

GCC/IBT/Labor Institute
**Powered Industrial Trucks (PIT)
Health and Safety Awareness Training**



Compiled by The Labor Institute and the
Graphic Communications Conference of International
Brotherhood of Teamsters (GCC/IBT)
OSHA Grant # SH-18793-09-60-F11

Draft 1.3

July 2009

©2009 The Labor Institute

GCC/IBT/Labor Institute

Powered Industrial Truck (PIT) Health and Safety Awareness Training

Compiled by The Labor Institute and the
Graphic Communications Conference of International Brotherhood of Teamsters (GCC/IBT)

Draft 1.3

July 2009

©2009 The Labor Institute

Project Team

**Principal GCC-IBT Officers
in Charge:**

Robert Lacey, GCC/IBT International Vice President

Grant Director:

Joe Anderson, The Labor Institute

**Training and Curriculum
Director:**

Les Leopold, The Labor Institute

**Training and Curriculum
Associate Director:**

Paul Renner, The Labor Institute

**Curriculum Writer/
Training and Evaluation
Coordinator:**

Kathy Burris, The Labor Institute

Curriculum Development and Adaptation

**Coordination, Adaptation, Training
and Support Team (CATS):**

Gene Binda and Rob Theisen, of GCC/IBT;
Joe Anderson, Paul Renner and Kathy Burris
of The Labor Institute

Research Director:

David Dembo, Council on International and
Public Affairs

Chief Medical Advisor:

Dr. Steven Markowitz, Mt. Sinai School of Medicine

Desktop Publishing:

Jean Urano, The Labor Institute

This book is written and produced by The Labor Institute, a nonprofit organization (36 East 12th Street, Suite 702, New York, NY 10003, 917-606-0511), and the Graphic Communication Conference of the International Brotherhood of Teamsters (1900 L Street, NW, Washington, D.C. 20036-5007, 202-462-1400). The primary structure, writing, editing, layout and illustration are the responsibility of The Labor Institute staff, members of the USW-United Steelworkers, USW Local 4-149.

This material was produced under grant number SH-18793-09-60-F11 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products or organizations imply endorsement by the U.S. Government.

Table of Contents

Introduction	1
Activity 1: Hazards of Powered Industrial Trucks (PIT) (2 tasks)	7
Activity 2: Mapping Hazards at Work (2 tasks)	27
Activity 3: Systems of Safety (3 tasks)	43
Activity 4: Identifying Near-Misses (3 tasks)	63
Activity 5: Incident Investigation using the Logic Tree (2 tasks)	79
Activity 6: Lessons Learned (3 tasks)	101
Activity 7: The OSHA Standard, 1910.178 Powered Industrial Trucks (1 task)	121
Appendix A: Safety Inspection Form, PIT and Forklifts	A-1
Appendix B: Clarification regarding the policy for the use of seat belts on PIT in general industry	B-1
Appendix C: Interpretive Letter	C-1

Introduction

Why Is This Training Taking Place?

The Graphic Communications Conference of the International Brotherhood of Teamsters (GCC/IBT), in cooperation with The Labor Institute of New York, received a training grant from the U. S. Department of Labor's Occupational Safety and Health Administration (OSHA). OSHA announced a request for grant applications under its Susan Harwood Training Grant Program. GCC-IBT and The Labor Institute successfully applied for a grant to train workers and employers in Powered Industrial Truck safety in high hazard worksites as identified by OSHA and represented by the Graphic Communications Conference of International Brother of Teamsters. This grant was awarded in April 2009.

To accomplish these goals, GCC/IBT workers will be trained as trainers to train their peers, their managers and other workers in hazard awareness and prevention based on a Systems of Safety philosophy and perspective.

More about this Training

This workbook provides an overview of multiple ways to identify hazards and some ideas for actions to correct these identified hazards. The examples in this workbook are not comprehensive. Anyone interested in more comprehensive training in these hazard identification mechanisms should contact the GCC/IBT through Robert Theisen at ggai@ggai.com, or the Labor Institute's Project Director Joe Anderson at joelwest@aol.com.

This GCC/IBT/LI Powered Industrial Trucks training grant also provides PIT certification training for operators using a separate training workbook. For information on certification training contact the GCC/IBT through Rob Theisen at ggai@ggai.com or The Labor Institute through Joe Anderson at joeliwest@aol.com.

continued

More about this Training *(continued)*

The information contained in this workbook comes from many sources. Activity 5: Lessons Learned, is an idea, and in part or whole adapted from materials produced by The Labor Institute and the United Steelworkers International Union under grant number 46DO-HT11 Susan Harwood Training Grant Program.

Worker-Trainers

The Labor Institute has a long history of involvement with health and safety efforts and training. **It is our belief that our membership is really the best resource for making our facilities safe and for protecting the community from harm.**

Together with GCC/IBT we are putting that belief into practice. That is why the GCC/IBT/Labor Institute* program is committed to conducting the training by GCC/IBT rank-and-file worker-trainers. In addition, the training will be done using a non-lecture approach, called the Small Group Activity Method, through which workers truly participate in their own education.

The average time a task takes to be worked through is 20 to 35 minutes. Activities have at least one task, sometimes more. A normal training day is eight hours, which is about five Activities including breaks and lunch.

* The Labor Institute is a nonprofit educational group, located in New York City, that provides innovative worker-oriented educational programs to unions and community groups around the country. The staff of the The Labor Institute are dues-paying members of USW Local 4-149.

The Small Group Activity Method (SGAM)

The training activities in this workbook use the Small Group Activity Method.

Why a Non-Lecture Approach?

Worker-oriented educators have learned the hard way that working adults learn best in situations that maximize active participation and involvement. The trainer-centered, lecture-style teaching methods used in most programs actually hurt the learning process, promote passivity on the part of workers, de-value our knowledge and skills and make us feel inadequate. As we all know, too many lectures “go in one ear and out the other.”

The Small Group Activity Method puts the learner in the center of the workshop. Participants are put to work in the workshop solving real-life problems, building upon our own skills and experiences. Instead of learning by listening, as we are expected to do in a lecture-style course, we learn by doing.

Origins

The Small Group Activity Method is based on a training procedure developed by England's Trade Union Congress (TUC). (The TUC is the organizational equivalent of the AFL-CIO.) The TUC used this participatory, non-lecture method to train over 250,000 shop stewards on health and safety issues in the 1970s and early 1980s. The Labor Institute in New York, which had pioneered a similar method around economic issues for workers, further developed the procedure into the Small Group Activity Method.

Through the use of this non-lecture approach, The Labor Institute has succeeded in training workers to be trainers. Since 1980, The Labor Institute has shared this method with over 200 different unions and community groups in the United States and Canada.*

Basic Structure

The Small Group Activity Method is based on **Activities**. An Activity can take from 30 minutes to an hour. Each Activity has a common basic structure:

- **Small Group Tasks**
- **Report-Back**
- **Summary**

1. Small Group Tasks: The workshop always operates with people working in groups at tables. (Round tables are preferable.) Each Activity has a task, or set of tasks, for the groups to work on. The idea is to work together, not to compete. Very often there is no one right answer. The tasks require that the groups use their experience to tackle problems and make judgments on key issues. Part of the task often includes looking at factsheets and reading short handouts.

2. Report-Back: For each task, the group selects a **scribe** whose job it is to take notes on the small group discussion and report back to the workshop as a whole. (The report-back person was first called the “scribe” by an OCAW worker-trainer during a 1982 session with Merck stewards in New Jersey.) During the **report-back**, the scribe informs the entire workshop on how his or her group tackled the particular problem. The trainer records these reports on large pads of paper in front of the workshop so that all can refer to it. After the scribe’s report, the workshop is thrown open to general discussion about the problem at hand.

3. Summary: Before the discussion drifts too far and wide, the trainer needs to bring it all together during the **summary**. Here, the trainer highlights the key points, and brings up any problems and points that may have been overlooked in the report-back. Good summaries tend to be short and to the point.

continued

The Small Group Activity Method (SGAM)

Three Basic Learning Exchanges

The Small Group Activity Method is based on the idea that every workshop is a place where learning is shared. With SGAM, learning is not a one-way street which runs from trainer to worker. Nor is SGAM simply a bull-session where we all sit around and talk. Rather, SGAM is a structured procedure that allows us to share information. It is based on three learning exchanges:

- **Worker to Worker**
- **Worker to Trainer**
- **Trainer to Worker**

Worker to Worker: Most of us learn best from each other. We should never underestimate how much real education takes place worker to worker. SGAM is set up in such a way as to make this worker-to-worker learning exchange a key element of all of our workshops. We do this by first allowing people to learn from each other by solving problems in their small groups.

Worker to Trainer: Lecture-style training assumes that the trainer knows all the answers. SGAM believes that trainers also have a lot to learn. On many subjects, any group of workers will often have as much, or more, collective knowledge as any one expert or teacher. With SGAM the trick is to learn as much as possible from the workshop participants. This is done mainly during the report-backs. Because SGAM allows us to listen to those we are training, we get to learn more and more about the realities people face. Also, because our training method shows genuine respect for workers' knowledge, it helps build confidence among those we are training. Confidence is the key to adult learning.

Trainer to Worker: This is the traditional learning procedure of school. It also has its place in SGAM. It comes at the end. This is our chance to clear up confusion and make the points we think are key. By waiting until the summary section, we now know better what people need to know.

Activity 1: Hazards of Powered Industrial Trucks (PIT)

Purpose

To identify potential Powered Industrial Trucks (PIT) hazards at our workplaces.

This Activity has two tasks.

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Task 1

Pick a scribe at your tables to record your answers and report back to the larger group.

The chart below lists some common hazards associated with forklifts. There is a column of percentages randomly listed next to the hazards.

Based on your work experience, draw a line to connect the overall percentage of incidents to the appropriate incidents.

Overall percentage of PIT Incidents		Some Common Forklift or PIT Incidents and Accidents
14%		Pedestrians injured by PIT's
18%		Rollovers
3%		Load and falling debris
26%		Workers unaware of PIT danger are struck by PITs
14%		Lifting people
35%		Improper training

Task 2

Factsheet Reading Method for Task 2:

The Small Group Activity Method places workers at the center of the learning experience. It is designed to draw on two bodies of knowledge: 1) The knowledge and experiences workers bring into the room and 2) the factsheets contained in your workbooks.

The factsheet method, described below, builds upon your knowledge through the introduction of new ideas and concepts.

The process is as follows:

Each of you will be assigned a small number of factsheets to read. You will then share this new information with your table.

The idea is for each of you to take ownership and responsibility for the information contained in your factsheets and to describe it to the others in your group.

Factsheets will be assigned as follows:

Starting with the scribe and moving to the left, count out loud from 1 to 11. Keep going around the table until all numbers (factsheets) are distributed. For example, if there are four people at your table, the scribe will have self-assigned Factsheets 1, 5 and 9, the person to their left will be responsible for Factsheets 2, 6 and 10, etc. The numbers that you have assigned yourself correspond to Factsheets 1 through 11 on pages 11 through 22.

Once everyone has read their assigned factsheets, your scribe will go around the table and ask each of you to explain to the rest of your group what you have learned. No notes need be taken during this discussion. The factsheets should be explained in order as they were assigned (1 through 11), as many times factsheets build on previous factsheets. Once this process is complete, your trainer will read the scenario and the task. In this way we all start at the same place and with the same information.

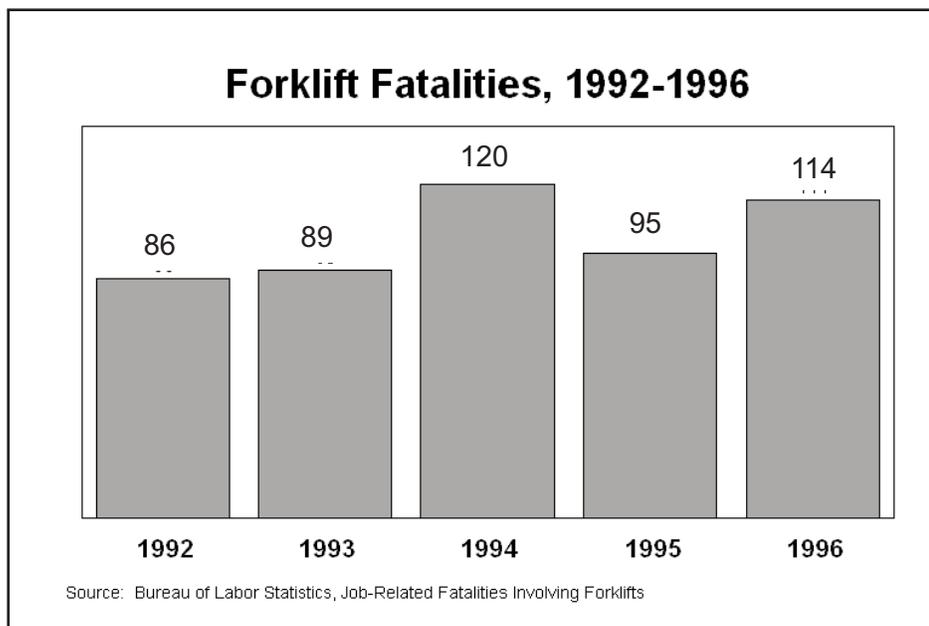
1. Being a Pedestrian Can Be Dangerous

- According to a detailed study of fork-lift incidents published in the *American Journal of Industrial Medicine*, “the most common incident involved pedestrians (35%) who were struck by a PIT, or the load being carried by a PIT, or a rack or bin that had been struck by a PIT.”
- A study of the U.S. auto industry reviewed 916 injuries from PIT incidents over a three-year period in a variety of automobile facilities including assembly, stamping, parts and warehouses. Remarkably, they found that more than a third of the incidents (322), involved pedestrians.

Source: *Injuries Related to Forklifts and Other Powered Industrial Trucks in Automobile Manufacturing* authored by James W. Collins, Gordon S. Smith, Susan P. Baker and Margaret Warner.

2. Forklift Accidents Are much too Common

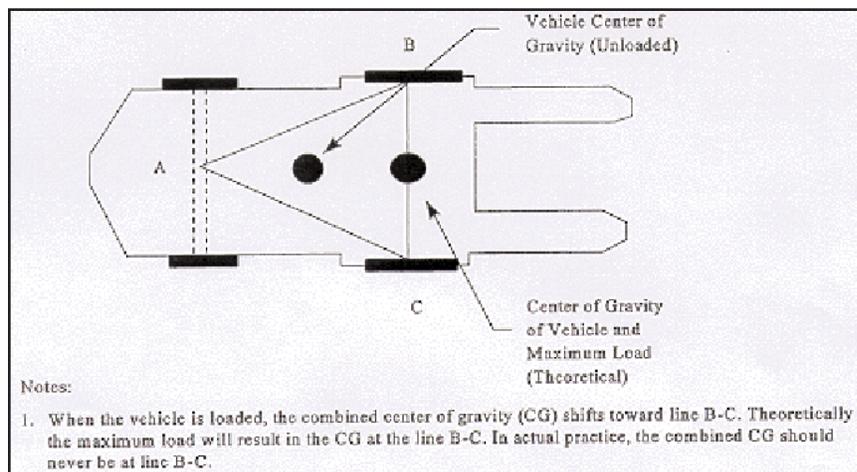
Powered industrial accidents cause approximately 100 fatalities and 36,340 serious injuries in general industry and construction.



Source: <http://www.osha.gov/dcsp/ote/trng-materials/pit/ppt/slide9.html>

3. The PIT Stability Triangle: Your Key to Safe Operations

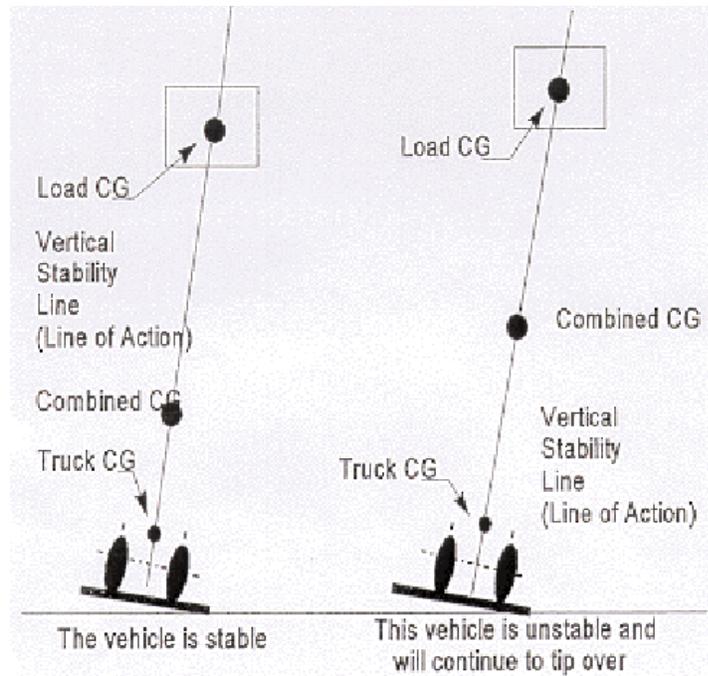
Most PITs have a three-point suspension system. The vehicle is supported at three points. This is true even if the vehicle has four wheels. The trucks steer axle is attached to the truck by a pivot pin in the axle's center. When the points are connected with imaginary lines, this three-point support forms a triangle called the stability triangle.



continued

3. The PIT Stability Triangle: Your Key to Safe Operations *(continued)*

When the vehicle's load center falls within the stability triangle, the vehicle is stable and will not tip over. When the line of action or the vehicle/load center combination falls outside the stability triangle, the vehicle is unstable and may tip over.



See Appendix A (page 142) for more detailed information.

Source: Powered industrial trucks. – 1910.178 App A.

4. Rollovers Dangers

A full 26% of forklift accidents are the result of a lift tipping over. Lifts should have a “roll over protection system” which will prevent the driver from being thrown and crushed in case the lift tips or falls over. Sometimes serious injury or death is incurred when a lift tips because the seats of the vehicle are poorly designed. The seats should be constructed with arm rests and shoulder extensions that prevent the operator from being ejected out of the seat or sliding sideways in when an accident occurs. There should also be “Grab Handles” in the operator’s compartment so that one can brace himself if the lift starts to tip. In some cases a poorly maintained forklift won't have seat belts.



It is a proper safety precaution to always wear seat belts when operating a PIT if they are installed equipment or when retrofitted by the manufacturer (See Appendix B for further clarification or http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=22315). If manufacturer retrofitting is made available for a PIT without a seatbelt and the employer fails to take advantage of this offer, this maybe an OSHA violation.

1910.178(q)(7): industrial trucks shall be examined before being placed in service, and shall not be placed in service if the examination shows any condition adversely affecting the safety of the vehicle. Such examination should be made at least daily.

Source: http://www.construction-injuries.com/pages/forklift_accidents.html.

5. Load and Falling Debris from PITs Cause Injuries

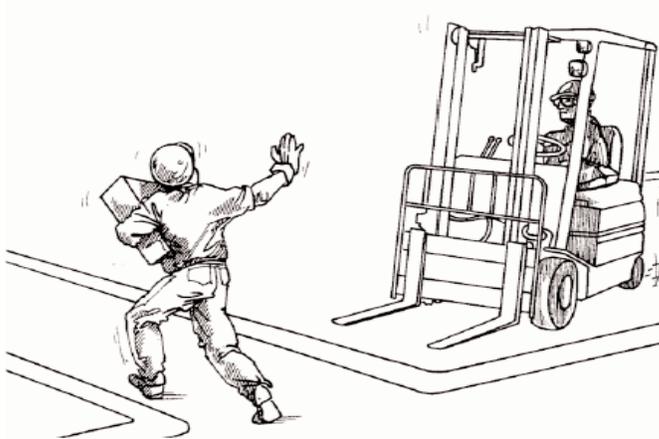
Fourteen percent of forklift accidents are the result of a load or other debris falling on a worker. The forklift should have a “All Falling Object Protection System” that completely protects the operator from falling objects. Sometimes these accidents happen because the fork does not have “back rest extensions” allowing the load to fall over the top of the extended mast. Forks should be equipped with “Back rest extensions.”



Source: http://www.construction-injuries.com/pages/forklift_accidents.html.

6. Pedestrians Beware: Maintenance, Inspection and Warning Devices are Critical

Eighteen percent of forklift accidents occur when a walking employee or other pedestrians are struck by a lift, often because they are busy with other tasks and not fully aware of a lift operating nearby. The best pedestrian designated walkways are those that have strong physical barriers between the walkway and the forklift right of way. Lifts should be equipped with automatic signal alarms that sound during operation so that those nearby are aware of its location. Often this type of accident occurs because a poorly maintained lift does not have very basic safety features such as rear view mirrors.



It is also the responsibility of the employer to set up an inspection and maintenance program. In every workplace that uses lifts there should be a set of operation rules posted in plain view. Maintenance and inspection should be done on a regular basis to prevent problems. There are hazards associated with lack of

maintenance and inspection such as potential equipment malfunction that could cause dangers to the operators and those in the area. Warning devices on a lift fail if they are not inspected and maintained. Improperly maintained PIT internal combustion engines cause significant air quality issues, and there are hazards inherent to maintaining large heavy PIT machines including toxic solvents used internally with PITs as well as for maintenance.

Source: http://www.construction-injuries.com/pages/forklift_accidents.html.

7. Don't Lift People

Fourteen percent of forklift accidents occur because the lift is inappropriately used to elevate workers.



Interpretations of the construction PIT standards and other OSHA interpretations provide specific language for the lifting personnel provided the equipment specifically allows for the use of a platform designed for this purpose. If the allowable proper equipment is properly installed and operated lifting personnel with a PIT is allowed. See Appendix C for the interpretive letter.

We suggest using equipment that is specifically designed for lifting personnel and provides control of the lift to the person or persons being lifted.

Source: http://www.construction-injuries.com/pages/forklift_accidents.html.

8. It is Dangerous to Operate PITs if not Properly Trained

Three percent of forklift accidents occur because the operator lost control of the vehicle. Sometimes these accidents occur because employees are asked to operate when they have not been properly trained. OSHA has a standard training and evaluation program that all forklift operators must complete before they are can operate. If an operator has not been adequately trained and evaluated according to these guidelines, the employer can be found negligent. It is the employer's responsibility to notify untrained and unlicensed employees that forklifts are off limits.

Source: http://www.construction-injuries.com/pages/forklift_accidents.html.

9. PITs Accidents and Unexpected Hazards

Accidents happen and in the case of forklifts and PITs the result of these accidents can have some unforeseen hazardous consequences.

- Forklifts can pierce drums containing hazardous solvents chemicals causing a toxic release or a flammable hazard.
- Small nicks or holes in liquid containers placed in the way of PIT's can be made to leak by contact and cause slipping hazards.
- Strong acids (such as sulfuric acid) are used in batteries. Make sure you are properly protected if you are required to work with acids. To prevent injury:
 - Wear protective clothing such as rubber boots, a rubber apron, chemical goggles, face shields, and rubber gloves to guard against chemical splashes and burns. Know where the closest available eye wash stations are located.
 - When charging batteries, acid should be poured into water; water should not be poured into acid. (This may result in an explosion.)
- PITs should only be used in hazardous atmospheres where they are designed and approved for use. Reference the standard in the Appendix, 1910.178(c)(2)(iv) Table N1, page 127 for appropriately designed PITs for specific hazardous conditions.

Source: http://www.nycosh.org/workplace_hazards/Forklift%20Fact%20Sheet.html.

10. Maintenance and Operation of Propane Trucks

Extra precautions need to be taken with trucks powered by propane or liquefied petroleum gas (all of which are discussed in the regulation):

Always check for gas leaks. Never start the motor if there is a leak.

Don't store the truck near intense heat or explosive materials.

If the truck is to be left standing for any length of time, shut off the hand valve and let the fuel system run dry.

Source: http://www.nycosh.org/workplace_hazards/Forklift%20Fact%20Sheet.html.

11. Tips for Forklift Operators

- In stockrooms, double-acting doors should have windows installed to minimize the possibility of employees being struck by a powered industrial truck, particularly forklifts. **Signal horn before entering doorway.**
- Whether loaded or empty, carry forks and platforms on lift trucks as low as possible. This reduces the possibility of overturning the truck or dumping the load.
- Loads should not be raised or lowered during travel. Internal combustion-powered trucks should never be used in small buildings or areas where there is inadequate ventilation.
- Wheels, high-lift platform rollers, chain sprockets and other moving parts should be guarded if they can potentially injure the operator or others.

Source: http://www.nycosh.org/workplace_hazards/Forklift%20Fact%20Sheet.html.

Task 2 (continued)

Purpose restated: To identify potential Powered Industrial Trucks (PIT) hazards at our workplaces.

- 1. Reviewing your answers to Task 1 are there any percentages you want to change? Were you surprised by that?**

Be prepared to report your answers to the large group.

- 2. What is the most common forklift or PIT accident in your workplace? Make a list and report back to the group**

Summary: Hazards of Powered Industrial Trucks (PIT)

1. PITs are necessary for our work at most workplaces.
2. Identifying hazards created by the use of PITs is the first step to preventing workplace accidents and injuries.
3. Powered industrial truck accidents cause approximately 100 fatalities and 36,340 serious injuries in general industry and construction annually.
4. PIT hazards affect more than just the operator:
 - Pedestrians are in danger;
 - There are other PIT hazards such as air quality, slipping hazards, falling loads; and
 - Maintenance and inspection can be hazardous work.

EVALUATION**Activity 1: Hazards of Powered Industrial Trucks (PIT)**

1. How important is this Activity for workers? Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Which factsheets are the most important to distribute to the workers? (Please list the page numbers.)
3. What would you suggest be done to improve this Activity?

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Activity 2: Mapping Hazards at Work

Purpose

To learn how to develop a Hazard Map that workers can use to identify and locate hazards so that those hazards can be targeted for elimination.

This Activity has two tasks.

Task 1

Factsheet Reading Method for Task 1:

The Small Group Activity Method places workers at the center of the learning experience. It is designed to draw on two bodies of knowledge: 1) The knowledge and experiences workers bring into the room and 2) the factsheets contained in your workbooks.

The factsheet method, described below, builds upon this knowledge through the introduction of new ideas and concepts.

The process is as follows:

Each of you will be assigned a small number of factsheets to read. You will then share this new information with your table.

The idea is for each of you to take ownership and responsibility for the information contained in your factsheets and to describe it to the others in your group.

Factsheets will be assigned as follows:

Starting with the scribe and moving to the left, count out loud from 1 to 6. Keep going around the table until all numbers (factsheets) are distributed. For example, if there are four people at your table, the scribe will have self-assigned Factsheets 1 and 5, the person to their left will be responsible for Factsheets 2 and 6, etc. The numbers that you have assigned yourself correspond to Factsheets 1 through 6 on pages 29 through 35.

Once everyone has read their assigned factsheets, your scribe will go around the table and ask each of you to explain to the rest of your group what you have learned. No notes need be taken during this discussion. The factsheets should be explained in order as they were assigned (1 through 6), as many times factsheets build on previous factsheets. Once this process is complete, your trainer will read the scenario and the task. In this way we all start at the same place and with the same information.

1. Using Hazard Mapping to Identify Possible Risks

A Hazard Map is a visual representation of the workplace where there are hazards that could cause injuries or illness.

The Hazard Mapping method draws on what workers know from on-the-job experience. The Hazard Mapping approach is best when conducted with a small group of workers with some similarity in their work. For example, a group of workers who do work in the same type of workplace or a group of maintenance workers who all worked in several buildings but do the same kind of work.

2. Using Hazard Mapping to Identify Area-Wide Hazards or Hazards in Specific Areas of Work

The Hazard Mapping process can be used to identify risks at a large workplace and to specify hazards associated with an **AREA, BUILDING, JOB CLASSIFICATION** or **PROCESS**.

After completing the large workplace map, it may be obvious that a more detailed map of certain areas or buildings would be helpful in “narrowing down” the processes, areas or jobs that have more dangerous hazards or where worker exposures to hazards are greatest.

For example hazard maps might target:

- Physical Hazards;
- Frequency of Exposure;
- Level of Exposure;
- A Specific Chemical or Agent; or
- Workers or Job Titles Most Likely to Be Exposed.

3. Why Hazard Map?

Hazard Mapping is only one method for identifying occupational safety and health hazards. If your workplace has other systems for identifying hazards, those results can be included on your Hazard Map.

The point of Hazard Mapping is to pool the knowledge about hazards from all of your coworkers so that you can organize to eliminate the hazards.



HM activism 12-03

4. Hazard Mapping Labels

HAZARD CODE KEY		
	Blue	Electrical Hazard
	Green	Chemical Hazard
	Orange	Physical Hazard
	Brown	Flammable/Explosive Hazard
	Black	Other Hazards (specify)

Level of Hazard Key	
1	Low Hazard
2	Medium Hazard
3	High Hazard
4	Very High Hazard

Definitions of the four levels of hazards would vary from industry to industry and from site to site. Each workplace should develop their own definitions if desired.

5. Examples of Hazard Mapping Labels

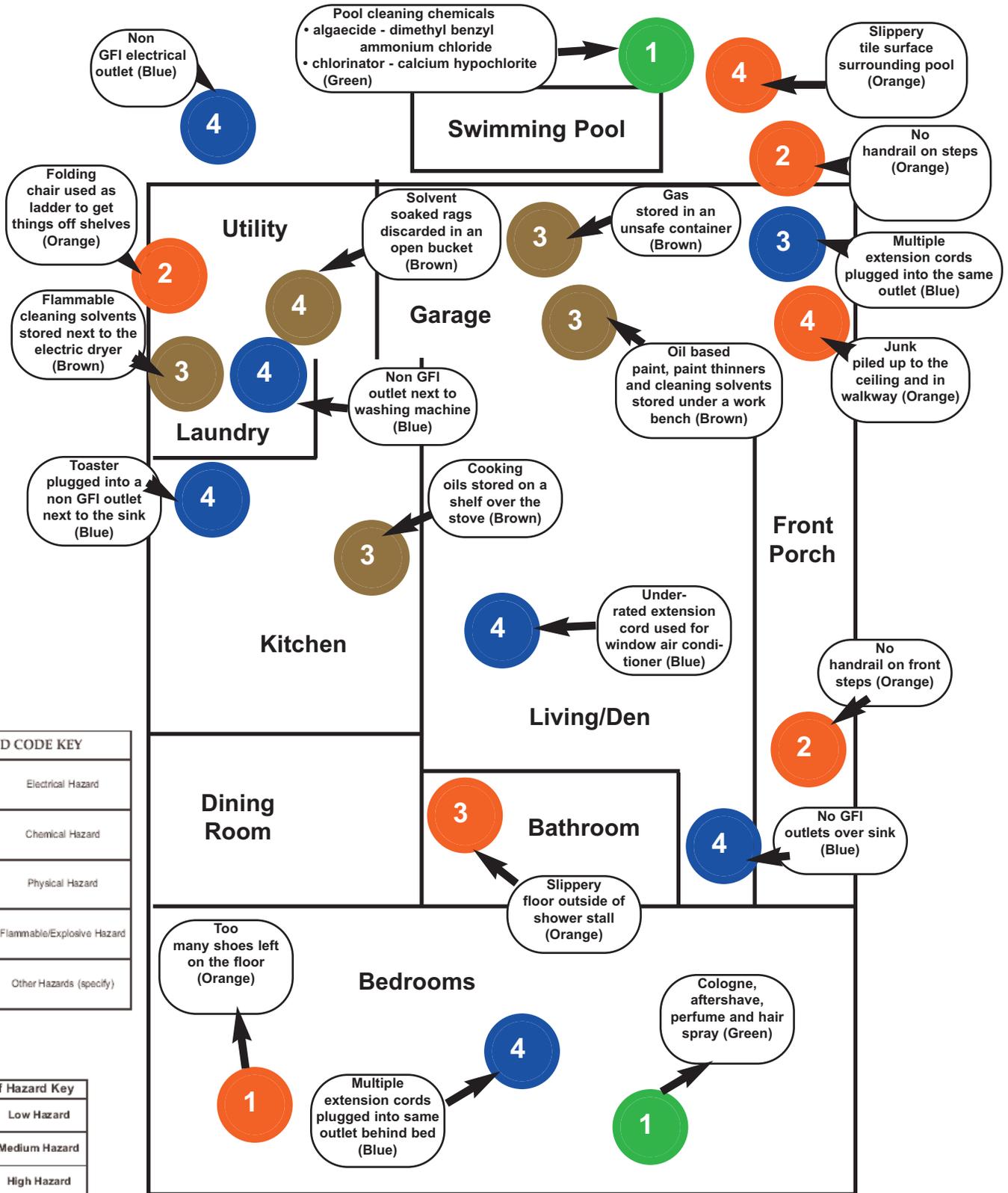
EXAMPLES: HAZARD CODES AND LEVELS OF HAZARD	
	A number "2" inside a Blue Circle indicates "Class 2, Medium Hazard, Electrical."
	A number "3" inside a Green Circle indicates "Class 3, High Hazard, Chemical."
	A number "4" inside an Orange Circle indicates "Class 4, Very High Hazard, Physical."
	A number "1" inside a Brown Circle indicates "Class 1, Low Hazard, Flammable/Explosive."
	A number "2" inside a Black Circle indicates "Class 2, Medium Hazard, Other Hazard."

6. Example of a Hazard Map

On the next page is an example of a hazard map. These are included to:

- Show how a home would appear when you identify present hazards and assign them a level of severity (page 35);
- Allow workers to begin to view their workplace with hazards in mind; and
- Begin to think about how to create a hazard map of an area in your workplace.

6a. Home Diagram (Entire House)



HAZARD CODE KEY	
●	Electrical Hazard
●	Chemical Hazard
●	Physical Hazard
●	Flammable/Explosive Hazard
●	Other Hazards (specify)

Level of Hazard Key	
1	Low Hazard
2	Medium Hazard
3	High Hazard
4	Very High Hazard

Task 1 *(continued)*

Purpose Restated: To identify potential Powered Industrial Trucks (PIT) hazards at our workplaces.

Task

Using the list that you and others developed in Task 2 which is listed at the front of the room and your experiences, pick a workplace or a work area represented by someone at your table and draw a hazard map of PIT hazards.

Begin by following the steps on the next page.

Step 1:

Make a drawing on the sheet of paper provided that shows a rough picture of the scene. Write large and use the entire sheet of paper for your drawing. Label specific danger areas and equipment.

Step 2:

Mark the hazards with a color-coded circle on the map to show **WHAT** and **WHERE** the hazards are. Use colored dots, pencils or markers, whichever is provided. *(Refer to the codes on Factsheet 4.)*

Step 3:

Label each hazard with a number (1 to 4) to show the LEVEL OF THE HAZARD that is present. *(Refer to the codes on Factsheet 4.)*

Step 4:

Label each hazard with a NAME OR BRIEF DESCRIPTION OF THE HAZARD. *(See an example on the sample map in Factsheet 6a.)*

To best develop your Hazard map, you should proceed one step at a time (Steps 1-4). When you have finished your Hazard Map, you should place it on the wall and during report back your scribe will explain the map.

Task 2

This Hazard Mapping Project was designed for workers to use to eliminate hazards in their workplace. Four important elements of the project are listed below.

1. Circulate the map so that all in the area can add to the map;
2. Make your recommendations to fix the hazards identified;
3. Present your Hazard Map to your employer; and
4. Follow up to make sure fixes are made.

Each of the above elements will probably require several steps by workers at your workplace in order for each element to be successful.

To kick-start this Hazard Mapping Project, complete the questions on the next page and use it as a guide.

During report-back your facilitator will put one element per flipchart (four flipcharts) and will list the steps your group determines will be needed for each element.

1. Who will circulate the map so that all in the area can add to the map? What steps need to be done to circulate the map and who is responsible for each step?

Who:

Steps Taken:

Responsible for steps taken:

2. Who will make your recommendations to fix the hazards identified? What steps need to be done to make your recommendations to fix the hazards and who is responsible for each step?

Who:

Steps Taken:

Responsible for steps taken:

3. Who will present your Hazard Map to your employer? What steps need to be done to present your hazard map to your employer and who is responsible for each step?

Who:

Steps Taken:

Responsible for steps taken:

4. Who will follow up to make sure fixes are made? What steps need to be done to follow-up to make sure fixes are made and who is responsible for each step?

Who:

Steps Taken:

Responsible for steps taken:

Summary: Mapping Hazards at Work

1. In creating a Hazard Map we are making a visual representation of workplace hazards that could lead to injury, illness or even death.
2. We can use Hazard Mapping to identify workplace hazards in order to eliminate them.
3. In Hazard mapping workers make valuable contributions to health and safety based on their collective skills, experience and know-how.
4. Using the hazard map in conjunction with a plan involves more workers and advises us of the actions we need to take to eliminate PIT hazards at work.

EVALUATION**Activity 2: Mapping Hazards at Work**

1. How important is this Activity for workers? Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

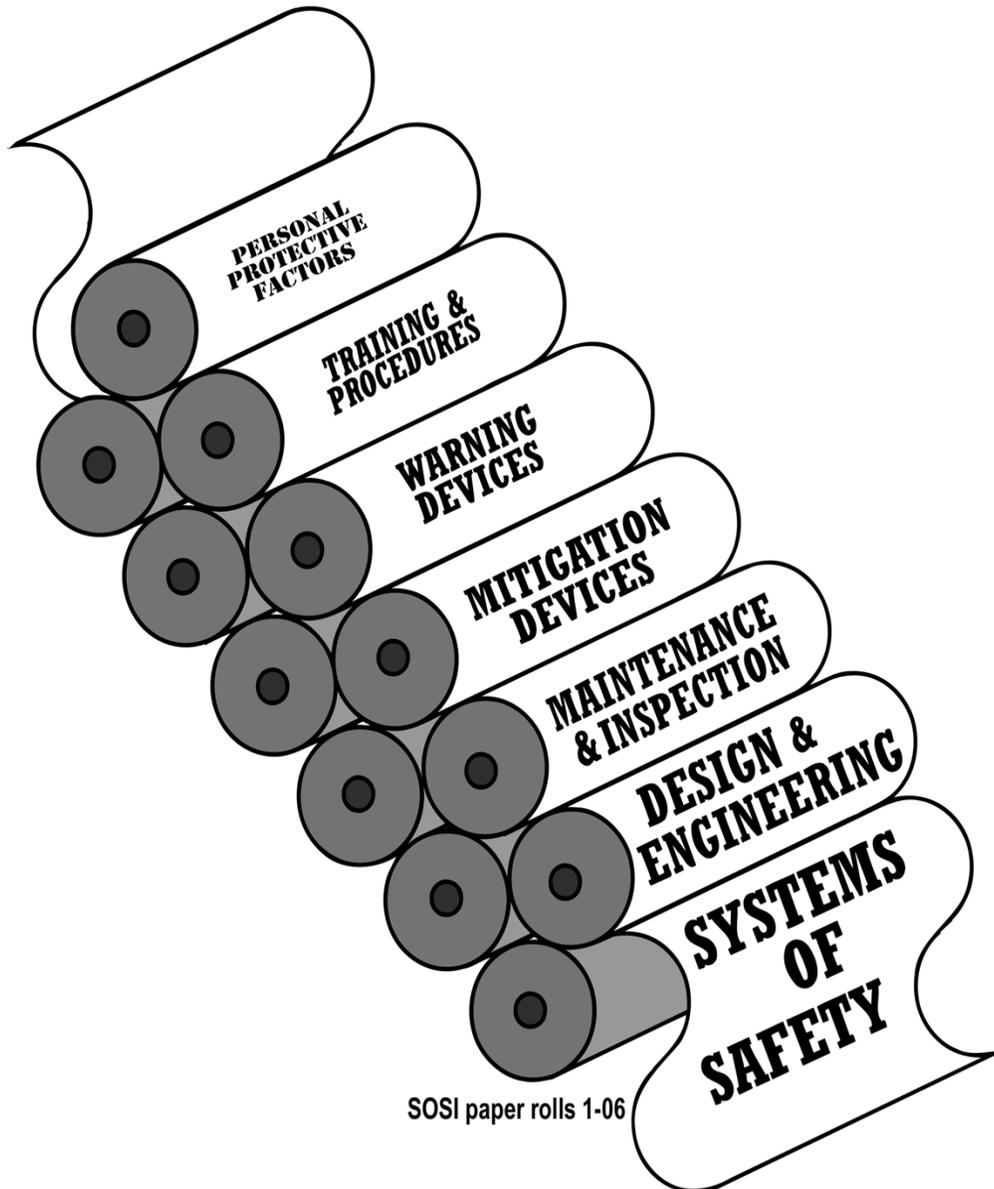
2. Which factsheets are the most important to distribute to the workers? (Please list the page numbers.)
3. What would you suggest be done to improve this Activity?

Activity 3: Systems of Safety

Purpose

To introduce the concept of Systems of Safety and accident prevention.

This Activity has three tasks.



Task 1

Factsheet Reading Method for Task 1:

The Small Group Activity Method places workers at the center of the learning experience. It is designed to draw on two bodies of knowledge: 1) The knowledge and experiences workers bring into the room and 2) the factsheets contained in your workbooks.

The factsheet method, described below, builds upon this knowledge through the introduction of new ideas and concepts.

The process is as follows:

Each of you will be assigned a small number of factsheets to read. You will then share this new information with your table.

The idea is for each of you to take ownership and responsibility for the information contained in your factsheets and to describe it to the others in your group.

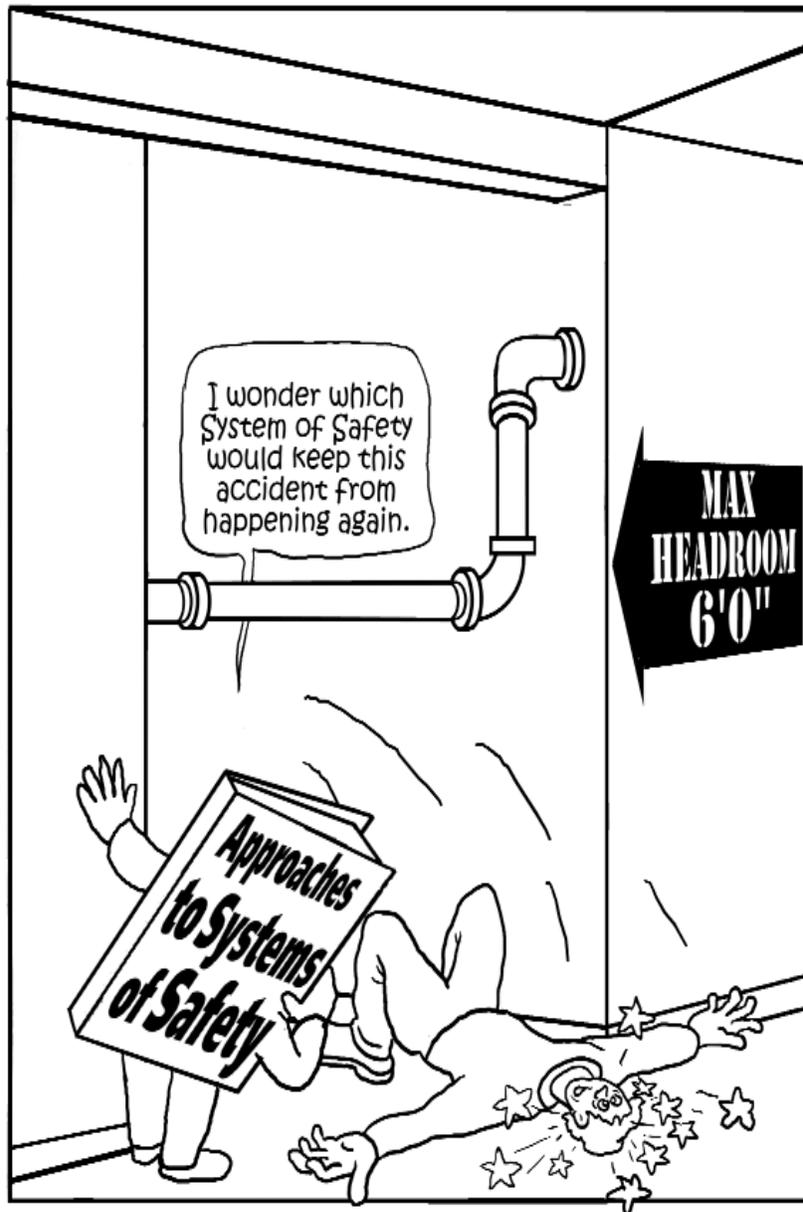
Factsheets will be assigned as follows:

Starting with the scribe and moving to the left, count out loud from 1 to 8. Keep going around the table until all numbers (factsheets) are distributed. For example, if there are four people at your table, the scribe will have self-assigned Factsheets 1 and 5, the person to their left will be responsible for Factsheets 2 and 6, etc. The numbers that you have assigned yourself correspond to Factsheets 1 through 8 on pages 45 through 52.

Once everyone has read their assigned factsheets, your scribe will go around the table and ask each of you to explain to the rest of your group what you have learned. No notes need be taken during this discussion. The factsheets should be explained in order as they were assigned (1 through 8), as many times factsheets build on previous factsheets. Once this process is complete, your trainer will read the scenario and the task. In this way we all start at the same place and with the same information.

1. What Are Systems of Safety?

Systems of Safety are proactive systems that actively seek to identify, control and/or eliminate workplace hazards.



Let's look at an incident where a worker bumped his head on a low pipe. How could this hazard be addressed by each of our Systems of Safety? (See the next six Factsheets.)

2. The Personal Protective Factors System

1. Personal Decision-making and Actions

- Look and think critically at the workplace;
- Work collectively to identify hazards; and
- Contribute ideas, experience and know-how that will lead to correcting the systems flaws.

2. Personal Protective Equipment (PPE) and Devices

- Wear PPE as necessary and required when higher levels of protection are not feasible.

3. Stop Work Authority

- Authority is given to all individuals, and they are encouraged, to stop work, equipment or processes due to unsafe conditions until a thorough Hazard Analysis can be performed.



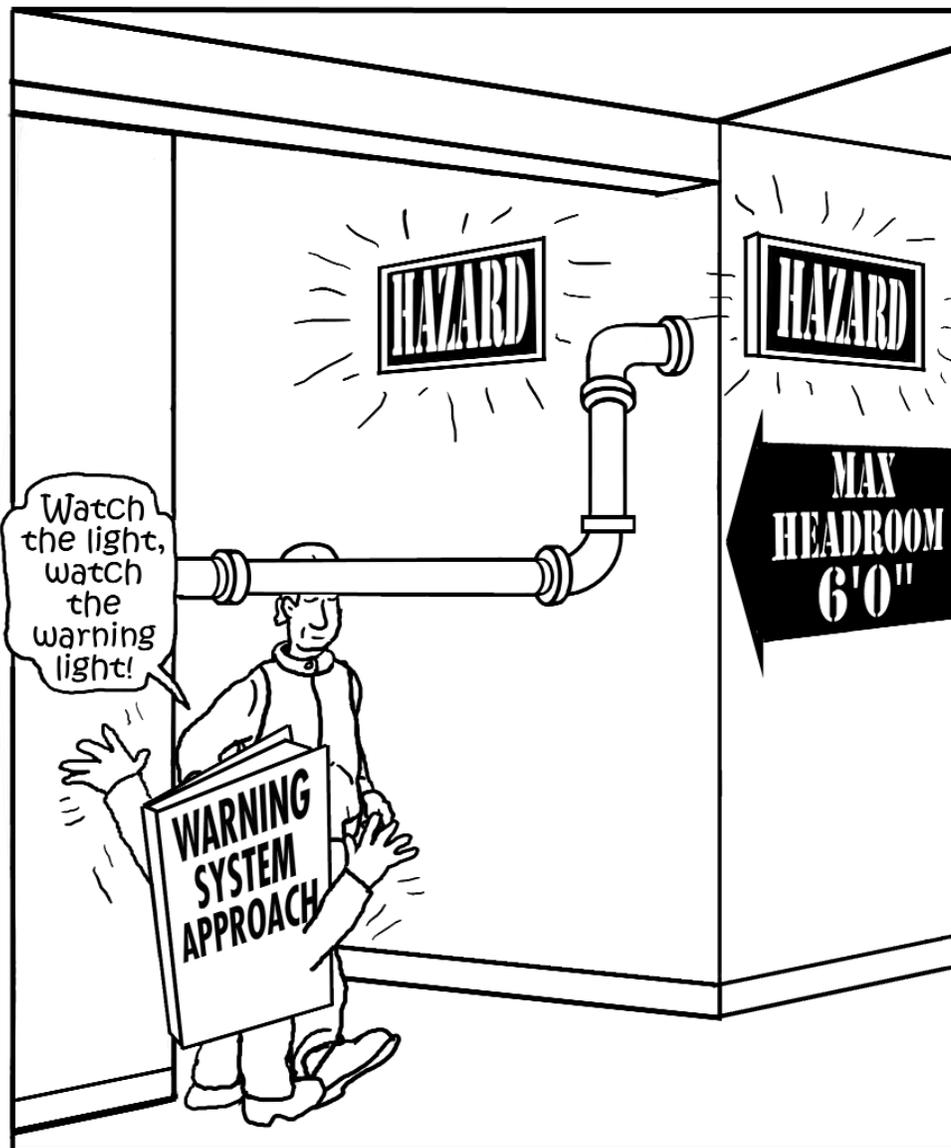
3. The Procedures and Training System

The operation and maintenance of processes that are dangerous require a system of written procedures and training. The greater the hazard, the greater is the need for Procedures and Training.



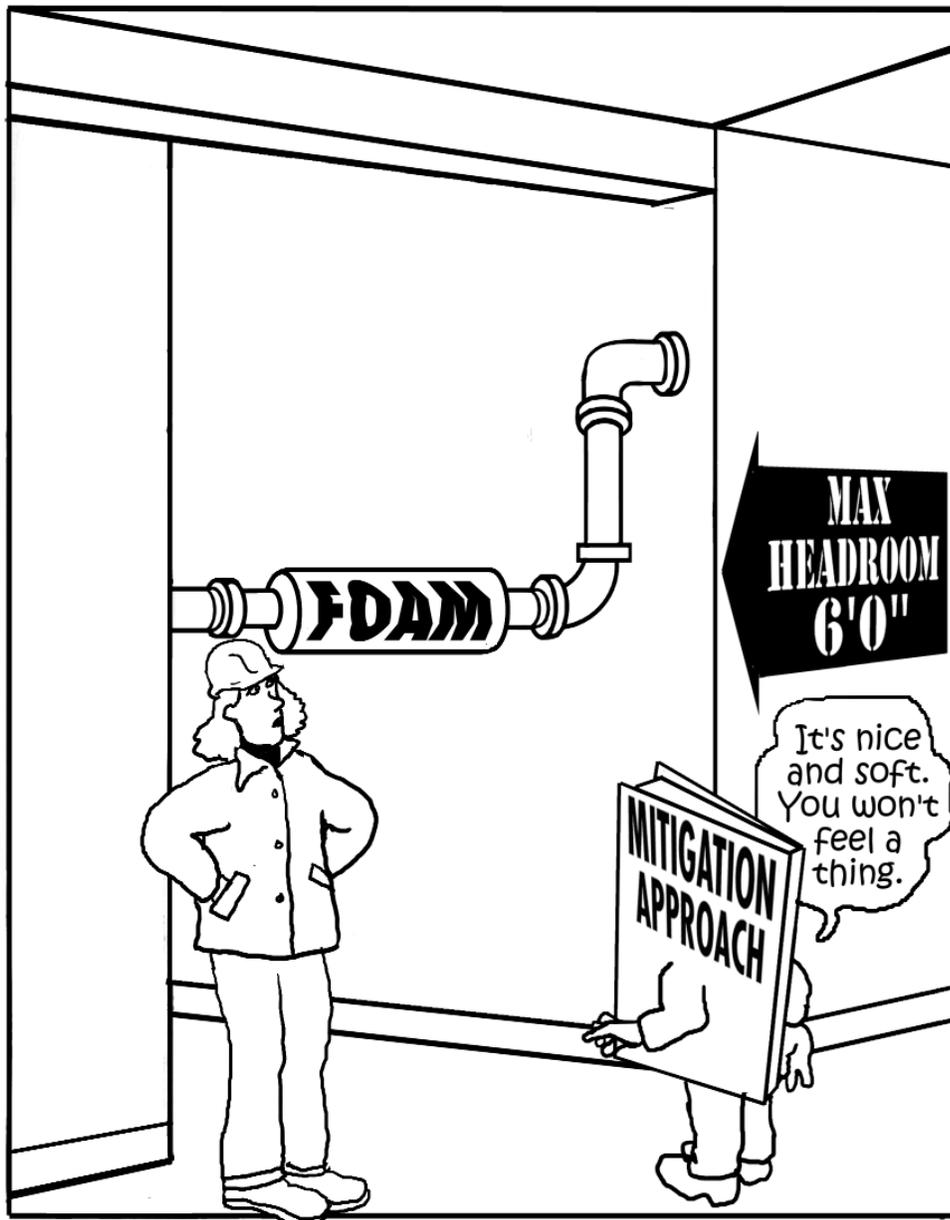
4. The Warning System

The Warning System of Safety includes the use of devices that warn of a dangerous or potentially dangerous situation. These devices require a person's intervention to control or mitigate the hazardous situation.



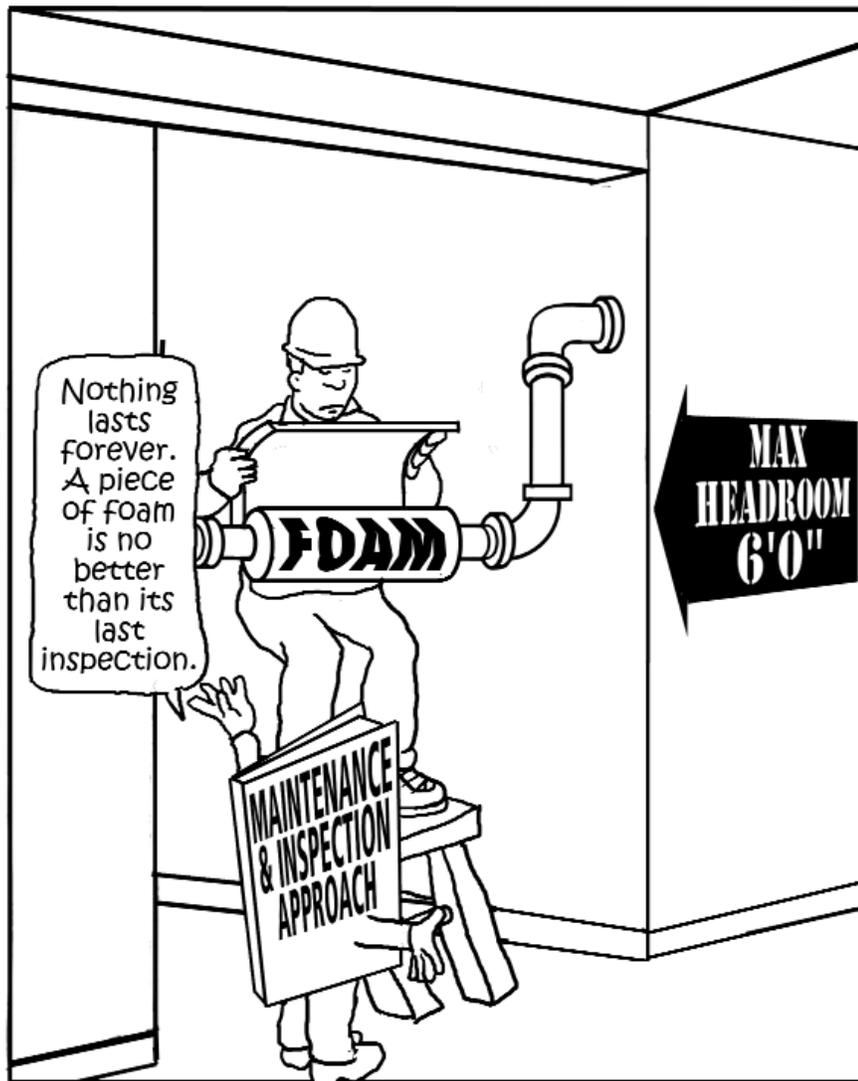
5. The Mitigation System

The Mitigation System of Safety involves the use of equipment that automatically acts to control or reduce the harmful consequences of hazardous incidents. Mitigation should be automatic and reliable.



6. The Maintenance and Inspection System

Properly designed equipment can turn into unsafe junk if it isn't properly maintained, inspected, and repaired. If the phrase "if it ain't broke, don't fix it" is used within a plant, the Maintenance and Inspection System is a failure. If you don't use preventive maintenance, then you end up doing breakdown maintenance.



7. Design and Engineering System of Safety

A central purpose of the Design System of Safety is to eliminate hazards through the selection of safe or low-risk processes and chemicals whenever possible.

One example of good design safety is the substitution of a less hazardous chemical such as sodium hypo-chlorite (bleach), for chlorine in treating cooling water. A release of toxic chlorine gas can travel in the wind for miles, whereas a spill of bleach is inherently less dangerous.



8. Systems and Sub-Systems (Examples)

Major Safety System	Design and Engineering	Maintenance and Inspection	Mitigation Devices	Warning Devices	Training and Procedures	Personal Protective Factors
Level of Prevention	Highest—the first line of defense	Middle—the second line of defense			Lowest—the last line of defense	
Effectiveness	Most Effective					Least Effective
Goal	To eliminate hazards	To further minimize and control hazards				To protect when higher level systems fail
EXAMPLES OF SAFETY SUB-SYSTEMS**	Technical	Preventive Maintenance	Enclosures, Barriers Dikes and Containment	Monitors	Operating Manuals and Procedures	Personal Decision-making and Actions HF
	Design and Engineering of Equipment, Processes and Software	Inspection and Testing	Relief and Check Valves	Process Alarms	Process Safety Information	Personal Protective Equipment and Devices HF
	Management of Change (MOC)**	Maintenance	Shutdown and Isolation Devices	Facility Alarms	Process, Job and Other Types of Hazard Assessment and Analysis	Stop Work Authority
	Chemical Selection and Substitution	Quality Control	Fire and Chemical Suppression Devices	Community Alarms	Permit Programs	
	Safe Siting	Turnarounds and Overhauls	Machine Guarding	Emergency Notification Systems	Emergency Preparedness and Response Training	
	Work Environment HF	Mechanical Integrity			Refresher Training	
	Organizational (must address a root cause)				Information Resources	
	Staffing HF				Communications	
	Skills and Qualifications HF				Investigations and Lessons Learned	
	Management of Personnel Change (MOPC)				Maintenance Procedures	
Work Organization and Scheduling HF				Pre-Startup Safety Review		
Workload						
Allocation of Resources						
Buddy System						
Codes, Standards, and Policies**						

HF - Indicates that this subsystem is often included in a category called **Human Factors**.
 * There may be additional subsystems that are not included in this chart. Also, in the workplace many subsystems are interrelated. It may not always be clear that an issue belongs to one subsystem rather than another.
 ** The Codes, Standards and Policies and Management of Change subsystems listed here are related to Design and Engineering. These subsystems may also be relevant to other systems; for example, Mitigation Devices. When these subsystems relate to systems other than Design and Engineering, they should be considered as part of those other systems, not Design and Engineering.

Revised October 2006

Task 1 *(continued)*

Purpose Restated: To introduce the concept of Systems of Safety and accident prevention.

Task:

Please begin by reading the following scenario:

At XYZ plant, forklift operators use the aisle between the finishing department and number one Machine Room as they collect drums for proper disposal. Employees also use the same aisle to access their work area.

This incident occurred five minutes prior to the start of first shift. Mary, an operator, was walking from the women's locker room in the finishing department to her work station. She was at the rear of a group of 10 employees going to their work stations. A third shift forklift operator was delivering an empty drum to the site. This was his last assignment before the end of his shift. After he had made his delivery he stopped to talk with the third shift machine foreman. Mary saw the forklift operator stop to talk with the foreman and assumed that the operator saw her so she proceeded to walk behind the forklift.

The forklift operator finished talking with the foreman and looked behind him. He saw the large group of people who had walked past him, but he didn't see anyone behind him. He put the forklift in reverse and backed up. He had gone about a foot when he heard screaming. That is when he realized that someone was behind him. He stopped and pulled the forklift forward and parked it.

Mary sustained major trauma. The forklift operator said that he looked but didn't see anyone behind him. His ability to see directly behind the forklift was hampered by the placement of the propane fuel tank and the design of the roll cage. He had completed his last assignment and was going to drop his forklift off at the rear of the plant.

continued

Task 1 (continued)

The injured employee said that she had always taken the same route to her work station. She walked behind the same forklift operator on numerous occasions and that he had always seen her before.

Listed below are summaries of the root causes from the accident in the previous scenario in the left column. In the right column are Systems of Safety that could contain these root causes. Using Systems of Safety Factsheets 1 through 8, chose which Systems of Safety contains the root causes listed below. Your group should choose one System of Safety (SOS) for each root cause. You should circle the selected SOS to indicate your group's answer.

Root Causes	Systems of Safety
A. Forklift designed with driver's visibility obstructed.	1. Personal Protective Factors 2. Design and Engineering
B. No communication occurred between driver and pedestrian.	1. Training and Procedures 2. Warning Devices
C. There was no warning that the forklift was going to back up.	1. Warning Devices 2. Design and Engineering
D. Aisles are commonly used for both forklift and pedestrian traffic.	1. Design and Engineering 2. Personal Protective Factors

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Task 2

Purpose Restated: To introduce the concept of Systems of Safety and accident prevention.

Using Factsheets 1 through 8 on pages 45 through 52, discuss the following questions with members of your group. Select a scribe to report your answers back to the class.

1. Below are the fixes in the left column. Please pick the Systems of Safety targeted by the fix from the right column.

Fixes	SOS Targeted (one for each action)
1. Install backup alarm on all forklifts.	A. Warning Devices B. Mitigation Devices
2. Designate aisle between finishing room and number one machine room for forklift traffic only.	A. Design and Engineering B. Training and Procedures
3. Contact forklift manufacturer to redesign propane tank and roll cage to increase visibility in the rear.	A. Design and Engineering B. Training and Procedures
4. Eliminate forklift use for last 20 and first 20 minutes of shift.	A. Mitigation Devices B. Training and Procedures
5. Include in training the importance of communications between a forklift driver and pedestrians.	A. Warning Devices B. Training and Procedures
6. Install convex mirrors on forklift to make full rear area visible to driver.	A. Mitigation Devices B. Warning Devices
7. Change procedure for forklift operation to include sounding horn before beginning to back up.	A. Training and Procedures B. Personal Protective Devices
8. Install automated material handling system to eliminate need for forklift as much as possible.	A. Mitigation Devices B. Design and Engineering

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Task 3

Purpose Restated: To introduce the concept of Systems of Safety and accident prevention.

The real test of a system “fix” is determined by whether the root causes are corrected.

In your group review the fixes listed below:

1. **Install backup alarm on all forklifts.**
2. **Designate aisle between finishing room and number one machine room for forklift traffic only.**
3. **Contact forklift manufacturer to redesign propane tank and roll cage to increase driver’s visibility in rear.**
4. **Eliminate scheduled forklift use the last 20 minutes of shift and the first 20 minutes of the shift.**
5. **Include section in forklift training and in general plant safety training on importance of communications between a forklift driver and pedestrians.**
6. **Install convex mirrors on forklift to make full rear area visible to driver.**
7. **Change procedure for forklift operation to include sounding horn before beginning to back up.**
8. **Install automated material handling system to eliminate need for forklift as much as possible.**

In the first column in the chart on the next page are the root causes, A through D, from Task 1.

If the **root cause** would be adequately corrected by one or more of the fixes listed above (1 through 8), then answer “yes” in the second column and list the number or numbers of the fixes that would have accomplished this in the third column. You may list more than one fix per root cause.

If the **root cause** would not be adequately corrected, then answer “no” in the second column and make recommendations that would completely correct the root cause. These recommendations should be recorded on the chart below.

Root Causes	Adequately Fixed (Yes/No)	Recommendations
A. The forklift was designed with visibility obstructed.		
B. There was no communication between driver and pedestrian.		
C. There was no warning that the forklift was backing up.		
D. The aisles were commonly used for both forklift and pedestrian traffic.		

1. In your group’s opinion, would any of the proposed fixes completely eliminate the hazard.

a) If yes, what was the fix?

b) If no, what would your recommendation(s) be?

Summary: Systems of Safety

1. Proactive Systems of Safety are the key to preventing disasters and injuries.
2. Major Systems of Safety include:
 - Design and Engineering;
 - Maintenance and Inspection;
 - Mitigation Devices;
 - Warning Devices;
 - Procedures and Training; and
 - Personal Protective Factors.
3. The Design and Engineering System can provide primary prevention by eliminating the possibility of a serious accident. The other Systems of Safety provide secondary prevention by reducing the probability or severity of an accident.
4. Each plant may have different structures and names for its Systems of Safety, but all plants have Systems of Safety.
5. Active worker, union and community involvement in Systems of Safety are essential for these systems to be effective.

EVALUATION**Activity 3: Systems of Safety**

1. How important is this Activity for workers? Please circle one number.

Activity Is Not Important		Activity Is Very Important		
1	2	3	4	5

2. Which factsheets are the most important to distribute to the workers? (Please list the page numbers.)

3. What would you suggest be done to improve this Activity?

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Activity 4: Identifying Near-misses

Purpose

To understand how a near-miss is a series of events that stops short of an incident.

This Activity has three tasks.

Task 1

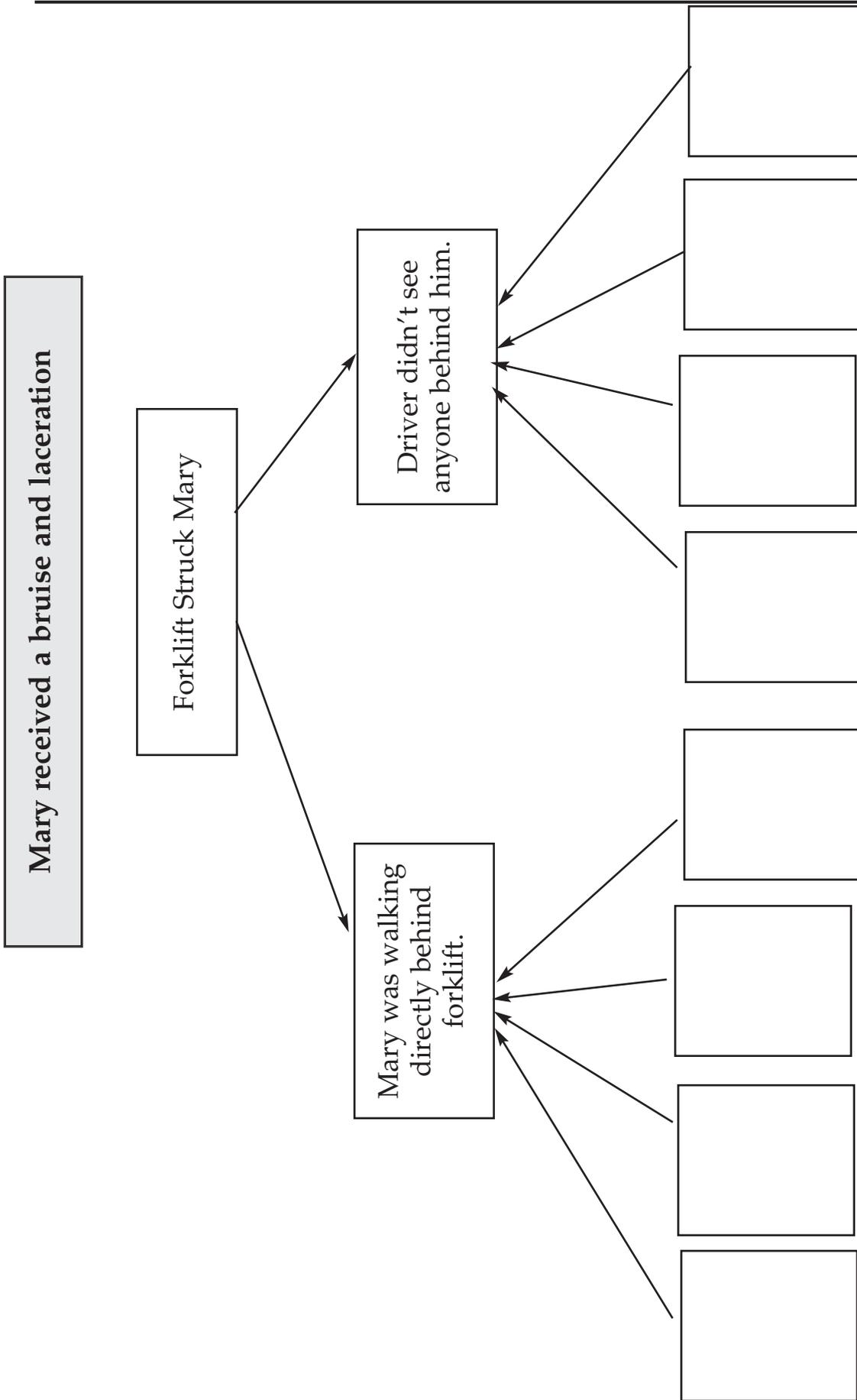
Scenario:

A worker severely injured her back on the job.

Events leading to the worker's injury:

1. The forklift struck Mary.
2. Mary didn't move quickly enough.
3. Mary was walking directly behind the forklift.
4. The operator continued to backup the forklift.
5. Mary didn't see the forklift in time.
6. There was no warning that the forklift was backing up.
7. Walking employees and forklifts use the same aisle.
8. Mary thought the driver saw her.
9. Mary was walking in the aisle at the same time that the barrel was being moved.
10. Driver didn't see anyone behind him.
11. Propane tank placement partially blocked the driver's view.
12. Design of the roll cage partially blocked the driver's view.

The facilitator will provide you with flipchart paper to recreate the chart on the following page. In your groups, decide which order these events should be placed leading up to the injury. Write them into the boxes in the diagram on your chart. Post your recreated chart on the wall and be prepared to explain it to the large group.



Task 2

Factsheet Reading Method for Task 2.

The Small Group Activity Method places workers at the center of the learning experience. It is designed to draw on two bodies of knowledge: The knowledge and experience workers bring into the room and the factsheets contained in your workbooks.

The factsheet method, described below, builds upon this knowledge through the introduction of new ideas and concepts.

The process is as follows:

Each of you will be assigned a small number of factsheets to read. You will then share this information with your table.

The idea is for each of you to take ownership and responsibility for the information contained in your factsheets and to describe it to the others in your group.

Factsheets will be assigned as follows:

Starting with the scribe and moving to the left, count out loud from 1 to 5. Keep going around the table until all numbers (factsheets) are distributed. For example, if there are four people at your table, the scribe will have self-assigned Factsheets 1 and 5, the person to their left will be responsible for Factsheet 2, etc. The numbers that you have assigned yourself correspond to Factsheets 1 through 5 on pages 67 through 72.

Once everyone has read their assigned factsheets individually, your scribe will go around the table and ask each of you to explain to the rest of your group what you have learned. No notes need to be taken during this discussion. The factsheets should be explained in the order they were assigned (1 through 5), as many times factsheets build on previous factsheets. Once this process is complete, your trainer will read the scenario and the task. In this way we all start at the same place and with the same information.

1. *All Hazards Are Near-misses Waiting to Happen*

Any hazard at our workplaces is just an accident or an incident waiting to happen. That makes perfect sense to most everyone who has ever thought about things like safety and health.

Most people, when they think about a close call or they have missed being hurt because of good luck, consider an event like that a near-miss.

The physical “near-miss” or a toxic “near-miss” is the same thing; a workplace hazard!

If in the perfect workplace all hazards were identified, controlled or eliminated, there would be no incidents or accident.

Seeking out the hazards at work and controlling or eliminating them is central to a functioning near-miss program.

2. Near-Misses are a Series of Events

Near-misses are really just a series of events that release the force of workplace hazards almost, but not quite to the point of an incident or accident. Just as this combinations of events nearly causes an incident or accident, so do the contributing hazards that cause what is traditionally thought of as a near-miss, an incident or accident that almost happens.

3. Two-headed Hazards

Workplace hazards come in two different categories: physical hazards and exposure hazards.

These hazards are just like their names make them sound.

Physical hazard

Something that affects a worker's body like a slip, trip or fall, being struck by an object, being caught in a machine, etc.

Exposure or toxic workplace hazard

One that exposes workers to toxins by inhalation, skin absorption and ingestion (swallowing).

Exposure hazards may be more dangerous because we can be exposed to many toxic hazards without even knowing it. Many times toxic exposures do not hurt, burn or make us feel ill; but they can be deadly in a minute, an hour, a day, a month or 25 years later.

Workplace hazards need to be controlled or eliminated; they should not be merely avoided or, even worse, considered normal.

4. Getting Past Normal

What is “normal?” Some might say:

- What I accept;
- What no longer concerns me;
- What I can do nothing about; and/or
- What I think someone else will take care of.

What if we asked someone who worked in our industry twenty or thirty-years ago what they accepted as “normal” back then?



Some might say:

- To remove asbestos from piping with a hammer, with no respirator and no protection for anyone in the area.
- To work in elevated areas with no fall protection.
- To clean skin with solvents or gasoline.
- Loud noise had only a temporary effect on our hearing.
- Operating forklifts with no safety protection

So what are we accepting as “normal” today?

Source: USW Near-miss Project Curriculum Team, November 30, 2006.

5. A Direct Line to an Accident

Workplace hazards are the cause of accidents. In the line of events or continuum that causes illness, injury and death at work, hazards are always the start or the root cause.

Any workplace hazard that has not caused an illness, injury or death is a near-miss.

- **A hazard leads to an action that results in an event.**
- **A hazard is a near-miss!**
- **A near-miss is an undetected and uncontrolled hazard.**

Task 3

Purpose restated: To understand how a near-miss is a series of events that stops short of an incident.

Near-miss programs fail for many reasons.

Program Failures:

1. Workers do not report near-miss incidents because they do not want to be disciplined or have their co-workers disciplined.
2. When a near-miss is reported, things don't get fixed.
3. The reporting system is so difficult, workers don't participate and the programs fail.
4. Near-misses are often seen as normal and accepted as a part of work.

A functioning near-miss program sees hazards as the "real" near-misses in a workplace and quickly works to control or eliminate them.

Task:

The four failures listed above are represented by the numbers 1-4. In the space next to each number in the chart on the next page, give ways a functioning near-miss program can eliminate the program failures.

Number of the Program Failure	How Can a Worker-designed Near-miss Program Eliminate this Failure?
1	
2	
3	
4	

Summary: Identifying Near-misses

1. A hazard is a near-miss because it exists.
2. There are two kinds of hazards: physical and exposure.
3. Hazards that are accepted as normal are most dangerous.
4. No hazard should be considered acceptable.
5. Traditional near-misses run in a connected sequence from hazard-to-action-to incident.
6. Reporting only hazards (and not near-miss actions) can be a core element of a functioning reporting.
7. We can't wait for near-miss actions to happen-they may not miss!
8. The identification of hazards without their elimination or control is a useless workplace health and safety activity.

EVALUATION**Activity 4: Identifying Near-misses**

1. How important is this Activity for workers? Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Which factsheets are the most important to distribute to the workers? (Please list the page numbers.)

3. What would you suggest be done to improve this Activity?

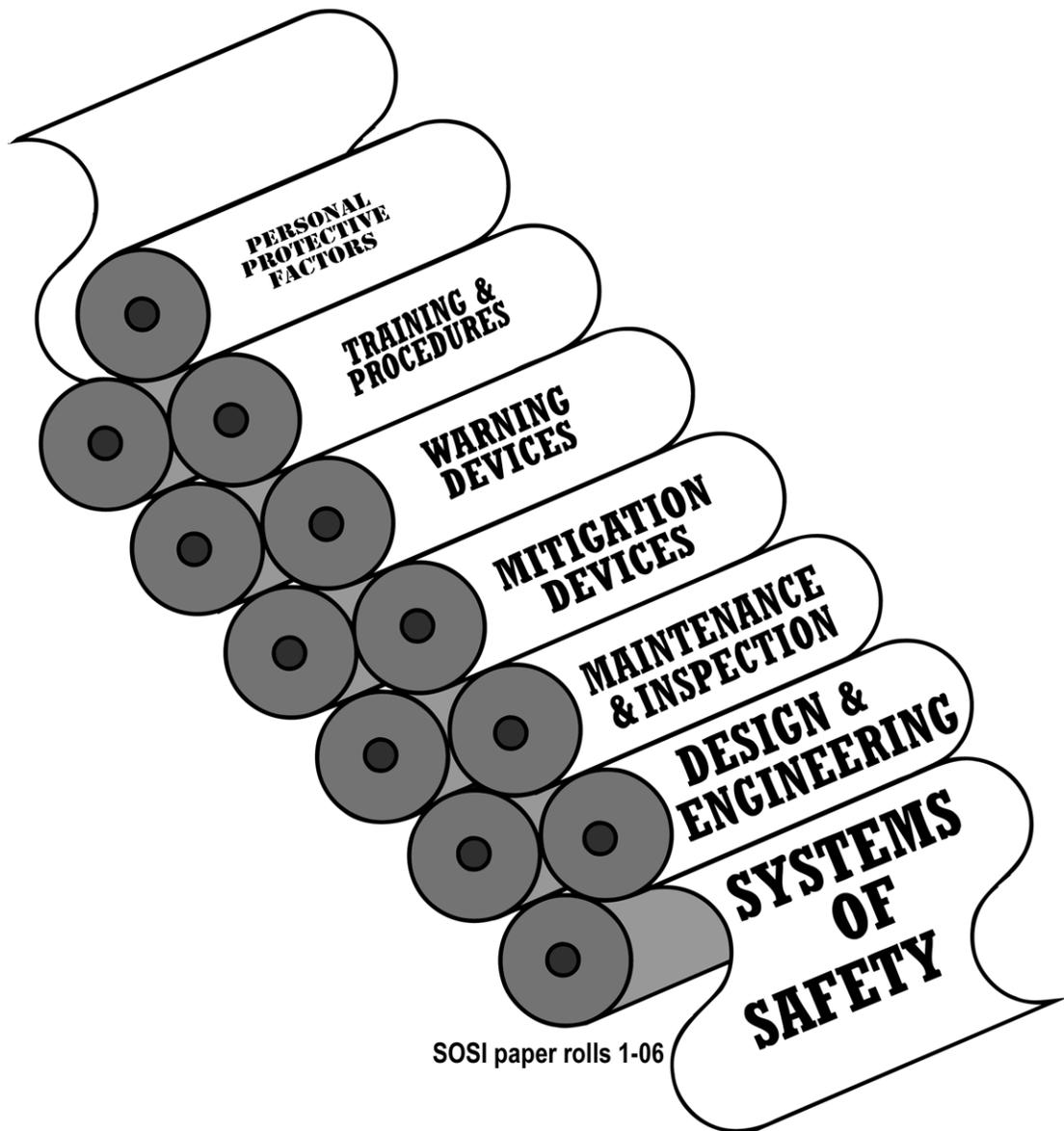
**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Activity 5: Incident Investigation Using Logic Tree

Purpose

To learn how to use Systems of Safety in a basic incident investigation to uncover the multiple root causes of an incident.

This Activity has two tasks.



Task 1

Factsheet Reading Method for Task 1:

The Small Group Activity Method places workers at the center of the learning experience. It is designed to draw on two bodies of knowledge: 1) The knowledge and experiences workers bring into the room and 2) the factsheets contained in your workbooks.

The factsheet method, described below, builds upon this knowledge through the introduction of new ideas and concepts.

The process is as follows:

Each of you will be assigned a small number of factsheets to read. You will then share this new information with your table.

The idea is for each of you to take ownership and responsibility for the information contained in your factsheets and to describe it to the others in your group.

Factsheets will be assigned as follows:

Starting with the scribe and moving to the left, count out loud from 1 to 7. Keep going around the table until all numbers (factsheets) are distributed. For example, if there are four people at your table, the scribe will have self-assigned Factsheets 1 and 5, the person to their left will be responsible for Factsheets 2, etc. The numbers that you have assigned yourself correspond to Factsheets 1 through 7 on pages 81 through 90.

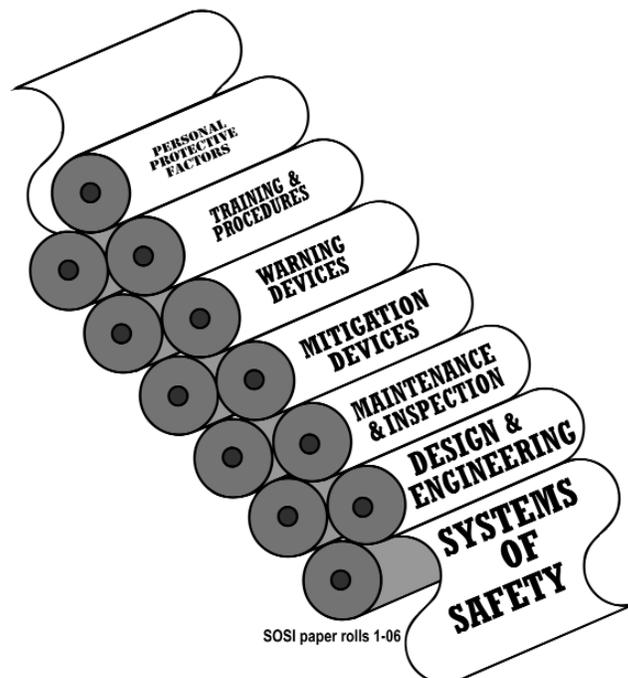
Once everyone has read their assigned factsheets, your scribe will go around the table and ask each of you to explain to the rest of your group what you have learned. No notes need be taken during this discussion. The factsheets should be explained in order as they were assigned (1 through 7), as many times factsheets build on previous factsheets. Once this process is complete, your trainer will read the scenario and the task. In this way we all start at the same place and with the same information.

1. What Are Systems of Safety?

Most facilities should have a developed program called Systems of Safety. This program outlines, in detail, how the plant will operate safely. This is a proactive program designed to prevent disasters and injuries from occurring.

The following components play key roles in eliminating or reducing hazardous conditions at the plant:

- Design and Engineering;
- Maintenance and Inspection;
- Mitigation Devices;
- Warning Devices;
- Procedures and Training; and
- Personal Protective Factors.



When it is clear that a plant is operating in an unsafe manner, workers must be involved in the process to investigate the root cause for the unsafe condition.

Source: Adapted in part from Harold Roland and Brian Moriarty, *System Safety Engineering and Management*, New York: John Wiley and Sons, 1983, p. 202.

2. The Design System and Engineering Systems: Two Sides for Safety

The highest level of hazard prevention is gained by using the Design and Engineering System, with each side of this system affecting health and safety.



The Organization side involves how work is organized and the roles people play. This involves issues such as:

- Staffing levels;
- Workload;
- Shifts and work schedules;
- Hours of work (including overtime); and
- How work is assigned and coordinated.

The Technical side involves the machinery and processes of work. This includes factors such as:

- Process and equipment design and engineering, including redesign;
- Selection of machinery, chemicals, and other materials; and
- Containment and control of health and safety hazards at their source.

If the workplace is to be truly safe and healthy, both the organizational and the technical sides of workplace design and engineering must be improved to the greatest extent possible. The coordination of the two sides is essential if Design and Engineering is to be effective in eliminating hazards.

Examples of Design and Engineering at home:

- Magnetic latches on refrigerators that prevent children from being trapped inside (many children have died in abandoned latch-type refrigerators);
- Chimney fires were virtually eliminated when wood was replaced by coal, gas and oil as the heating fuels of choice;
- The switch-over to latex-based paints drastically reduced lead exposures to children; and
- High current trip plugs in bathroom (ground fault interruptions [GFIs]) which have greatly reduced the possibility of electrical shock.

Examples of Design and Engineering in Industry:

- Use of lower process pressures and temperatures;
- Reformulating products so that less hazardous materials or processes are used;
- Reducing the inventory of hazardous materials;
- Safe-siting and spacing of process units, equipment and control rooms;
- Choice of less toxic, reactive and flammable chemicals;
- Enclosing processes;
- Use of fail-safe engineering concepts; and
- Ergonomic design of equipment and control panels.

continued

2. The Design System and Engineering Systems: Two Sides for Safety (*continued*)

Industry either designs and engineers hazards into the workplace or designs the workplace so that it is healthy and safe. The more hazards are designed and engineered into the workplace, the more it is necessary to apply lower level systems of safety to protect workers, the workplace and the community.

Source: Nicholas Ashford, *The Encouragement of Technological Change for Preventing Chemical Accidents*, Environmental Protection Agency, 1993.

3. The Maintenance and Inspection System

Properly designed equipment can turn into unsafe junk if it isn't properly maintained, inspected and repaired. If the phrase "if it ain't broke, don't fix it" is used within a plant, the maintenance system is a failure. If you don't use preventive maintenance, then you end up doing breakdown maintenance. For example:

At home:

- Preventive maintenance (checking air in tires);
- Inspection (checking tires for wear);
- Predictive maintenance (replacing worn tires); and
- Breakdown maintenance (changing a flat tire).

In industry:

- Preventive and predictive maintenance programs;
- Work repair requests are completed in a timely fashion;
- Keeping spare parts readily available;
- Equipment inspections for wear and damage;
- Maintenance workers are properly trained;
- Much needed repair work not delayed for production requirements; and
- Vibration monitoring and records kept on critical machinery.



4. The Mitigation System

The mitigation System of Safety involves the use of equipment that automatically acts to control or reduce the harmful consequences of hazardous incidents. Mitigation should be automatic and reliable.

Typical examples of mitigation devices are:

At home:

- Seat belts;
- Air bags;
- Circuit breakers; and
- Pressure relief on water heater.

In industry:

- Relief valves;
- Automatic shutdown devices;
- Check valves;
- Dikes; and
- Machine guarding.



5. The Warning System

The warning System of Safety includes the use of devices that warn of a dangerous or potentially dangerous situation. These devices require a person's intervention to control or mitigate the hazardous situation. Examples of warning devices include:

At home:

- Smoke alarm;
- High temperature or low oil light on an automobile; and
- Weather alerts and warnings.

In industry:

- Fire, spill and evacuation alarms;
- Control room alarms;
- Emergency shower worker-in-trouble alarms;
- Fixed continuous monitors and alarms for hazards and toxic releases; and
- Back-up alarms on vehicles.



6. The Procedures and Training System

The operation and maintenance of processes that are dangerous require a system of written procedures and training. The greater the hazard, the greater the need for procedures and training.

Elements of an effective procedures and training system include:

At home:

- Procedures for programming a VCR;
- Learning to drive an automobile;
- Cardiopulmonary resuscitation (CPR); and
- Evacuation procedures and drills for fire at home.

In industry:

- Permit programs for hot work, lock and tag, confined space, etc.;
- Emergency response plan and training drills;
- Operator training; and
- Operating procedures.



7. Personal Protective Factors

The Occupational Safety and Health Act guarantees all workers in the U.S. the right to a workplace free of recognized safety and health hazards. Though we have strived for this goal, we have a long way to go to achieve it. All workplace systems have flaws. In some cases those flaws threaten our life and health, the well-being of our communities and the security of our jobs. The severity of these flaws depends on the type of work as well as priority, knowledge and resources applied to eliminating hazards.

An outdated view of Workers' Role in Health and Safety: This view holds that workers' primary contribution to health and safety is wearing Personal Protective Equipment and being continually monitored for their behavior. Personal Protective Equipment and behavior are the primary emphasis when workers' roles are focused on compensating for hazards that industry has built into the workplace.



7. Personal Protective Factors (*continued*)

A modern view: The GCC-IBT and the Labor Institute's view is that workers' primary roles in health and safety are to look critically at the workplace, work collectively to identify lurking hazards, and then to contribute ideas, experience and know-how to correct system flaws. When systems flaws are corrected using higher-level solutions like Design and Engineering Systems, hazards are either eliminated or greatly reduced. This approach, especially when applied over time, helps to reduce or eliminate the need to focus on personal protective factors such as Personal Protective Equipment or behavior. Workers are then left to apply their know-how and experience to their normal work.

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Task 1 *(continued)*

Purpose Restated: To learn how to use Systems of Safety in a basic incident investigation to uncover the multiple root causes of an incident.

Task:

The goal of any incident investigation is to fix the identified hazard at the highest level.

After a thorough investigation the team of workers was able to identify the facts of the incident. Many were obvious; but others were not. The facts as determined by the team are listed below:

1. Mary received a bruise and laceration.
2. The forklift struck Mary.
3. Mary didn't move quickly enough.
4. Mary was walking directly behind the forklift.
5. Hal, the driver, continued to backup the forklift.
6. Mary didn't see the forklift in time.
7. There was no warning that the forklift was backing up.
8. Walking employees and forklifts use the same aisle.
9. Mary thought the driver saw her.
10. Mary was walking in the aisle at the same time that the barrel was being moved.
11. Hal didn't see anyone behind him.
12. Propane tank placement partially blocked the driver's view.
13. Design of the roll cage partially blocked the driver's view.

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

continued

Task 1 *(continued)*

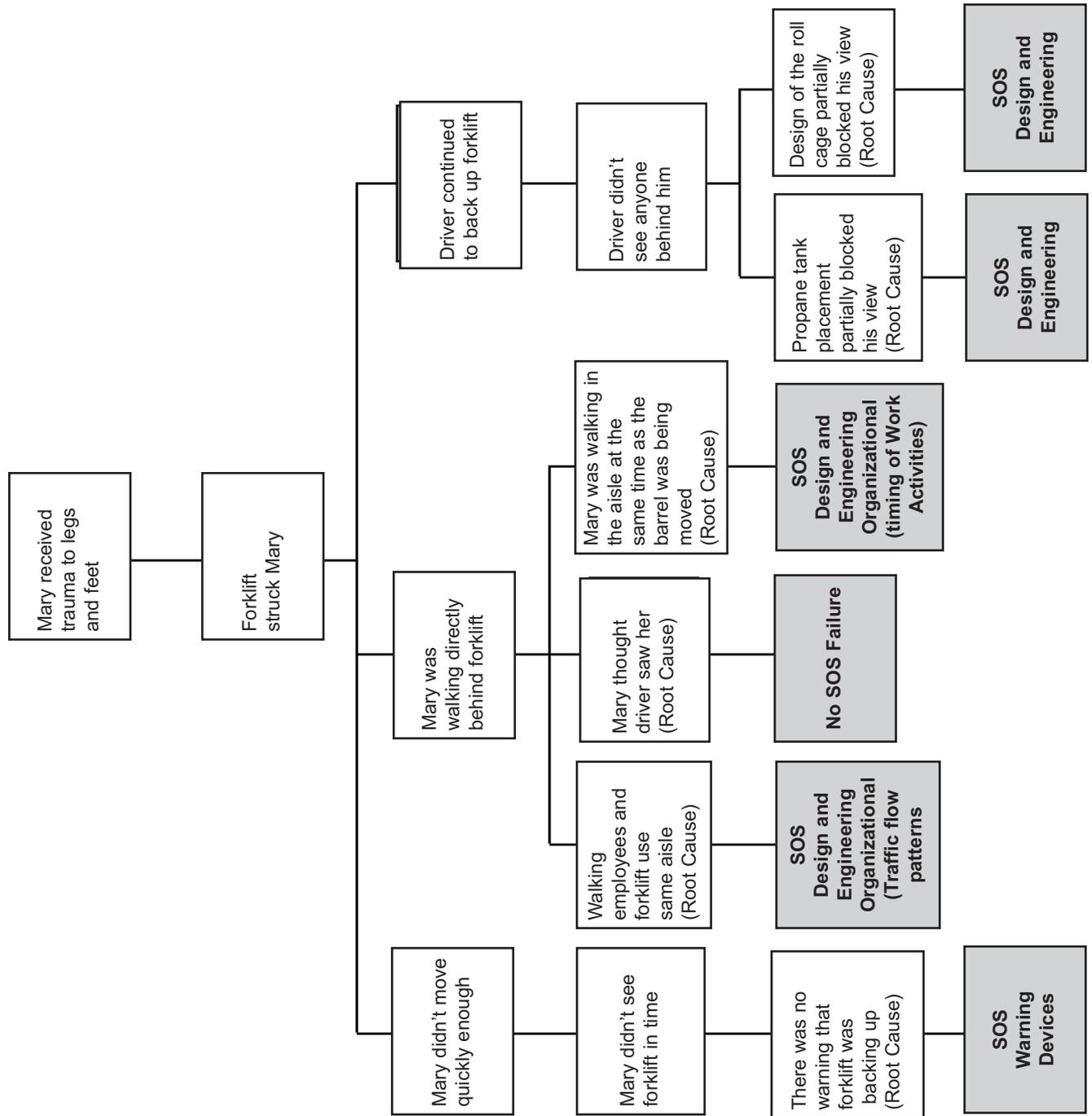
The workers then used the facts listed on the previous page to develop the logic tree shown on page 95.

As a group, review and discuss the logic tree on the next page and using your experience and intuition, answer the questions below.

1. What is the goal in developing each leg of the logic tree?

2. Where do we want the branches of the tree to lead?

3. At what location in the logic tree are the root causes always located?



Task 2

Let's now review the recommended fixes as determined by the team of workers. Select a scribe to report your answers back to the class.

1. Analyze the actions taken (listed in first column of the chart below) to attempt to eliminate the hazard of a pedestrian being struck by a forklift. More than one Systems of Safety is listed for each action. Your group should choose the System of Safety (SOS) in which each action was taken to attempt to eliminate the hazard. Be ready to give reasons for your choices. You should circle the selected SOS to indicate your group's answer.

(Note: The logic tree identified the failed Systems of Safety. This is not necessarily the system that the fix would be made in.)

Recommendations	In Which SOS was the recommendation made? (One for each action)
1. Install backup alarm on all forklifts.	A. Warning Devices B. Mitigation Devices
2. Designate aisle between finishing room and number one machine room for forklift traffic only.	A. Design and Engineering B. Training and Procedures
3. Contact forklift manufacturer to redesign propane tank and roll cage to increase visibility in the rear.	A. Training and Procedures B. Design and Engineering
4. Eliminate forklift use for last 20 and first 20 minutes of shift.	A. Mitigation Devices B. Training and Procedures C. Design and Engineering
5. Include in training the importance of communications between a forklift driver and pedestrians.	A. Warning Devices B. Training and Procedures
6. Install convex mirrors on forklift to make full rear area visible to driver.	A. Mitigation Devices B. Warning Devices
7. Change procedure for forklift operation to include sounding horn before beginning to back up.	A. Training and Procedures B. Personal Protective Factors
8. Install automated material handling system to eliminate need for forklift as much as possible.	A. Mitigation Devices B. Design and Engineering

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Summary: Incident Investigation Using Logic Tree

1. Identifying the facts is the first step in a Systems of Safety Investigation.
2. The logic tree is a powerful tool in organizing investigation facts to identify root causes and failed Systems of Safety.
3. Systems of Safety are the key to making recommendations to fix root causes.
4. Major Systems of Safety (in order of effectiveness):
 - Design and Engineering;
 - Maintenance and Inspection;
 - Mitigation Devices;
 - Warning Devices;
 - Training and Procedures; and
 - Personal Protective Factors.
5. The Design and Engineering System is the system workers should first look to address the hazards.

EVALUATION**Activity 5: Incident Investigation Using Logic Tree**

1. How important is this Activity for workers? Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Which factsheets are the most important to distribute to the workers? (Please list the page numbers.)

3. What would you suggest be done to improve this Activity?

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Activity 6: Lessons Learned

Purpose

To share “lessons learned” gained from incident investigations.

To understand “lessons learned” through a Systems of Safety viewpoint.

This Activity has three tasks.

Task 1

As a fork truck operator was entering a trailer to unload it, the trailer moved away from the dock resulting in the rear wheels of the fork truck entering the divide between the dock and the trailer. The operator received a back injury from the jarring. Upon investigation, it was discovered that the trailer was not chocked and only the trailer brakes were being used to secure the trailer to the dock. Workers indicated that when they used the wheel chocks they would become wedged and very difficult to remove. Also, dock locks were available; however, paper buildup in the outside dock area impeded the use of the dock locks. Although the operator was not certified, his trainer reported that he was a competent forklift operator. Previous investigations identified the issue of the nonworking dock locks.

As a result of this incident the company issued the following memo to all employees.

Intra-Office Memo

To: All Employees
From: The Human Resources Department
Re: Forklift Incident and Injury
Date: August 15, 2006

Recently one of our valued employees severely injured his back when the forklift he was operating fell between the loading dock and the trailer he was attempting to unload, wrenching his back. He is temporarily out of work.

Our investigation revealed the following:

- The operator did not keep his forklift certification current.
 - All forklift operators are required to have proper training and certification. If you operate a forklift it is your responsibility to be sure that you have the proper training and current certification. Anyone operating a forklift without current certification will be suspended pending investigation and disciplinary hearings. We will not tolerate uncertified operators at our facilities for your safety and the safety of those around you.

-
- The trailer was not secured by chocks.
 - It is every fork lift operator's responsibility to follow safety rules when operating their machines. The failure to not properly chock a vehicle will result in suspension pending investigation and disciplinary hearings.
 - Dock locks were not engaged and locked.
 - It is every fork lift operator's responsibility to follow safety rules when operating their machines. The failure to not properly engage and lock dock locks will result in suspension pending investigation and disciplinary hearings.

We value our employees, and are as interested in your safety as much as you are. We implement safety rules for your benefit. In the end you are responsible for your safety at work and the safety of your coworkers. If you see anyone acting in an unsafe manner, for their well-being and for the well-being of those around them, report them to your supervisor. Safety is serious business, and we will take serious steps to assure that our workplace is safe. Violators of safety rules will be reminded of the importance of following these rules; if they repeat their unsafe behaviors they will be suspended and discharged if they refuse to alter their bad safety habits.

After reviewing the statements by the company concerning the forklift accident on the loading dock, indicate if your group thinks that the employer solutions will prevent this accident from reoccurring. Using the Systems of Safety, how would you identify the employers fix. If disagreeing with the employers fix, be prepared to explain why your group disagrees and make a better Systems of Safety fix for the employer's recommendation.

continued

Task 1 (continued)

Employer's Accident Cause	Prevent Reoccurrence (Yes or No)	Employer's Fix in SOS	Better SOS Fix
The operator did not keep forklift certification current.			
The trailer was not secured by chocks.			
Dock locks were not engaged and locked.			

If your group has chosen better SOS fixes to the employer identified causes, please explain your reasons below.

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Task 2

The Union investigated the forklift accident independently. The following is the Lessons Learned report that they generated which includes a logic tree that was used for analysis and a list of Systems of Safety recommendations targeted to prevent this kind of accident. The report was circulated in the workplace where this incident happened; sent to workers at other workplaces doing the same kind of work owned by the same company; and forwarded to the International Union that posted this Lessons Learned on a website accessible to anyone.

Title: Fork Truck Accident While Unloading Trailer

Identifier: Volume 06 Issue 2

Date Issued: August 15, 2006

Lessons Learned Statement

The inability to utilize the dock locks, hard to use wheel chocks and the sole reliance upon trailer brakes to secure a trailer at a loading dock added up to an injured employee. *Systems of Safety* are utilized to provide prevention from this type of incident. The protection provided by the redundant mechanical systems of dock locks, wheel chocks and trailer brakes provide a well defined **Design and Engineering Systems of Safety** approach. The practice of operating with only one of the three mechanisms being utilized eliminates the protection afforded by the redundant design.

Despite previous reports of the condition of the dock locks, there was no action taken within the **Maintenance and Inspection Systems of Safety** to clean or repair the equipment. No review was made within the **Design and Engineering Systems of Safety** to review if better technology was available for the environment in which these locks operated.

The wheel chocks, while very effective in securing the trailers, were difficult to remove after loading and unloading and, therefore, became a nuisance most often avoided. Despite repeated complaints and nonuse, there was never a **Design and Engineering** review to see if new or better designs of wheel chocks were available.

The **Training and Procedures** *Systems of Safety* for the fork truck drivers should include visual checks to assure all securing mechanisms are operable prior to proceeding with their entry into the trailer. An administrative policy that states that the job will not begin or will be discontinued at the first failure of any of the three mechanisms would provide maximum protection through the **Design and Engineering** safety sub-system of Organizational Policies.

Discussion

As a fork truck operator was entering a trailer to unload it, the trailer moved away from the dock resulting in the rear wheels of the fork truck entering the divide between the dock and the trailer. The operator received a back injury from the jarring. Upon investigation, it was discovered that the trailer was not chocked and only the trailer brakes were being used to secure the trailer to the dock. Workers indicated that when they used the wheel chocks they would become wedged and very difficult to remove. Also, dock locks were available; however, paper buildup in the outside dock area was such that it impeded the use of the dock locks. Although the operator was not certified, his trainer reported that he was performing the job properly.

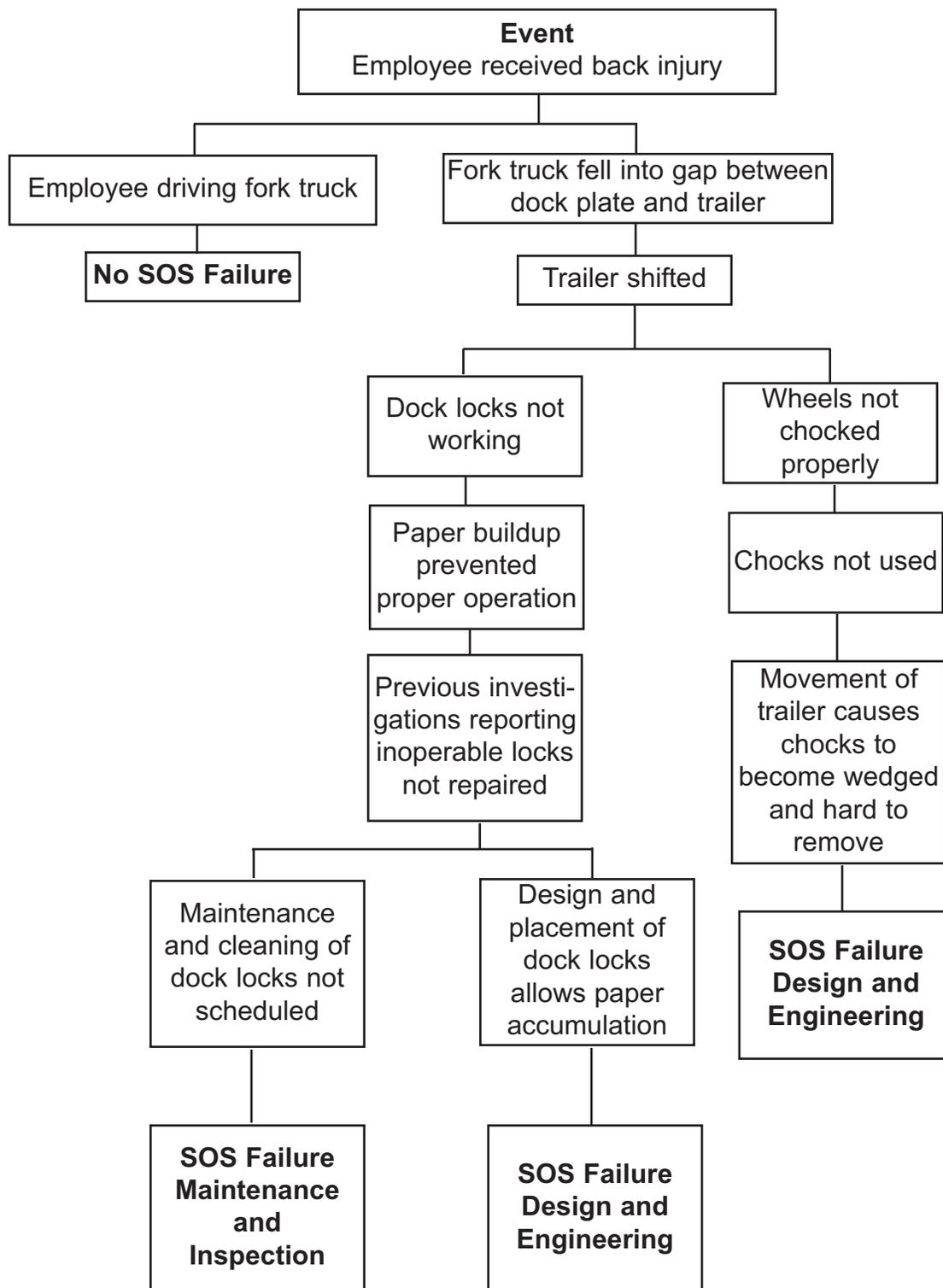
Previous investigations were performed to address the issue of the nonworking dock locks.

continued

Task 2 (continued)

Analysis

The **Logic Tree** is a pictorial representation of a logical process that maps an incident from its occurrence, “the event,” to facts of the incident and the incident’s root causes.



Recommended Actions

1. Keep dock locks in working order at all times.
2. Require that wheels be chocked; trailer brakes secured and dock locks be in place before unloading can begin.
3. Seek new type of chocks that are easier to remove.
4. Seek newer dock locks that are more dependable in the environment in which they exist.
5. Training and procedures for fork truck drivers should require visual conformation of chocks in place, dock locks secured and trailer's brakes applied before entering the trailer.

continued

Task 2 *(continued)*

Working in your groups and using the Lessons Learned Statement, Discussion, Analysis and Recommended Actions, answer the two questions below. Your facilitator will give each group an opportunity to share answers with the large group.

1. Complete the chart on the next page by:

- Referring back to the employer's memo, put an "X" beside the recommended actions that would be implemented.
- Referring back to the Union's Lessons Learned recommendations, place an "X" by the action that you think should be implemented.
- Prepare to share with the group the reasons for your answers.

2. Give examples of ways to apply the Lessons Learned Statement at your workplace.

Employer Recommended Actions

	What Employer's memo would implement	What do you think should be implemented
1. Keep dock locks in working order at all times.		
2. Require that wheels be chocked, trailer brakes secured and dock locks be in place before unloading can begin.		
3. Seek new type of chocks that are easier to remove.		
4. Seek newer dock locks that are more dependable in the environment in which they exist.		
5. Training and procedures for fork truck drivers should require visual confirmation of chocks in place, dock locks secured and trailer's brakes applied before entering the trailer.		

Task 3

Review the following description of the incident and the logic tree. Construct a short lessons learned identifying systems of safety fixes that will prevent this incident. Refer to the Lessons Learned statement in Task 2 as an example.

At XYZ plant, forklift operators use the aisle between the finishing department and number one Machine Room as they collect drums of used oil for proper disposal. Employees also use the same aisle to access their work area.

Five minutes prior to the start of a shift an operator, was walking from the women's locker room to her work station. She was at the rear of a group of 10 workers walking to their work stations. A forklift operator stopped to talk with a foreman. The pedestrian saw the forklift operator stop to talk and assumed that the forklift operator saw her, so she proceeded to walk behind the forklift.

The forklift operator finished talking with the foreman and looked behind him. He saw the large group of people who had walked past him, but he didn't see anyone behind him. He put the forklift in reverse and backed up. He had gone about a foot when he heard screaming. That is when he realized that someone had been behind him. He stopped and pulled the forklift forward and parked it.

The pedestrian sustained major trauma to both of her legs and feet and required months of treatment and therapy to recover from her injuries.

The forklift operator's rear vision was hampered by the placement of the propane fuel tank and the design of the roll cage.

The injured employee said that she had always taken the same route to her work station, and that she walked behind the same forklift operator on numerous occasions and that he had always seen her before.

After a thorough investigation the team of workers was able to identify the facts of the incident. Many were obvious; but others were not. The facts as determined by the team are listed on the next page:

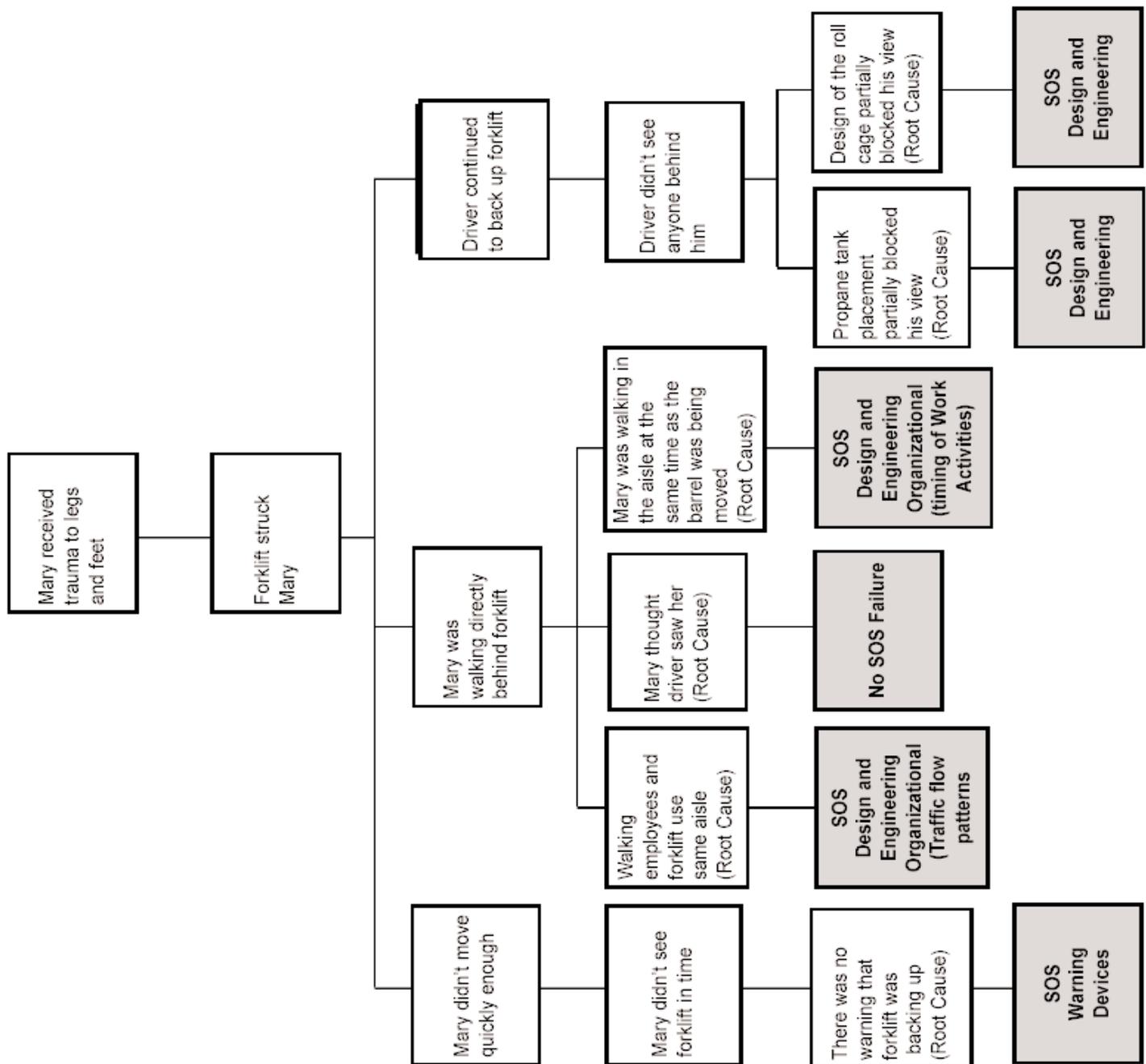
-
1. Mary received a bruise and laceration.
 2. The forklift struck Mary.
 3. Mary didn't move quickly enough.
 4. Mary was walking directly behind the forklift.
 5. Hal, the driver, continued to backup the forklift.
 6. Mary didn't see the forklift in time.
 7. There was no warning that the forklift was backing up.
 8. Walking employees and forklifts use the same aisle.
 9. Mary thought the driver saw her.
 10. Mary was walking in the aisle at the same time that the barrel was being moved.
 11. Hal didn't see anyone behind him.
 12. Propane tank placement partially blocked the driver's view.
 13. Design of the roll cage partially blocked the driver's view.

continued

Task 3 (continued)

Analysis

The Logic Tree is a pictorial representation of a logical process that maps an incident from its occurrence, "the event," to facts of the incident and the incident's root causes.



Task 3 *(continued)*

2. On a sheet of flipchart paper, list your recommended actions to share with the group. Refer to the recommended actions in Task 2 as an example.

3. How would you share this information with others to help prevent an incident like this from recurring?

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Summary: Lessons Learned

1. Creating Systems of Safety Lessons Learned gets to the true root cause of an incident.
2. The Systems of Safety recommendations for preventing an incident that are put into affect are real prevention of future accidents.
3. The value of Lessons Learned are only realized if broadcast to the largest interested group possible.
4. Making Lessons Learned available to anyone is the ultimate contributions workers can make to helping others prevent incidents and accidents.

EVALUATION**Activity 6: Lessons Learned**

1. How important is this Activity for workers? Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Which factsheets are the most important to distribute to the workers? (Please list the page numbers.)

3. What would you suggest be done to improve this Activity?

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Activity 7: The OSHA Standard, 1910.178 Powered Industrial Trucks

Purpose

To gain a general understanding of the OSHA standard, 1910.178
Powered Industrial Trucks.

To learn how to reference the PIT Standard.

This Activity has one task.

Task 1

Please begin by reading the following scenario once again:

At XYZ plant, forklift operators use the aisle between the finishing department and number one Machine Room as they collect drums of used oil for proper disposal. Employees also use the same aisle to access their work area.

This incident occurred five minutes prior to the start of first shift.

Mary, an operator, was walking from the women's locker room in the finishing department to her work station. She was at the rear of a group of 10 employees going to their work stations. A third shift forklift operator was delivering an empty drum to the site. This was his last assignment before the end of his shift. After he had made his delivery he stopped to talk with the third shift machine foreman to ask when his canceled PIT refresher training was to be rescheduled. Mary saw the forklift operator stop to talk with the foreman and assumed that the operator saw her so she proceeded to walk behind the forklift.

The forklift operator finished talking with the foreman and looked behind him. He saw the large group of people who had walked past him, but he didn't see anyone behind him. He put the forklift in reverse and backed up. He had gone about a foot when he heard screaming. That is when he realized that someone had been behind him. He stopped and pulled the forklift forward and parked it.

Mary sustained major trauma to both of her legs and feet and required months of treatment and therapy to recover from her injuries.

The forklift operator said that he looked but didn't see anyone behind him. His ability to see directly behind the forklift was hampered by the placement of the propane fuel tank and the design of the roll cage. The forklift was not inspected prior to being reintroduced into system. He had completed his last assignment and was going to drop his forklift off at the rear of the plant.

The injured employee said that she had always taken the same route to her work station, and that she walked behind the same forklift operator on numerous occasions and that he had always seen her before.



Regulations (Standards - 29 CFR)
Powered industrial trucks. - 1910.178

[← Regulations \(Standards - 29 CFR\) - Table of Contents](#)

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** N
- **Subpart Title:** Materials Handling and Storage
- **Standard Number:** 1910.178
- **Title:** Powered Industrial Trucks
- **Appendix:** A

1910.178(a)

General requirements.

1910.178(a)(1)

This section contains safety requirements relating to fire protection, design, maintenance, and use of fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines. This section does not apply to compressed air or nonflammable compressed gas-operated industrial trucks, nor to farm vehicles, nor to vehicles intended primarily for earth moving or over-the-road hauling.

1910.178(a)(2)

All new powered industrial trucks acquired and used by an employer shall meet the design and construction requirements for powered industrial trucks established in the "American National Standard for Powered Industrial Trucks, Part II, ANSI B56.1-1969", which is incorporated by reference as specified in § 1910.6, except for vehicles intended primarily for earth moving or over-the-road hauling.

1910.178(a)(3)

Approved trucks shall bear a label or some other identifying mark indicating approval by the testing laboratory. See paragraph (a)(7) of this section and paragraph 405 of "American National Standard for Powered Industrial Trucks, Part II, ANSI B56.1-1969", which is incorporated by reference in paragraph (a)(2) of this section and which provides that if the powered industrial truck is accepted by a nationally recognized testing laboratory it should be so marked.

1910.178(a)(4)

Modifications and additions which affect capacity and safe operation shall not be performed by the customer or user without manufacturers prior written approval. Capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

1910.178(a)(5)

If the truck is equipped with front-end attachments other than factory installed attachments, the user shall request that the truck be marked to identify the attachments and show the approximate weight of the truck and attachment combination at maximum elevation with load laterally centered.

1910.178(a)(6)

The user shall see that all nameplates and markings are in place and are maintained in a legible condition.

1910.178(a)(7)

As used in this section, the term, "approved truck" or "approved industrial truck" means a truck that is listed or approved for fire safety purposes for the intended use by a nationally recognized testing laboratory, using nationally recognized testing standards. Refer to 1910.155(c)(3)(iv)(A) for definition of nationally recognized testing laboratory.

1910.178(b)

Designations. For the purpose of this standard there are eleven different designations of industrial trucks or tractors as follows: D, DS, DY, E, ES, EE, EX, G, GS, LP, and LPS.

1910.178(b)(1)

The D designated units are units similar to the G units except that they are diesel engine powered instead of gasoline engine powered.

1910.178(b)(2)

The DS designated units are diesel powered units that are provided with additional safeguards to the exhaust, fuel and electrical systems. They may be used in some locations where a D unit may not be considered suitable.

1910.178(b)(3)

The DY designated units are diesel powered units that have all the safeguards of the DS units and in addition do not have any electrical equipment including the ignition and are equipped with temperature limitation features.

1910.178(b)(4)

The E designated units are electrically powered units that have minimum acceptable safeguards against inherent fire hazards.

1910.178(b)(5)

The ES designated units are electrically powered units that, in addition to all of the requirements for the E units, are provided with additional safeguards to the electrical system to prevent emission of hazardous sparks and to limit surface temperatures. They may be used in some locations where the use of an E unit may not be considered suitable.

1910.178(b)(6)

The EE designated units are electrically powered units that have, in addition to all of the requirements for the E and ES units, the electric motors and all other electrical equipment completely enclosed. In certain locations the EE unit may be used where the use of an E and ES unit may not be considered suitable.

1910.178(b)(7)

The user shall see that all nameplates and markings are in place and are maintained in a legible condition.

1910.178(b)(8)

The G designated units are gasoline powered units having minimum acceptable safeguards against inherent fire hazards.

1910.178(b)(9)

The GS designated units are gasoline powered units that are provided with additional safeguards to the exhaust, fuel, and electrical systems. They may be used in some locations where the use of a G unit may not be considered suitable.

1910.178(b)(10)

The LP designated unit is similar to the G unit except that liquefied petroleum gas is used for fuel instead of gasoline.

1910.178(b)(11)

The LPS designated units are liquefied petroleum gas powered units that are provided with additional safeguards to the exhaust, fuel, and electrical systems. They may be used in some locations where the use of an LP unit may not be considered suitable.

1910.178(b)(12)

The atmosphere or location shall have been classified as to whether it is hazardous or nonhazardous prior to the consideration of industrial trucks being used therein and the type of industrial truck required shall be as provided in paragraph (d) of this section for such location.

1910.178(c)

Designated locations.

1910.178(c)(1)

The industrial trucks specified under subparagraph (2) of this paragraph are the minimum types required but industrial trucks having greater safeguards may be used if desired.

1910.178(c)(2)

For specific areas of use see Table N-1 which tabulates the information contained in this section. References are to the corresponding classification as used in subpart S of this part.

1910.178(c)(2)(i)

Power-operated industrial trucks shall not be used in atmospheres containing hazardous concentration of acetylene, butadiene, ethylene oxide, hydrogen (or gases or vapors equivalent in hazard to hydrogen, such as manufactured gas), propylene oxide, acetaldehyde, cyclopropane, diethyl ether, ethylene, isoprene, or unsymmetrical dimethyl hydrazine (UDMH).

1910.178(c)(2)(ii)**1910.178(c)(2)(ii)(a)**

Power-operated industrial trucks shall not be used in atmospheres containing hazardous concentrations of metal dust, including aluminum, magnesium, and their commercial alloys, other metals of similarly hazardous characteristics, or in atmospheres containing carbon black, coal or coke dust except approved power-operated industrial trucks designated as EX may be used in such atmospheres.

1910.178(c)(2)(ii)(b)

In atmospheres where dust of magnesium, aluminum or aluminum bronze may be present, fuses, switches, motor controllers, and circuit breakers of trucks shall have enclosures specifically approved for such locations.

1910.178(c)(2)(iii)

Only approved power-operated industrial trucks designated as EX may be used in atmospheres containing acetone, acrylonitrile, alcohol, ammonia, benzene, benzol, butane, ethylene dichloride, gasoline, hexane, lacquer solvent vapors, naphtha, natural gas, propane, propylene, styrene, vinyl acetate, vinyl chloride, or xylenes in quantities sufficient to produce explosive or ignitable mixtures and where such concentrations of these gases or vapors exist continuously, intermittently or periodically under normal operating conditions or may exist frequently because of repair, maintenance operations, leakage, breakdown or faulty operation of equipment.

1910.178(c)(2)(iv)

Power-operated industrial trucks designated as DY, EE, or EX may be used in locations where volatile flammable liquids or flammable gases are handled, processed or used, but in which the hazardous liquids, vapors or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in the case of abnormal operation of equipment; also in locations in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation but which might become hazardous through failure or abnormal operation of the ventilating equipment; or in locations which are adjacent to Class I, Division 1 locations, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clear air, and effective safeguards against ventilation failure are provided.

TABLE N-1. -- SUMMARY TABLE ON USE OF INDUSTRIAL TRUCKS IN VARIOUS LOCATIONS

Classes	Unclassified	Class I locations	Class II locations	Class III locations
Description of classes.	Locations not possessing atmospheres as described in other columns.	Locations in which flammable gases or vapors are, or may be, present in the air in quantities sufficient to produce explosive or ignitable mixtures.	Locations which are hazardous because of the presence of combustible dust.	Locations where easily ignitable fibers or flyings are present but not likely to be in suspension in quantities sufficient to produce ignitable mixtures.

Groups in classes	None	A	B	C	D
Examples of locations or atmospheres in classes and groups.	Piers and wharves inside and outside general storage, general industrial or commercial properties.	Acetylene	Hydrogen	Ethyl ether	Gasoline Naphtha Alcohols Acetone Lacquer solvent Benzene

(Continued)

E	F	G	None
Metal dust	Carbon black coal dust, coke dust	Grain dust, flour dust, starch dust, organic dust.	Baled waste, cocoa fiber, cotton, excelsior, hemp, istle, jute, kapok, oakum, sisal, Spanish moss, synthetic fibers, tow.

	1	2
--	---	---

Divisions (nature of hazardous conditions)	None	Above condition exists continuously, intermittently, or periodically under normal operating conditions.	Above condition may occur accidentally as due to a puncture of a storage drum.
--	------	---	--

(Continued)

1	2	1	2
Explosive mixture may be present under normal operating conditions, or where failure of equipment may cause the condition to exist simultaneously with arcing or sparking of electrical equipment, or where dusts of an electrically conducting nature may be present.	Explosive mixture not normally present, but where deposits of dust may cause heat rise in electrical equipment, or where such deposits may be ignited by arcs or sparks from electrical equipment.	Locations in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.	Locations in which easily ignitable fibers are stored or handled (except in the process of manufacture).

Authorized uses of trucks by types in groups of classes and divisions

Groups in classes	None	A	B	C	D	A	B	C
Type of truck authorized:								
Diesel:								
Type D D**	
Type DS
Type DY
Electric:								
Type E E**	
Type ES
Type EE
Type EX	EX	....	....	....
LP-Gas:								
Type LP LP**	

Groups in classes	None	A	B	C	D	A	B	C
Gasoline:								
Type G	G**	...	....	....	....	....	....	....
Type GS .....	.....	....	...	....	....	....	...	....
LP-Gas								
Type LP	LP**	..	....	....	....	....	....	....
Type LPS .....	.....	....	....	....	....	...	....	....
Paragraph Ref. in No. 505.	210.211		201 (a)		203 (a)			209 (a)

(Continued)

Authorized uses of trucks by types in groups of classes and divisions

Groups in classes	D	E	F	G	E	F	G	None	None
Type of truck authorized:									
Diesel:									
Type D .....	....	....	....	....	....	....	...	....
Type DS	DS .	....	....	....	....	....	DS .	....	DS
Type DY	DY .	....	....	....	....	....	DY .	DY .	DY
Electric:									
Type E .....	....	....	....	....	....	....	....	....	E
Type ES	ES .	....	....	....	....	....	ES .	....	ES
Type EE	EE .	....	....	....	....	....	EE .	EE .	EE
Type EX	EX .	....	EX .	EX .	....	....	EX .	EX .	EX
Gasoline:									
Type G .....	....	....	....	....	....	....	....	....
Type GS	GS .	....	....	....	....	....	GS .	....	GS
LP-Gas:									
Type LP .....	....	....	....	....	....	....	....	....
Type LPS	LPS.	....	....	....	....	....	LPS.	....	LPS
Paragraph Ref. in No. 505.	204 (a), (b)		202 (a)	205 (a)		209 (a)	206 (a), (b)	207 (a)	208 (a)

** Trucks conforming to these types may also be used -- see subdivision (c)(2)(x) and (c)(2)(xii) of this section.

1910.178(c)(2)(v)

In locations used for the storage of hazardous liquids in sealed containers or liquified or compressed gases in containers, approved power-operated industrial trucks designated as DS, ES, GS, or LPS may be used. This classification includes locations where volatile flammable liquids or flammable gases or vapors are used, but which, would become hazardous only in case of an accident or of some unusual operating condition. The quantity of hazardous material that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that should receive consideration in determining whether or not the DS or DY, ES, EE, GS, LPS designated truck possesses sufficient safeguards for the location. Piping without valves, checks, meters and similar devices would not ordinarily be deemed to introduce a hazardous condition even though used for hazardous liquids or gases. Locations used for the storage of hazardous liquids or of liquified or compressed gases in sealed containers would not normally be considered hazardous unless subject to other hazardous conditions also.

1910.178(c)(2)(vi)

1910.178(c)(2)(vi)(a)

Only approved power operated industrial trucks designated as EX shall be used in atmospheres in which combustible dust is or may be in suspension continuously, intermittently, or periodically under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures, or where mechanical failure or abnormal operation of machinery or equipment might cause such mixtures to be produced.

1910.178(c)(2)(vi)(b)

The EX classification usually includes the working areas of grain handling and storage plants, room containing grinders or pulverizers, cleaners, graders, scalpers, open conveyors or spouts, open bins or hoppers, mixers, or blenders, automatic or hopper scales, packing machinery, elevator heads and boots, stock distributors, dust and stock collectors (except all-metal collectors vented to the outside), and all similar dust producing machinery and equipment in grain processing plants, starch plants, sugar pulverizing plants, malting plants, hay grinding plants, and other occupancies of similar nature; coal pulverizing plants (except where the pulverizing equipment is essentially dust tight); all working areas where metal dusts and powders are produced, processed, handled, packed, or stored (except in tight containers); and other similar locations where combustible dust may, under normal operating conditions, be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

1910.178(c)(2)(vii)

Only approved power-operated industrial trucks designated as DY, EE, or EX shall be used in atmospheres in which combustible dust will not normally be in suspension in the air or will not be likely to be thrown into suspension by the normal operation of equipment or apparatus in quantities sufficient to produce explosive or ignitable mixtures but where deposits or accumulations of such dust may be ignited by arcs or sparks originating in the truck.

1910.178(c)(2)(viii)

Only approved power-operated industrial trucks designated as DY, EE, or EX shall be used in locations which are hazardous because of the presence of easily ignitable fibers or flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

1910.178(c)(2)(ix)

Only approved power-operated industrial trucks designated as DS, DY, ES, EE, EX, GS, or LP S shall be used in locations where easily ignitable fibers are stored or handled, including outside storage, but are not being processed or manufactured. Industrial trucks designated as E, which have been previously used in these locations may be continued in use.

1910.178(c)(2)(x)

On piers and wharves handling general cargo, any approved power-operated industrial truck designated as Type D, E, G, or LP may be used, or trucks which conform to the requirements for these types may be used.

1910.178(c)(2)(xi)

If storage warehouses and outside storage locations are hazardous only the approved power-operated industrial truck specified for such locations in this paragraph (c) (2) shall be used. If not classified as hazardous, any approved power-operated industrial truck designated as Type D, E, G, or LP may be used, or trucks which conform to the requirements for these types may be used.

1910.178(c)(2)(xii)

If general industrial or commercial properties are hazardous, only approved power-operated industrial trucks specified for such locations in this paragraph (c) (2) shall be used. If not classified as hazardous, any approved power-operated industrial truck designated as Type D, E, G, or LP may be used, or trucks which conform to the requirements of these types may be used.

1910.178(d)

Converted industrial trucks. Power-operated industrial trucks that have been originally approved for the use of gasoline for fuel, when converted to the use of liquefied petroleum gas fuel in accordance with paragraph (q) of this section, may be used in those locations where G, GS or LP, and LPS designated trucks have been specified in the preceding paragraphs.

1910.178(e)

Safety guards.

1910.178(e)(1)

High Lift Rider trucks shall be fitted with an overhead guard manufactured in accordance with paragraph (a) (2) of this section, unless operating conditions do not permit.

1910.178(e)(2)

If the type of load presents a hazard, the user shall equip fork trucks with a vertical load backrest extension manufactured in accordance with paragraph (a) (2) of this section.

1910.178(f)

Fuel handling and storage.

1910.178(f)(1)

The storage and handling of liquid fuels such as gasoline and diesel fuel shall be in accordance with NFPA Flammable and Combustible Liquids Code (NFPA No. 30-1969), which is incorporated by reference as specified in Sec. 1910.6.

1910.178(f)(2)

The storage and handling of liquefied petroleum gas fuel shall be in accordance with NFPA Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58-1969), which is incorporated by reference as specified in Sec. 1910.6.

1910.178(g)

Changing and charging storage batteries.

1910.178(g)(1)

Battery charging installations shall be located in areas designated for that purpose.

1910.178(g)(2)

Facilities shall be provided for flushing and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries.

1910.178(g)(3)

[Reserved]

1910.178(g)(4)

A conveyor, overhead hoist, or equivalent material handling equipment shall be provided for handling batteries.

1910.178(g)(5)

Reinstalled batteries shall be properly positioned and secured in the truck.

1910.178(g)(6)

A carboy tilter or siphon shall be provided for handling electrolyte.

1910.178(g)(7)

When charging batteries, acid shall be poured into water; water shall not be poured into acid.

1910.178(g)(8)

Trucks shall be properly positioned and brake applied before attempting to change or charge batteries.

1910.178(g)(9)

Care shall be taken to assure that vent caps are functioning. The battery (or compartment) cover(s) shall be open to dissipate heat.

1910.178(g)(10)

Smoking shall be prohibited in the charging area.

1910.178(g)(11)

Precautions shall be taken to prevent open flames, sparks, or electric arcs in battery charging areas.

1910.178(g)(12)

Tools and other metallic objects shall be kept away from the top of uncovered batteries.

1910.178(h)

Lighting for operating areas.

1910.178(h)(1)
[Reserved]

1910.178(h)(2)
Where general lighting is less than 2 lumens per square foot, auxiliary directional lighting shall be provided on the truck.

1910.178(i)
Control of noxious gases and fumes.

1910.178(i)(1)
Concentration levels of carbon monoxide gas created by powered industrial truck operations shall not exceed the levels specified in 1910.1000.

1910.178(j)
Dockboards (bridge plates). See 1910.30(a).

1910.178(k)
Trucks and railroad cars.

1910.178(k)(1)

The brakes of highway trucks shall be set and wheel chocks placed under the rear wheels to prevent the trucks from rolling while they are boarded with powered industrial trucks.

1910.178(k)(2)
Wheel stops or other recognized positive protection shall be provided to prevent railroad cars from moving during loading or unloading operations.

1910.178(k)(3)

Fixed jacks may be necessary to support a semitrailer and prevent upending during the loading or unloading when the trailer is not coupled to a tractor.

1910.178(k)(4)
Positive protection shall be provided to prevent railroad cars from being moved while dockboards or bridge plates are in position.

1910.178(l)

Operator training.

1910.178(l)(1)
Safe operation.

1910.178(l)(1)(i)
The employer shall ensure that each powered industrial truck operator is competent to operate a powered industrial truck safely, as demonstrated by the successful completion of the training and evaluation specified in this paragraph (l).

1910.178(l)(1)(ii)
Prior to permitting an employee to operate a powered industrial truck (except for training purposes), the employer shall ensure that each operator has successfully completed the training required by this paragraph (l), except as permitted by paragraph (l)(5).

1910.178(l)(2)

Training program implementation.

1910.178(l)(2)(i)

Trainees may operate a powered industrial truck only:

1910.178(l)(2)(i)(A)

Under the direct supervision of persons who have the knowledge, training, and experience to train operators and evaluate their competence; and

1910.178(l)(2)(i)(B)

Where such operation does not endanger the trainee or other employees.

1910.178(l)(2)(ii)

Training shall consist of a combination of formal instruction (e.g., lecture, discussion, interactive computer learning, video tape, written material), practical training (demonstrations performed by the trainer and practical exercises performed by the trainee), and evaluation of the operator's performance in the workplace.

1910.178(l)(2)(iii)

All operator training and evaluation shall be conducted by persons who have the knowledge, training, and experience to train powered industrial truck operators and evaluate their competence.

1910.178(l)(3)

Training program content. Powered industrial truck operators shall receive initial training in the following topics, except in topics which the employer can demonstrate are not applicable to safe operation of the truck in the employer's workplace.

1910.178(l)(3)(i)

Truck-related topics:

1910.178(l)(3)(i)(A)

Operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate;

1910.178(l)(3)(i)(B)

Differences between the truck and the automobile;

1910.178(l)(3)(i)(C)

Truck controls and instrumentation: where they are located, what they do, and how they work;

1910.178(l)(3)(i)(D)

Engine or motor operation;

1910.178(l)(3)(i)(E)

Steering and maneuvering;

1910.178(l)(3)(i)(F)

Visibility (including restrictions due to loading);

1910.178(l)(3)(i)(G)

Fork and attachment adaptation, operation, and use limitations;

1910.178(l)(3)(i)(H)
Vehicle capacity;

1910.178(l)(3)(i)(I)
Vehicle stability;

1910.178(l)(3)(i)(J)
Any vehicle inspection and maintenance that the operator will be required to perform;

1910.178(l)(3)(i)(K)
Refueling and/or charging and recharging of batteries;

1910.178(l)(3)(i)(L)
Operating limitations;

1910.178(l)(3)(i)(M)

Any other operating instructions, warnings, or precautions listed in the operator's manual for the types of vehicle that the employee is being trained to operate.

1910.178(l)(3)(ii)

Workplace-related topics:

1910.178(l)(3)(ii)(A)
Surface conditions where the vehicle will be operated;

1910.178(l)(3)(ii)(B)
Composition of loads to be carried and load stability;

1910.178(l)(3)(ii)(C)
Load manipulation, stacking, and unstacking;

1910.178(l)(3)(ii)(D)
Pedestrian traffic in areas where the vehicle will be operated;

1910.178(l)(3)(ii)(E)
Narrow aisles and other restricted places where the vehicle will be operated;

1910.178(l)(3)(ii)(F)
Hazardous (classified) locations where the vehicle will be operated;

1910.178(l)(3)(ii)(G)
Ramps and other sloped surfaces that could affect the vehicle's stability;

1910.178(l)(3)(ii)(H)
Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a buildup of carbon monoxide or diesel exhaust;

1910.178(l)(3)(ii)(I)
Other unique or potentially hazardous environmental conditions in the workplace that could affect safe operation.

1910.178(l)(3)(iii)
The requirements of this section.

1910.178(l)(4)

Refresher training and evaluation.

1910.178(l)(4)(i)
 Refresher training, including an evaluation of the effectiveness of that training, shall be conducted as required by paragraph (l)(4)(ii) to ensure that the operator has the knowledge and skills needed to operate the powered industrial truck safely.

1910.178(l)(4)(ii)
 Refresher training in relevant topics shall be provided to the operator when:

1910.178(l)(4)(ii)(A)
 The operator has been observed to operate the vehicle in an unsafe manner;

1910.178(l)(4)(ii)(B)
 The operator has been involved in an accident or near-miss incident;

1910.178(l)(4)(ii)(C)
 The operator has received an evaluation that reveals that the operator is not operating the truck safely;

1910.178(l)(4)(ii)(D)
 The operator is assigned to drive a different type of truck; or

1910.178(l)(4)(ii)(E)
 A condition in the workplace changes in a manner that could affect safe operation of the truck.

1910.178(l)(4)(iii)
 An evaluation of each powered industrial truck operator's performance shall be conducted at least once every three years.

1910.178(l)(5)
Avoidance of duplicative training. If an operator has previously received training in a topic specified in paragraph (l)(3) of this section, and such training is appropriate to the truck and working conditions encountered, additional training in that topic is not required if the operator has been evaluated and found competent to operate the truck safely.

1910.178(l)(6)
Certification. The employer shall certify that each operator has been trained and evaluated as required by this paragraph (l). The certification shall include the name of the operator, the date of the training, the date of the evaluation, and the identity of the person(s) performing the training or evaluation.

1910.178(l)(7)
Dates. The employer shall ensure that operators of powered industrial trucks are trained, as appropriate, by the dates shown in the following table.

If the employee was hired:	The initial training and evaluation of that must be completed:
Before December 1, 1999 ...	By December 1, 1999.
After December 1, 1999	Before the employee is assigned to operate a powered industrial truck.

1910.178(l)(8)

Appendix A to this section provides non-mandatory guidance to assist employers in implementing this paragraph (l). This appendix does not add to, alter, or reduce the requirements of this section.

1910.178(m)

Truck operations.

1910.178(m)(1)

Trucks shall not be driven up to anyone standing in front of a bench or other fixed object.

1910.178(m)(2)

No person shall be allowed to stand or pass under the elevated portion of any truck, whether loaded or empty.

1910.178(m)(3)

Unauthorized personnel shall not be permitted to ride on powered industrial trucks. A safe place to ride shall be provided where riding of trucks is authorized.

1910.178(m)(4)

The employer shall prohibit arms or legs from being placed between the uprights of the mast or outside the running lines of the truck.

1910.178(m)(5)

-

1910.178(m)(5)(i)

When a powered industrial truck is left unattended, load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set. Wheels shall be blocked if the truck is parked on an incline.

1910.178(m)(5)(ii)

A powered industrial truck is unattended when the operator is 25 ft. or more away from the vehicle which remains in his view, or whenever the operator leaves the vehicle and it is not in his view.

1910.178(m)(5)(iii)

When the operator of an industrial truck is dismounted and within 25 ft. of the truck still in his view, the load engaging means shall be fully lowered, controls neutralized, and the brakes set to prevent movement.

1910.178(m)(6)

A safe distance shall be maintained from the edge of ramps or platforms while on any elevated dock, or platform or freight car. Trucks shall not be used for opening or closing freight doors.

1910.178(m)(7)

Brakes shall be set and wheel blocks shall be in place to prevent movement of trucks, trailers, or railroad cars while loading or unloading. Fixed jacks may be necessary to support a semitrailer during loading or unloading when the trailer is not coupled to a tractor. The flooring of trucks, trailers, and railroad cars shall be checked for breaks and weakness before they are driven onto.

1910.178(m)(8)

There shall be sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

1910.178(m)(9)

An overhead guard shall be used as protection against falling objects. It should be noted that an overhead guard is intended to offer protection from the impact of small packages, boxes, bagged material, etc., representative of the job application, but not to withstand the impact of a falling capacity load.

1910.178(m)(10)

A load backrest extension shall be used whenever necessary to minimize the possibility of the load or part of it from falling rearward.

1910.178(m)(11)

Only approved industrial trucks shall be used in hazardous locations.

1910.178(m)(12)

[Removed and Reserved]

1910.178(m)(13)

[Reserved]

1910.178(m)(14)

Fire aisles, access to stairways, and fire equipment shall be kept clear.

1910.178(n)

Traveling.

1910.178(n)(1)

All traffic regulations shall be observed, including authorized plant speed limits. A safe distance shall be maintained approximately three truck lengths from the truck ahead, and the truck shall be kept under control at all times.

1910.178(n)(2)

The right of way shall be yielded to ambulances, fire trucks, or other vehicles in emergency situations.

1910.178(n)(3)

Other trucks traveling in the same direction at intersections, blind spots, or other dangerous locations shall not be passed.

1910.178(n)(4)

The driver shall be required to slow down and sound the horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view, the driver shall be required to travel with the load trailing.

1910.178(n)(5)

Railroad tracks shall be crossed diagonally wherever possible. Parking closer than 8 feet from the center of railroad tracks is prohibited.

1910.178(n)(6)

The driver shall be required to look in the direction of, and keep a clear view of the path of travel.

1910.178(n)(7)

Grades shall be ascended or descended slowly.

1910.178(n)(7)(i)

When ascending or descending grades in excess of 10 percent, loaded trucks shall be driven with the load upgrade.

1910.178(n)(7)(ii)

[Reserved]

1910.178(n)(7)(iii)

On all grades the load and load engaging means shall be tilted back if applicable, and raised only as far as necessary to clear the road surface.

1910.178(n)(8)

Under all travel conditions the truck shall be operated at a speed that will permit it to be brought to a stop in a safe manner.

1910.178(n)(9)

Stunt driving and horseplay shall not be permitted.

1910.178(n)(10)

The driver shall be required to slow down for wet and slippery floors.

1910.178(n)(11)

Dockboard or bridgeplates, shall be properly secured before they are driven over. Dockboard or bridgeplates shall be driven over carefully and slowly and their rated capacity never exceeded.

1910.178(n)(12)

Elevators shall be approached slowly, and then entered squarely after the elevator car is properly leveled. Once on the elevator, the controls shall be neutralized, power shut off, and the brakes set.

1910.178(n)(13)

Motorized hand trucks must enter elevator or other confined areas with load end forward.

1910.178(n)(14)

Running over loose objects on the roadway surface shall be avoided.

1910.178(n)(15)

While negotiating turns, speed shall be reduced to a safe level by means of turning the hand steering wheel in a smooth, sweeping motion. Except when maneuvering at a very low speed, the hand steering wheel shall be turned at a moderate, even rate.

1910.178(o)

Loading.

1910.178(o)(1)

Only stable or safely arranged loads shall be handled. Caution shall be exercised when handling off-center loads which cannot be centered.

1910.178(o)(2)

Only loads within the rated capacity of the truck shall be handled.

1910.178(o)(3)

The long or high (including multiple-tiered) loads which may affect capacity shall be adjusted.

1910.178(o)(4)

Trucks equipped with attachments shall be operated as partially loaded trucks when not handling a load.

1910.178(o)(5)

A load engaging means shall be placed under the load as far as possible; the mast shall be carefully tilted backward to stabilize the load.

1910.178(o)(6)

Extreme care shall be used when tilting the load forward or backward, particularly when high tiering. Tilting forward with load engaging means elevated shall be prohibited except to pick up a load. An elevated load shall not be tilted forward except when the load is in a deposit position over a rack or stack. When stacking or tiering, only enough backward tilt to stabilize the load shall be used.

1910.178(p)

Operation of the truck.

1910.178(p)(1)

If at any time a powered industrial truck is found to be in need of repair, defective, or in any way unsafe, the truck shall be taken out of service until it has been restored to safe operating condition.

1910.178(p)(2)

Fuel tanks shall not be filled while the engine is running. Spillage shall be avoided.

1910.178(p)(3)

Spillage of oil or fuel shall be carefully washed away or completely evaporated and the fuel tank cap replaced before restarting engine.

1910.178(p)(4)

No truck shall be operated with a leak in the fuel system until the leak has been corrected.

1910.178(p)(5)

Open flames shall not be used for checking electrolyte level in storage batteries or gasoline level in fuel tanks.

1910.178(q)

Maintenance of industrial trucks.

1910.178(q)(1)

Any power-operated industrial truck not in safe operating condition shall be removed from service. All repairs shall be made by authorized personnel.

1910.178(q)(2)

No repairs shall be made in Class I, II, and III locations.

1910.178(q)(3)

T hose repairs to the fuel and ignition systems of industrial trucks which involve fire hazards shall be conducted only in locations designated for such repairs.

1910.178(q)(4)

Trucks in need of repairs to the electrical system shall have the battery disconnected prior to such repairs.

1910.178(q)(5)

All parts of any such industrial truck requiring replacement shall be replaced only by parts equivalent as to safety with those used in the original design.

1910.178(q)(6)

Industrial trucks shall not be altered so that the relative positions of the various parts are different from what they were when originally received from the manufacturer, nor shall they be altered either by the addition of extra parts not provided by the manufacturer or by the elimination of any parts, except as provided in paragraph (q)(12) of this section. Additional counterweighting of fork trucks shall not be done unless approved by the truck manufacturer.

1910.178(q)(7)

Industrial trucks shall be examined before being placed in service, and shall not be placed in service if the examination shows any condition adversely affecting the safety of the vehicle. Such examination shall be made at least daily. Where industrial trucks are used on a round-the-clock basis, they shall be examined after each shift. Defects when found shall be immediately reported and corrected.

1910.178(q)(8)

Water mufflers shall be filled daily or as frequently as is necessary to prevent depletion of the supply of water below 75 percent of the filled capacity. Vehicles with mufflers having screens or other parts that may become clogged shall not be operated while such screens or parts are clogged. Any vehicle that emits hazardous sparks or flames from the exhaust system shall immediately be removed from service, and not returned to service until the cause for the emission of such sparks and flames has been eliminated.

1910.178(q)(9)

When the temperature of any part of any truck is found to be in excess of its normal operating temperature, thus creating a hazardous condition, the vehicle shall be removed from service and not returned to service until the cause for such overheating has been eliminated.

1910.178(q)(10)

Industrial trucks shall be kept in a clean condition, free of lint, excess oil, and grease. Noncombustible agents should be used for cleaning trucks. Low flash point (below 100 deg. F.) solvents shall not be used. High flash point (at or above 100 deg. F.) solvents may be used. Precautions regarding toxicity, ventilation, and fire hazard shall be consonant with the agent or solvent used.

1910.178(q)(11)

[Reserved]

1910.178(q)(12)

Industrial trucks originally approved for the use of gasoline for fuel may be converted to liquefied petroleum gas fuel provided the complete conversion results in a truck which embodies the features specified for LP or LPS designated trucks. Such conversion equipment shall be approved. The description of the component parts of this conversion system and the recommended method of installation on specific trucks are contained in the "Listed by Report."

[39 FR 23502, June 27, 1974, as amended at 40 FR 23073, May 28, 1975; 43 FR 49749, Oct. 24, 1978; 49 FR 5322, Feb. 10, 1984; 53 FR 12122, Apr. 12, 1988; 55 FR 32015, Aug. 6, 1990; 61 FR 9227, March 7, 1996; 63 FR 66270, Dec. 1, 1998; 68 FR 32368, June 2, 2003; 71 FR 16672, April 3, 2006]

[Next Standard \(1910.178 App A\)](#)

[Regulations \(Standards - 29 CFR\) - Table of Contents](#)

[Back to Top](#)

www.osha.gov

www.dol.gov

[Contact Us](#) | [Freedom of Information Act](#) | [Customer Survey](#)
[Privacy and Security Statement](#) | [Disclaimers](#)

Occupational Safety and Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

U.S. Department of Labor
Occupational Safety & Health Administration




www.osha.gov

Search [GO](#) [Advanced Search](#) | [A-Z](#)

Regulations (Standards - 29 CFR)
Powered industrial trucks. - 1910.178 App A

[← Regulations \(Standards - 29 CFR\) - Table of Contents](#)

• Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	N
• Subpart Title:	Materials Handling and Storage
• Standard Number:	1910.178 App A
• Title:	Powered industrial trucks.

Appendix A -- Stability of Powered Industrial Trucks (Non-mandatory Appendix to Paragraph (I) of This Section)

A-1. Definitions.

The following definitions help to explain the principle of stability:

Center of gravity is the point on an object at which all of the object's weight is concentrated. For symmetrical loads, the center of gravity is at the middle of the load.

Counterweight is the weight that is built into the truck's basic structure and is used to offset the load's weight and to maximize the vehicle's resistance to tipping over.

Fulcrum is the truck's axis of rotation when it tips over.

Grade is the slope of a surface, which is usually measured as the number of feet of rise or fall over a hundred foot horizontal distance (the slope is expressed as a percent).

Lateral stability is a truck's resistance to overturning sideways.

Line of action is an imaginary vertical line through an object's center of gravity.

Load center is the horizontal distance from the load's edge (or the fork's or other attachment's vertical face) to the line of action through the load's center of gravity.

Longitudinal stability is the truck's resistance to overturning forward or rearward.

Moment is the product of the object's weight times the distance from a fixed point (usually the fulcrum). In the case of a powered industrial truck, the distance is measured from the

point at which the truck will tip over to the object's line of action. The distance is always measured perpendicular to the line of action.

Track is the distance between the wheels on the same axle of the truck.

Wheelbase is the distance between the centerline of the vehicle's front and rear wheels.

A-2. General.

A-2.1. Determining the stability of a powered industrial truck is simple once a few basic principles are understood. There are many factors that contribute to a vehicle's stability: the vehicle's wheelbase, track, and height; the load's weight distribution; and the vehicle's counterweight location (if the vehicle is so equipped).

A-2.2. The "stability triangle," used in most stability discussions, demonstrates stability simply.

A-3. Basic Principles.

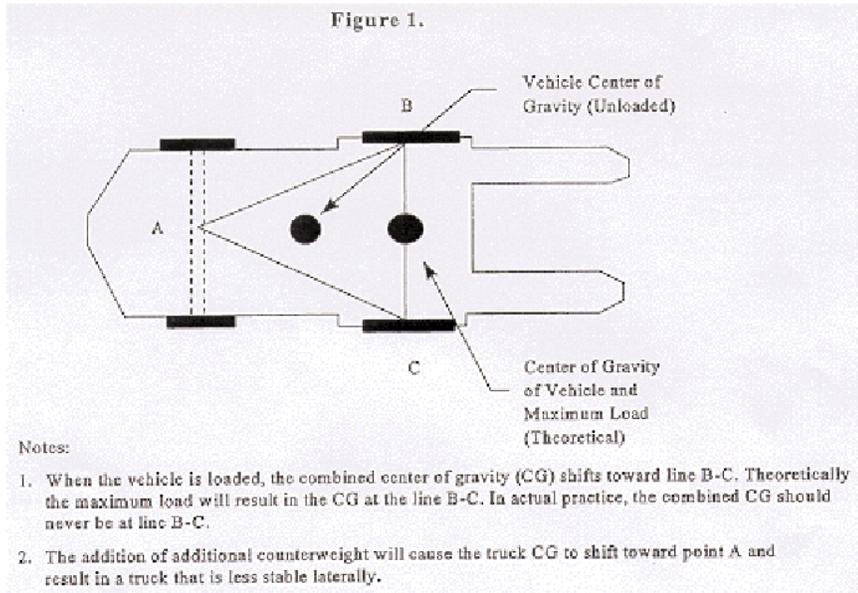
A-3.1. Whether an object is stable depends on the object's moment at one end of a system being greater than, equal to, or smaller than the object's moment at the system's other end. This principle can be seen in the way a see-saw or teeter-totter works: that is, if the product of the load and distance from the fulcrum (moment) is equal to the moment at the device's other end, the device is balanced and it will not move. However, if there is a greater moment at one end of the device, the device will try to move downward at the end with the greater moment.

A-3.2. The longitudinal stability of a counterbalanced powered industrial truck depends on the vehicle's moment and the load's moment. In other words, if the mathematic product of the load moment (the distance from the front wheels, the approximate point at which the vehicle would tip forward) to the load's center of gravity times the load's weight is less than the vehicle's moment, the system is balanced and will not tip forward. However, if the load's moment is greater than the vehicle's moment, the greater load-moment will force the truck to tip forward.

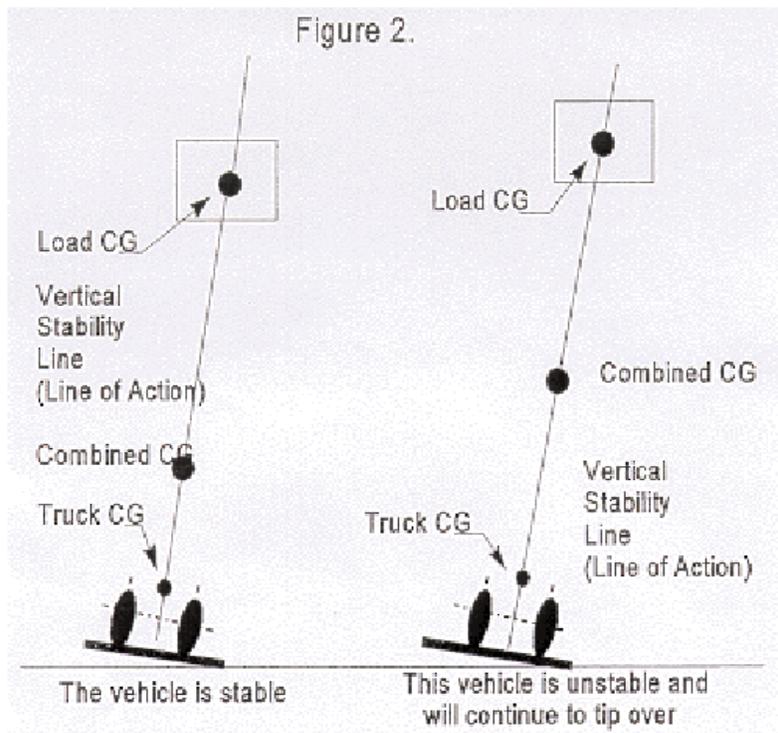
A-4. The Stability Triangle.

A-4.1. Almost all counterbalanced powered industrial trucks have a three-point suspension system, that is, the vehicle is supported at three points. This is true even if the vehicle has four wheels. The truck's steer axle is attached to the truck by a pivot pin in the axle's center.

When the points are connected with imaginary lines, this three-point support forms a triangle called the stability triangle. Figure 1 depicts the stability triangle.



A-4.2. When the vehicle's line of action, or load center, falls within the stability triangle, the vehicle is stable and will not tip over. However, when the vehicle's line of action or the vehicle/ load combination falls outside the stability triangle, the vehicle is unstable and may tip over. (See Figure 2.)



A-5. Longitudinal Stability.

A-5.1. The axis of rotation when a truck tips forward is the front wheels' points of contact with the pavement. When a powered industrial truck tips forward, the truck will rotate about this line. When a truck is stable, the vehicle-moment must exceed the load-moment. As long as the vehicle-moment is equal to or exceeds the load-moment, the vehicle will not tip over. On the other hand, if the load moment slightly exceeds the vehicle-moment, the truck will begin to tip forward, thereby causing the rear to lose contact with the floor or ground and resulting in loss of steering control. If the load-moment greatly exceeds the vehicle moment, the truck will tip forward.

A-5.2. To determine the maximum safe load-moment, the truck manufacturer normally rates the truck at a maximum load at a given distance from the front face of the forks. The specified distance from the front face of the forks to the line of action of the load is commonly called the load center. Because larger trucks normally handle loads that are physically larger, these vehicles have greater load centers. Trucks with a capacity of 30,000 pounds or less are normally rated at a given load weight at a 24-inch load center. Trucks with a capacity greater than 30,000 pounds are normally rated at a given load weight at a 36- or 48-inch load center. To safely operate the vehicle, the operator should always check the data plate to determine the maximum allowable weight at the rated load center.

A-5.3. Although the true load-moment distance is measured from the front wheels, this distance is greater than the distance from the front face of the forks. Calculating the maximum allowable load-moment using the load-center distance always provides a lower load-moment than the truck was designed to handle. When handling unusual loads, such as those that are larger than 48 inches long (the center of gravity is greater than 24 inches) or that have an offset center of gravity, etc., a maximum allowable load-moment should be calculated and used to determine whether a load can be safely handled. For example, if an operator is operating a 3000 pound capacity truck (with a 24-inch load center), the maximum allowable load-moment is 72,000 inch-pounds (3,000 times 24). If a load is 60 inches long (30-inch load center), then the maximum that this load can weigh is 2,400 pounds (72,000 divided by 30).

A-6. Lateral Stability.

A-6.1. The vehicle's lateral stability is determined by the line of action's position (a vertical line that passes through the combined vehicle's and load's center of gravity) relative to the stability triangle. When the vehicle is not loaded, the truck's center of gravity location is the only factor to be considered in determining the truck's stability. As long as the line of action of the combined vehicle's and load's center of gravity falls within the stability triangle, the truck is stable and will not tip over. However, if the line of action falls outside the stability triangle, the truck is not stable and may tip over. Refer to Figure 2.

A-6.2. Factors that affect the vehicle's lateral stability include the load's placement on the truck, the height of the load above the surface on which the vehicle is operating, and the vehicle's degree of lean.

A-7. Dynamic Stability.

A-7.1. Up to this point, the stability of a powered industrial truck has been discussed without considering the dynamic forces that result when the vehicle and load are put into motion. The weight's transfer and the resultant shift in the center of gravity due to the dynamic forces created when the machine is moving, braking, cornering, lifting, tilting, and lowering loads, etc., are important stability considerations.

A-7.2. When determining whether a load can be safely handled, the operator should exercise extra caution when handling loads that cause the vehicle to approach its maximum design characteristics. For example, if an operator must handle a maximum load, the load should be carried at the lowest position possible, the truck should be accelerated slowly and evenly, and the forks should be tilted forward cautiously. However, no precise rules can be formulated to cover all of these eventualities.

[63 FR 66270, Dec. 1, 1998]

[63 FR 66270, Dec. 1, 1998]



[Next Standard \(1910.179\)](#)



[Regulations \(Standards - 29 CFR\) - Table of Contents](#)



[Back to Top](#)

www.osha.gov

[Contact Us](#) | [Freedom of Information Act](#) | [Customer Survey](#)
[Privacy and Security Statement](#) | [Disclaimers](#)

Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Summary: Referencing the OSHA Standard, 1910.178 Powered Industrial Trucks

1. The OSHA standard is a tool than we can use for our protection by demanding that the law be enforced.
2. It is important to be familiar with the PIT Standard for all workers, especially those working around or with PIT's.
3. Allying the elements of the standard to identified PIT hazards before an incident or an accident is am important tool for preventing PIT incidents and accidents.
4. The OSHA standards are minimum requirements; every workplace is unique and lessons learned should include situations which are above and beyond OSHA standards to ensure that workers are safe.

EVALUATION**Activity 7: OSHA Standard 1910.178
Powered Industrial Trucks**

1. How important is this Activity for workers? Please circle one number.

Activity Is Not Important			Activity Is Very Important	
1	2	3	4	5

2. Which factsheets are the most important to distribute to the workers? (Please list the page numbers.)

3. What would you suggest be done to improve this Activity?

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

Appendix A

Safety Inspection Form

Powered Industrial Vehicles & Forklifts

Safety Inspection Form Powered Industrial Vehicles & Forklifts

A. Aisles

<u>YES</u>	<u>NO</u>	<u>N/A</u>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1. Are aisle widths maintained? 29 CFR 1910.22(b)(1)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	2. Are aisles and passageways properly illuminated?
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	3. Are aisles in good condition? 29 CFR 1910.22(b)(1)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	4. Are aisles kept clean and free of obstructions? 29 CFR 1910.22(b)(1)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	5. Are aisles marked? 29 CFR 1910.22(b)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	6. Are fire aisles, access to stairways, and fire equipment kept clear? 29 CFR 1910.178(m)(14)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	7. Is there safe clearance for equipment through aisles and doorways? 29 CFR 1910.176(a)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	8. Are aisles marked and maintained in good condition?

B. Battery Charging/Truck Operations

<u>YES</u>	<u>NO</u>	<u>N/A</u>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	9. Are all exposures from dust, fumes, etc., controlled? 29 CFR 1910.1000(a) 29 CFR 1910.1000(b) 29 CFR 1910.1000(c)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	10. Are batteries charged in a properly vented area? 29 CFR 1910.178(g)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	11. Are facilities provided for flushing spilled electrolyte? 29 CFR 1910.178(g)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	12. Do the noise levels conform to exposure limit standards? 29 CFR 1910.95(b)(1)

Battery Charging/Truck Operations continued

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|---|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 13. Do you prevent open flames, sparks in immediate area?
29 CFR 1910.178(g)(11) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 14. Is local ventilation sufficient to disperse fumes?
29 CFR 1910.178(g)(2) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 15. Is smoking prohibited in battery charging area?
29 CFR 1910.178(g)(10) |

C. Equipment

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|--|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 16. Are all cord-connected, electrically operated tools used by employees at their workstation in good condition?
29 CFR 1910.242(a) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 17. Are portable lamps used to illuminate spray areas suitable for use in Hazardous Conditions?
29 CFR 1910.107(c)(8) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 18. Are the forklifts in your facility correctly designated for your type of operation (based on atmosphere, hazards of materials handled, etc.)?
29 CFR 1910.178(c)(2) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 19. Is necessary personal protective equipment available?
29 CFR 1910.252(b)(2) |

D. Forklift Operations

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|---|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 20. Are all industrial trucks not in safe operating condition removed from service?
29 CFR 1910.178(q)(1) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 21. Are industrial trucks equipped with flashing lights, horn, overhead guard and load limits?
29 CFR 1910.178(a)(2) |

Forklift Operations continued

<u>YES</u>	<u>NO</u>	<u>N/A</u>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	22. Are repairs to fuel and ignition systems conducted only in areas specifically designed for them? 29 CFR 1910.178(q)(3)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	23. Are the brakes on each industrial truck capable of bringing the vehicle to a complete safe stop when fully loaded?
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	24. Are the required lift truck operating rules posted and enforced?
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	25. Are your forklifts inspected before being placed in service? Inspections should be daily, or after each shift, if used around the clock. 29 CFR 1910.178(q)(7)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	26. Is directional lighting provided on each industrial truck that operates in an area with less than 2 lumens per square foot candles per square foot of general lighting? 29 CFR 1910.178(h)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	27. Is filling fuel tanks prohibited while engines are running? 29 CFR 1910.178(p)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	28. Will the industrial truck's parking brake effectively prevent the vehicle from moving when unattended? 29 CFR 1910.178(m)(5)(i)

E. Fueling

<u>YES</u>	<u>NO</u>	<u>N/A</u>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	29. Are fueling operations done in such a manner that the likelihood of spillage will be minimal? 29 CFR 1910.178(p)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	30. Is it prohibited to fuel an internal combustion engine with a flammable liquid when the engine is running? 29 CFR 1910.178(p)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	31. When spillage occurs during fueling operations, are measures taken to control vapors before restarting the engine? 29 CFR 1910.178(p)(3)

F. Housekeeping – General

<u>YES</u>	<u>NO</u>	<u>N/A</u>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	32. Are all spilled materials or liquids cleaned up immediately? 29 CFR 1910.141(a)(3)(ii)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	33. Are mats, grating, etc. used where drainage is needed? 29 CFR 1910.22(a)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	34. Are work areas clean? 29 CFR 1910.22(a)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	35. Are work surfaces kept dry or are appropriate means taken to assure the surfaces are slip resistant? 29 CFR 1910.22(a)(2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	36. Is an adequate cleaning schedule maintained to avoid accumulation of dust and or potential contaminants? 29 CFR 1910.141(a)(3)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	37. Is the compressed air for cleaning less than 30 psi? [Note: OSHA recommends under 30 psi when cleaning off clothing.] 29 CFR 1910.242(b)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	38. Is proper housekeeping maintained?

G. Materials Handling

<u>YES</u>	<u>NO</u>	<u>N/A</u>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	39. Are aisle ways designated, permanently marked, and kept clear to allow unhindered passage? 29 CFR 1910.176(a)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	40. Are containers stored, stacked, blocked, and limited in height so they are stable and secure? 29 CFR 1910.176(b)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	41. Are dock boards (bridge plates) used when loading or unloading operations are taking place between vehicles and docks? 29 CFR 1910.178(n)(11) 29 CFR 1910.30(a)

Materials Handling continued

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|---|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 42. Are motorized vehicles and mechanized equipment inspected daily or prior to use?
29 CFR 1910.178(q)(7) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 43. Are trucks and trailers secured from movement during loading and unloading operations?
29 CFR 1910.178(m)(7) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 44. Are vehicles shut off and brakes set prior to loading or unloading?
29 CFR 1910.178(m)(5)(i) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 45. Is there safe clearance for equipment through aisles and doorways?
29 CFR 1910.176(a) |

H. Operations

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|--|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 46. Are special precautions taken to protect employees during construction and repair operations?
29 CFR 1910.36(c)(1) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 47. Are tools or equipment functional and in good repair? |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 48. Does PPE have ANSI or ASTM specifications marked on it?
29 CFR 1910.133(b)(1)
29 CFR 1910.135(b)(1)
29 CFR 1910.136(b)(1) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 49. Is filling fuel tanks prohibited while engines are running?
29 CFR 1910.178(p)(2) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 50. Is personal protective equipment (PPE) functional and in good repair?
29 CFR 1910.132(a)
29 CFR 1910.132(e) |

I. PPE: Foot

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|---|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 51. Is appropriate foot protection required where there is the risk of foot injuries?
29 CFR 1910.132(a)
29 CFR 1910.136(a) |

J. PPE: Head

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|--|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 52. Are hard hats inspected periodically for damage to the shell and suspension system?
29 CFR 1910.135(b) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 53. Are hard hats provided and worn where danger of falling objects exists?
29 CFR 1910.135(a)(1) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 54. Is personal protective equipment provided and are all employees required to use PPE as needed to protect against head injury?
29 CFR 1910.132(a)
29 CFR 1910.135(a)(1) |

K. Training

- | <u>YES</u> | <u>NO</u> | <u>N/A</u> | |
|-----------------------|-----------------------|-----------------------|---|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 55. Are only trained personnel as required in 1910.178(l) allowed to operate Powered Industrial Trucks?
29 CFR 1910.178(l) |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 56. Have you documented what methods you use to train forklift operators?
29 CFR 1910.178(l) |

Evaluator _____

Date _____

Appendix B

Clarification regarding the policy for the use of seat belts on PIT in general industry



UNITED STATES DEPARTMENT OF LABOR
OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION

www.OSHA.gov A-Z Index: [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#) Search OSHA 

Standard Interpretations

12/11/1996 - Clarification regarding the policy for the use of seat belts on powered industrial trucks in general industry.

[← Standard Interpretations - Table of Contents](#)

OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at <http://www.osha.gov>.

December 11, 1996

Mr. Stuart Flatow
American Trucking Associations
2200 Mill Road
Alexandria, VA 22314-4677

Dear Mr. Flatow:

This is in response to your November 5 letter requesting clarification of the October 9, 1996, memorandum to Regional Administrators regarding the Occupational Safety and Health Administration (OSHA) enforcement policy for the use of seat belts on powered industrial trucks in general industry. I regret the delay in responding to your inquiry.

Your specific inquiry concerned when and under what conditions OSHA would cite an employer for not taking advantage of the powered industrial truck manufacturer's operator restraint system or seat belt retrofit program. Generally, OSHA will cite an employer for the lack of seat belt use on powered industrial trucks, when the Agency can document that an employer has been specifically notified and offered a retrofit program by the manufacturer and has not retrofitted an applicable powered industrial truck. OSHA will determine, on a case-by-case basis, whether to cite an employer for not taking advantage of a manufacturer's seat belt retrofitting program, after consultation with the Regional Solicitor.

Should you have further questions on this response, please contact [the Office of General Industry Enforcement at 202 693-1850].

Sincerely,

John B. Miles, Jr., Director
[Directorate of Enforcement Programs]

[Corrected 10/22/2004]

[← Standard Interpretations - Table of Contents](#)

Appendix C
Interpretive Letter

Standard Interpretations

11/27/2001 - Applicable standards to lifting personnel on a platform supported by a rough-terrain forklift.

Standard Interpretations - Table of Contents

. Standard Number: 1926.451; 1926.451(a)(1); 1926.451(a)(6); 1926.451(c)(2)(iv); 1926.451(c)(2)(v); 1926.452; 1926.453; 1926.454; 1926.602; 1926.602(c); 1926.602(c)(1)(vi); 1926.602(c)(1)(viii); 1926.602(d)

OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at <http://www.osha.gov>.

November 27, 2001

Mr. Mark W. Monson, CSP
General Casualty
10400 Viking Drive, Suite 300
Eden Prairie, MN 55344

Re: §§1926.451(c)(2)(iv) and (v) and 1926.602(c)

Dear Mr. Monson:

This responds to your January 3, 2000, letter to the Occupational Safety and Health Administration (OSHA), in which you ask several questions regarding the use of rough-terrain forklifts (powered industrial trucks) for lifting personnel in a platform. You ask which requirements must be followed by a contractor using a rough-terrain forklift for lifting personnel in a platform, and if there are any specific requirements other than those found in §1926.602. We apologize for the long delay in providing this response.

In short, requirements for the use of lifting and hauling equipment for material handling in construction, such as rough-terrain forklifts are set out in §1926.602(c). In addition, OSHA's construction standards for scaffolds (Subpart L of 29 CFR Part 1926, §§1926.451-1926.454 and Appendices A-E) also contain requirements that protect employees working on platforms elevated by forklift trucks. We explain these in detail below.

continued

Letter (*continued*)

In OSHA's forklift standard, under §1926.602(c)(1)(vi), the designs of all industrial trucks used by an employer are required to meet the American National Standards Institute (ANSI) B56.1-1969, Safety Standards for Powered Industrial Trucks. Paragraph (c) of §1926.602 was first published as an OSHA standard in 1971. OSHA has not undertaken rulemaking to revise §1926.602(c). However, in 1993, paragraph (viii) was added to §1926.602(c)(1) as part of an administrative rulemaking to codify existing applicable general industry standards as construction standards. That paragraph, ((c)(1)(viii), is derived from section 603.L of ANSI B56.1-1969), sets out additional precautions for the protection of personnel being elevated by a powered industrial truck.

As mentioned above, other construction standards (besides §1926.602(c)) contain requirements to protect employees working on platforms. In Subpart L, the standard for scaffolds, the term "platform" is defined as "a work surface elevated above lower levels." Therefore, §§1926.451, 1926.452 and 1926.454 of OSHA's standards for scaffolds would be applicable for capacity, construction, access, use, fall protection, and training.

Note that, under §1926.451(c)(2)(iv), the standard states that front-end loaders and "similar pieces of equipment" shall not be used to support scaffold platforms unless specifically designed by the manufacturer for such use. The next paragraph (§1926.451(c)(2)(v)) specifically addresses forklifts used to support scaffold platforms, stating that the entire platform must be attached to the fork, and that the forklift is not to be moved horizontally while the platform is occupied.

In the Preamble to Subpart L, published in the August 30, 1996, **Federal Register**, OSHA discussed comments that asked if the Agency "should prohibit the use of cranes, derricks, forklifts, front-end loaders, and similar pieces of equipment for the support of scaffold platforms [emphasis added]." At the end of that discussion, in explaining our findings leading to the promulgation of the final standard, we stated:

OSHA finds there is insufficient reason to totally ban the use of **forklifts**, front-end loaders and similar pieces of equipment as scaffold supports. OSHA notes that the commenters are in general agreement that all equipment not specifically designed to support scaffold platforms must not be used....

* * * * *

All supported scaffolds, including those supported by forklifts, front-end loaders and similar pieces of equipment, must comply with the applicable requirements of §1926.451 for capacity, construction, access, use, and fall protection [emphasis added].

(Quotation from **61 FR 46044**, August 30, 1996)

In construction, powered industrial trucks, which include rough terrain forklifts, are “similar pieces of equipment” to forklifts and front end loaders in this context. Therefore, they fall within the requirements of §1926.451(c)(2)(iv) and (v), along with the other requirements of that section for capacity, construction, access, use, and fall protection. So, in response to your query whether a contractor can field-design a personnel platform for a rough terrain forklift, use of such a platform is permitted only if the machine supporting the personnel platform was designed for that purpose and both the machine and platform meet the requirements in §1926.451 for capacity, construction, access, use, and fall protection.

If the manufacturer’s operator manual states that a forklift is not to be used for elevating personnel platforms, use of the equipment to support such a platform would violate this provision. Consequently, OSHA prohibits the use of such equipment to elevate personnel. If the owner's manual for the equipment is silent on whether the equipment may be used to elevate personnel, the employer must determine if the forklift was designed for such purposes. The standard places the obligation on the employer to ensure that this type of equipment is used to elevate personnel only where the manufacturer has designed it to do so. The employer would either have to find out from the manufacturer that it was designed for this use or (where that information is unavailable) obtain a certification by a registered professional engineer that the equipment was so designed.

Your letter also mentions that you have been told the basket [that is, the platform for elevating personnel] must not extend more than 10 inches beyond the wheelbase of the machine in use. This is correct. That requirement is found in the ANSI B56.6-1992, Safety Standards for Rough Terrain Forklift Trucks. Paragraph 8.25.1(b) of B56.6-1992 refers to 10 inches (250 mm) as a limit for the distance, greater than the overall width of the truck, beyond which the platform is not [to be designed] to exceed.

As discussed above, OSHA’s standards for the use of lifting and hauling equipment for material handling in construction, such as rough-terrain forklifts, set out in §1926.602(c), require that provisions in ANSI B56.1-1969 be met. Other than for §1926.602(d), which addresses operator training, we have not incorporated the ANSI B56.6-1992 as an OSHA construction standard. However, under §1926.451(a)(1) of the scaffold standard, the machine must “be capable of supporting, without failure, its own weight and at least four times the maximum intended load applied or transmitted to it.” If the rated capacity of the machine with the platform is based on this 10-inch (250-mm) limitation, then this provision of the scaffold standard would prohibit exceeding that limitation. In addition,

continued

Letter (*continued*)

under §1926.451(a)(6), scaffolds must be “designed by a qualified person and shall be constructed and loaded in accordance with that design.” If the manufacturer of the machine has designed it with this 10-inch limitation, then it would also be a violation of §1926.451(a)(6) to exceed it.

If you require any further assistance, please do not hesitate to contact us again by writing to: OSHA - [Directorate of Construction, Office of Construction Standards and Guidance], Rm. N3468, 200 Constitution Avenue, N.W., Washington, D.C. 20210.

Sincerely,

Russell B. Swanson, Director
Directorate of Construction