Training Booklet

Hazard Recognition & Management Field Guide

JSI
Job-Site Safety Institute

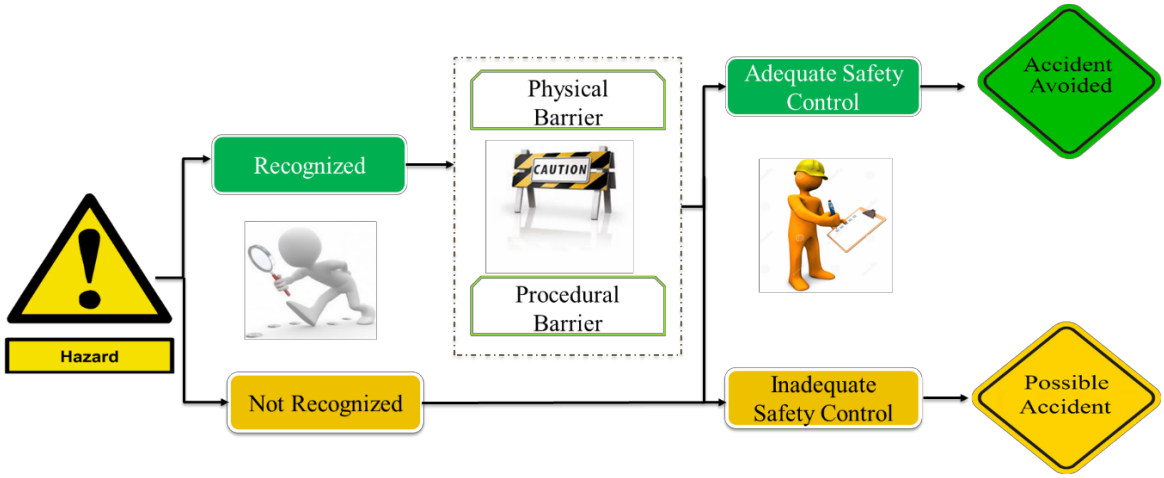
NC State
Construction Safety Laboratory

INTRODUCTION

MOST ACCIDENTS CAN BE PREVENTED

Most accidents are preventable if safety hazards are properly recognized and managed. This booklet is intended to highlight important barriers to effective hazard recognition and management that workers experience. An understanding of these barriers can enhance hazard recognition performance and reduce the risk of workplace injuries.

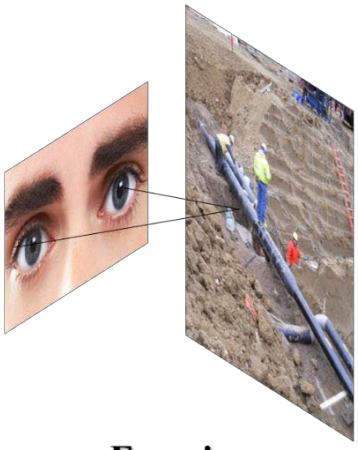
HAZARD RECOGNITION IS THE FIRST STEP IN THE ACCIDENT PREVENTION PROCESS



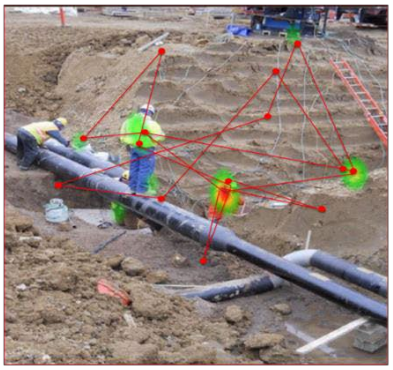
UNRECOGNIZED HAZARDS PUT WORKERS AT RISK!

HAZARD RECOGNITION

HAZARD RECOGNITION IS A VISUAL SEARCH TASK



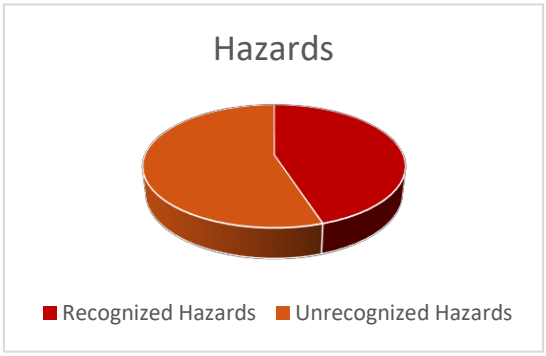
Examine



Visual Search

Hazard Recognition

40%- 50% OF SAFETY HAZARDS REMAIN UNRECOGNIZED



Evidence from the global construction industry suggests that up to 50% of safety hazards may remain unrecognized. These unrecognized hazards often remain unmanaged and can expose workers to unanticipated risk and injury.

WHY DO HAZARDS REMAIN UNRECOGNIZED?

Following are the most common reasons why we fail to recognize hazards in our work environments.

1. SELECTIVE ATTENTION

Often, we pay attention to only selective areas in a construction workplace when looking for safety hazards. For example, the image on the left portrays areas that received attention when a worker was tasked with identifying safety hazards. The distribution of attention was captured using an eye-tracking device that can be used to capture any search process. While much of the attention was devoted to the primary task and other workers, other areas in the workplace also present relevant hazards (e.g., unattended compressed gas tank) that remained unrecognized.

What to do?

A thorough search of the workplace is necessary to achieve desirable levels of hazard recognition. Always remember that hazards in the work vicinity, even those that may not be directly related to the task being performed can impose safety risk. Pay particular attention to the equipment, tools, and construction material in the workplace which may not be in the primary work area.

2. OPERATIONAL UNFAMILIARITY

We may not be familiar with the operation of certain equipment or tools. As a result, we may not be able to recognize potential hazards that can result from the operation of such equipment or tools.

What to do?

Before beginning any task make sure you know all the tools and equipment that you will use. If you are unfamiliar with any equipment, ask your supervisor, read the safety guidelines and make sure you understand all the risks associated with the equipment.

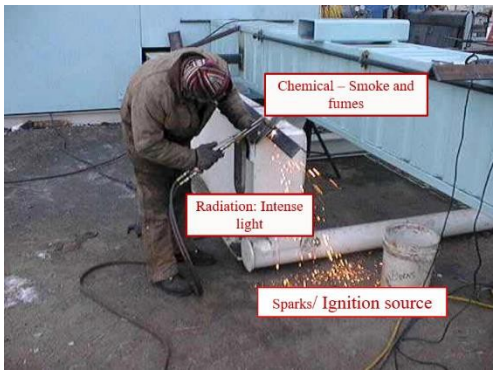
3. PREMATURE SEARCH TERMINATION

Construction environments generally contain numerous safety hazards. To prevent injuries, we need to recognize and manage all potential safety hazards. However, sometimes we tend to terminate the hazard recognition activity prematurely after a few generic hazards such as trip potential, leading-edge, and the likelihood of pinch-points are identified. However, in most cases, there are often additional hazards that can cause harm.

What to do?

Make sure you devote sufficient time to examine and identify all relevant safety hazards. Look for hazard types that go beyond the generic hazards that are generally part of every job safety analysis report. Anticipate other tasks being performed around you and ensure you are aware of the potential hazards arising from such activities. Use Visual Cues (discussed in the next section) to guide your hazard search.

4. MULTIPLE HAZARDS ASSOCIATED WITH SINGLE SOURCE

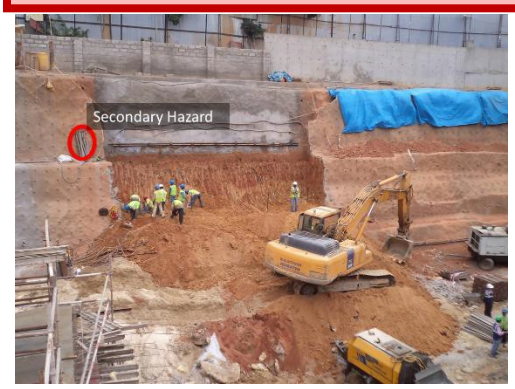


Certain sources and activities may pose multiple safety hazards. For example, an electric cable on the floor may be associated with a trip hazard and an electrical hazard. In these cases, workers often report only one of the hazards instead of all relevant ones.

What to do?

After identifying a hazard that is associated with a particular source, ask yourself if there are any additional hazards that the same source can impose. Visual Cues will be useful to guide you through the hazard recognition process.

5. HAZARDS THAT ARE SECONDARY TO THE PRIMARY TASK



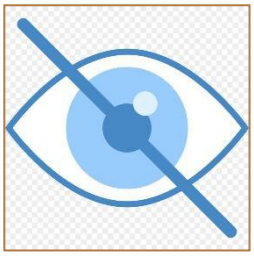
These are hazards within the work environment but are either secondary or unrelated to the primary task being performed. Sometimes, we tend to focus more attention on hazards associated with the primary task that is being performed, while devoting very little attention to other hazard types that are relevant and within the work vicinity.

What to do?

Remember to scan your environment carefully and thoroughly. Hazards that can impose significant risk can be lurking within or outside your primary

work area. Some examples of commonly unrecognized hazards include overhead powerlines that are unrelated to the ongoing work, unattended equipment not being currently operated, falling objects from other tasks being performed in the vicinity, struck by potential from moving traffic or construction equipment (cranes, excavator boom, etc.) that is unrelated to the primary task that you are involved in.

6. VISUALLY UNPERCEIVABLE/ OBSCURE HAZARDS



Not all hazards can be seen! Few examples include gases (e.g., CO, H2S), vapors (e.g., gasoline), fumes (e.g., fumes from hot work), and hot surfaces. Apart from visually unperceivable hazards, certain hazards may be obscured or blocked from your line of sight (e.g., underground power cables)

What to do?

Evaluate your surroundings to see if there could be any visually unperceivable or obscure hazards. Examples of such hazards include colorless and sometimes odorless gases that may be released from an operation, hot surfaces such as pipelines that transport hot substances, etc.

Precautionary measures must be taken during excavation and trenching operations as underground utilities and electrical power lines may be present. Moreover, hidden hazards such as electrical cables on the floor of a cluttered worksite, hand tools left among other construction material, protruding nails within used or reusable formwork material can all pose substantial safety risk.

7. LATENT AND STORED ENERGY HAZARDS

Construction environments may contain dormant hazards that may appear to not impose any imminent danger. Such hazards often remain in work environments as latent or stored energy hazards for extended periods without causing any harm. However, the unexpected release or trigger of these latent sources of stored energy hazards can result in dramatic injury and illnesses

What to do?

While examining your work environment, look to see if there are dormant energy sources that can be released. These include high-pressure pipelines, vessels, and hydraulic lines; cave-in potential during excavation and trenching operations; the possibility of arc flash incidents while working on energized equipment; the release of mechanical energy from compressed springs; and unexpected chemical reactions and explosions in the workplace.

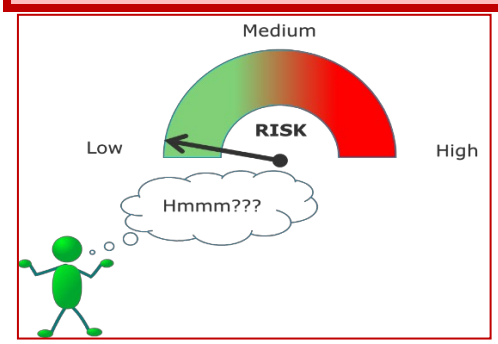
8. UNFAMILIAR TASK

Sometimes we are unfamiliar with certain tasks and their associated safety hazards. This may be because of a lack of familiarity with certain work operations or as a result of being relatively new to the construction industry. Sometimes we may be familiar with the tasks we undertake, but may not be familiar with the tasks an adjacent crew is performing – which can also cause harm.

What to do?

Break down the task into multiple sub-tasks and make sure you understand every step and try to envision the hazards that may arise due to each step. If you are unfamiliar with how a task is performed or the associated safety hazards, just stop, and ASK!

9. HAZARDS THOUGHT TO IMPOSE LOW RISK



Sometimes we incorrectly assume that certain hazards impose only minimal levels of safety risk. We consider that these hazards are a normal part of the work. As a result, these hazards often remain unreported and unmanaged which can result in injury.

What to do?

Ensure you recognize hazards that you think are a normal part of your work operations. Growing accustomed to certain safety hazards are known to be a principal cause of unexpected safety hazards.

10. HAZARDS WITH NO IMMEDIATE EFFECT

Not all hazards have an immediate outcome or result in an immediate injury. Oftentimes, we overlook hazards where the cause and effect relationship is much more uncertain or not immediately observable.

What to do?

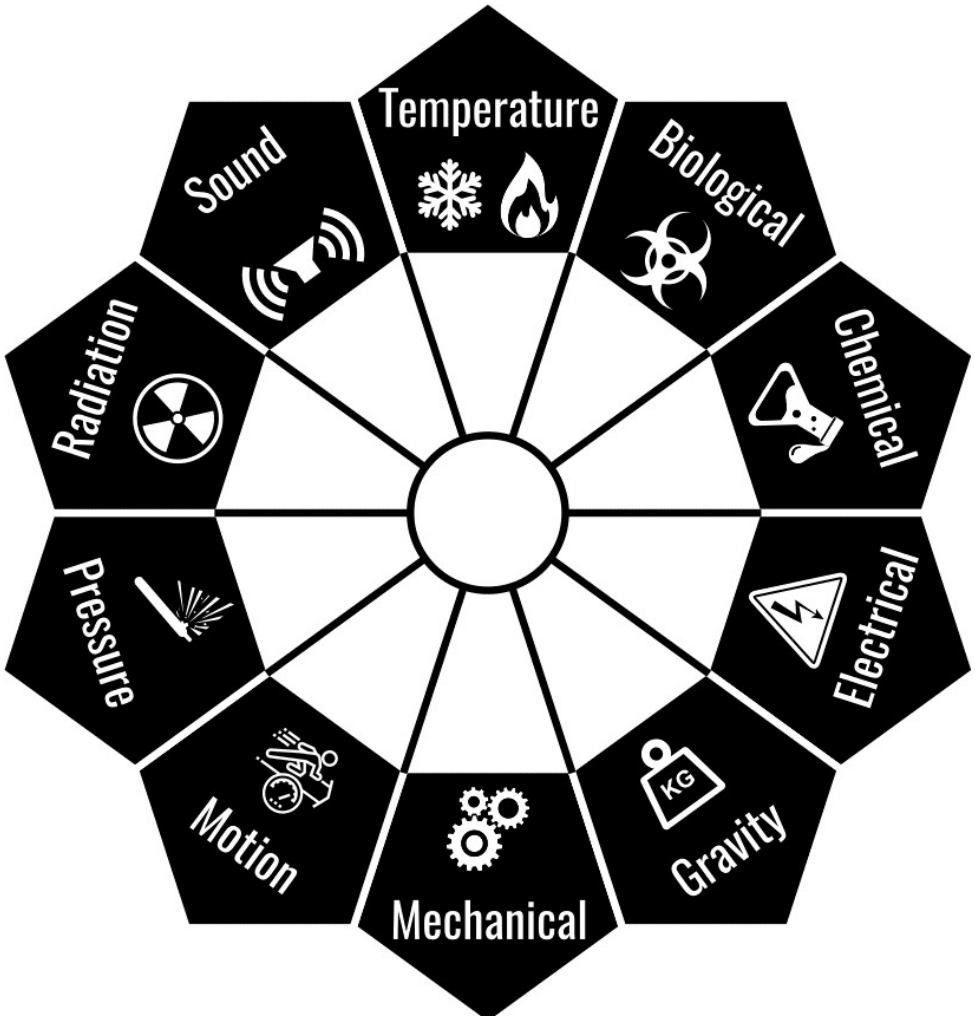
Envision the long-term effects of the task you are performing or the condition in which you are performing. If it is discomforting it might not be safe. Examples of common hazards without an immediate effect or outcome include work operations requiring improper body postures; exposure to concrete dust, silica, and welding fumes; repeated manual lifting and the adoption of unsafe lifting techniques.

SYSTEMATIC HAZARD SEARCH

VISUAL CUES

Most of us simply look around the workplace and hope to identify all safety hazards. However, adopting a systematic approach over the more traditional haphazard approach can result in superior hazard recognition levels. The use of the energy wheel (shown below) to sequentially identify hazards that are associated with each of the energy sources has been demonstrated to improve hazard recognition levels. The strategy is increasingly becoming common in the construction industry with organizations such as Chevron adopting the approach.

The concept behind this is simple. Most accidents occur when workers are exposed to undesirable energy sources. Using the energy sources to guide hazard recognition can yield superior performance.



1. GRAVITY HAZARDS

These include objects that can fall or conditions that result in falls. Examples: falling objects, collapsing roof, and a body tripping or falling.

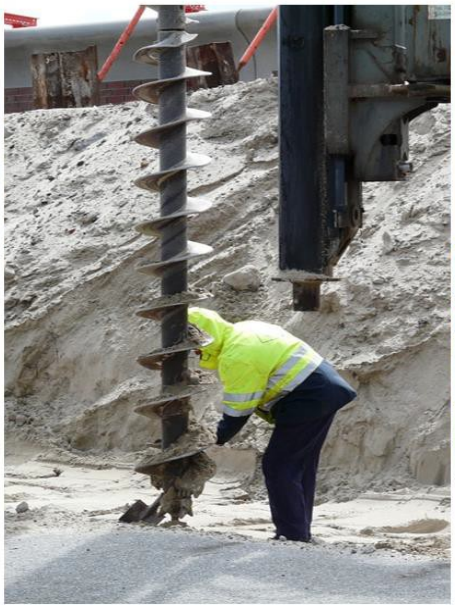
2. MOTION HAZARDS

The change in position of objects or substances. Examples: vehicle, vessel or equipment movement, flowing water, wind, body positioning: lifting, straining, or bending.

3. MECHANICAL HAZARDS

The energy of the components of a mechanical system, i.e. rotation, vibration, motion, etc. within otherwise stationary piece of equipment/machinery.

Examples: rotating equipment, compressed springs, drive belts, conveyors, motors



4. ELECTRICAL HAZARDS

The presence and flow of an electric charge. Examples: power line, transformers, static charge, lightning, energized equipment, wiring, batteries

5. PRESSURE HAZARDS

Energy applied by a liquid or gas which has been compressed or is under vacuum. Examples: pressure piping, compressed gas cylinders, control lines, vessels, tanks, hoses, pneumatic and hydraulic equipment.

6. CHEMICAL HAZARDS

The energy present in chemical that inherently, or through reaction, has the potential to create a physical or health hazards. Examples: flammable vapors, reactive hazards, carcinogens or other toxic compounds, corrosives, pyrophoric, combustibles, inert gas, welding fumes

7. TEMPERATURE HAZARDS

The differences in the thermal energy of objects or the environment, which the human body senses as either heat or cold. Examples: open flame and ignition sources, hot or cold surface, liquids or gases, hot work, friction, general environmental conditions, steam, extreme and changing weather conditions

8. RADIATION HAZARDS

The energy emitted from radioactive elements and naturally occurring radioactive materials. Examples: lighting issues, welding arc, X-rays, solar rays, microwaves, or other non-ionizing sources

9. SOUND HAZARDS

Sound is produced when a force causes an object or substance to vibrate. Examples: impact noise, vibration, high-pressure relief, equipment noise

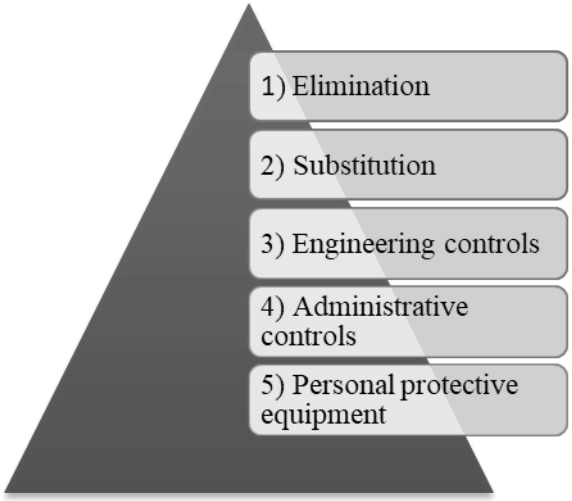
9. BIOLOGICAL HAZARDS

Living organisms that can present a hazard. Examples: animals, bacteria, viruses, insects, bloodborne pathogens, improperly handled food, contaminated water

HAZARD MANAGEMENT

ONCE RECOGNIZED HAZARDS NEED TO BE MANAGED EFFICIENTLY

While safety hazards can be managed using various strategies, we should always try to adopt the most effective means to manage hazards. If that is not possible due to practical concerns, we may then move to the adoption of lesser effective hazard management strategies. The hazard management pyramid (shown below), adopted from NIOSH research, can guide you through this process. Follow this hierarchy when deciding the appropriate hazard management strategy for each hazard. (See examples below)



The best approach to avoid hazard exposure is to eliminate the hazard that can cause injury. For example, an energized power cable running through the worksite may be removed or de-energized to prevent exposure. However, when the hazard cannot be removed or eliminated, we should try replacing the hazard with something that does not pose a safety risk. For example, the use of a battery operated equipment may be associated with lower levels of safety risk, replacing lead-basedd paints with non-lead paints can reduce risk, etc.

The next line of defense is putting in controls that isolate people from hazards without eliminating or replacing it. For example, fixed barricades can be placed around energized operational equipment or near excavations to prevent entry. If that is not feasible for some reason, the next effective control measure is to use administrative controls such as adopting a lockout/tagout program to prevent hazard exposure.

Finally, if none of the above control strategies are possible, we may have to rely solely on personal protective equipment (PPE) such as hard hats, safety glasses, etc. Remember that in most cases, we use certain personal protective equipment as a site-based policy irrespective of whether we anticipate hazard exposure.

KEY TAKEAWAYS

1. A disproportionate number of injuries have been attributed to poor hazard recognition levels in the construction industry.
2. Improving hazard recognition and management is fundamental to effective safety management.
3. The use of the hazard recognition visual cues to aid systematic hazard search can improve hazard recognition levels.
4. After the hazards are recognized, the hierarchy of safety controls can aid with the selection of appropriate hazard management techniques.