- The eye shield was evidently not in place.
- There was no regulation regarding unauthorized use of equipment.
- The freight handler was not from this foreman's department.
- A grinding wheel of this type is proper for sharpening bale hooks.

Possible Solutions for Case II

1. It should be obvious to the group that the primary cause of this incident was one or more unsafe procedures. The foreman made a mistake by assuming the freight handler knew how to use a bench grinder. The freight handler committed several unsafe procedures. First, he did not use the eye protection that was available. Second, he must have put the hook in a position that let the point slip between the tool rest and the wheel.
2. While you may get such comments from the group as "fire the foreman," the solution should focus on a rigidly enforced rule, "no unauthorized use of equipment."
3. The following procedures can also be set up:
   a. a policy regarding the sharpening of tools, such as returning tools to the tool crib for sharpening or replacement
   b. a training program if the freight handlers are to do the sharpening
   c. a lockout device interlocked with the starting switch to prevent the wheel from operating when the eye shield is not in the proper position

Summary

Point out to the group that the two cases, Case I and Case II, bring out the importance of unsafe conditions and unsafe procedures as the causes of incidents. Stress the importance of searching for all possible causes.

Point out that in Case II there were a number of places where the incident prevention program needed tightening in order to prevent similar incidents in the future.

Emphasize the importance of checking procedures and conditions in advance to prevent incidents of this type. Mention the importance of a job safety analysis as a tool for preventing incidents.

CASE III

A tool truck driver, making his routine crib stops, picked up a crib attendant.

The attendant had requested a ride to another part of the facility because he knew the driver would be going in that direction.

The truck driver deviated from his aisle route and angled through a cleared but darkened area. This area was being prepared for new machinery installation and at that time of night was not fully lighted.

The attendant, who was sitting on the right side of the cab, suddenly noticed that the truck was headed for a steel building column. Before he could warn the driver, the left front corner of the truck struck and glanced off the column.

The impact threw the driver against the column and about 15 ft (4.6 m) away from the truck. The truck continued for approximately 50 ft (15.3 m) before the rider could get behind the wheel to apply the brakes and bring the truck to a stop.

The driver suffered a skull fracture, concussion, and severe injuries to the left arm and chest. He was taken immediately to the local hospital, where he died from a blood clot about three weeks later.

What could have been done to prevent this incident or similar incidents in the future?

Guide and Background Information for Case III

Explain to the group, if asked, that these trucks are not designed to carry passengers. In order for a rider to sit on the seat, the driver must move over, which puts him or her in an awkward position.

Following are other pertinent facts:

- The aisles were not marked in this particular area.
- The area was not "roped off" and there were no signs to indicate equipment was being installed.
- The truck was not equipped with a seat belt.
- The incident happened on the second shift (about 10 p.m.).
- The machinery installation had been going on for an extended period of time.
- There were no rules concerning riders.
- The driver was experienced.

Possible Solutions for Case III

1. The driver's failure to stay within the main aisle was an important factor in the incident. Properly marked aisles might have prevented the driver from taking a shortcut.

2. When there are properly marked aisles, truck drivers should be instructed and trained in proper procedures.
3. Better illumination might also have prevented the incident. Because the installation had been going on for some time, the area should have been properly illuminated.
4. The area could have been roped off or marked.
5. A rigidly enforced rule against "no riders" should have been instituted.
6. Installation of seat belts in equipment of this type is a possibility, but because of the nature of the work, not generally done.

Summary

Stress to the group that the incident was caused by a combination of factors:

- The unsafe conditions were poor lighting, unmarked aisles, and lack of signs.
- The unsafe procedures were the driver's "shortcutting" and picking up a rider. The lack of a rule against riders did not exonerate the driver because he had to make room for the rider and had to be aware that he was not in the best position to control the truck. The rider also must have been aware of the situation when he moved into the seat.

CASE IV

A truck driver and a millwright were in the process of moving a pump, weighing approximately 2,000 lbs, that was mounted on a skid. They were using a mobile crane, and as the operator was backing up with the crane boom elevated at about a 30-degree angle, the rear wheels of the crane rose off the ground. To compensate for this overbalanced condition, the operator, while proceeding backwards, raised the crane boom to an approximate 60-degree angle. His co-worker at the time was observing the load on the crane boom and did not notice an overhead 440-volt line.

The crane boom became entangled in the overhead 440-volt wires, located approximately 18 ft (5.4 m) above ground. When the operator observed this, he jumped off the operating platform and was not injured. The insulation on the 440-volt line was not cut, so the crane boom did not become energized.

What could have been done to prevent this incident or similar incidents in the future?

GUIDE FOR IDENTIFYING CAUSAL FACTORS & CORRECTIVE ACTIONS

Case Number

Answer questions by placing an X in the "Y" circle or box for yes or in the "N" circle or box for no.

PART 1 EQUIPMENT

○ Y ☐ N **1.0 WAS A HAZARDOUS CONDITION(S) A CONTRIBUTING FACTOR?**
If yes, answer the following. If no, proceed to Part 2.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
○ Y ☐ N	1.1 Did any defect(s) in equipment/tool(s)/material contribute to hazardous condition(s)?		Review procedure for inspecting, reporting, maintaining, repairing, replacing, or recalling defective equipment/tool(s)/material used.	
☐ Y ○ N	1.2 Was the hazardous condition(s) recognized? If yes, answer A and B. If no, proceed to 1.3.		Perform job safety analysis. Improve employee ability to recognize existing or potential hazardous conditions. Provide test equipment, as required, to detect hazard. Review any change or modification of equipment/tool(s)/material.	
☐ Y ○ N	A. Was the hazardous conditions(s) reported?		Train employees in reporting procedures. Stress individual acceptance of responsibility.	
☐ Y ○ N	B. Was employee(s) informed of the hazardous condition(s) and the job procedures for dealing with it as an interim measure?		Review job procedures for hazard avoidance. Review supervisory responsibility. Improve supervisor/employee communications. Take action to remove or minimize hazard.	
☐ Y ○ N	1.3 Was there an equipment inspection procedure(s) to detect the hazardous condition(s)?		Develop and adopt procedures (for example, an inspection system) to detect hazardous conditions. Conduct test.	
☐ Y ○ N	1.4 Did the existing equipment inspection procedure(s) detect the hazardous condition(s)?		Review procedures. Change frequency or comprehensiveness. Provide test equipment as required. Improve employee ability to detect defects and hazardous conditions. Change job procedures as required.	
☐ Y ○ N	1.5 Was the correct equipment/tool(s)/material used?		Specify correct equipment/tool(s)/material in job procedures.	
☐ Y ○ N	1.6 Was the correct equipment/tool(s)/material readily available?		Provide correct equipment/tool(s)/material. Review purchasing specifications and procedures. Anticipate future requirements.	

Figure 7–3. A causal factors analysis breaks down each incident into areas that contribute to an injury: equipment, environment, personnel, and management. By answering each question and placing an X in either a circle or a box will determine that item's relationship to the injury as a causal factor.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
☐ Y ○ N	1.7 Did employee(s) know where to obtain equipment/ tool(s)/material required for the job?		Review procedures for storage, access, delivery, or distribution. Review job procedures for obtaining equipment/tool(s)/ material.	
○ Y ☐ N	1.8 Was substitute equipment/ tool(s)/material used in place of correct one?		Provide correct equipment /tool(s)/material. Warn against use of substitutes in job procedures and in job instruction.	
○ Y ☐ N	1.9 Did the design of the equipment/tool(s) create operator stress or encourage operator error?		Review human factors engineering principles. Alter equipment/ tool(s) to make it more compatible with human capability and limitations. Review purchasing procedures and specifications. Check out new equipment and job procedures involving new equipment before putting into service. Encourage employees to report potential hazardous conditions created by equipment design.	
○ Y ☐ N	1.10 Did the general design or quality of the equipment/ tool(s) contribute to a hazardous condition?		Review criteria in codes, standards, specifications, and regulations. Establish new criteria as required.	
○	1.11 List other causal factors in "Comment" column.			

PART 2 ENVIRONMENT

○ Y ☐ N **2.0 WAS THE LOCATION OF EQUIPMENT/MATERIALS/EMPLOYEE(S) A CONTRIBUTING FACTOR?**
If yes, answer the following. If no, proceed to Part 3.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
○ Y ☐ N	2.1 Did the location/position of equipment/material/ employee(s) contribute to a hazardous condition?		Perform job safety analysis. Review job procedures. Change the location, position, or layout of the equipment. Change position of employee(s). Provide guardrails, barricades, barriers, warning lights, signs, or signals.	
☐ Y ○ N	2.2 Was the hazardous condition recognized? If yes, answer A and B. If no, proceed to 2.3.		Perform job safety analysis. Improve employee ability to recognize existing or potential hazardous conditions. Provide test equipment, as required, to detect hazard. Review any change or modification of equipment/tools/materials.	
☐ Y ○ N	A. Was the hazardous condition reported?		Train employees in reporting procedures. Stress individual acceptance of responsibility.	

Figure 7–3. Continued.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
☐ Y ○ N	B. Was employee(s) informed of the job procedures for dealing with the hazardous condition as an interim action?		Review job procedures for hazard avoidance. Review supervisory responsibility. Improve employee/supervisor communications. Take action to remove or minimize hazard.	
☐ Y ○ N	2.3 Was employee(s) supposed to be in the vicinity of the equipment/material?		Review job procedures and instruction. Provide guardrails, barricades, barriers, warning lights, signs, or signals.	
☐ Y ○ N	2.4 Was the hazardous condition created by the location/position of equipment/material visible to employee(s)?		Change lighting or layout to increase visibility of equipment. Provide guardrails, barricades, barriers, warning lights, signs or signals, floor stripes, etc.	
☐ Y ○ N	2.5 Was there sufficient workspace?		Review workspace requirements and modify as required.	
○ Y ☐ N	2.6 Were environmental conditions a contributing factor (for example, illumination, noise levels, air contaminant, temperature extremes, ventilation, vibration, radiation)?		Monitor, or periodically check, environmental conditions as required. Check results against acceptable levels. Initiate action for those found unacceptable.	
○	2.7 List other causal factors in "Comment" column.			

PART 3 PEOPLE

○ Y ☐ N **3.0 WAS THE JOB PROCEDURE(S) USED A CONTRIBUTING FACTOR?**
If yes, answer the following. If no, proceed to Part 3.6.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
☐ Y ○ N	3.1 Was there a written or known procedure (rules) for this job? If yes, answer A, B, and C. If no, proceed to 3.2.		Perform job safety analysis and develop safe job procedures.	
☐ Y ○ N	A. Did job procedures anticipate the factors that contributed to the accident?		Perform job safety analysis and change job procedures.	
☐ Y ○ N	B. Did employee(s) know the job procedure?		Improve job instruction. Train employees in correct job procedures.	
○ Y ☐ N	C. Did employee(s) deviate from the known job procedure?		Determine why. Encourage all employees to report problems with an established procedure to supervisor. Review job procedure and modify if necessary. Counsel or discipline employee. Provide closer supervision.	

Figure 7–3. Continued.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
☐ Y ○ N	3.2 Was employee(s) mentally and physically capable of performing the job?		Review employee requirements for the job. Improve employee selection. Remove or transfer employees who are temporarily, either mentally or physically, incapable of performing the job.	
○ Y ☐ N	3.3 Were any tasks in the job procedure too difficult to perform (for example, excessive concentration or physical demands)?		Change job design and procedures.	
○ Y ☐ N	3.4 Is the job structured to encourage or require deviation from job procedures (for example, incentive, piecework, work pace)?		Change job design and procedures.	
○	3.5 List other causal factors in "Comment" column.			

○ Y ☐ N **3.6 WAS LACK OF PERSONAL PROTECTIVE EQUIPMENT OR EMERGENCY EQUIPMENT A CONTRIBUTING FACTOR IN THE INJURY?**
If yes, answer the following. If no, proceed to Part 4.
Note: The following causal factors relate to the *injury*.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
☐ Y ○ N	3.7 Was appropriate personal protective equipment (PPE) specified for the task or job? If yes, answer A, B, and C. If no, proceed to 3.8.		Review methods to specify PPE requirements.	
☐ Y ○ N	A. Was appropriate PPE available?		Provide appropriate PPE. Review purchasing and distribution procedures.	
☐ Y ○ N	B. Did employee(s) know that wearing specified PPE was required?		Review job procedures. Improve job instruction.	
☐ Y ○ N	C. Did employee(s) know how to use and maintain the PPE?		Improve job instruction.	
☐ Y ○ N	3.8 Was the PPE used properly when the injury occurred?		Determine why and take appropriate action. Implement procedures to monitor and enforce use of PPE.	
☐ Y ○ N	3.9 Was the PPE adequate?		Review PPE requirements. Check standards, specifications, and certification of the PPE.	

Figure 7–3. Continued.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
☐ Y ○ N	3.10 Was emergency equipment specified for this job (for example, emergency showers, eyewash fountains)? If yes, answer the following. If no, proceed to Part 4.		Provide emergency equipment as required.	
☐ Y ○ N	A. Was emergency equipment readily available?		Install emergency equipment at appropriate locations.	
☐ Y ○ N	B. Was emergency equipment properly used?		Incorporate use of emergency equipment in job procedures.	
☐ Y ○ N	C. Did emergency equipment function properly?		Establish inspection/monitoring system for emergency equipment. Provide for immediate repair of defects.	
○	3.11 List other causal factors in "Comment" column.			

PART 4 MANAGEMENT

○ Y ☐ N **4.0 WAS A MANAGEMENT SYSTEM DEFECT A CONTRIBUTING FACTOR?**
If yes, answer the following. If no, STOP. Your causal factor identification exercise is complete.

	Causal Factors	Comment	Possible Corrective Actions	Recommended Corrective Actions
○ Y ☐ N	4.1 Was there a failure by supervision to detect, anticipate, or report a hazardous condition?		Improve supervisor capability in hazard recognition and reporting procedures.	
○ Y ☐ N	4.2 Was there a failure by supervision to detect or correct deviations from job procedure?		Review job safety analysis and job procedures. Increase supervisor monitoring. Correct deviations.	
☐ Y ○ N	4.3 Was there a supervisor/employee review of hazards and job procedures for tasks performed infrequently? (Not applicable to all incidents.)		Establish a procedure that requires a review of hazards and job procedures (preventive actions) for tasks performed infrequently.	
☐ Y ○ N	4.4 Was supervisor responsibility and accountability adequately defined and understood?		Define and communicate supervisor responsibility and accountability. Test for understandability and acceptance.	
☐ Y ○ N	4.5 Was supervisor adequately trained to fulfill assigned responsibility in accident prevention?		Train supervisors in accident prevention fundamentals.	
○ Y ☐ N	4.6 Was there a failure to initiate corrective action for a known hazardous condition that contributed to this incident?		Review management safety policy and level of risk acceptance. Establish priorities based on potential severity and probability of recurrence. Review procedure and responsibility to initiate and carry out corrective actions. Monitor progress.	
○	4.7 List other causal factors in "Comment" column.			

Figure 7–3. Concluded.

It is critical that an organization periodically review existing incident investigation reports to verify that all corrective actions have been completed. Each report should document the date that the corrective actions were completed and the names of the person or persons who completed that corrective actions as well as the name of the person(s) who verified that the corrective actions were adequately completed.

Users may add other data to the form to fulfill local or corporate requirements. Types of data that might be added include information typical to a specific industry or organization. For example, an establishment regulated by the Mine Safety and Health Administration (MSHA) may wish to add an MSHA identification number, required training, and training received.

SUMMARY OF KEY POINTS

Key points covered in this chapter include:

- The purpose of an incident investigation is to determine causes and recommend corrective actions to eliminate or control hazards and prevent recurrence of similar incidents. All incidents should be investigated, not only those that cause serious injury or property damage. The investigation should emphasize fact-finding, not fault-finding.
- An organization should set up a site-specific plan for responding to incidents. The plan should specify what should be done in case of an incident, list names and phone numbers of people to call, and assign specific responsibilities to all persons involved in the emergency response plan. All supervisors expected to respond to an incident should be trained on the specific incident investigation steps as well as causal factor analyses.
- When an incident occurs, supervisors should first see that injured persons get immediate medical attention and then secure the incident site for the investigation duration. Evidence can be preserved on film, recorded on tape, diagrammed, or sketched.
- Witnesses are often the best source of information about an incident. Supervisors should speak with anyone who was in the incident area in addition to those who actually witnessed the event.
- Witnesses should be interviewed one at a time as soon after the incident as possible to ensure accurate recall. The supervisor may ask witnesses to reenact, with appropriate safeguards, how the incident happened. Interviews