Training the Eyes, Not Just the Memory



Picture this exercise. You put a photograph of a busy work area on the screen and give the group 30 seconds to find every hazard. One worker spots the missing guard. Another sees the forklift entering a pedestrian route. Someone notices the damaged extension cord. A few people identify the suspended load.

Then you reveal the hazards they missed. There are six more. One worker is standing where the load will swing. A ladder has been placed where a door can strike it. A hose crosses a travel path behind the crew. A temporary repair has altered the way a machine is normally isolated. Nobody noticed the small leak under the process line.

The usual training response is to explain each missed hazard. That may be useful, but it misses the more interesting question. These workers already knew that unstable loads, line-of-fire exposures, electrical defects, poor housekeeping, and uncontrolled energy can injure people. So why did they fail to see them?

The answer is that hazard recognition is not only a knowledge problem. It is also a perceptual and search problem. Workers have to direct attention, interpret visual cues, recognize patterns, notice deviations, and anticipate how a changing scene could create an exposure. Those are skills that can be practised.

That creates a different job for the safety trainer. Instead of asking only, “Did I teach the hazards?” the trainer should also ask, “Did I make these workers better at finding hazards when the workplace is crowded, familiar, changing, and imperfect?”

Hazard knowledge is not the same as hazard vision

Safety training often treats hazard recognition as if it happens automatically once workers know the definitions. Teach fall hazards, electrical hazards, caught-between hazards, chemical hazards, and mobile-equipment hazards, then assume those categories will appear in the worker’s mind when the real condition appears.

Sometimes they do. Sometimes they do not. Real workplaces do not present hazards as neatly labelled examples. They contain clutter, competing activity, incomplete information, routine distractions, changing work, and strong production cues. A worker may be focused on completing a task, communicating with a coworker, finding a tool, checking a measurement, or moving material. The hazard may be visible without becoming the thing that captures attention.

NIOSH mining research has treated visual search and pattern recognition as distinct competencies within hazard recognition. The agency's EXAMiner work also separates general hazard knowledge from site-specific knowledge and the skills workers use to search for and recognize patterns in realistic scenes. That distinction matters because it tells trainers that there is something teachable between knowing the rule and seeing the risk.

For the purposes of training, it is useful to think of that capability as hazard vision. Hazard vision is not eyesight and it is not a medical measure of visual acuity. It is the learned ability to search deliberately, notice meaningful cues, connect them to possible harm, and anticipate what may happen next.

What the research tells trainers

NIOSH's "Search Like an EXAMiner" intervention identifies three broad barriers that can interfere with hazard recognition: **experience, workplace complexity, and change**. The intervention was designed to give workers and supervisors a systematic way to think about those barriers during workplace examinations.

The research is also a useful warning against assuming experience makes somebody immune to missed hazards. In one NIOSH study using realistic panoramic mine images, safety experience and hazard familiarity affected recognition performance, but even participating safety and health professionals did not identify every hazard. A related NIOSH paper reported that the safety and health professionals in one study accurately identified only 61 percent of the hazards. The point is not that experienced people are poor observers. It is that **no level of experience removes the need for a disciplined search process**.

Older NIOSH research on degraded images is even more interesting for trainers. Rather than showing hazards under perfect viewing conditions, researchers used images in which important cues were less obvious. In the first study reported in the 2003 paper, miners trained with degraded images performed significantly better on follow-up hazard-recognition measures than miners trained using traditional methods. The later field results reported alongside that work are intriguing, but they should not be read as proof that one training technique alone caused injury reductions. The stronger instructional lesson is simpler: **training people only on obvious examples may not prepare them for subtle ones**.

Why people can look directly at work and still miss the hazard

Attention is selective

Workers cannot process every visual detail in a busy environment with equal

depth. Attention is allocated. The task itself often determines where the eyes and mind go first. A mechanic troubleshooting a fault may become highly attentive to the failed component and less attentive to the changing conditions around the repair area.

This is why simply telling workers to “pay attention” is poor instruction. A better trainer gives them a search strategy that redistributes attention deliberately.

Familiarity can reduce scrutiny

Experience helps workers recognize patterns quickly. It can also create expectations. When a task has been completed the same way hundreds of times, normal conditions become background. A small deviation may not feel important enough to interrupt the familiar pattern.

The training question for an experienced worker is therefore not only, “What hazards are associated with this task?” It is also, “What is different today?”

Complexity competes for attention

A warehouse aisle, shutdown area, construction project, maintenance bay, or production line can contain several crews, vehicles, energy sources, temporary controls, contractors, equipment states, and communication demands at once. The more complex the environment becomes, the easier it is for a worker to stop searching after finding the first few obvious hazards.

Trainers can counter this by teaching multiple deliberate passes through a scene rather than one unguided look.

The obvious hazard can hide the important one

Dramatic hazards capture attention. A large suspended load, open excavation, or moving vehicle may become the centre of the worker’s visual field. That can be appropriate, but it can also create tunnel vision. The next incident pathway may be developing somewhere else.

A strong exercise asks workers to identify the obvious hazard and then deliberately search for the second hazard that could be missed because everyone is watching the first.

Static pictures encourage static thinking

Many hazard-identification exercises freeze the workplace in time. Real work moves. Vehicles reverse, loads swing, people enter zones, pressure changes, weather shifts, materials settle, guards are removed, and temporary conditions become permanent through repetition.

Workers need to learn to ask not just, “What is hazardous now?” but, “What will become hazardous if this work continues for another 10 seconds, five minutes, or one shift?”

Teach workers to SCAN

A trainer needs something more useful than “look carefully.” The SCAN framework gives workers a repeatable way to search while still leaving room for unexpected hazards.

	Action	What the worker does
S	**Survey the whole environment**	**Start wide. Deliberately move attention across the entire work area rather than stopping when the first hazards are found.**
C	**Check energy, movement, and interfaces**	**Look for gravity, electrical, mechanical, hydraulic, pneumatic, thermal, chemical, pressure, motion, vehicles, people, and places where systems or crews interact.**
A	**Ask what changed and what happens next**	**Compare today with normal conditions. Predict movement, escalation, failure, and the next step in the work.**
N	**Notice what you expected not to see**	**Challenge assumptions. Search for the unusual, missing, improvised, temporary, inconsistent, or out-of-place condition.**

SCAN is not intended to replace a required inspection form, job hazard analysis, pre-use checklist, or regulatory workplace examination. It is a cognitive search routine. That distinction matters. Checklists are valuable memory aids, but NIOSH researchers have also cautioned that relying too narrowly on listed items can direct attention away from hazards that are not on the list.

The best trainers teach workers to use both. Use the checklist to make sure required items are not forgotten. Use SCAN to make sure the worker is still looking at the actual workplace rather than merely completing the document.

Six exercises that train hazard vision

1. The 30-second scan

Show a realistic image of the organization’s own workplace for 30 seconds. Remove it and ask participants to record what they noticed. When the image returns, do not begin by counting correct answers. Ask how they searched. Where did their attention go first? Which area did they never inspect? Which hazard did they see but decide was unimportant? This converts a simple “spot the hazard” game into a discussion about search strategy.

2. The disappearing hazard

Create two almost identical images with one meaningful condition changed. A guard is removed. A forklift begins reversing. A worker steps into the line of fire. A valve position changes. A barricade has moved. A hose is now routed through a travel path. Show the first image, then the second, and ask what changed. The objective is to develop sensitivity to deviations rather than only recognition of familiar hazard categories.

3. Start with the consequence

Instead of asking, “What hazards do you see?” ask, “What could seriously injure someone here in the next five minutes?” Then ask, “What would have to happen first?” Workers begin to trace an incident pathway. This pushes the exercise away from finding violations and toward anticipating energy transfer, movement, loss of control, and exposure.

4. Search in deliberate passes

Give workers several passes through the same scene. On the first pass, search for energy. On the second, search for movement. On the third, look only at interfaces between workers, equipment, contractors, traffic, or processes. On the fourth, search for change. On the fifth, ask what happens if the primary control fails. The aim is not to make every field inspection take five times longer. It is to teach a disciplined pattern that becomes faster with practice.

5. The novice and expert comparison

Ask a new worker and an experienced worker to examine the same scene independently. Compare what each noticed. Do not turn it into a competition. Ask what the experienced worker recognized immediately because of pattern familiarity, what familiarity may have caused that person to accept as normal, and what the newer worker questioned because it looked unusual. Both perspectives can improve the group’s search process.

6. Degrade the image

Do not always highlight the hazard with an arrow, circle, bright colour, or perfect camera angle. Use real images where part of the hazard is obscured, lighting is imperfect, the cue is small, or the scene contains competing visual

information. Progressively reveal more detail if necessary. This mirrors the instructional principle behind NIOSH’s degraded-image research and forces learners to work with imperfect cues rather than wait for the trainer to make the answer obvious.

Stop using cartoon hazards as the finish line

There is nothing wrong with an easy exercise at the beginning of training. It establishes vocabulary and lets less experienced participants enter the discussion. The problem is when the difficulty never increases.

Many classic safety illustrations contain absurdly obvious violations. A worker stands on the top of a damaged ladder beside exposed electrical parts while another worker walks under a suspended load. The class finds everything in seconds. Everyone feels successful, but the exercise may be testing whether participants can recognize a caricature rather than whether they can find a subtle exposure in a real operation.

Better trainers use progressive difficulty. Begin with obvious examples. Then add clutter. Reduce the visibility of the cue. Introduce competing activity. Make one condition technically acceptable but vulnerable to change. Add an experienced worker doing something that looks normal but creates an exposure. Include a scene where the first apparent hazard is not the highest-consequence one.

The target is not to trick workers. The target is to make practice resemble the perceptual difficulty of the work.

Teach where hazards tend to hide

One way to improve search quality is to organize training around the places where risk often becomes difficult to see, rather than only around hazard categories.

At interfaces

Look where two systems meet. Pedestrians and mobile equipment. Maintenance and production. Contractor and host employer. Worker and automation. Day shift and night shift. Temporary power and permanent installations. Interfaces create assumptions about who is responsible and what the other side will do.

During transitions

Startup, shutdown, shift change, maintenance, jam clearing, cleaning, commissioning, line changeovers, weather changes, and emergency recovery all alter the normal state of work. Train workers to increase scrutiny when the system is between stable states.

Behind the obvious hazard

Ask what everyone is likely to look at first, then inspect what that focus could cause them to ignore.

Inside routine work

The conditions people stop questioning are often the conditions that need a fresh look. Ask, “What do we accept here only because we see it every day?”

Where something changed

A different tool, material, crew, route, supplier, schedule, piece of equipment, software update, weather condition, or work sequence can invalidate an old assumption.

Downstream of the task

An action can be locally safe while creating exposure elsewhere. Opening a valve, repositioning material, bypassing a route, isolating one system, or changing ventilation can transfer risk to another worker or area.

Give feedback on the search, not only the score

A worker who finds 8 of 10 hazards has a score. A trainer who understands how that worker searched has information that can improve performance.

Instead of stopping at “You missed two hazards,” ask the worker to reconstruct the scan. Good questions include:

- Where did you look first, and why?
- What area received the least attention?
- Which cue made you recognize the hazard?
- Did you see anything that you decided was normal or acceptable?
- What were you expecting to find before you started?
- What changed between the first and second pass?
- Which hazard became more important when you thought about what would happen next?
- If this were your own work area, what additional information would you want before deciding it was safe?

This feedback is especially valuable because two people can miss the same hazard for different reasons. One may never look at that part of the scene. Another may look directly at it but fail to recognize the cue. A third may recognize the condition but underestimate the consequence. Those are different training problems.

The first worker needs a better search strategy. The second needs stronger pattern recognition or site-specific knowledge. The third needs better risk interpretation. Treating all three as a generic “knowledge gap” wastes the

diagnostic value of the exercise.

Use the workplace as the training library

The most powerful hazard-recognition content may already exist on the trainer's phone, inspection system, or safety photo archive. Images from the organization's own locations contain context that stock photography cannot reproduce. Workers recognize the equipment, traffic patterns, housekeeping standards, temporary fixes, seasonal conditions, and operating constraints.

That does not mean trainers should photograph unsafe conduct for entertainment or publicly embarrass the worker who happened to be in the frame. Use images ethically. Remove identifying details where appropriate, focus discussion on conditions and decisions, and avoid turning hazard recognition into a blame exercise.

Build a controlled image library organized by task, location, energy source, interface, change, and consequence. Include safe examples as well as hazardous ones. If every image contains a violation, learners quickly learn that the correct answer is always "something is wrong." Real judgment requires recognizing when controls are adequate too.

The image library also makes training more current. A five-minute exercise using a photograph from last week's shutdown may generate better discussion than a generic slide deck created five years ago.

Measure whether workers are becoming better observers

Do not measure this program only by course completion or whether participants enjoyed the exercise. Hazard-vision training produces several more useful indicators.

At the individual level, trainers can track recognition of critical hazards, the categories most often missed, the time required to find high-consequence conditions, whether the worker searches the full scene, and whether performance improves when the visual context becomes more difficult.

At the team level, look for changes in the quality of pre-task discussions, inspection findings, near-miss reports, supervisor observations, and the specificity of hazards identified during field conversations. Be careful with attribution. An increase in reported hazards may mean conditions worsened, but it can also mean workers became better at seeing and reporting them. A decrease can mean risk improved or that reporting weakened. Interpretation still requires operational context.

Most importantly, test transfer. Several weeks after the classroom exercise, take a small group into a controlled area and ask them to perform a real search. Listen to how they use the SCAN routine. The goal is not to create another

paperwork exercise. It is to find out whether the search behaviour appears in the workplace.

Where leading-edge technology can help

360-degree environments

Panoramic scenes require workers to decide where to direct attention rather than passively viewing a cropped photograph. NIOSH’s EXAMiner software uses panoramic workplace scenes and allows trainers to use supplied environments or create custom content that reflects local hazards.

Eye tracking and gaze feedback

Research in construction and mining has used eye tracking to examine how people visually search for hazards. The practical promise is not surveillance. It is feedback. A trainer could show a learner that attention repeatedly clustered in one part of a scene while an important exposure received almost no visual attention.

Virtual reality

VR can create dynamic scenes in which conditions change, workers move, cues appear gradually, and decisions have simulated consequences. NIOSH’s more recent VR mine-rescue work describes immersive training as a supplement to traditional training and emphasizes scenario practice, realism, debriefing, and assessment rather than replacing hands-on instruction.

AI-assisted scene variation

Generative tools may eventually help trainers create variations of approved workplace scenarios, alter conditions, or generate additional practice examples. The same rule that applies elsewhere in safety training applies here. AI can assist with production, but a qualified person must validate the technical content and ensure the scene does not teach an invented hazard, impossible equipment state, or incorrect control.

A 30-day experiment for the safety trainer

A trainer does not need VR hardware or an eye-tracking laboratory to begin. A smartphone, a projector, and disciplined facilitation are enough for a useful pilot.

1. **Week 1.** Collect 10 to 15 workplace images representing normal work, changing conditions, interfaces, and several subtle hazards. Include safe scenes as controls.
2. **Week 2.** Run a baseline exercise. Give workers a limited search period, record what they identify, and ask them to explain how they searched. Do not teach SCAN until after the baseline.

3. **Week 2.** Teach SCAN and practise deliberate search passes using several new images. Include at least one degraded or cluttered scene.
4. **Week 3.** Repeat with a different set of scenes. Increase difficulty and include conditions that require anticipating what happens next rather than spotting a static defect.
5. **Week 4.** Move the exercise into a controlled real work area. Ask participants to narrate their search process and compare what they notice with the baseline patterns.
6. **End of month.** Review the misses, not only the successes. Which hazards were repeatedly overlooked? Which areas received little attention? Did experienced and new workers miss different things? Use those patterns to redesign the next month of training.

The trainer self-audit

A trainer who wants to develop hazard vision can use these questions to test the current program.

- Do my exercises require workers to search, or do I point directly at the hazard?
- Are the examples realistic enough to contain competing visual information?
- Do I train workers to anticipate movement and change, or only identify static conditions?
- Do I use examples from our own workplace?
- Do I include safe scenes as well as unsafe ones?
- Do I progressively increase difficulty?
- Do I ask how the worker searched, or only whether the answer was correct?
- Do I teach workers to look beyond checklist items?
- Do I compare novice and experienced perspectives without turning the exercise into a contest?
- Do I test whether the search behaviour transfers into the field?

The better question at the end of training

Great safety trainers spend enormous effort deciding what workers need to know. Hazard recognition adds another responsibility. Trainers also need to think about what workers need to notice.

A worker can pass a quiz on line-of-fire hazards and still stand in one. A supervisor can know every item on an inspection form and still overlook the condition that is not on the list. An experienced operator can recognize hundreds of familiar patterns and miss the one small deviation that makes today different.

That does not mean knowledge is unimportant. Knowledge gives visual cues meaning. The improvement comes from joining knowledge with a disciplined search process, realistic practice, meaningful feedback, and repeated exposure to the kind of ambiguity workers encounter in real operations.

The next time you put a workplace image on the screen, do not be satisfied when

the class finds the circled hazard. Remove the circle. Add the clutter. Ask what changes next. Ask where they looked. Ask what they assumed. Then give them another chance to search.

The better question at the end of safety training may no longer be only, “Can this worker name the hazards?” It may be, “Have we made this worker better at finding the hazard before it finds them?”