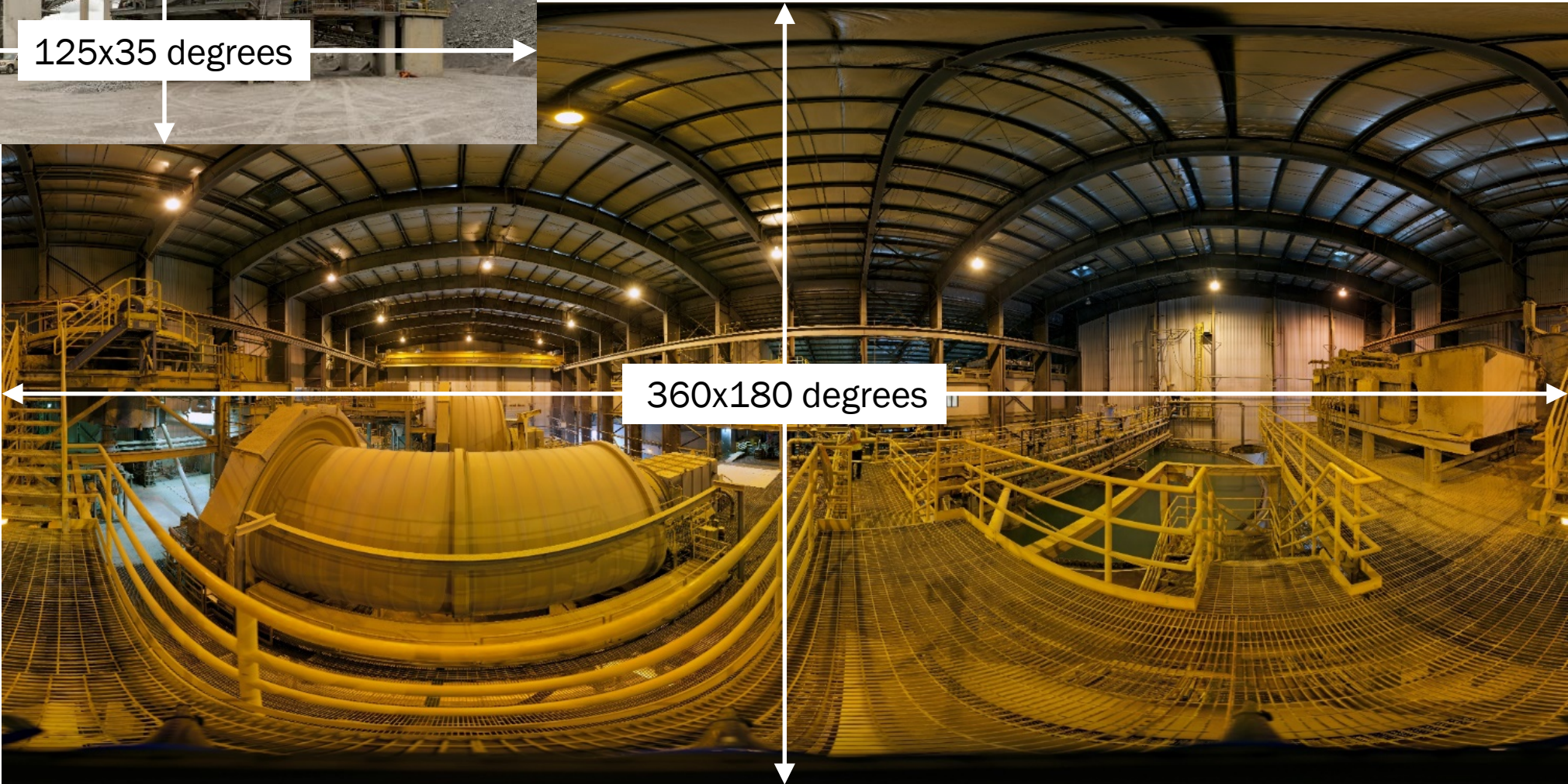
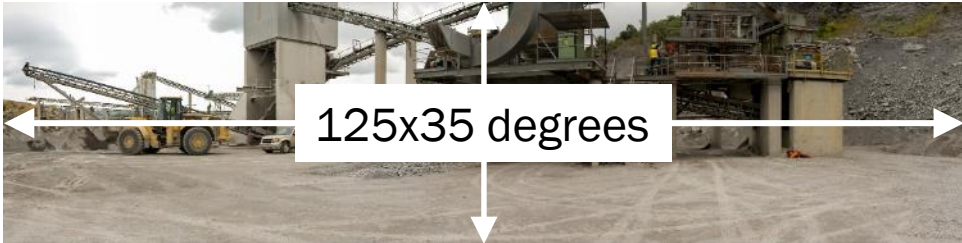


Computer



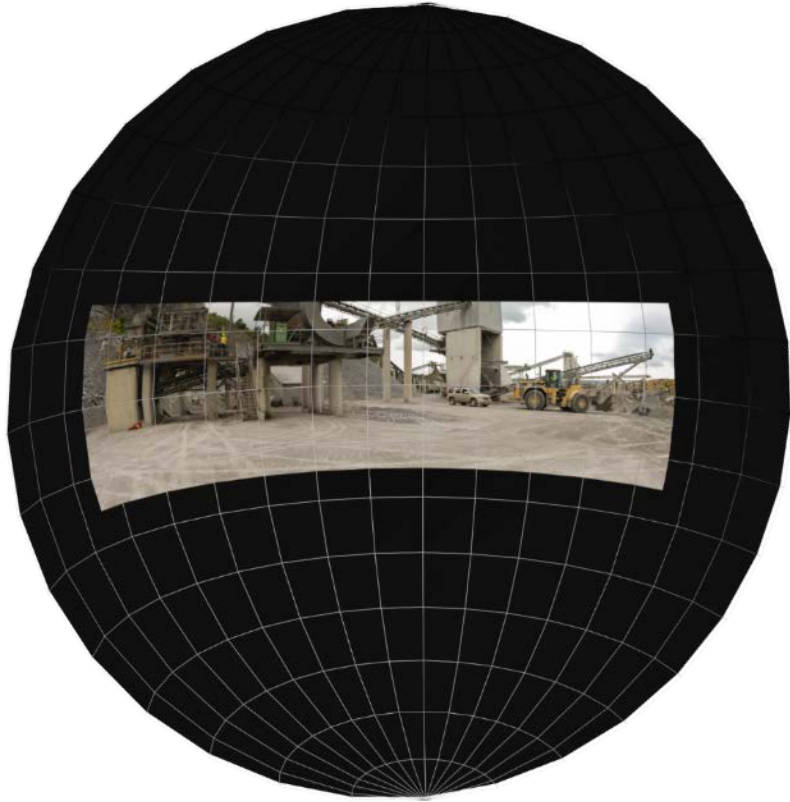
EXAMiner

Panoramic width

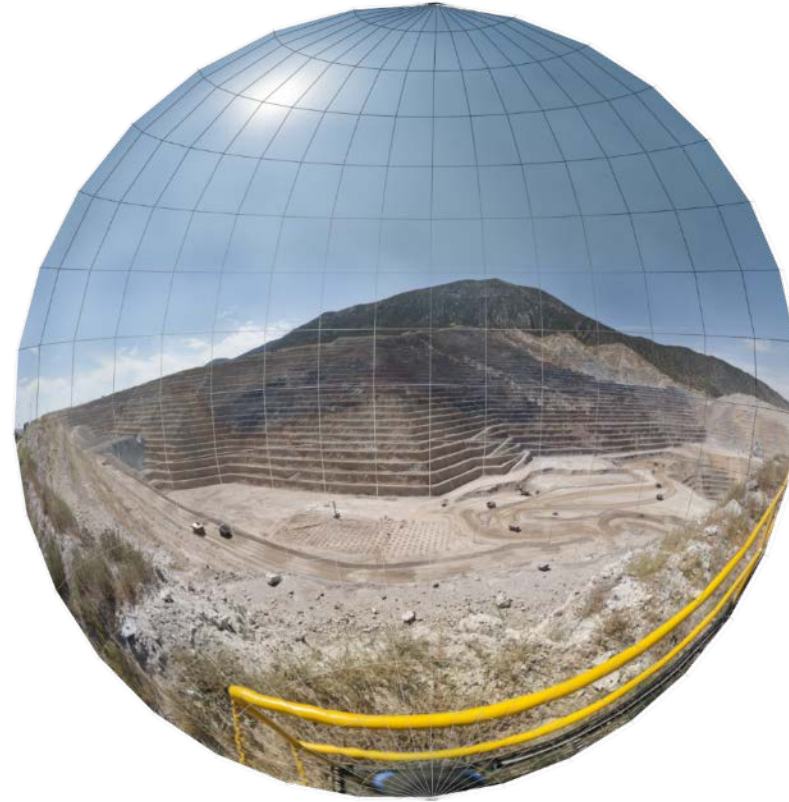


Panoramic overlay on spherical surface

125x35 degrees



360x180 degrees

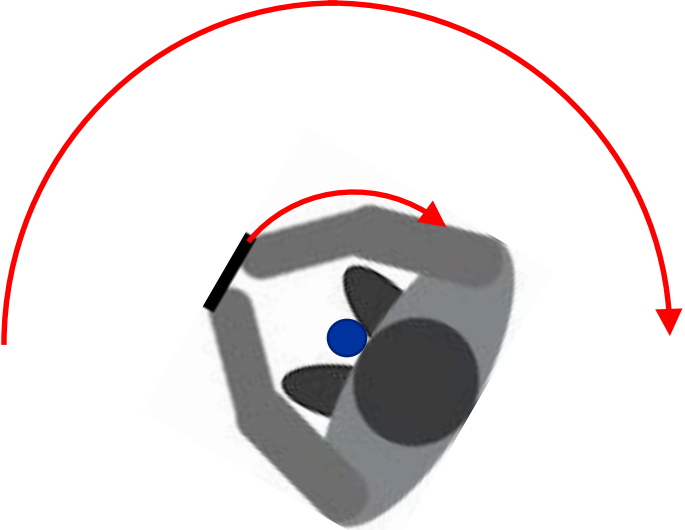


Composition

1. Distances (foreground, subject, background)
2. Occlusion or visual clutter
3. Main pitfall – relative size of the subject



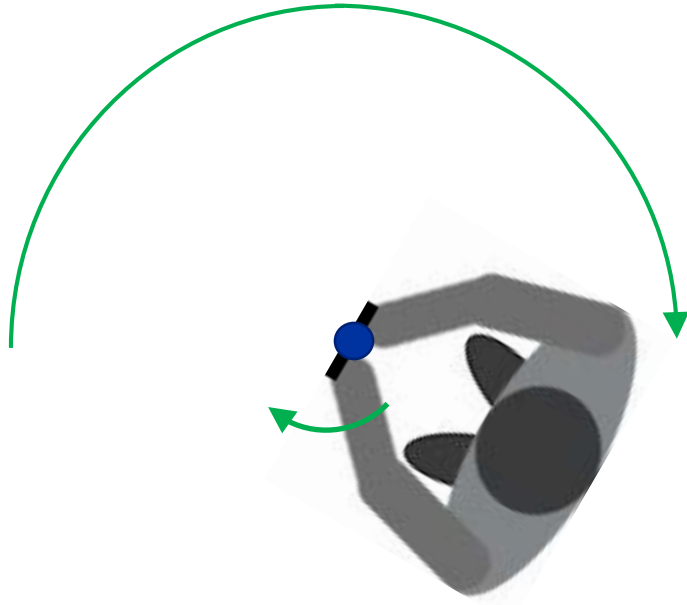
Pivot around the camera, not around your feet



Feet



Pivot around the camera, not around your feet



Camera







Motion and scene dynamics



Find your camera app on your phone



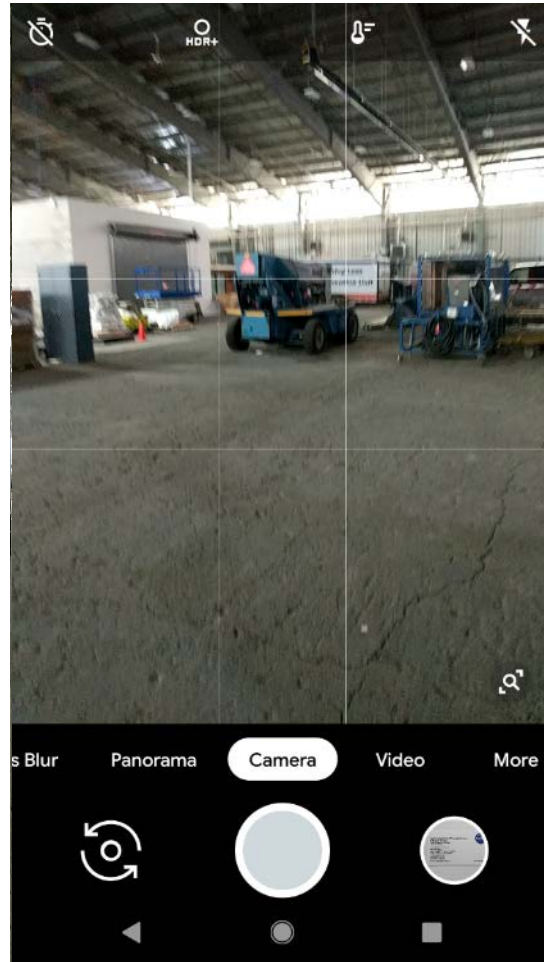
Android



Apple




Take a panoramic picture



Camera Activity: Practice taking a panoramic photo

1. Find your camera app
2. Set mode to panorama
3. Take a panoramic photo

Capture Panorama


- Open Camera App
 - Press camera icon 
 - Center camera on horizon
 - Press circle (lower center)
 - Slowly rotate camera 360 degrees clockwise
 - Allow time for panorama to process
- Exit Camera App or Repeat



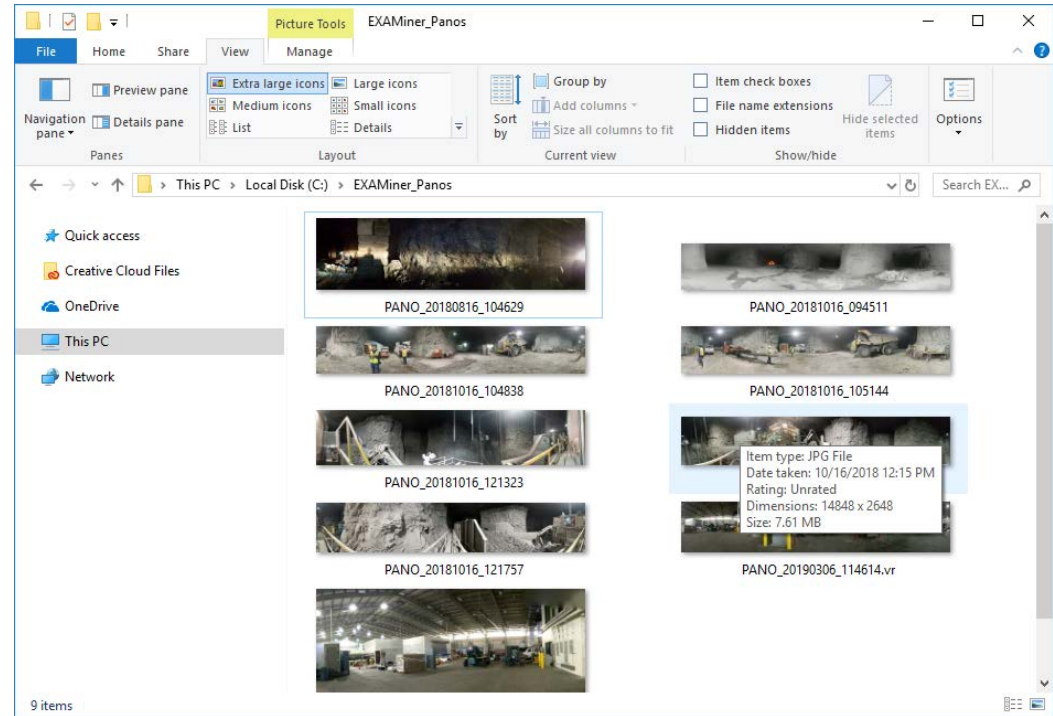
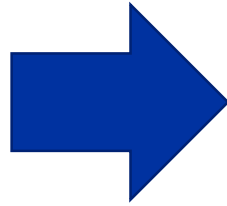
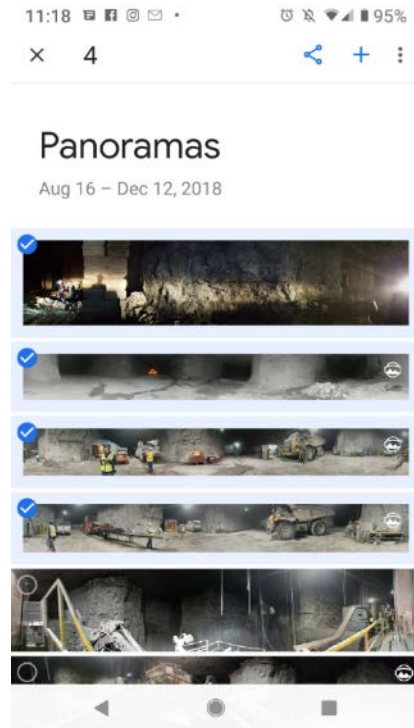
Camera Activity: Photoshoot

1. Identify the primary subject
2. Identify secondary subjects – at least one
3. Select point of view for shot (lighting and composition)
4. Capture panoramic image(s)

Capture Panorama

- Open Camera App
 - Press camera icon 
 - Center camera on horizon
 - Press circle (lower center)
 - Slowly rotate camera 360 degrees clockwise
 - Allow time for panorama to process
- Exit Camera App or Repeat

Transfer your pictures from your phone to your computer



1. File share service such as Google Drive
2. Email
3. USB cable to connect to PC.



Available now on NIOSH Mining Website:

<https://www.cdc.gov/niosh/mining/works/coversheet2050.html>

For questions, please contact Jon Hrica

Email: jhrica@cdc.gov

Phone: 412.386.5237



NIOSH Mining Program
www.cdc.gov/niosh/mining

