



Railroad Crew Resource Management Training Course

Mechanical Track: For Locomotive Repair Shop Crews, Locomotive Servicing Crews, Inbound/Outbound Inspection Teams, and Car Repair Shop Crews

Facilitator's Guide



U.S. Department of Transportation

Texas Transportation Institute

**Railroad
Crew Resource Management
(CRM) Training Course**
Mechanical Track

(Insert Date Here)

Crew Resource Management 1

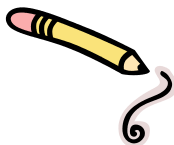


OBJECTIVE OF SLIDE: *To act as a title slide while participants are arriving to the training room.*

Next slide



** Facilitator Notes*



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Introduction

Registration and Introductions

- **Safety Briefing**
- **Registration**
- **Introductions**

Crew Resource Management 2

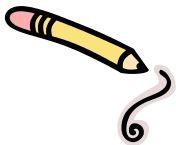


OBJECTIVE OF SLIDE: *To register participants for the course, introduce participants and facilitator(s), and to give a safety briefing.*



DISCUSS:

- *Safety briefing items*
- *Facilitator background and accomplish class records/preparations (While the facilitator is discussing his/her background, have class fill out appropriate sign-in sheet.)*
- *Discuss participant background (After the facilitator has finished introducing himself/herself and formal class record/preparations are complete, have each participant introduce him/herself to the group/facilitator and state what his/her job is and how many years he/she has been working that job. Facilitator can use discretion as to whether to acknowledge unusual participant background, which can aid setting the class at ease with the facilitator.)*




Next slide

** Facilitator Notes*

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Introduction

Group Discussion



What are some things you do to ensure safety on the job, on a daily basis?

Crew Resource Management 3



OBJECTIVE OF SLIDE: *Instructor-led focused discussion/exercise and icebreaker*

Group Discussion

- *Overview: In small groups (3-5), participants answer question on slide. Through this, a list is created on a flip chart of activities that participants carry out to assure and improve safety. Discussion follows. Time: 15 minutes Supplies needed: Flip Chart, Markers*
- *Break class into groups of 4-5 individuals.*



SUGGESTED SCRIPT: “Now that we are in these groups, I want each group to answer this question. I will give you about 5 minutes. Afterward, I am going to ask each group for some of their answers, and I am going to write them down on this flipchart. So, in your small groups think about the things you do on a daily basis, to ensure safety on the job. Someone in the group write down some of these things for your group. Go ahead and get started.”

Give the groups 5 minutes to come up with ideas.

*After 5 minutes has elapsed, have each group give you **one** thing they do everyday that ensures safety on the job. Repeat this activity several times.*



ASK: “What are some of the things you do to ensure safety on the job, on a daily basis?”

Use discussion facilitation techniques

Probing Questions:

- *“How do you get those things done?”*
- *“Do you do these things on your own?”*
- *“How many other people are involved?”*
- *“Does the way you interact/communicate with these people affect the safety on the job?”*
- *“Do their actions impact your personal safety?”*
- *“Do you have a team-based outlook on job performance and safety?”*

Record the participant's answers on a flip chart, identifying those things that are CRM oriented in the natural course of conversation.

Examples of Possible Answers—Stretches, check equipment, preparation, communicate, check maintenance procedures manual for each job, have a thorough job briefing, conduct a debriefing after finishing my work, get rest, wear proper personnel protective equipment, etc.

Make sure you ask each group to give you an example until you have enough to facilitate a discussion.



SUGGESTED SCRIPT: “Great. These are the things we are doing right now on the job to ensure safety. So guess what. We are already practicing many CRM techniques. As we will learn today, CRM has to do with communication (*point out communication examples on flipchart*), technical proficiency (*point out technical proficiency examples on flipchart*), teamwork (*point out teamwork examples on the flipchart*), and situational awareness (*point out situational awareness examples on the flipchart*). The point is—we are already doing some of the things that are important to CRM; however, this course is designed to make us more aware of the things we do and to improve our understanding and practice of CRM skills.”



SUGGESTED SCRIPT: “Let's go over the schedule for today.”

Next slide

** Facilitator Notes*



Introduction

Class Schedule

Morning: Modules 1-3

Afternoon: Modules 4-6

Crew Resource Management 4



OBJECTIVE OF SLIDE: *To give participants the schedule for the class*

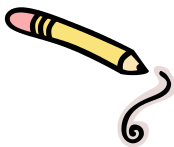
** The facilitator can input the exact time schedule of the course on to this slide in the presentation*



DISCUSS:

- *Length of course*
- *Breaks*
- *Lunch*

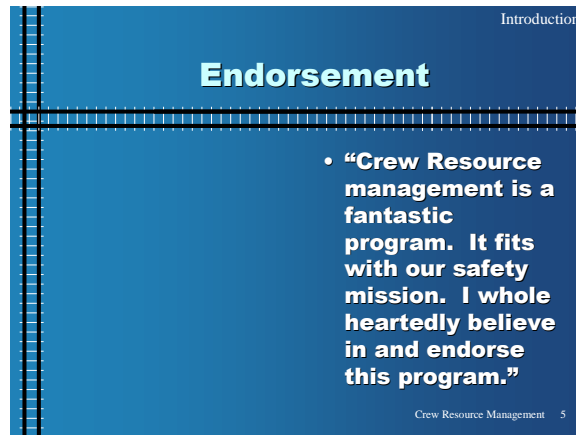
- *Cell Phones—Ideally the facilitator should have all participants turn off their cell phones/beepers or other devices such that they do not interrupt the course. However, some participants might need to accept phone calls during the course. The facilitator should inquire before the start of the course about who needs to accept phone calls.*
- *As the facilitator, you should request that anyone requiring the availability of their cell phone should accommodate the class by having the ringer in Silent mode.*



Next slide

** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To show the participants that this course is endorsed by senior management or relevant union representatives, thus creating more buy-in.*

** The default condition for this presentation has this slide hidden. Endorsement should be sought by senior management or relevant union representatives. If endorsement is found, this slide can be unhidden from the slide show before the start of the course. To hide/unhide a slide: In PowerPoint click “Slide Show” on the menu bar, then click on “Hide Slide” to deselect “hide” for this slide.*



SUGGESTED SCRIPT: “This Crew Resource Management training program is part of the larger safety initiatives here at _____ (name of railroad). Senior management has reviewed this program and is 100 percent behind it. _____ (name of endorser) believes that this program is essential in trying to decrease the number of accidents in the yard, in the shops, and out on the tracks.”



REFER TO SLIDE AND EXPAND: *Read what the senior management or relevant union representatives have stated on slide.*



SUGGESTED SCRIPT: “Let’s begin by looking at what you can expect to get out of your attendance at this course.”

Next slide



** Facilitator Notes*

Introduction

Overall Course Objectives

- Understand what CRM is and what it is not
- Understand the loss and gain of situational awareness
- Understand that safety hinges on both individual and team actions

Crew Resource Management 6



OBJECTIVE OF SLIDE: *For participants to understand the overall course objectives*



SUGGESTED SCRIPT: “These are the overall objectives of this course. These are the things that we want you to know; the things that when you leave here you will be able to do. By the end of this course you should be able to...”

** When going through the objectives of the course, try linking the objectives back to the items listed on the flip chart in terms of the thing the participants do everyday that ensures safety on the job. For example, after stating the objective, “understand the loss and gain of situational awareness,” you can connect it to the item “get enough rest” in the discussion earlier, stating that by getting enough rest and understanding the effects of fatigue, we can have a better understanding of the loss of situational awareness.*



REFER TO SLIDE AND EXPAND:

- Understand what CRM is and what it is not.
- Recognize when you are losing situational awareness and making proper efforts to regain awareness of the situation.
- Understand that safety hinges on both individual and team actions.

Next slide

Introduction

Overall Course Objectives

- Know techniques and attitudes that foster effective communication within and between teams
- Be able to describe how job safety is affected by circumstances both on and off the job
- Know CRM practices and appreciate their value in improving railroad safety

Crew Resource Management 7



OBJECTIVE OF SLIDE: *Continuation of previous slide.*



SUGGESTED SCRIPT: “The final three objectives of this course are...”



REFER TO SLIDE:

- “Know techniques and attitudes that foster effective communication within and between teams.”
- “Be able to describe how job safety is affected by circumstances both on and off the job. For example: Lack of rest—if you come to work tired it will probably effect how you will work that day. We will learn that we need to communicate to other members of our team about our fatigue before starting a job.”
- “Know CRM practices and appreciate their value in improving railroad safety.”

Next slide

Introduction

Course Outline

1. Introduction/Defining CRM
2. Technical Proficiency
3. Situational Awareness
4. Communications
5. Teamwork
6. Assertiveness

Crew Resource Management 8



OBJECTIVE OF SLIDE: *After completing this slide, participants should understand (1) that the overall purpose of CRM is to increase safety and (2) the outline of the course.*

It's All About Safety



SUGGESTED SCRIPT: “Like we talked about in the group discussion a few minutes ago, crew resource management is based in **safety**. Using good crew resource management techniques will create a safer working environment by decreasing the number of errors. These accidents, as will be discussed in more detail, can cause injuries and even death. By using good crew resource management techniques you can improve the environment in which you work.

“Thus the overall objective of this course is to get you, when you leave this class, to have a better understanding of CRM principles and how to use CRM techniques effectively, and change certain behaviors to create a safer work environment.”

Really emphasize at the beginning of the point that this training is focused on worker safety.

Course Outline



SUGGESTED SCRIPT: “For the purpose of this training course CRM is broken into six different sections or modules. These are an Introduction to CRM, Technical Proficiency, Situational Awareness, Communication, Teamwork, and Assertiveness. The first module, Introduction to CRM, will give you a broad overview of CRM. The main content of the course comes from modules two through six. We are breaking the content of CRM up into these five modules in order to better understand each one; yet, as you will see throughout the course, they are all related to each other and intertwined to varying degrees.”



REFER TO SLIDE AND EXPAND:

1. Introduction/Defining CRM
2. Technical Proficiency
3. Situational Awareness
4. Communications
5. Teamwork
6. Assertiveness



SUGGESTED SCRIPT: “We will be using real scenarios developed from the accident/incident investigation reports written by the Federal Railroad Administration (FRA) or the National Transportation Safety Board (NTSB) to illustrate and evaluate these techniques to understand how to use them. Often the narratives are taken verbatim from FRA or NTSB reports with only minor changes made to shorten or summarize the events in the report.

“So that is what we are going to help you think about today during this course – human factors related errors.”



ASK: “Now when most of our friends and neighbors, or non-railroaders think about human factors errors on the railroad, what do you think is the first thing that comes to their mind?”

Probing questions:

- “What always gets a lot of attention in railroading?”
- “As a railroader, what do think the average non-railroader thinks of when asked, ‘What are human-factors errors?’”

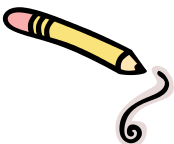
If they mentioned it in the discussion, say “you mentioned it in the discussion”

(correct answer–Fatigue)



SUGGESTED SCRIPT: “That is right.....Fatigue.”

Next slide



 * *Facilitator Notes*

Introduction

Where is Fatigue?

- **How is fatigue related to CRM?**

Crew Resource Management 9



OBJECTIVE OF SLIDE: *To give participants an introduction to how fatigue is related to CRM.*



SUGGESTED SCRIPT: “Some activities that you might carry out to assure and improve safety are activities related to decreasing fatigue or anti-fatigue measures. Some of these are eating the right kinds of foods and getting enough sleep.”



ASK: “When our friends and neighbors, or non-railroaders, think about fatigue on the railroad, who do they typically think about?”

Get some answers from group (most likely answer: engineers and conductors).



SUGGESTED SCRIPT: “Mechanical work can be just as tiring and can also lead to high levels of fatigue. What if someone in the shops was up all night with a sick baby or a car inspector was called in to work overtime? As you all are aware, fatigue is not just an issue with train crews.”



ASK: “So how is fatigue related to CRM?”

Get some answers from group.



SUGGESTED SCRIPT: “As you will discover throughout this program, CRM is a safety program aimed at using all of one’s resources to ensure safe operations. CRM deals with human factors accidents by making individuals more aware of the situation, having better communication skills, and working better as a team, thereby decreasing human error types of accidents. We’ll see as we go through the training program, CRM training is a counter fatigue technique. As each individual and team communicates more proficiently and works together better as a team (remember communication and teamwork are two modules in this program), the team as a whole can help to counteract fatigue in each individual. This is only possible,

however, by practicing good CRM techniques. By the end of this program you should have a better understanding of how important it is not to be fatigued and the effects of fatigue, as well as how to counteract fatigue.”

Next slide



** Facilitator Notes*

Introduction

Module 1: Introduction

- Explain where CRM techniques originated
- Describe the difference between CRM and crew management
- Describe how CRM can be used to reduce human error accidents
- Name the five main areas of CRM practices

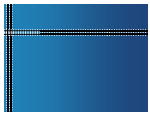
Crew Resource Management 10



OBJECTIVE OF SLIDE: *To explain to participants the objectives of Module 1.*



SUGGESTED SCRIPT: “So now we are going to begin Module 1, which is an introduction to CRM. By the end of Module 1, you should be able to.....”



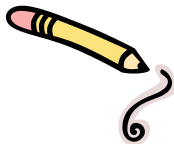
REFER TO SLIDE AND EXPAND:

- Explain where CRM techniques originated.
- Describe the difference between CRM and crew management.
- Describe how CRM can be used to reduce human error accidents.
- Name the five main areas of CRM practices.



SUGGESTED SCRIPT: “Before we can effectively do all these things, we need to agree on what CRM is. So, let’s define what we mean by the term Crew Resource Management.”

Next slide



** Facilitator Notes*

Introduction

CRM

- A crew's effective use of all available resources to achieve safe and efficient train operations

Crew Resource Management 11



OBJECTIVE OF SLIDE: *To define CRM.*



SUGGESTED SCRIPT: “Before I formally introduce the topic of CRM, I want everyone to watch a video that might help us understand where CRM came from. As we will see later in the program, most people attribute the development of CRM to the airline industry. However, we came across a film that was made approximately 50 years ago following a rail accident investigation. It shows that the railroad industry was thinking about human factors accidents, and what we now call CRM, a long time ago. Thus, these ideas are not new to the railroad industry.”



Video: *Show CRM Video Clip 1–Trouble at Troublesome*

After-video discussion topic: This video was made in the late 1950s, although CRM is not mentioned in the video. This video is about CRM. This video illustrates that these topics have been around for a long time. It is nothing new.



SUGGESTED SCRIPT: “This is the definition we are going to be using throughout this program. Crew Resource Management is...”



Click on mouse



REFER TO SLIDE:

A crew's effective use of all available resources to achieve safe and efficient train operations.

Explain this definition in laymen terms using an example familiar to the group of learners.



SUGGESTED SCRIPT: “This definition may seem complicated at first; however, it is easier to understand if we break it down into its component parts. First we’ll look at the word ‘crew’.”

Next slide



** Facilitator Notes*

Introduction

Crew Concept Discussion

- **Definition of a crew: “Any group of people working at tasks designed to accomplish a common mission, goal, or objective.”**

Crew Resource Management 12



OBJECTIVE OF SLIDE: *To explain to the participants what we mean by the term crew, as well as give them a framework for understanding that a crew is not just their immediate (elemental) crew but also includes others at work on the railroad (interactive crew).*

Crew Concept Discussion



ASK: “What are some common tasks that you accomplish as **individuals**?”

WAIT! *Don’t answer your own question, get some answers from the group.*

Answers might include: checking tools for defects, signing out equipment, etc.

*Once participants give you some common tasks that they accomplish as individuals, show how those tasks could **not** be accomplished without the help of other people or team members.*

For example:

Machinist: “I check the instruction sheets for the job and go check out the tools I will need from the tool crib.”

Facilitator: “Do you ask the shop foreman to review your tool list before you go to the tool crib?”

Get participants to understand that in the railroad environment, ultimately no one works in total isolation from the efforts of others.



SUGGESTED SCRIPT: “Almost every task in the railroading environment is accomplished not by an individual working by themselves but as part of a larger crew or team.”

Define what we mean by crew and/or team



SUGGESTED SCRIPT: “That is why this is called **CREW** Resource Management. It is crew based just like the work we do. That is also why we define CRM as “A crew’s effective use of all available resources to achieve safe and efficient train operations.” It is not just how each of you as individuals use all available resource to achieve safe and efficient train operations, but how the crew does. Let’s explore this idea of a crew a little more.”



Click on mouse



SUGGESTED SCRIPT: “A crew is defined as....”

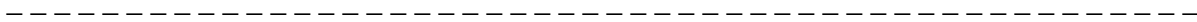


REFER TO SLIDE: “Any group of people working at tasks designed to accomplish a common mission, goal, or objective.”



SUGGESTED SCRIPT: “In railroading, teams or crews can be classified into two types.”

Next slide



** Facilitator Notes*

Introduction

Two Types of Railroad Teams

- **ELEMENTAL TEAM**—Basic teams that carry out functions at the railroads
Example: *Road Crew or MOW Crew*
- **INTERACTIVE TEAM**—Formed when an elemental team must interact with an outside individual or another elemental team or teams to safely carry out an activity
Example: *Dispatcher, MOW Crew, and Road Crew working together to move train through a work area*

Crew Resource Management 13



OBJECTIVE OF SLIDE: *To explain to the participants the meaning of elemental and interactive teams.*



SUGGESTED SCRIPT: “These two types of teams are elemental teams and interactive teams. Elemental teams are the basic teams that carry out functions at the railroads. For example, a train crew (engineer/conductor). This is an example of an elemental team. Locomotive servicing crews or an inbound or outbound inspection crew would be examples in the mechanical department.”



ASK: “As a mechanical/ maintenance team on the job, who else do you interact with besides each other while on a job?”

Answers could be: Yardmaster, supervisor, shop superintendent, contractors, clerks, etc.



SUGGESTED SCRIPT: “Right, when you broaden your concept of what makes a crew, you take into account all of these other people that help you get your work done. This is an interactive team. Interactive teams are those teams that are formed when an elemental team must interact with an outside individual or another elemental team(s) to safely carry out an activity. Many times interactive teams are formed for only a short time; for example, when a train crew, dispatch, and MOW crew must communicate with one another in order to move a train through a work area. Once the train has moved through the work area safely, that interactive team disbands. An example in mechanical would be a train inspection crew reporting to the yardmaster that a train is ready to depart.”

Make sure the participants understand the difference between an elemental team and an interactive team, and give examples of each that are relevant to the participants.



SUGGESTED SCRIPT: “Again, the definition of CRM is: a crew’s effective use of all available resources to achieve safe and efficient train operations. This definition encompasses both elemental teams and interactive teams. Let’s look at some examples of elemental teams in different areas of the railroad.”

Next slide



** Facilitator Notes*

Elemental teams (by functional areas)		Introduction
TRANSPORTATION		MECHANICAL
Road Crews		Locomotive Repair Shop Crews
Yard Crews		Locomotive Servicing Crews
Dispatchers		In/Outbound Inspection Crews
Hostlers	ENGINEERING	Car Repair Shop Crews
	Section Gangs	
	Production Gangs	
	Structures (B&B)	
	Signal Maintainers	
	Electrical/Catenary Crews	

Crew Resource Management 14



OBJECTIVE OF SLIDE: *To make sure the participants understand the difference between an elemental team and an interactive team, and to give examples of each that are relevant to the participants.*



SUGGESTED SCRIPT: “Here are some examples of different elemental teams broken down into different functional areas including transportation, engineering and mechanical.

Transportation includes all the train, yard, and engineman (TY&E) personnel. For example: road crews, yard crews, dispatchers, and hostlers. These are personnel involved in the direct movement of the trains.

The engineering group includes section gangs, production gangs, structures (Bridge & Building), signal maintainers, and electrical/catenary crews which exist on some passenger lines. These are the personnel that work on the track, signals, and structures.

The mechanical group includes locomotive repair shop crews, locomotive servicing crews, in/outbound inspection crews, and car repair shop crews. These are the personnel that repair, maintain, and service rolling stock.”



REFER TO SLIDE:

** Go through the different kinds of elemental teams*



SUGGESTED SCRIPT: “Again, the definition of CRM is: ‘a crew’s effective use of all available resources to achieve safe and efficient train operations.’ This definition encompasses both elemental teams and interactive teams. Let’s go back and look at the definition of CRM again.”

Next slide



** Facilitator Notes*

Introduction

Crew Resource Management

- A crew's effective use of all available **resources** to achieve safe and efficient train operations

Crew Resource Management 15



OBJECTIVE OF SLIDE: *To have participants understand that there are different types of resources that they use.*



Resources

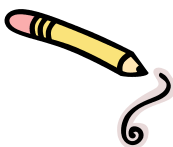
SUGGESTED SCRIPT: “We have defined what we mean by a crew. How about use of all available resources? What are resources?”



ASK: “What does this mean? What do we mean by resources?”

Don't get answers—lead into next slide.

Next slide



** Facilitator Notes*

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Introduction

Resources?

- Equipment
- Computer Resources, Paperwork
- **People**

Crew Resource Management 16



OBJECTIVE OF SLIDE: *To have participants understand that there are different types of resources that they use.*

Resources

SUGGESTED SCRIPT: “When we talk about resources, we mean equipment,”



Click on mouse

“Computer Resources or Paperwork,”



Click on mouse

“and People,”



Click on mouse

Equipment

SUGGESTED SCRIPT: “An example of equipment is the tools we use. For example: *wrenches, computer terminal, multi-meter, radio, cell phones, etc.*”

Computer Resources, Paperwork

SUGGESTED SCRIPT: “Computer resources and paperwork are also a resource. For example: *a bad order report describing equipment failure, daily/weekly maintenance plan, etc.*”



Introduction

What CRM is **NOT**

- **NOT: A crew calling program**
- **NOT: A quick fix that can be implemented overnight**
- **NOT: A short-term accident-reduction program**

Crew Resource Management 17



OBJECTIVE OF SLIDE: *To show the participants what CRM is not.*

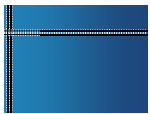


What CRM is NOT

SUGGESTED SCRIPT: “At first the term Crew Resource Management or the letters CRM may bring to mind a variety of other concepts that you have heard previously. Thus, to avoid any confusion or pre-conceptions, we want to make clear what CRM is **NOT**. I am going to point out a few of these topics that have been traditionally confused with the CRM that we will be discussing today.”



Click on mouse



REFER TO SLIDE AND EXPAND: “Not a crew calling program. At many railroads the group that schedules train crews is called crew management. However, although the names are similar, this is not related to crew calling or learning how to schedule crews.”



Click on mouse

“Not a training program administered in only a few specialized or “fix it” cases.”



Click on mouse

“Not a quick fix that can be implemented overnight.”



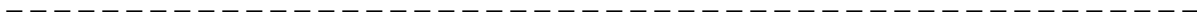
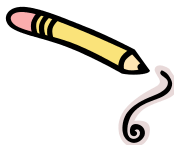
Click on mouse

“Not a short-term accident-reduction program. It will take some time to implement CRM in the railroad environment as it will for CRM have a noticeable effect on safety and accidents.”



SUGGESTED SCRIPT: “No one should have any preconceived ideas about what CRM is. This way you will not have any fixed ideas of what you are about to hear as we progress through the rest of the day.”

Next slide



** Facilitator Notes*

Introduction

CRM is.....

- **A human factors training program based in safety**
- **Process that addresses the entire crew and other related staff**
- **Heightened awareness of attitudes and behaviors of crewmembers and their impact on safety**

Crew Resource Management 18



OBJECTIVE OF SLIDE: *To have participants understand, in a broad conceptual manner, what CRM is.*

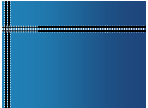
CRM is



SUGGESTED SCRIPT: “Now I am going to give you a little background information on what CRM is.”



Click on mouse



REFER TO SLIDE AND EXPAND: “Because so much of CRM revolves around how we as humans interact with our environment, CRM is considered a human factors training program. CRM is based in safety (as opposed to a technical training program which describes how to perform specific job functions). It focuses on human capabilities and limitations with respect to human/system interfaces, operations, and system integration, which all focus on the safety of work. It is based on the idea that everyone wants everyone here to be able to go home at the end of the day with no injuries.”



Click on mouse



REFER TO SLIDE AND EXPAND: “CRM is a process that addresses the entire crew and other related staff. It is a comprehensive system for improving crew performance and involves the entire crew and how they work as a team.”



Click on mouse



REFER TO SLIDE AND EXPAND: “CRM entails a heightened awareness of attitudes and behaviors of crewmembers and their joint impact on safety. Thus it looks directly at attitudes and behaviors.”



Next slide

** Facilitator Notes*

Introduction

CRM is.....

- **Team-based framework through which to evaluate conditions, apply rules, and perform work tasks *safely***
- **Forum that encourages individuals to examine their behavior and make adjustments to improve teamwork**
- **Focuses on effectiveness of the team rather than just the competence of individuals**

Crew Resource Management 19



OBJECTIVE OF SLIDE: *To continue to have participants understand, in a broad conceptual manner, what CRM is.*

CRM is

REFER TO SLIDE AND EXPAND: “CRM provides a team-based framework through which to evaluate conditions, apply rules, and perform work tasks *safely*. It is looking at work from the perspective of a team rather than from an individual.”



Click on mouse

REFER TO SLIDE AND EXPAND: “CRM is a forum that allows individuals to examine their behavior and make individual decisions on how to improve teamwork. Part of working together as a team, and what we are going to talk about today, is realizing that you do work as part of a team and that your actions affect the members of your team. Being conscious of this is the first step to improving teamwork because it allows team members to think about how what they are doing is going to affect their team members. This understanding can help team members adjust the way they work in a team environment and their communication with their team. This, in turn, can greatly improve safety.”



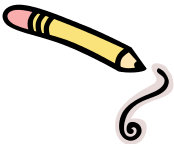
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REFER TO SLIDE AND EXPAND: “A focus on the function of crewmembers as teams, not as a collection of technically competent individuals. For example, as we will talk about in a moment, CRM has been in place in the airline industry for several years. Prior to it being implemented, there were cases where senior captain would tell the co-pilot, “Listen, I’m the captain of this plane, I am going to fly it, do everything, and make all the decisions by myself.” These pilots would not listen to, take input from, or let the co-pilots be involved in the flight or making decisions regarding the flight. There were many accidents as a result of this, and many times the last thing heard from the co-pilot on the black box recorder was, “I knew you were going to do that.” The captain was failing to use a valuable asset (highly-trained and experienced co-pilot). The co-pilot, who knew the captain was missing something

that affected the safety of the flight, lacked the assertiveness to overcome the cultural pressure of “the captain is always right” to point out the problem to the captain. Many times these pilots had high scores on tests of technical skills; thus they were some of the most technically competent pilots the airline had. However, they did not know how to work in a team environment, and that cost them their lives.”

Possible expansion: Compare and contrast how basketball players perform during the season with their team and how they usually play in an all-star game (with a collection of players from different teams). During the regular season, with practice each player learns teamwork, and knows the ins and outs of his/her team. Thus, from the beginning to the end of the regular season, there tends to be a change from the group as a collection of individual players, to a team. During an all-star game, players throughout the league are re-combined into other teams. Although the players on each all-star team are the best of the best, typically the all-star teams do not function very well as a ‘team.’ Thus many times the ‘all-star’ game is a very ‘sloppy’ game.

Next slide



** Facilitator Notes*

Introduction

History & Background of CRM

- Started in airlines
- Moved outside the cockpit
- Moved into other industries
- Similarity between tasks/teams
- National Transportation Safety Board recommends CRM for rail

Crew Resource Management 20



OBJECTIVE OF SLIDE: *To give participants background information on CRM*

History/Background of CRM

SUGGESTED SCRIPT: “Before we get started explore some background on CRM.”

Started in the Airlines



Click on mouse



SUGGESTED SCRIPT: “Official CRM training started in the airline industry. CRM was first developed as cockpit resource management by the National Aeronautics and Space Administration (NASA) and commercial airlines a quarter century ago in order to combat the increasing numbers of aircraft accidents that were attributed to pilot error. Research into the causal factors of these accidents found that, in many cases, the actual performance failure that led to the crash was related to improper crew coordination or improper communication of critical information within the crew, rather than a lack of flying skill or technical knowledge on the part of the pilots. CRM was created specifically to stop the kinds of airline accidents we just talked about on the previous slide. This early CRM involved leadership training for the captains and assertiveness training for co-pilots.”

Moved Outside the Cockpit



Click on mouse



SUGGESTED SCRIPT: “Since that early work and positive results found as a result of CRM, CRM training and its concepts have evolved within commercial aviation to include not only pilots but the entire flight crew, air traffic controllers, ground crews, and aircraft maintenance personnel.”

Moved Into Other Industries



Click on mouse



SUGGESTED SCRIPT: “After seeing the successful results in the airline industry, other industries started to pick up CRM. Military aviation, tank, and shipboard crews have all adopted CRM training programs, as have commercial shipping, medical, nuclear power, and other industries. For example, a surgical team in the medical industry has to work together in order to perform an operation/surgery. Often, life threatening mistakes can occur as a result of miscommunication between the surgeon, anesthesiologists, and nurses (*give an example if possible*). In all cases, positive safety benefits have accrued from instituting formal training in core CRM skills, such as crewmember proficiency, improved communication and teamwork among crewmembers, conflict resolution, and maintaining situational awareness.”

Similarity Between Tasks/Teams



Click on mouse



SUGGESTED SCRIPT: “Many similar functions take place in these other industries and the airline industry. Many of these job tasks are very similar in their use of CRM-related activities (for example, situational awareness, communication, and teamwork). There are also similarities between all these industries in terms of the types and sizes of crews that operate and the interaction between members of those crews.

“As many of you know, NTSB keeps a record of every accident in all transportation industries, including the airline industry, marine/commercial shipping industry, and the rail industry. They categorize accidents according to many different factors in order to get a better understanding of the exact causes of accidents and where problems are occurring. The FRA also keeps records of reported accidents and categorizes them by cause, injury or death count, and cost for repair.”

NTSB Recommends Rail CRM



Click on mouse



ASK: “Can you think of some reasons why NTSB recommended this type of training for the rail industry?”

Get answers from participants.



SUGGESTED SCRIPT: “This is because everyone here works in a team/crew environment where a high level of situational awareness, communication, and teamwork is needed in order to accomplish the work safely. Also, similar to these industries, the railroad is a high consequence industry, meaning that if a team fails to function properly, there can be enormous negative consequences.”



SUGGESTED SCRIPT: “Specifically, it was after a rail accident at Butler, IN, in 1998 that NTSB recommended to FRA, the Association of American Railroads (AAR), the American Short Line and Regional Railroad Association (ASLRRA), Norfolk Southern Railway (NS) and other railroads to develop a “Train CRM” program. This recommendation was based largely upon the positive benefits that NTSB had seen from CRM programs in other transportation industries from CRM implementation.

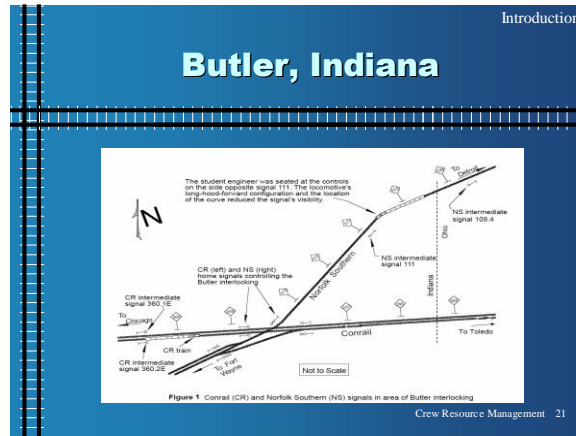
“Let’s go into a little more detail of that Butler, IN accident, so we can understand the event that really set this in motion.”

Next slide



** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To go into more depth on the Butler, IN example.*



SCENARIO: BUTLER, IN

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Butler, IN” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.
- Read the scenario titled “Butler, IN” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario, questions, and some of the possible answers.
- When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.

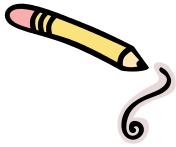


Click on mouse during the discussion to show several more pictures of accident scene. These pictures include a map of the where the accident occurred, as well as the student engineer’s view of signal 111 from the locomotive cab.

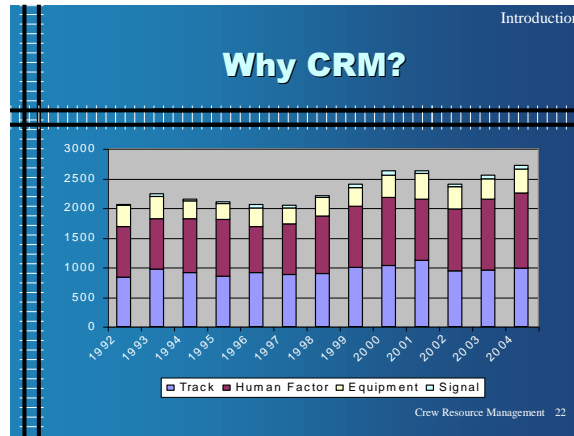


SUGGESTED SCRIPT: “Let’s look at some statistics on the number human factors accidents throughout the industry.”

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To show the proportion of human factors accidents in the rail industry*

Why CRM?



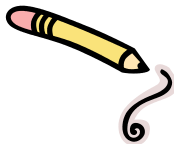
SUGGESTED SCRIPT: “As you can see, this graph shows the number of train accidents per year for the last 10 years. The axis on the left represents the number of accidents each year. The axis on the bottom represents each year. Each bar represents the total number of accidents that occurred that year in the rail industry.

“Each bar is also broken into different sections, representing the type of accident. The blue section at the bottom represents accidents that are caused by defects in track. The yellow at the top represents the number of accidents caused by equipment failure. The green at the very top (might be hard to see) represents the accidents caused by signal failures.

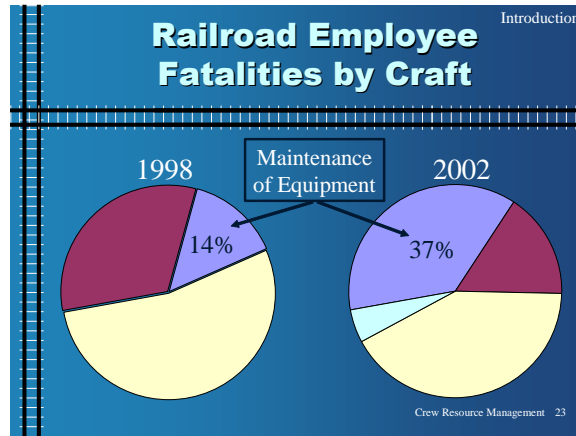
“This purple section represents the number of accidents caused by human factors. These are accidents often caused by failure to use proper CRM skills—the exact topic that we are talking about here today. Looking at the graph you can see that a human failure, that is failures of you and me, causes more accidents than track, signal, or equipment failure. In fact, in recent years the number of accidents caused by human factors alone are comparable to the number of accidents caused by track, signal, and equipment combined. Much of this trend can be attributed to improvements in the mechanical reliability of components in the other areas over time, resulting in human factors-caused accidents becoming a larger percentage of the total accident rate. This illustrates why we are here today to discuss some methods for tackling this cause of railroad accidents.”

** This graph was created from data gathered from the “Railroad Safety Statistics Interim Report, 2003,” published by FRA.*

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To show the proportion of human factors accident in the rail industry (by craft).*



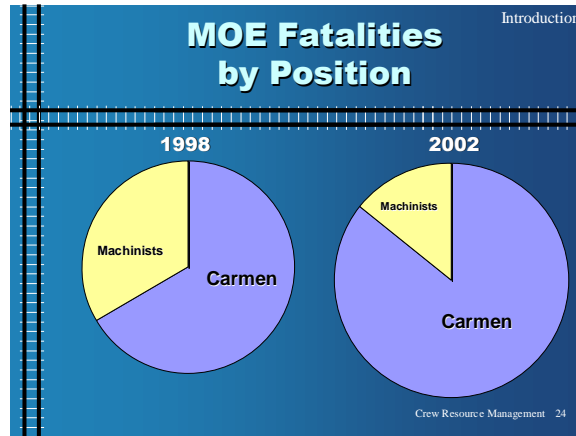
SUGGESTED SCRIPT: “These two pie charts represent the fatalities that occurred on the railroad in the years 1998 (left pie chart) and 2002 (right pie chart). The pie chart is broken up into the percentage of fatalities by the craft. As you can see, Maintenance of Equipment (MOE) employees have a large percentage of the fatalities in the rail industry. This is true for all years.”



Next slide

** Facilitator Notes*

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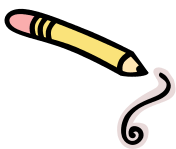
OBJECTIVE OF SLIDE: *To show the proportion fatalities in the MOE area in the years 1998 and 2002.*



SUGGESTED SCRIPT: “These two graphs show the proportion of fatalities in the MOE area in the years 1998 (left pie chart) and 2002 (right pie chart). As you can see from the graphs, it is not just the employees out in the yard that are particularly susceptible to injuries and fatalities. It is also employees in the repair shops.”



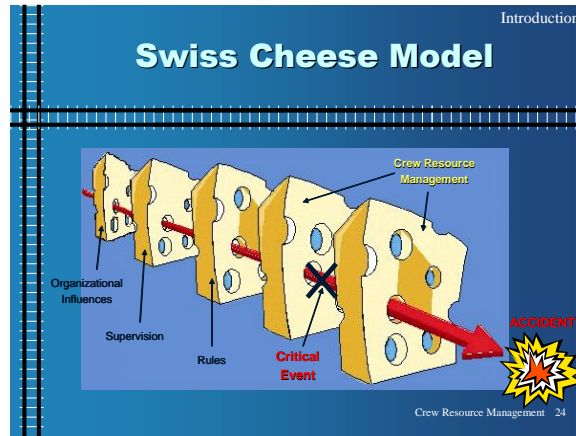
SUGGESTED SCRIPT: “Everyone in this room, as mechanical department employees, has a lot to lose when an accident occurs. As we saw from the previous graph, most of these fatal accidents are caused by human error. That is why developing an understanding of CRM skills and human factors is so important for the group sitting in this room right now.”



Next slide

** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To show the participants the Swiss Cheese Model, which is a way to think about how accidents happen.*

** This graph is based on James Reason's (1990) Swiss Cheese model/approach to understanding human error, and it has been modified to be more understandable and relevant to the current audience. Reference: Reason, J. (1990). Human error. New York: Cambridge University Press.*



SUGGESTED SCRIPT: “We all know that when an accident occurs, it is very difficult to look back and point to one specific cause of that accident. There are usually several factors/causes that can add up and result in an accident. I realize that there are many factors involved in an accident, and I am sure all of you in this room realize that fact. Even accident investigators like NTSB and FRA understand that. For example, when NTSB reports on a railroad accident, they list all the contributing factors of an accident, including organizational factors, supervisory factors, and human factors. As a result, NTSB reports can become very long due to the level of detail included. NTSB accident reports also give recommendations to the regulators (FRA), the organization (railroad), supervisors, and crews, stating what each can do to prevent these accidents from occurring in the future.

“The Swiss Cheese model reflects the idea that many different factors/causes can lead up to an accident. The reason for talking about it now is that throughout this program we are going to be talking about and going through, in detail, several accident scenarios to reinforce the CRM skills we are discussing. Because this is a CRM class, we are going to concentrate on those causes and factors related to the crew. We are going to try to give you some ideas of what you can do to prevent accidents from occurring as a result of not working together as a team. It would do us no good to concentrate today's time on organizational factors because there is not much that you or I can do to change organizational factors. However, we can change the way we work together with our fellow crewmembers, which is what CRM is all about, and why we are here today.

“In this model, the red arrow is a potential accident. Each piece of cheese is a filter that would seek to block or prevent a potential accident from occurring. Imagine that there are lots of other potential accidents that are coming in from the top left of the model but are being blocked by the pieces of cheese (filters). The problem is that there are holes in the pieces of cheese where it is ineffective in blocking the accident. Each hole in a piece of cheese is a hole in the filter, where an accident can get through. When a potential accident comes in from the

left, it has the potential of being blocked by organizational influences, supervision, rules, or effective CRM.

“Let’s talk about some of these filters. Let’s start with the organizational filter.”



ASK: “What are some of the things that an organization does in order to prevent accidents from occurring?”

Discuss organizational influences.

Organizational influences include:

- *Equipment (Hole–bad equipment)*
- *Facilities (Hole–poor facilities)*
- *Training (Hole–inadequate training)*
- *Funding (Hole–lack of funding)*
- *Design (Hole–poor design)*
- *Organizational Safety Climate–(Hole–poor safety climate)*
- *Policies (Hole–unsafe policies)*



ASK: “What are some of the things that a supervisor does in order to prevent accidents from occurring?”

Discuss supervisory influences.

Supervision includes:

- *Training (Hole–lack of training in a specific area)*
- *Leadership (Hole–Lack of leadership)*
- *Motivation (Hole–Lack of Motivation)*
- *Knowledge (Hole–does not give subordinates enough info, job/safety briefings, etc)*
- *Adherence to policies (Hole–lets subordinates break the rules)*



ASK: “How do rules prevent accidents from occurring?”

Discuss how rules prevent accidents.

Rules include:

- *Create Safe Standards (Hole–lack of rule or unsafe rule)*



ASK: “How does CRM prevent accidents from occurring?”

Discuss how CRM prevents accidents from occurring.

CRM includes:

- *Technical Proficiency (Hole–lack of technical proficiency)*
- *Situational Awareness (Hole–lack of situational awareness)*
- *Communication (Hole–lack of communication)*
- *Teamwork (Hole–lack of teamwork)*
- *Assertiveness (Hole–lack of assertiveness)*



SUGGESTED SCRIPT: “As you can see from the model, the importance of working together as a team and practicing good CRM skills is paramount to preventing accidents. First, as everyone in this room knows, you are the last defense in preventing an accident. You are the ones working on the equipment that makes railroading possible. Second, as you can see from the model, CRM has two chances to prevent an accident. First, it can prevent an accident by stopping an error from occurring in the first place. For example, by communicating and working together a team can identify a maintenance discrepancy and repair it before it becomes an equipment failure out on the road. Second, after a minor error with a piece of equipment has been reported, the maintenance team can investigate and find the underlying cause, effect repairs, and prevent a more serious system failure from occurring. If the maintenance team communicates, uses situational awareness to really understand the underlying causes of the problem, prioritizes its responses, and works together as a team, an accident or further repair work can potentially be prevented.”

“So, even though we understand that there can be many factors involved in an accident, which are all important, what we are talking about today is CRM. The last two filters in the model. The last two ways to prevent an accident from occurring. This is what we in this room can have a direct effect on and what can make us safer and even save our lives.”

Next slide



** Facilitator Notes*

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Introduction

Benefits of CRM Practices

- **Increased safety**
 - **Decrease errors that result in accidents**
 - **Accidents are costly**
- **Intangible benefits**

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OBJECTIVE OF SLIDE: *To show the participants the overall benefits of CRM training*

Increased Safety



Click on mouse



SUGGESTED SCRIPT: “As stated previously, CRM is a safety program. The overall objective of this CRM training is to increase safety.”



Click on mouse



SUGGESTED SCRIPT: “How can the application of CRM techniques make the workplace safer? Well, CRM training makes the workplace safer because using CRM skills can decrease the occurrence or the impact of mistakes and errors which result in accidents. It has been shown to decrease the number of accidents related to human factors in other industries and, as was shown in that previous graph, human factors remains a big contributor to accidents in the rail industry.”



ASK: “What are some of the results or outcomes of accidents? What do accidents cause?”

Get answers from participants.



Click on mouse



SUGGESTED SCRIPT: “We all know that accidents are costly. They cause injuries, loss of life, property damage, and lost time. In 2001, it cost the U.S. railroad industry as a whole over 56 million dollars to replace/fix the trains, cars, equipment, and/or track from an accident that resulted from mechanical or electrical failures. We all know train accidents are costly things. We also know that they can be fatal.”

** These statistics come from the FRA’s online accident data base. It can be found at <http://safetydata.fra.dot.gov/officeofsafety/Default.asp>.*

** Statistics about the cost of accidents and the number of fatalities at a particular railroad might make more of an impact in this section. You can search the FRA’s online accident database by railroad.*

Intangible Benefits



Click on mouse



SUGGESTED SCRIPT: “Practicing good CRM techniques also has intangible benefits. For example, by practicing proper CRM techniques, a more relaxed and less stressful work environment can be created. An improved work environment can also have a positive impact on home life.”

**Add a personal example from the facilitator stating that when he/she works in these environments he/she likes going to work and enjoys work more than when working in a stressful environment.*

Next slide

** Facilitator Notes*





OBJECTIVE OF SLIDE: *To go through an example of a CRM-related accident.*

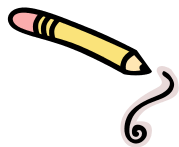


SCENARIO: CAR INSPECTOR PARKS ON HUMP TRACK

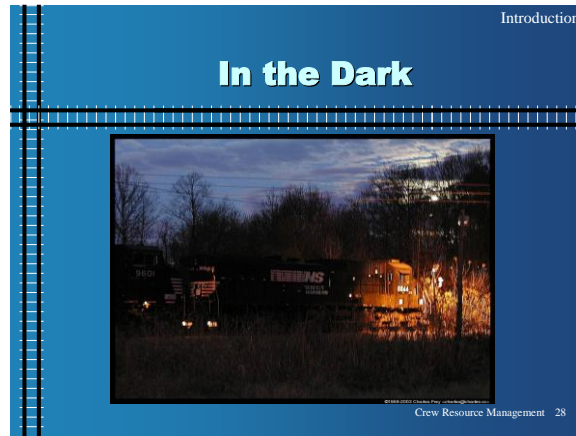
- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Car Inspector Parks on Hump Track” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Car Inspector Parks on Hump Track” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

Next slide

** Facilitator Notes*



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OBJECTIVE OF SLIDE: *To go through another example of a CRM-related accident.*



SUGGESTED SCRIPT: “Let’s go through another example.”

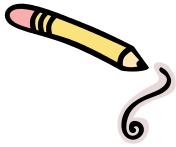


SCENARIO: IN THE DARK

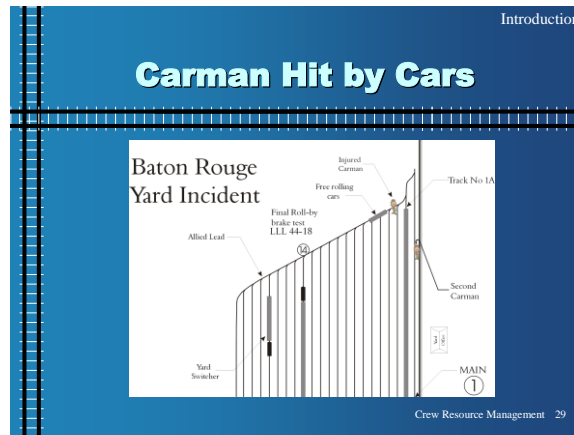
- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “In the Dark” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “In the Dark” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer or answers to particular questions.*

The facilitator should encourage/cause the participants to evaluate for themselves exactly how this accident example is related to Human Factors and CRM.

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To go through another example of a CRM-related accident.*



SCENARIO: CARMAN HIT BY CARS

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Carman Hit by Cars” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.
- Read the scenario titled “Carman Hit by Cars” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.
- When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.



ASK: “Do these examples give you a better understanding of the kinds of accidents and incidents that we are discussing today?”



SUGGESTED SCRIPT: “Hopefully, these examples and your own experience will give you a general framework for understanding some of the topics and issues that we are going to discuss. Then you will be able to think about them in a more real sense, in light of your day-to-day work. We will have more examples throughout this program.”



SUGGESTED SCRIPT: “Before we go on to the next slide, I want to make one thing clear. Most of the time, when we make a mistake, it does not result in an accident like the ones we just discussed. The CRM techniques we will learn today also relate to the mistakes and errors we make that do not result in these huge accidents. We need to realize that we are aiming for reducing mistakes and errors, regardless of whether they result in an accident because sooner or later, the errors will result in an accident.”



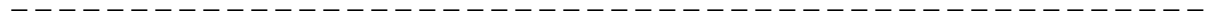
ASK: “Can you think of a time when you were a part of at crew that made a mistake that did not result in an accident?”

WAIT!!! Don't get answers from participants.

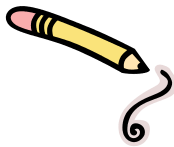


SUGGESTED SCRIPT: “Before we go on to the next slide, let me give everyone a few seconds to think back to when we made an error that could have resulted in an accident but didn't. I'm sure it has happened to everyone here.”

Next slide



** Facilitator Notes*



Introduction

Main CRM Elements

- **Technical Proficiency**
- **Situational Awareness**
- **Communication**
- **Teamwork**
- **Assertiveness**

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OBJECTIVE OF SLIDE: *To show participants the Main Elements of CRM.*

Main CRM Elements



SUGGESTED SCRIPT: “As stated at the beginning of the course, the content of this CRM course is broken into five different sections or modules. These are technical proficiency, situational awareness, communication, teamwork, and assertiveness. We are breaking the content of CRM up into these five modules in order to better understand each one; yet as you will see throughout the course they are all related to each other and intertwined.”



REFER TO SLIDE AND EXPAND:

“The first module is technical proficiency. It refers to knowing the equipment that you use, and the procedures for using it so that you can execute the task. It also describes your knowledge of the rules and how to apply them.

“The second module or main area of CRM is situational awareness. In the railroad working environment, crews and individuals in those crews must be aware of the situation and the environment around them at all times. An understanding of how to be situationally aware, how to recognize when you are not, and how to regain situational awareness is an integral part of developing CRM skills and workplace safety.

“Next is communication. We all know what communication is, but it is **not** just talking to someone else. We are going to look at it more broadly. We define communication as the flow of information among all crewmembers. This way we can discuss things like implicit or understood communication, body language, assertiveness in communication, use of hand signals, two-way communication, and picking up cues from the tone in which people may speak. All of these relate to proper communication skills that will be helpful in the railroad operating environment.

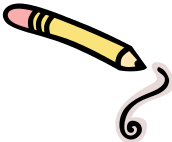
“The fourth module is teamwork. Teamwork refers to the crew’s ability to work together to achieve some outcome. It is the idea that we all need to work together and make our individual performance support team performance.

“The final module is assertiveness. Being assertive entails being appropriately persistent, timely, clear, focused, and can include proposing a solution to a problem. Many times being assertive at the right time can prevent an accident from occurring. In this module we will talk about steps to take for assertive communication.”

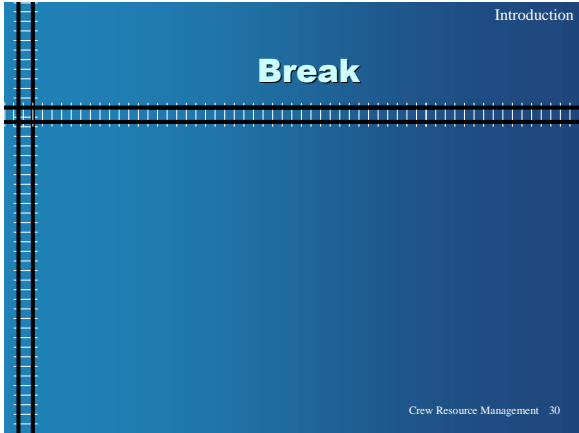


SUGGESTED SCRIPT: “As you might have already noticed, although technical proficiency, situational awareness, communication, teamwork, and assertiveness can be seen as five distinct elements, they usually interact with each other in the real working environment. For example, let’s say that you notice (situational awareness) that a new employee is having trouble working some piece of equipment (technical proficiency). You decide to call the foreman training the new guy and tell him that the new employee might need some more help (communication). However, the foreman doesn’t truly understand the importance of the situation; thus you use certain assertiveness techniques to communicate to the foreman the urgency of the situation (assertiveness).”

Next Slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To be a placeholder for participants while taking a break.*

Allow participants to take a 10-15 minute break.



** Facilitator Notes*

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Technical Proficiency

Module 2: Technical Proficiency

Learning objective:

- **Name the three elements of technical proficiency as related to CRM practices**

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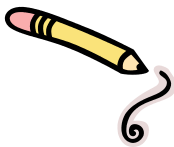
OBJECTIVE OF SLIDE: *To show the participants the learning objective of Module 2.*

Module 2: Technical Proficiency



SUGGESTED SCRIPT: “Let’s start in on module 2, technical proficiency. This will be the shortest of all of the modules today because this is where you currently get most of your training. However, we will talk about how an individual’s and a team’s technical proficiency can affect situational awareness, communication, and teamwork. After you have completed this module, you should be able to name the three elements of technical proficiency as related to CRM practices.”

Next Slide



** Facilitator Notes*

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Technical Proficiency

Elements of Technical Proficiency

1. Knowing your equipment
2. Knowing your procedures
3. Skilled performance

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OBJECTIVE OF SLIDE: *To show the three elements of technical proficiency.*

Three Elements of Technical Proficiency

SUGGESTED SCRIPT: “Technical proficiency means just that. In order to practice good CRM skills, everyone first must be good at doing all the tasks of his/her jobs. One needs to be competent and able in three different areas: equipment, procedures, and execution.”

Knowing Your Equipment

SUGGESTED SCRIPT: “You must know your equipment; for example, a carman needs to be familiar with the jacking equipment he/she uses everyday in performing his/her job.”

Knowing Your Procedures

SUGGESTED SCRIPT: “You need to know your procedures; for example, a machinist needs to be able to differentiate the procedure in replacing a fork or blade, rod bearing, and a main journal bearing.”

Skilled Performance

SUGGESTED SCRIPT: “Lastly, each one of you needs to be able to actually physically perform the tasks based upon your knowledge of the proper procedures and the equipment.”

SUGGESTED SCRIPT: “In order to be technically proficient, we need all three of these together. We cannot work safely, and perhaps not work at all, if we are missing even one. For example, perhaps you know the equipment and can perform the task; however, if you don’t know the proper procedures, it can cause accidents and/or injury.

“Many of us assume that each individual in a work team (or crew) is proficient at performing the tasks making up his/her job. Technical proficiency is a key component to CRM because it

is easy to see that in order for individuals to perform their job safely, they must know both their equipment and procedures and be able to execute their job properly. For example, it does no good for a team to have good communication skills, have situational awareness, and work well together if the individual members of the crew do not know how to do their job properly. Thus, technical proficiency is fundamental to CRM. However, because much of the other training provided by each railroad is focused on teaching you about the specific technical aspects of your job, we do not deal with these subjects in great detail in CRM training.”

Next slide

** Facilitator Notes*



Technical Proficiency

Technical Proficiency

- **Evaluating the technical proficiency of fellow crewmembers**
 - New rules/procedures
 - New crewmembers

Crew Resource Management 34



OBJECTIVE OF SLIDE: *To show participants that at times they need to evaluate or assess the technical proficiency of fellow crewmembers.*

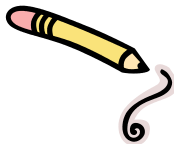


SUGGESTED SCRIPT: “An important dynamic of technical proficiency and its relation to CRM is your ability to evaluate (or assess) the technical proficiency of your fellow crewmembers. For example, sometimes new equipment or procedures are implemented here at the railroad. These can be large changes like remote control or smaller changes like filling out paperwork differently. Changed procedures and/or equipment, no matter how large or small, will affect the situation, communication, and teamwork of individuals in one or more work groups. Such changes have effects on the practices encouraged by CRM.

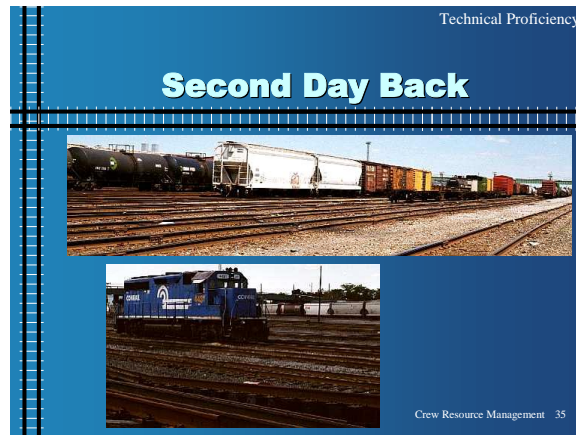
“Likewise, many times the technical proficiency of new employees is not at peak levels. Learning also occurs on the job. New individuals may not have as much knowledge about equipment and procedures, and they may not be able to execute the task like an experienced machinist, electrician, pipefitter, or carman would. Similarly, even experienced members of a team have a tendency to depend on their experience; they may not know the proper procedures and can get in a habit of executing a task incorrectly.

“Part of working as a team and having good CRM skills is being aware of team members who are lacking in technical proficiency and knowing how to effectively communicate this to all the team. We will talk about this later in the program.”

Next Slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To give an example of a real-life incident where a lack of technical proficiency leads to a fatality.*



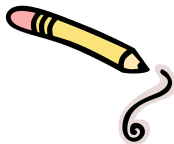
SCENARIO: SECOND DAY BACK

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Second Day Back” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Second Day Back” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



SUGGESTED SCRIPT: “Let’s go on to module 3, situational awareness.”

Next slide



** Facilitator Notes*

Situational Awareness

Module 3: Situational Awareness

Learning objective:

- **Understand situational awareness and how job safety is affected by circumstances both on and off the job**

Crew Resource Management 35



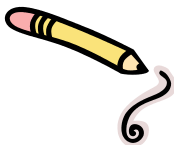
OBJECTIVE OF SLIDE: *To show the overall learning objective of situational awareness.*



Module 3: Situational Awareness

SUGGESTED SCRIPT: “Our third module is about situational awareness, a factor very fundamental to CRM success. When you complete this module you should have an understanding of situational awareness and how job safety is affected by circumstances both on and off the job.”

Next slide



** Facilitator Notes*

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Situational Awareness

Specific Learning Objectives: Situational Awareness

- State the two elements of situational awareness
- Describe how a team/crew's perception of the situation is adopted
- Describe personal and team cues that indicate potential safety breakdowns

Crew Resource Management 37



OBJECTIVE OF SLIDE: *To show the specific learning objectives of the situational awareness module.*

Specific Learning Objectives: Situational Awareness



SUGGESTED SCRIPT: “When we are finished with this module, each of you should be able to....”



Click on mouse



REFER TO SLIDE: “State the two elements of situational awareness.”



Click on mouse



REFER TO SLIDE: “Describe how a team/crew’s perception of the situation is adopted.”



Click on mouse



REFER TO SLIDE: “Describe personal and team cues that indicate potential safety breakdowns.”

Next Slide



** Facilitator Notes*

Situational Awareness

Specific Learning Objectives: Situational Awareness (cont.)

- Describe the potential impact of stress and fatigue on worker perceptions of developing situations
- Explain to a co-worker why maintaining situational awareness is so important to job safety
- List four good habits that individuals can develop to maintain situational awareness on a team

Crew Resource Management 38

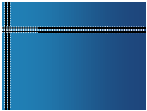


OBJECTIVE OF SLIDE: *To show more of the specific learning objectives of the situational awareness module.*

Specific Learning Objectives: Situational Awareness (cont.)



Click on mouse



REFER TO SLIDE: “Describe the potential impact of stress and fatigue on worker perceptions of developing situations.”



Click on mouse



REFER TO SLIDE: “Explain to a co-worker why maintaining situational awareness is so important to job safety.”

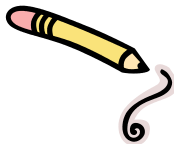


Click on mouse



REFER TO SLIDE: “List four good habits that individuals can develop to maintain situational awareness on a team.”

Next Slide



** Facilitator Notes*

Situational Awareness

Situational Awareness

1. Reality versus Perception of Situation
2. Situational Cues
3. Steps in Maintaining Situational Awareness
4. Steps in Regaining Situational Awareness
5. Maintaining and Recognizing a Loss of Situational Awareness
6. Fatigue

Crew Resource Management 39



OBJECTIVE OF SLIDE: *To show participants the outline of module 3: situational awareness.*



SUGGESTED SCRIPT: “The idea of situational awareness is at the heart of effective CRM practices. To better understand what is meant by the term situational awareness, we want to visit six aspects of the topic.”



REFER TO SLIDE:

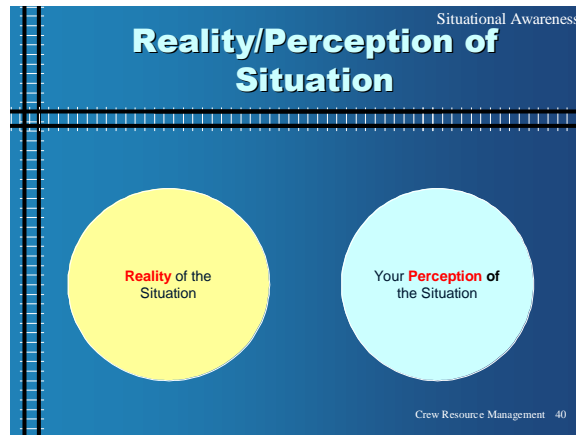
1. Reality versus Perception of Situation
2. Situational Cues
3. Recognizing a loss of Situational Awareness
4. Regaining Situational Awareness
5. Maintaining Situational Awareness
6. Fatigue

Next Slide



** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To familiarize participants with the concepts of reality of the situation and perception of the situation.*

Beginning Summary of Situational Awareness



SUGGESTED SCRIPT: “Situational awareness is knowing what is going on in the environment around you. This includes knowing where you are in your environment, as well as where others in your crew are. It involves recognizing and constantly taking in cues or information from your environment. Besides simply taking in cues, it is also being constantly aware of what each cue or combination of cues is telling you about the current situation or the future situation in which you will find yourself. This is the essence of defensive driving when operating your personal vehicle. It is an understanding of how cues and environment will likely change in each future slice of time, without assuming that they are always going to act in the same way.”

“There are two conceptual elements of situational awareness. An understanding of these elements and how they interact will help you understand situational awareness as a whole. The two elements of situational awareness are...”

- The reality of the situation
- Your perception of the situation

“Your goal should always be to get your perception to match reality.”

Reality of the Situation



SUGGESTED SCRIPT: “The reality of the situation is how the situation really is. It is what is actually going on around you. Unlike the perception of the situation, it is not influenced by you or your take on things.”

Perception of the Situation



SUGGESTED SCRIPT: “Your perception of the situation is exactly that—how **you** **perceive** the situation and the environment around you. It is your belief about what is going on, whether conscious or unconscious. You create your perception of the situation by taking in, gathering, and interpreting information and environmental cues. Of course, missing cues or misinterpreting cues can cause bad things to happen.”



ASK: “Does everyone understand the difference between these concepts?”

Grasping this concept will be important to understanding much of the rest of this module.



ASK: “Using these two concepts, how do accidents occur?”

Have the class figure it out.

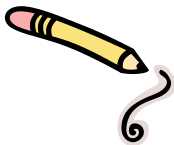
- *Example of answers: When we do not perceive the situation correctly. When our perception of the situation is not in line with the reality of the situation.*



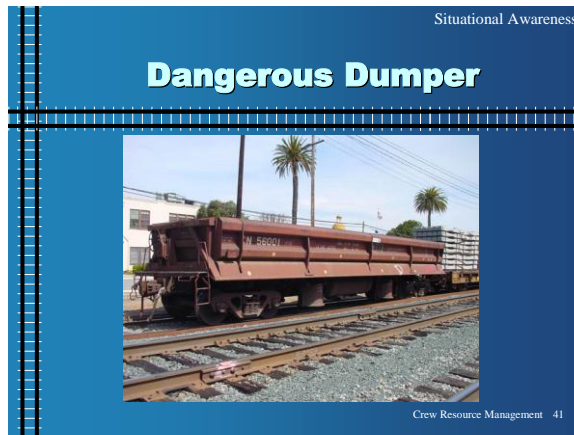
SUGGESTED SCRIPT: “Exactly, when one’s perception of the situation is not in line with the reality of the situation is when there is increased potential for accidents to occur.”

“Now let’s go through a scenario/accident that was caused because a crew’s perception of the situation was not in line with the reality of the situation.”

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To give participants an example of an accident caused by a loss of situational awareness.*



SCENARIO: DANGEROUS DUMPER

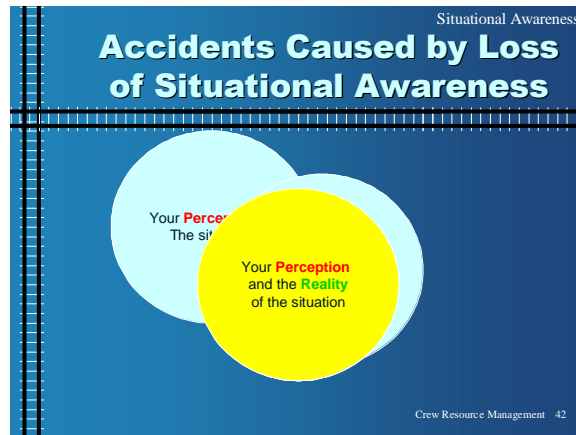
- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Dangerous Dumper” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Dangerous Dumper” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

Next slide



** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To explain how we have situational awareness problems when a crew's perception of the situation is not in line with the reality of the situation, which is also called a loss of situational awareness.*



SUGGESTED SCRIPT: “In the example we just talked about, here is the reality of the situation.”

Point to Reality of the Situation circle.



SUGGESTED SCRIPT: “The air cylinder bolt area was unsafe to weld due to the remaining solvent near the welding site.”



Click on mouse

Point to Perception of the Situation circle.




SUGGESTED SCRIPT: “And here is the carmen's perception of the situation: The area is safe to weld because the solvent was wiped clean and there is no chance of an explosion or fire.”

Point to the part of the figure that is non-overlapping in the reality circle.



SUGGESTED SCRIPT: “The non-overlapping part is the part that we have wrong. This is what contributes to an accident. Why? Because we think, behave, and make decisions based on our perception of the situation. As one's perception of a situation gets farther away from reality—this area gets bigger—and individual and team actions, because they are based on perceptions, become errors—and errors cause accidents.



“For example ( *Click on mouse*), here one's perception of the situation is fairly close to matching the reality of the situation. You are aware of most cues in the environment and that human error accidents are less likely to occur.

“However, what we are striving for is this--”



Click on mouse



SUGGESTED SCRIPT: “The goal is for our perception of the situation to perfectly overlap the reality of the situation. Crewmembers need to be aware of all environmental cues so that they can better predict what is going to occur and make better decisions. This will lead each crewmember to be cognizant of those environmental characteristics that we must be watched carefully in order to be safe in daily work activities.”

Team Situational Awareness

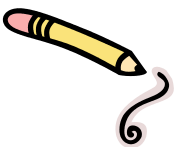


SUGGESTED SCRIPT: “Each individual has his/her own perception of the situation, but you are not working out there by yourself. You are working as a member of a team. This is important in understanding team situational awareness. There is one reality of the situation; yet there are as many perceptions of the situations as there are members of your team. Usually, each crewmember’s perception of the situation varies to a certain degree, and each covers a slightly different area of the reality of the situation (remember the circle). Thus as a team, you have a better chance of discovering the true reality of the situation than you do as an individual. However, this will not occur unless you communicate with your fellow team members your unique understanding of the situation (what is going on) and ask for their understanding of the situation. If you are working, within a crew, but no one is communicating, you can fail to benefit from other’s useful knowledge and errors can occur. On the other hand, if one team member notices something that the other team members need to know to avoid error, that team member can appropriately communicate the information and prevent the error from occurring.”



SUGGESTED SCRIPT: “Let’s talk a little more in depth about cues.”

Next slide



** Facilitator Notes*

Situational Awareness

Cues

- **Environmental**
 - **Equipment**
 - **Crewmember**
- **Personal**

Crew Resource Management 43



OBJECTIVE OF SLIDE: *For participants to gain knowledge of the different types of environmental and personal cues.*

Cues



SUGGESTED SCRIPT: “So as we have just seen, human factors accidents occur when our perception of the situation does not equate with the reality of the situation. We know this sometimes happens because we are not acquiring all the cues that we need. Likewise, our perception could fail to be in line with reality because we are judging the cues incorrectly. We are getting the cues, but we are not looking at them or evaluating them correctly.

“Before we can figure out how to acquire more cues and how to read those cues appropriately, we must understand the different kinds of situational cues.

“There are cues that can be used to obtain a better understanding of the reality of a situation, and there are cues that help us to understand our own or other’s perception of situations.

“There are two main types of cues—those are the cues that happen outside of us and the ones that we recognize personally—within ourselves. Environmental cues are cues that happen outside of us, while personal cues are discerned internally from experience.

“Two principal environmental cues are equipment cues and crewmember cues.”

Equipment Cues



SUGGESTED SCRIPT: “Equipment cues come from all the different pieces of equipment that you use. Out on the track and in the shops, there are a lot of the cues you get from the equipment we use. Some examples of equipment cues that a machinist might recognize are the crack of a torque wrench as it meets the preset limit for a bolt being tightened, or the sound of dynamic brake grid fans coming on during a locomotive load test.”



Crewmember Cues

SUGGESTED SCRIPT: “Crewmember cues are the information you get from fellow crewmembers. When working as a team, we all know that fellow crewmembers are important sources of information. They are important resources. Fellow crewmembers often provide you with information that you need to know in order to complete your job and complete it well. Some examples of crewmember cues would be a foreman seeing a carman having difficulty with an assigned task and asking if the carman needs assistance or a machinist pointing out a hazard to an electrician approaching a locomotive.”



Personal Cues

SUGGESTED SCRIPT: “The biggest personal cue that makes up our perception of the situation is our experience. Our experience leads us to have expectations about the situation. These expectations help us make prepare for a given situation. An example of personal cues would be recognizing that you are fatigued or thirsty and needing to take a break before continuing with the job.”

Next Slide



** Facilitator Notes*

Situational Awareness

Are Cues Valid?

- Are equipment, crewmember, and personal cues always correct?

Crew Resource Management 44



OBJECTIVE OF SLIDE: *To have participants question the validity of the cues they use to make up their perception of the situation.*



SUGGESTED SCRIPT: “So we use cues from our equipment (lights, indicators, and sounds), cues from our fellow crewmembers (communication information), and cues from ourselves (expectations based on our experience). We use all of these cues to make up our perception of the situation. However, we should not completely base our decisions on these cues and assume that they are always valid and correct. Often cues can be incorrect, which can cause our perception of the situation to be quite a bit off from the reality of the situation.”

Equipment



SUGGESTED SCRIPT: “For example, equipment—how do we know that the information we get from our equipment is correct? First, we should keep the equipment in good shape and make notes when there are problems. If you know a piece of equipment does not always work correctly, you should be wary of the information you get from that equipment and perhaps double check information from another source (for example, another crewmember).”

Crew Members



SUGGESTED SCRIPT: “Many times crewmembers do not give valid or correct cues. For example, sometimes there can be miscommunication between crewmembers. It is important to double check or repeat back important information to make sure you understand it correctly. We will go into more detail on crewmember cues in the next module, communication. Another reason crewmember cues or information might not be valid is that they might be complacent, fatigued, and/or under stress themselves. We will talk about some of the signs of fatigue and what to do when you or a crewmember are fatigued in a moment.”



Personal Cues

SUGGESTED SCRIPT: “As stated previously, in addition to environmental cues and crewmember cues, there are also personal cues that create our perception of the situation. These personal cues often involve deviations from our expectations and are based on our past experiences. These expectations are usually helpful because they allow you to plan for what is going to occur in the future. However, sometimes we rely too heavily on our expectations and become complacent. When things change from what has happened in the past, our expectations can be incorrect, and we need to be ready to regain our situational awareness. Remember, don’t rely entirely on your past experience and expectations. We all know that situations can change quickly, especially in the railroad environment.

“Next we will talk about some steps you can take to maintain situational awareness.”

Next Slide

** Facilitator Notes*



Situational Awareness

Steps in Maintaining Situational Awareness

- Planning and preparing
- Avoiding distractions
- Distributing workload
- Prioritizing your decisionmaking
- Communicating with your crewmembers
- Recognizing a deteriorating situation

Crew Resource Management 45



OBJECTIVE OF SLIDE: *To show the participants how to maintain situational awareness.*

Steps In Maintaining Situational Awareness



SUGGESTED SCRIPT: “There are several methods that you can use to maintain your situational awareness.”



Click on mouse



SUGGESTED SCRIPT: “The first step in maintaining situational awareness is to plan and prepare. Your plan is the foundation on which you analyze different cues in the environment. You need to constantly update your plan as different situational cues become available.”



ASK: “What is the one thing that everyone here does every day in order to plan and prepare?”

Get answers from group.

Answer: Conduct a job briefing.



SUGGESTED SCRIPT: “Each day we have a job briefing. The job briefing is an important component of planning and preparing for the day’s work. Job briefings help define crewmembers’ responsibilities and provide a forum for crewmembers to give input into different personal or environmental situations that might be present. Similarly, it allows participants to ask questions and clarify roles and responsibilities so that everyone is working on the same plan and can be prepared for the day’s work activities. We will talk more about job briefings later in the day.”



Click on mouse



SUGGESTED SCRIPT: “You can also better maintain your situational awareness by avoiding distractions. When we talk about distractions, these are environmental distractions that are not relevant to the task at hand. When we become distracted by cues that are not relevant to the task, it hinders our ability to pay attention to cues that are relevant to what we are doing.

“There are several different kinds of distractions, including personal distractions, task distractions, and mechanical distractions. Personal distractions include being hungry, fatigued, or feeling ill. We can also be distracted by things in our personal or home life (for example, a family member being sick). Task distractions include radio communication, filling out paperwork, and other things you need to do as part of your job. These things need to be done as part of your job; however, you should not let them distract you from the primary task that you are supposed to be performing at the time. Mechanical distractions can lead to accidents. For example, suppose a loud noise on an adjacent track distracts a machinist while he is working on an engine causing him/her to lose situational awareness and drop a tool or injure him/herself. He/ she must not get preoccupied with a single event and forget the task that he/she is performing. Similarly, he/she must not mull over a past situation, and neglect the task at hand.”



ASK: “If the distraction and subsequent dropping of the tool results in damage to the engine or an injury, do you think this goes down in the records as caused by mechanical failure or human error?”



SUGGESTED SCRIPT: “Most likely, it will be attributed to human error, so don’t dwell on a problem.”

Other examples of distractions

Example #1: On September 11, 2001, an engineer was listening to his radio of news coverage of the terrorist attacks. He ran a signal and collided with another train.

Example #2: In the Clarendon head-on collision scenario (located in the communication section of the transportation track) the engineer was distracted by a cell phone call and did not get the track warrant information, running a signal, and colliding with another train.



Click on mouse



SUGGESTED SCRIPT: “Another way to maintain situational awareness is to distribute your workload. The first step is to recognize when you are being overloaded with too many tasks at once. We can be overloaded in several ways, including mental overload and physical overload. Mental overload can occur when we are receiving too much information to be able to take it all in at once. Physical overload occurs when we try to physically do too much at one time. When we become mentally or physically overloaded, it can compromise our safety and the safety of our fellow crewmembers.

“When we are being overloaded, we need to redistribute our workload. The first step in this is to admit to yourself and others when you are being overloaded. Many times we pride ourselves on taking on many tasks at once; however, this can quickly become too much. We can distribute our workload by working on just the tasks that need to be accomplished now and saving the less important tasks for later. We can also ask for help from a co-worker. If you constantly feel overloaded, you can talk to your supervisor about other ways to prevent an unsafe situation.”



Click on mouse



SUGGESTED SCRIPT: “Prioritizing your decisionmaking can also help you maintain situational awareness. You have to make many decisions every day about the course of action to take in a specific situation, and the quality and timeliness of those decisions is of the utmost importance. In order to prioritize your decisionmaking, you need to first assess the situation. This involves defining the nature of the problem, determining how much time is available for dealing with the problem, and figuring out how much risk is involved, both immediately and in the future. After assessing the situation, choose a course of action. Before choosing, you should think about the risks and perhaps consult with your other team members. Communicating with other team members can give you insights into the decision that you might have missed.”

**Later in the program we will talk about some of the benefits of team decisionmaking.*



SUGGESTED SCRIPT: “In order to maintain your situational awareness it is imperative that you communicate with your fellow crew members. This relates to what we talked about earlier in this module, namely team situational awareness. Communicating what you perceive in the environment, and different cues that you pick up on to other members of the team/crew increases the team’s overall situational awareness. Crews who communicate well usually make fewer errors because their assessment of the situation is more accurate. The crew has a better chance of getting their perception of the situation closer to the reality of the situation when they communicate with each other.”

“There are three questions you can ask yourself that will help you maintain situational awareness through communication. Ask...”

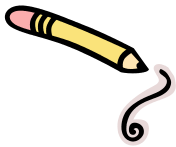
1. “What do my fellow crewmembers know that I need to know?
 - “If you realize that they know something that will help you do your job or will allow you to do it more safely, ask your team members for that information.”
2. “What do I know that they need to know?
 - “If you know something that you believe would help your fellow crewmembers perform their jobs more efficiently or safely, you need to speak up and communicate the information to them.
3. “What do none of us know that we need to know?
 - “It is good to ask yourself this question periodically during work. Sometimes we miss information or overlook something. By asking ourselves this question, it might help us determine what it is we are missing and allow us to go about getting that information.”



SUGGESTED SCRIPT: “Recognizing a deteriorating situation as early as possible is also a way to maintain situational awareness. Acknowledging your personal limits allows you to better recognize a deteriorating situation. Communicating to fellow crewmembers when you are fatigued, under stress, complacent, confused, or not thinking ahead will help the crew as a whole recognize a deteriorating situation at its beginning stages. Many times our instinct tells them that they have lost situational awareness, even before we can consciously point out that something is wrong. Remember, if it doesn’t feel right, it probably isn’t. You need to trust your instincts.

“In the next slide, we will talk more steps you can take to regain situational awareness once you have realized you have lost it.”

Next Slide



** Facilitator Notes*

Situational Awareness

Steps in Regaining Situational Awareness

- **Communicate**
- **Resolve**
- **Monitor**

Crew Resource Management 45



OBJECTIVE OF SLIDE: *To show the participants steps to take to regain situational awareness.*



SUGGESTED SCRIPT: “So far we have talked about a variety of factors that could lead to losing situational awareness. These include failing to plan/prepare, being distracted, being mentally or physically overloaded, not prioritizing your decisionmaking, dwelling on a problem, or not communicating with your fellow crewmembers. So, how do we regain situational awareness? The first step is to admit that we have lost it. It is often difficult to admit to oneself, or to others, that we have lost situational awareness; however, it is very important that we do so.”



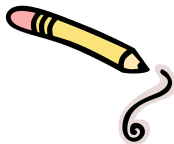
REFER TO SLIDE AND EXPAND: “The three steps in regaining situational awareness are (1) communicating, (2) resolving, and (3) monitoring.”

- 1) **Communicate:** “When you first realize that you have lost situational awareness, you need to communicate to your fellow crewmembers. This will allow them to help you regain it.”
- 2) **Resolve:** “You must determine exactly how you lost situational awareness and resolve the problem. You will need to then search for information and cues in the environment so that you can regain situational awareness.”
- 3) **Monitor:** “Lastly, you should monitor the issue or problem that led you to lose situational awareness and analyze why it happened. In order to prevent the same problem from happening again, you should talk to your fellow crewmembers about ideas on how to not allow it to happen again.”



SUGGESTED SCRIPT: “Now let’s talk about when we are most likely to maintain, or recognize a loss of, situational awareness.”

Next Slide



** Facilitator Notes*

Situational Awareness

Maintaining and Recognizing a Loss of Situational Awareness

- **Most likely to maintain or recognize a loss of situational awareness when we**
 - **Operate under low stress**
 - **Request and accept feedback from fellow crewmembers**
 - **Develop skills for questioning our own knowledge and experience**
 - **Are not fatigued**

Crew Resource Management 47



OBJECTIVE OF SLIDE: *To show participants when they are most likely to maintain or recognize a loss of situational awareness.*

Maintaining or Recognizing a Loss of Situational Awareness



SUGGESTED SCRIPT: “We are most likely to maintain or recognize a loss of, situational awareness when we...”



REFER TO SLIDE AND EXPAND: “Operate under low stress. Stress can affect our physical and mental health. We can become fatigued, depressed, or have a variety of symptoms like headaches, digestive, and heart problems. This can cause us to lose situational awareness and not recognize that we have lost it. By working under low stress, we are more likely to maintain and recognize a loss of situational awareness. We will talk more about stress and fatigue and its effect on us in a moment.”



REFER TO SLIDE AND EXPAND: “Request and accept feedback from fellow crewmembers. Feedback is very important when working together as a team. It is sometimes difficult to request feedback about behaviors and decisions; however, it is essential for a high performance team. Accepting feedback can also be difficult. Nevertheless, we should take input from our fellow crewmembers into consideration when working in any high consequence industry, not just the railroad.”



REFER TO SLIDE AND EXPAND: “Lastly, we are most likely to maintain or recognize a loss of situational awareness when we are not fatigued.”



SUGGESTED SCRIPT: “Let’s watch a short video related to fatigue.”



VIDEO: *Show CRM Video Clip 2–Fatigue*



ASK: “Did the worker want to admit he was fatigued?”

Possible answers: No

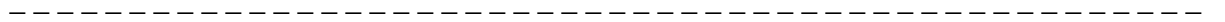


SUGGESTED SCRIPT: “The worker did not want to admit that he was fatigued, even though he was yawning and giving signs of being fatigued. The good thing was the foreman was assertive enough to take control of the situation, and require that they take a break. We will go into more depth on assertiveness later in the day.”



SUGGESTED SCRIPT: “Let’s get into more detail about fatigue and its effects.”

Next slide



** Facilitator Notes*

Fatigue

- What is fatigue?
- What are some factors that lead to fatigue?
- What are some specific characteristics of railroading that could potentially lead to fatigue?
- What are some symptoms of fatigue?



OBJECTIVE OF SLIDE: *To explain the concept of fatigue.*



SUGGESTED SCRIPT: “One issue associated with recognizing a loss of situational awareness is fatigue.”



SUGGESTED SCRIPT: “Studies show that chronic fatigue affects 80 percent of all shift workers. As we stated earlier in the program, fatigue itself has been the cause of nearly one-third of human factor rail accidents since 1985, which has cost nearly \$50 million in damage since then. Fatigue cannot only cause a loss of situational awareness, but also lead one to not recognize that there is a loss of situational awareness.”



ASK: “What is fatigue?”

(Answers might include: being tired, not thinking properly, being exhausted)



SUGGESTED SCRIPT: “Cognitive fatigue is the deterioration of a person’s mental capacities or physical energy. Thus it can be both mental and physical. Mentally it affects one’s decisionmaking, reason and judgment, and the ability to remember and process contextual information. Physically it can slow down our response time.”



ASK: “What are some factors that affect fatigue?”

(Answers might include: how much you sleep, the environment, how much you eat)



SUGGESTED SCRIPT: “Some factors that affect fatigue are how much sleep or rest you get, the time of day/circadian affects, your health including any medications you might be taking, alcohol, stress, the environment, and nutrition. There are lots of factors that have an effect on fatigue. Remember that all of these factors are cumulative, meaning that they add up.”



ASK: “What are some specific characteristics of railroading that could potentially lead to fatigue?”

(Potential answers could include: shift-work, monotony, changing workloads, irregular meal times, etc.)



SUGGESTED SCRIPT: “Much of the work on the railroad is shift work. Shift work can go against the body’s natural sleep-wake cycle. This can cause difficulty falling asleep, a shorter sleep cycle, and other physical problems. This lack of quality sleep is one of the biggest fatigue factors for shift workers. Studies show that chronic sleep problems affect 60 percent to 80 percent of all shift workers (including railroaders). The workload for employees on the railroad is also constantly changing, which can increase fatigue. Similarly, when working on the railroad many times you don’t get to eat on a regular schedule. This can also cause fatigue. Work on the railroad in general is full of conditions that can lead to fatigue.”



ASK: “What are some symptoms of fatigue?”

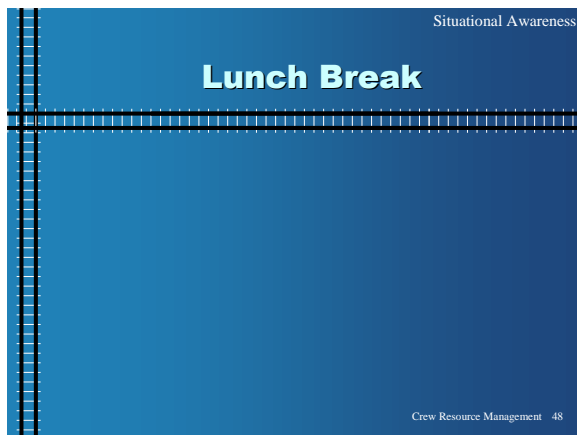
(Potential answers could include: being tired, forgetfulness, lack of response, etc.)



SUGGESTED SCRIPT: “Some symptoms of fatigue are forgetfulness, impaired or poor decisionmaking, slowed reaction time, poor performance and communication, being fixated, apathetic and lethargic, having a bad mood and nodding off.”

“Speaking of being fatigued, let’s take a lunch break.”

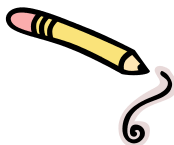
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OBJECTIVE OF SLIDE: *As a placeholder as participants eat lunch.*

Eat Lunch

Next Slide



** Facilitator Notes*

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Situational Awareness

Module 4: Communication

Objective: Know techniques and attitudes that foster effective communication within and between teams

Crew Resource Management 49



OBJECTIVE OF SLIDE: *To show participants the objectives of this module on communication.*



VIDEO: *Show CRM Video Clip 3–Bad Communication*



ASK: “Does this type of communication ever happen on the railroad? With new employees?”



Click on mouse

Module 4: Communication



SUGGESTED SCRIPT: “The fourth module is communication. When we complete this module, we should know techniques and attitudes that foster effective communication within and between teams.”

Next slide



** Facilitator Notes*

Learning Objectives: Communication

- List six ways information should be communicated in order to be effective
- Demonstrate techniques used in two-way communication
- Explain the pros and cons of different non-face-to-face communication

Crew Resource Management 51



OBJECTIVE OF SLIDE: *To go through the specific learning objectives of the communication module.*

Specific Learning Objectives: Communication



SUGGESTED SCRIPT: “When finished with this module, you should be able to....”



Click on mouse



REFER TO SLIDE: “List six ways information should be communicated in order to be effective.”



Click on mouse



REFER TO SLIDE: “Demonstrate techniques used in two-way communication.”



Click on mouse



REFER TO SLIDE: “Explain the pros and cons of different non face-to-face communication methods.”

Next slide

Learning Objectives: Communication (cont.)

Communication

- List some ways that new technologies can change communication patterns
- Illustrate good and bad techniques for communicating in a job briefing

Crew Resource Management 51



OBJECTIVE OF SLIDE: *To continue to explain to participants the specific learning objectives of the communications module.*

Specific Learning Objectives: Communication (cont.)



SUGGESTED SCRIPT: “When you are finished with this module, you should also be able to...”



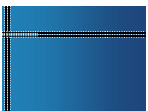
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REFER TO SLIDE: “List some ways that new technologies can change communication patterns.”



Click on mouse



REFER TO SLIDE: “Finally, illustrate good and bad techniques for communicating in a job briefing.”

Next slide



** Facilitator Notes*

Communication

Outline of Module

- Oral communication
- Two-way communication/active listening
- Other communication methods
 - Radio/written/verbal/hand signals
- Job briefing

Crew Resource Management 53



OBJECTIVE OF SLIDE: *To outline module 4: communications.*



SUGGESTED SCRIPT: “In this module we will discuss...”



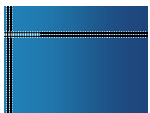
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REFER TO SLIDE: Oral communication



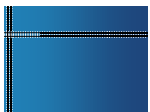
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REFER TO SLIDE: Two-way communication/active listening



Click on mouse



REFER TO SLIDE: Other communication methods like radio/written/hand signals

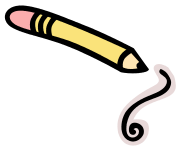


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REFER TO SLIDE: Job briefing

** Note: This module is not only about communicating with other members of your crew, but also covers communication with members outside your crew, where CRM and communication techniques can be helpful.*



Next slide

** Facilitator Notes*



OBJECTIVE OF SLIDE: *To go through an example of an actual train accident caused by a breakdown in communications, so that participants have a better understanding of the topic.*



SUGGESTED SCRIPT: “Now let’s go over an example of how a breakdown in communications can lead to tragedy.”



SCENARIO: NO BLUE FLAG PROTECTION

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “No Blue Flag Protection” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “No Blue Flag Protection” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



SUGGESTED SCRIPT: “Let’s get into more detail about communication.”

Next Slide



** Facilitator Notes*

Communication

Oral Communication

- Clear
- Accurate
- Complete
- Organized
- Concise
- Timely



Crew Resource Management 58

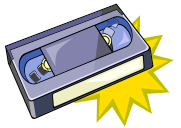


OBJECTIVE OF SLIDE: *To have participants understand oral communication.*

Oral Communication



SUGGESTED SCRIPT: “As we can see from the scenarios we’ve discussed today, when communicating with other individuals at the railroad, we must be clear, accurate, complete, organized, concise, and on time.”



VIDEO: *Show CRM Video Clip 4–Good Communication 1*

Clear



SUGGESTED SCRIPT: “First, communication must be clear. It must be understood by the receiver. Sometimes we use slang or certain words or phrases that are only understandable to our particular working group or friends. Many times people of different cultural backgrounds use different phrases and words to describe the same things. It can help the receiver understand the message if you use phrases and words that can be understood by them. Similarly, after working within a particular crew or division, a certain language develops within the group. Remember, if there is a new employee in the group, he or she might not understand exactly what is being communicated. Also, railroad employees come from all over the country even the world, and many times they have different accents, which at times can make them difficult to understand. If you do not understand someone for any reason, ask him/her to repeat what he/she said.”

Accurate



SUGGESTED SCRIPT: “Oral communication must be accurate. Misinformation can have grave consequences. Before communicating information, double check to make sure it is correct.”



Complete

SUGGESTED SCRIPT: “A message must be complete. Make sure you don’t leave out any pertinent information.”



Organized

SUGGESTED SCRIPT: “Effective communication is organized. Messages are better received if they are organized in a way that helps the receiver understand them. Many times the sender has a series of messages to send (as in a procedure)—try to organize messages so that there is some sort of logical flow or order to it.”

** For example in CRM video clip 4—Good Communication 1, when Mike communicates the layout of the yard to Mark, he is organized. He states, “actually this yard runs from two to seven, two through seven,” then he uses his hands to illustrate and says, “two, three, four, five, six....and seven.” He then says “this is track five” and indicates the track they are standing next to with his hands. This is organized communication. He didn’t say, “that is track 3, and over there is track 7, and here is 5 and over there is 2,” pointing all over the place. That would be disorganized.*

Concise



SUGGESTED SCRIPT: “Communication must also be concise. We often put more words in our communication than is necessary, and this just jumbles the message. When communicating a message, try to make it as short as possible, while still being complete and clear.”

Timely



SUGGESTED SCRIPT: “We must also be on time. Almost all communication here at _____ (insert name of RR) is needed now. Once you realize that something needs to be communicated, do it then. Don’t wait or it might be too late.”

“So these are good ideas for communicating, but we all know that communication should not be one way—communication is two way, and a lot depends on the listener.”

Next slide



** Facilitator Notes*

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Communication

Two-Way Communication/ Active Listening

- Ask questions
- Restating or paraphrasing
- Recording information

Crew Resource Management 56



OBJECTIVE OF SLIDE: *To show participants several methods of improving two-way communications.*



SUGGESTED SCRIPT: “One-way communication is when one person is talking and the other person is listening. We saw an example of one-way communication at beginning of this module.”



ASK: “How does this compare to two-way communication? What are some things that are present in two-way communication that are missing in one-way communication?”

Get answers from group.



SUGGESTED SCRIPT: “Let’s look at this same situation only with two-way communication.”



VIDEO: *Show CRM Video Clip 5–Good Communication 2*



ASK: “What are some of the things that this new employee did which were good active listening techniques?”

Get answers from group the group—see if the participants can come up with all the behaviors that new employee displayed when communicating actively (asking questions, restating or paraphrasing, and recording information). Once they have mentioned each of these, explain each below using the script.



SUGGESTED SCRIPT: “That is right, two-way communication involves active listening which involves asking questions.”



Click on mouse

Ask Questions



SUGGESTED SCRIPT: “Asking questions helps make sure you understand a statement. Also, ask for any additional information that might help you understand the information better. When a new employee does not understand an acronym, he/she should ask what it means and should not be concerned about appearing dumb or ignorant. As we all know, it can be extremely noisy in the railroad environment. Sometimes we don’t hear things the first time and should ask questions to make sure we understood it, and heard it correctly.”



Click on mouse

Restating or Repeat in Your Own Words



SUGGESTED SCRIPT: “Another way that the new employee showed an active listening technique was to confirm his understanding of the information with the sender. He restated or paraphrased the message back to the sender. Paraphrasing can help not only show that you have heard the message but that you **U N D E R S T A N D** it.”



Click on mouse

Record Information



SUGGESTED SCRIPT: “Because we have a limited memory, we cannot remember everything, and many times throughout our work day there is information that we are given that we cannot remember unless we write it down. By writing down information, we can use the information later to remind ourselves of the communication and information.”

Next slide



** Facilitator Notes*

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Communication

Other Modes of Communication

- Radio
- Written
- Hand signals

Crew Resource Management 57



OBJECTIVE OF SLIDE: (1) For participants to understand that CRM is related to other modes of communication, (2) to understand the pros and cons of each and when to use each, and (3) to understand how different CRM factors are related to each mode.

Other Modes of Communication



SUGGESTED SCRIPT: “So far we have been discussing communication by giving examples of face-to-face, spoken communication.”



ASK: “Is this the only way we communicate with our fellow crewmembers or other members outside our crew? What are some other methods we use to communicate with our team members?”

Possible answers: (1) radio, (2) written, and (3) hand signals



Click on mouse



SUGGESTED SCRIPT: “One mode of communication we use regularly is the radio.”



Click on mouse



SUGGESTED SCRIPT: “Another mode of communication we use all the time is written communication.”



Click on mouse



SUGGESTED SCRIPT: “Another mode of communication we use is hand signals.”



Click on mouse

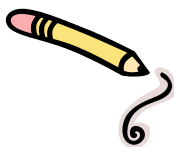


SUGGESTED SCRIPT: “Just like communicating verbally face to face, when communicating using the radio, in writing, or using hand signals, we must be clear, accurate, complete, organized, concise, and on time.”



SUGGESTED SCRIPT: “Let’s look at ways computers and other technology are being used in railroading and think about some of the effects of these. Specifically, how new and emerging technology will affect CRM, communication, and safety.”

Next slide



** Facilitator Notes*

Communication

New Technology

- Remote Control
- Cell Phones
- Cell-Based Walkie-Talkie
- Electronic Authority Exchange
- Hi-Rail Limits Compliance System
- Automated Information Exchange

Crew Resource Management 58



OBJECTIVE OF SLIDE: *For participants to understand that new technologies will always be introduced in the railroad environment and to be aware of how they might change the way we communicate with our team members.*



ASK: “What are some examples of new technologies involved in railroading? Listed here are several that were identified in rail operations.”

Participants are likely to suggest technologies like: Remote control, cell phones, cell-based walkie-talkies, perhaps Electronic Authority Exchange track and time, etc.



Click on mouse



SUGGESTED SCRIPT: “Yes, these, as well as other new technologies, including remote control, cell phones, and cell-based walkie-talkies. There is always going to be change in the technologies that we use to communicate on the railroad. When the way we do our work and the technologies we use change, it often takes some time to get up to speed. Many times there is a completely different set of cues that we must learn when technology changes or when the way we communicate with our team members changes.”

Remote Control



SUGGESTED SCRIPT: “Major changes in work procedures and technology (for example, remote control of locomotives), can change everything about the cues we take in, our environment, and how we communicate when we work.”



ASK: “What are the different cues that one takes in when they are working a remote control versus when they are in the cab?”

(Answers could be: weather, cues from remote control, cues from the other person with the remote control, cues from other trains and people: engineer does not have the safety of the cab, and now has to think about where they are on the ground, other tracks and movement in the yard.)



SUGGESTED SCRIPT: “Remote control puts the engineer (or operator) on the ground, thus he or she now has to deal with weather conditions, for example the rain, snow, and wind. Weather conditions can impose physical stress on the individual, and the communication is different between a remote control team and a traditional yard crew. Because we are outside and have physical stress, we need to be conscious of communication needs.”



ASK: “How are cell phones different from face-to-face communication? What are some issues we need to think about when communicating using cell phones?”

Answers could include direct contact outside official lines of communication, may help us get through to dispatcher or other personnel more easily, may be a distraction



SUGGESTED SCRIPT: “Yes, we communicate differently using cell phones. While they provide direct communication means with both work and non-work related personnel, they may also become a distraction (*see “Clarendon” accident in Transportation Track*). They are useful tools when used properly but can affect safety when used improperly.”

Cell-Based Walkie-Talkies



SUGGESTED SCRIPT: “How about cell-based walkie-talkies? Some railroads are providing these to some of their employees in order to provide a direct and reliable means of communication between personnel.”



ASK: “How are these cell-based walkie-talkies different from face-to-face communication? Also, how are they different from communicating over the radio? What are some issues we need to think about when communicating using cell-based walkie-talkies?”



SUGGESTED SCRIPT: “When communicating with a dispatcher, train crew, or MOW crew over the radio, other employees and crews using that same channel can hear that communication. By monitoring particular radio channels, crews can stay aware of the situation around them, and they can plan ahead and prepare for future situations. However, when we communicate to another person using a cell-based walkie-talkie, no one else on the railroad can hear us as they would over the radio. Other employees and crews on the railroad can no longer use the information they get from our conversation. Sure, the radio channels are less congested improving communication, but at the cost of the other communication benefits of broadcasting intentions over a radio net.”

Electronic Authority Exchange



SUGGESTED SCRIPT: “How about an Electronic Authority Exchange System? Electronic Authority Exchange that provides Form B information over wireless signals to computer terminals in work trucks means that that information is no longer available to those listening on the radio.”



ASK: How does use of Electronic Authority Exchange system change the way we communicate? Does it change the amount of information other crew and employees on the railroad can hear?"



SUGGESTED SCRIPT: "Other workers may or may not know the limits of the Form B as a result. Foremen receiving and acknowledging electronic authority acceptance must realize that their crewmembers must be briefed on the limits and to be even more wary of trains and other work crews operating nearby or through the area since they may not be aware of their presence. Communicating the presence of a Form B area becomes even more vital for the dispatcher."

Hi-Rail Limits Compliance System



SUGGESTED SCRIPT: "How about a Hi-Rail Limits Compliance System? A Hi-Rail Limits Compliance System typically uses Global Positioning Systems (GPS) to alert the operator of a Hi-Rail equipped vehicle when approaching the limits of the assigned authority."



ASK: "How does our use of a Hi-Rail Limits Compliance System change the way we communicate?"



SUGGESTED SCRIPT: "A Hi-Rail Limits Compliance System changes the way we communicate by increasing our dependence on outside automation to limit our movement over the track. It reduces communication error and provides real-time, direct communication between the dispatcher and the hi-rail truck's GPS system. But, once again, other personnel may not be aware of the assigned limits or Form B issuances that have been handled exclusively via computer wireless communications links."

Automated Information Exchange



SUGGESTED SCRIPT: "How about an Automated Information Exchange System? An Automated Information Exchange System allows conductors and other railroad personnel to submit reports using voice recognition technology via telephone from remote locations."



ASK: "How does our use of an Automated Information Exchange System change the way we communicate?"



SUGGESTED SCRIPT: “Automated Information Exchange reduces the amount of paperwork by allowing voice reporting of information, but it introduces the possibility of error in misinterpretation by the voice recognition software.”



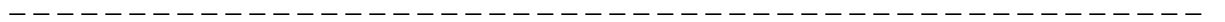
ASK: “What are some new technologies involved in the mechanical crafts? How might they change the way information is passed?”

Potential answers include: PDA-based reporting of car inspections, bar codes on parts, AEI readers for rolling stock, etc. Discuss each technology with the class and how communications might be affected by each.



SUGGESTED SCRIPT: “While each of these new technologies has been introduced due to certain benefits that they bring to railroad operations, CRM principles teach that crews should also be mindful of the effects that they can have upon current practices and expectations regarding communications.”

Next Slide



** Facilitator Notes*



Communication

Job Briefing Guidelines

- **Plan the job briefing**
- **Conduct the job briefing**
- **Brief for special conditions**
- **Followup by employee in charge**
- **Debriefing**

Crew Resource Management 59



OBJECTIVE OF SLIDE: To give participants some job briefing guidelines.



SUGGESTED SCRIPT: “We have mentioned job briefings throughout this course. We talked about job briefings in maintaining situational awareness. The first step in maintaining situational awareness is planning and preparing. The first thing we do every day to plan and prepare is to conduct a job briefing. Job briefings help define crewmembers’ responsibilities, the tasks to be performed, and the type of protection required. It also provides a forum for crewmembers to give input into different personal or environmental situations that might be present. Similarly, it allows participants to ask questions and clarify roles and responsibilities so that everyone is working on the same plan and can be prepared for the day’s work activities. There are several job briefing guidelines that, if followed, will ensure you get the most out of job briefings.”

Plan the Job Briefing



SUGGESTED SCRIPT: “The first guideline is to plan the job briefing. A good job briefing is usually planned ahead of time. For those conducting the job briefing, you should plan the work to be performed, consider existing and potential hazards, and think about how task assignments will be made and delegated to crewmembers.

“Some accidents occur on the railroad because employees or crew members who should have attended the job briefing were not there. Make sure all employees who need to be present are in attendance before you begin the briefing. If an employee is not present during the first job briefing, make sure he/she is briefed first thing when he/she arrives at the work site. Also make sure that everyone at the worksite is aware that someone new is in the work area.”



Conduct the Job Briefing

SUGGESTED SCRIPT: “The next guideline is to conduct the job briefing. When conducting a job briefing, you should explain the tasks and work to be accomplished to all employees involved in the work. You should have a discussion about hazards and suggest to the crew ways to eliminate or protect themselves against them. When delegating work tasks and assignments, make sure that each crewmember knows exactly what his/her work assignment is.”

“As with all communications, when giving a job briefing, you must be clear, accurate, complete, organized, concise, and on time. The employee giving the job briefing should then make sure that what he/she has said is understood by the crew. Ask questions to make sure that instructions were understood.”



Brief for Special Conditions

SUGGESTED SCRIPT: “Before ending the job briefing, make sure that you brief for special conditions. Many times special tools, material, equipment, or work methods are used during a particular work assignment. Make sure that employees involved in special work assignments know how to use the required tools and materials. Crewmembers working in the area but not using special equipment or tools, should be aware of specific safety issues involved in being around such equipment. For jobs that have a high level of complexity, make sure employees know any important issues involved in the job. Because the environment where crews either drive a train, work on a track, or move equipment can change dramatically, make sure all employees are aware of any special environmental conditions that might exist in the work area.”



Followup by Employee in Charge

SUGGESTED SCRIPT: “As we all know, things change after arriving on the job site. When there is a substantial enough change, which can affect the crew’s work or safety, another job briefing should be performed. This way everyone on the team stays up to date on any relevant changes in the work environment, keeping the team safe throughout the day.”



Debriefing

SUGGESTED SCRIPT: “Lastly, a debriefing is a good way to exchange information at the end of a work shift. By reflecting on work tasks that could have gone better, performance of job tasks can be improved the next time.”



ASK: “Should job briefings involve one-way or two-way communication?”

Possible Answers: Will probably state that communication should be two-way; however, it is usually one-way.



SUGGESTED SCRIPT: “Just like all communication, job briefings should involve two-way communication. The employee giving the job briefing should be open to receive feedback and information from other crewmembers. This will allow the group to be more aware of the situation.”

Next Slide



** Facilitator Notes*

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Communication

Active Participation (in job briefing)

- **Contribute facts and ideas**
- **Ask questions**
- **Listen/stay focused**
- **Clarify roles and expectations**

Crew Resource Management 60



OBJECTIVE OF SLIDE: *To show the participants how to be active participants in a job briefing.*



ASK: “How do we become active participants of a job briefing?”

Get answers from group

Contribute Facts and Ideas

REFER TO SLIDE AND EXPAND: “We communicate actively by first contributing facts and ideas. One of the benefits of working together as a team or crew is that more ideas and information can be gained from a greater number of individuals. However, these benefits cannot be realized if the crew does not contribute facts and ideas.”

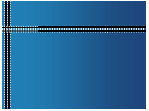
Ask Questions

REFER TO SLIDE AND EXPAND: “A job briefing is also a forum to ask questions. As in all communications, if you do not understand something, ask for clarification before the job briefing is over. Chances are many of the other attendees of the job briefing are wondering about the same thing.”

Listen/Stay Focused

REFER TO SLIDE AND EXPAND: “Likewise, in order to actively participate in a job briefing, you must listen and stay focused. It is sometimes difficult to stay focused during a job briefing; however, if you don’t, the information that you miss might be critical to your safety.”

Clarify Roles and Expectations

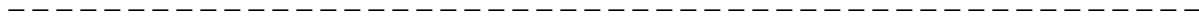


REFER TO SLIDE AND EXPAND: “Lastly, participants in a job briefing should clarify roles and expectations. This way you can avoid confusion and potential errors later during the workday. You should restate or paraphrase what your role and expectations are, as well as the timeframe specific work tasks are to be accomplished. Writing down or recording job briefing information is a good way to make sure you don’t forget any critical information.”

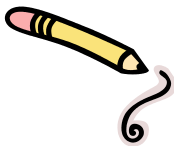


SUGGESTED SCRIPT: “Now let’s talk about teamwork.”

Next slide



** Facilitator Notes*



Teamwork

Module 5: Teamwork

- Understand that safety hinges on both individual and team actions

Crew Resource Management 64



OBJECTIVE OF SLIDE: *To introduce module 5 – teamwork.*



SUGGESTED SCRIPT: “The fifth module is teamwork. When you complete this module, you should understand that safety hinges on both individual and team actions.”

Next slide



** Facilitator Notes*

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Teamwork

Learning Objectives: Teamwork

- Explain why optimizing safety involves team responsibility, as well as individual responsibility
- List the benefits of improved team decisionmaking
- Be able to effectively use conflict resolution techniques

Crew Resource Management 62



OBJECTIVE OF SLIDE: *For participants to understand the specific objectives of module 5.*

Learning Objectives: Teamwork

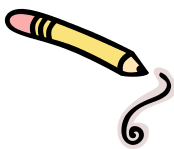


SUGGESTED SCRIPT: “The learning objectives for this module are...”



REFER TO SLIDE:

- Explain why optimizing safety involves team responsibility, as well as individual responsibility.
- List the benefits of improved team decisionmaking.
- Be able to effectively use conflict resolution techniques.



Next slide

** Facilitator Notes*

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Teamwork

- **Definition of a team-crew**
- **Team decisionmaking**
- **Conflict resolution**

Crew Resource Management 63



OBJECTIVE OF SLIDE: *For participants to understand the outline of module 5.*



TEAMWORK

SUGGESTED SCRIPT: “In this module we will talk about...”



REFER TO SLIDE:

- Definition of a team-crew
- Team decision-making
- Conflict resolution skills



Next slide

** Facilitator Notes*

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Teamwork

Definition of a Team/Crew

- A crew/team is “any group of people working at tasks designed to accomplish a common mission, goal, or objective”

Crew Resource Management 64



OBJECTIVE OF SLIDE: *To restate the definition of a team/crew and explain that teamwork is important.*

Definition of a Team/Crew



SUGGESTED SCRIPT: “Remember, we define CRM as “a **CREW’S** effective use of all available resources to achieve safe and efficient train operations.” It is not just how each of you as individuals use all available resource to achieve safe and efficient train operations but how the crew does.”



Click on mouse



SUGGESTED SCRIPT: “A crew is defined as....”



REFER TO SLIDE: “Any group of people working at tasks designed to accomplish a common mission, goal, or objective.”



SUGGESTED SCRIPT: “Let’s look at a scenario where teamwork broke down, resulting in an accident.”

Next slide



** Facilitator Notes*

Teamwork

EOTD Application without Blue Flag Protection

East Binghamton Yard Incident

AB crew to inspect for outboard train 202 on track No. 5

Co Worker locked and Blueflagged 1821 and track No. 4

Train 202 waiting for Power at Point on Number 1 Turnout

Number 2 Runner

Number 1 Runner

Outboard train 208 on track No. 4 completed All crew set

Carman locked and Blueflagged 1848 and track No. 5

Crew Resource Management 65



OBJECTIVE OF SLIDE: *To go into more depth on the EOTD application without blue flag protection scenario.*



SCENARIO: EOTD APPLICATION WITHOUT BLUE FLAG PROTECTION

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “EOTD Application Without Blue Flag Protection” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.
- Read the scenario titled “EOTD Application Without Blue Flag Protection” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.
- When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.

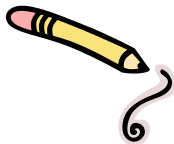


Click on mouse during the discussion to show a diagram of the accident scene.



SUGGESTED SCRIPT: “Let’s talk about team decisionmaking.”

Next slide



** Facilitator Notes*

Teamwork

Team Decisionmaking

Advantages of team decisionmaking

1. More complete information
2. More alternatives
3. Solution is accepted by the group
4. Solutions are accepted more by individuals outside the group

Crew Resource Management 66



OBJECTIVE OF SLIDE: *To have participants understand that making a decision as a team has both advantages and disadvantages.*

TEAM DECISIONMAKING



SUGGESTED SCRIPT: “As we are all aware, each of us make decisions every day when we work. These include decisions about our work processes. It is these decisions that can lead to safe or unsafe situations. We often make decisions as individuals, and there are situations in which an individual decision is warranted; however, there are also situations when it is better to use team decisionmaking. This entails calling on the experiences of your fellow crewmembers and asking them for advice in how to go about making the decision.

“Several advantages of making decisions as a team are listed here.”

More Complete Information

REFER TO SLIDE AND EXPAND: “As we have talked about throughout this program, a group brings different experiences and perspectives to a situation. Each member of a crew has his/her own perception of the situation; by communicating those perceptions in a group decision making forum, more complete and valid information can be gathered.”

More Alternatives

REFER TO SLIDE AND EXPAND: “Because crewmembers have different perceptions and experiences, they also can come up with different alternatives to problem solving. Thus as a group, there is a more, and a greater diversity of information. This means more alternatives for solving a problem can be communicated. The more alternatives a crew has, the more likely they will decide on the best and safest decision.”

Solution Is Accepted by the Group

REFER TO SLIDE AND EXPAND: “Most decisions made by an employee on the railroad will somehow affect their fellow crewmembers. Everyone likes to participate in decision that affects him/her personally. So by making a decision as a team and getting crew input, that final decision is more likely to be accepted by the crew.”

Solutions Are Accepted More by Individuals Outside the Group



REFER TO SLIDE AND EXPAND: “Finally, just like their acceptance with members of the crew themselves, when explaining to someone outside the group why a certain decision was made, it is more likely to be accepted if it was made by a team compared to an individual.”

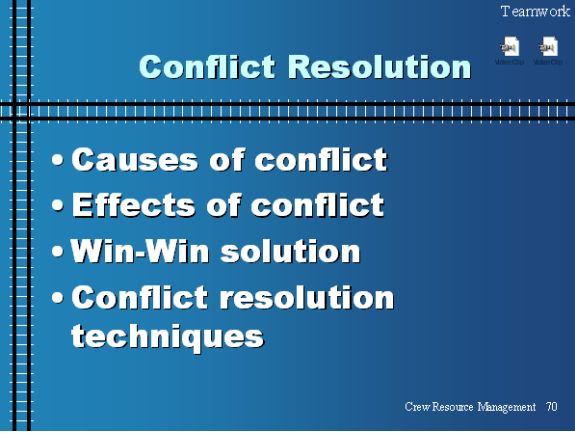


SUGGESTED SCRIPT: “Of course there are disadvantages as well. Usually individuals can make decisions faster than a team or group. So there are times when an individual decision is warranted. However, in the right circumstances, team decisions are usually better decisions.”

Next slide

** Facilitator Notes*





Teamwork

Conflict Resolution

- Causes of conflict
- Effects of conflict
- Win-Win solution
- Conflict resolution techniques

Crew Resource Management 70



OBJECTIVE OF SLIDE: *To have participants understand the causes and effects of conflict and how to resolve conflicts so that there is a win-win solution when possible.*

Conflict Resolution



VIDEO: *Show CRM Video Clip 6–Poor Conflict Resolution*



ASK: “Have any of you had a conflict like this? Do you think these workers will work together safely?”

Get answers from group.



SUGGESTED SCRIPT: “These two will probably not work together very well as a crew because of their conflict. That is why we need to resolve conflicts as soon as possible. Conflict within a crew occurs when there is disagreement over a decision or course of action.”

Causes of Conflict

REFER TO SLIDE AND EXPAND: “There are different causes of conflict. Conflict can be caused by personality differences, stress, poor communication, aggression, confusion over roles and responsibilities, loss of authority, or incompatible goals.”

Effects of Conflict

REFER TO SLIDE AND EXPAND: “Conflict can negatively affect many aspects of work because it can lead to mental fatigue. Conflict can thus shift attention away from important aspects of a work task, and it can lead to a loss of situational awareness. If resolved properly, conflict can lead to positive outcomes. These include the correction or prevention of mistakes by the crew and improved performance. A resolved conflict can also increase workers’ interest in work issues. It can also lead to an understanding between crewmembers. Thus, if handled properly, conflict can have positive effects in the long run.”

Win-Win Solution

REFER TO SLIDE AND EXPAND: “There are three different types of outcomes to a conflict. First there is a lose-lose outcome. This is when the parties either don’t deal with the problem or conflict, and there was a poor decision or compromise made. A win-lose outcome is when one person’s view is dominant and the other person’s concerns are not addressed. This usually leads to more conflict further down the line. What we are striving for is a win-win solution. This occurs when a solution is reached in which all parties’ concerns are reflected in the decision. You always want to work toward a solution where all parties feel that the solution appropriately addresses the situation.”

Conflict Resolution Techniques

REFER TO SLIDE AND EXPAND: “So, when a conflict exists, how do we go about solving it? First, we need to be physically and mentally prepared to deal with the conflict. Trying to resolve a conflict when you are fatigued, hungry, under stress, or thinking about something else is a bad idea. You should not respond to a conflict until after you are physically and mentally prepared. Similarly, you should delay responding to a conflict until you know what you would like to say or do. Take at least a moment to gather your thoughts before trying to resolve a conflict.

“One of the most important steps to resolving a conflict is to define the conflict. That is determining what the root cause of the conflict is. Often other issues and conflicts are actually the result of some disagreement or event that occurred previously. Often clarifying what the conflict is about, can clear up confusion by the parties and begin to resolve the conflict itself. By figuring out exactly what the root conflict is, you can use your resources to resolve that conflict.

“When resolving conflicts, use some of the effective communication techniques we discussed earlier in the communication module, including being clear, accurate, complete, organized, concise, and on time. Also, use some of the techniques discussed previously about two-way communication, including asking questions and restating/paraphrasing to check for understanding. If miscommunication occurs, it can make the conflict worse off. When resolving a conflict, each party should be assertive, yet not aggressive or passive. Many conflicts can become emotional; however, it is best to control emotions.”

SUGGESTED SCRIPT: “Now let’s revisit that conflicting engineer and conductor, and see if there is a better way to deal with conflict.”

VIDEO: *Show CRM Video Clip 7–Good Conflict Resolution*





SUGGESTED SCRIPT: “This is the proper way to deal with conflict. Discuss the reasons for conflict, and seek solutions that are acceptable to both parties.”

Next slide



** Facilitator Notes*

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Assertiveness

Module 6: Assertiveness

Objective: Understand the proper use of assertive communication

Crew Resource Management 71



OBJECTIVE OF SLIDE: *To have participants understand the overall objective of module 6.*



Assertiveness

SUGGESTED SCRIPT: “The objective of this module is that you understand the proper use of assertive communication.”

Next slide



** Facilitator Notes*

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Assertiveness

Assertiveness/Proper Challenges of Authority

- **Proper Assertiveness**
 - Asking questions
 - Do not attack the individual
 - Controlling of emotions
- **Corporate safety culture**
- **Taking other people's communication styles into account while being assertive/proactive**

Crew Resource Management 69



OBJECTIVE OF SLIDE: *To have participants understand the proper way to be assertive and challenge authority.*



SUGGESTED SCRIPT: “Teamwork and communication are important; however, sometimes there are still disagreements as to the best course of action. Authority, roles, seniority, or specified job functional areas make it hard for ideas, communication, and understanding to flow between crewmembers. In order to reap the benefits of working together in a team, team members must be assertive, especially in relation to safety. When being assertive, crewmembers should make sure they communicate their ideas or opinions, particularly when the safety of the crew depends on it, meaning that some situations might require being more or less assertive than others.”



SUGGESTED SCRIPT: “Some techniques used in being assertive are to....”

Ask Questions



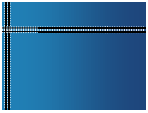
REFER TO SLIDE AND EXPAND: “Sometimes, it is difficult to challenge another person's actions or views without offending him or her. A good way to get around this is to ask questions. This allows you to gain information to make sure you understand the situation correctly and is less threatening to the other crewmember. For example, if you think a fellow crewmember has forgotten a step in a maintenance procedure or did not see a cue that you did, you should verbalize your concerns by asking, “Hey, did we forget to _____?” or “Did you see _____?” By asking questions, you are not directly challenging their competence. Rather, you are giving them an opportunity to re-evaluate what they are doing.”

Do Not Attack the Individual



REFER TO SLIDE AND EXPAND: Don't attack the individual personally. One technique to do this is to begin any objections with the word 'I.' For example, ‘I thought that we were supposed to _____ when we do ____.’ This is more effective than saying, ‘You always do that wrong. You should have done _____.’”

Controlling of Emotions



REFER TO SLIDE AND EXPAND: “Lastly, just like resolving conflict, when being assertive you should control your emotions. Expressing yourself in a calm and collected manner and not challenging a crewmember’s action directly is better than being aggressive and using an angry or threatening tone.”



SUGGESTED SCRIPT: “Let’s see an example of someone attempting to use these techniques.”



VIDEO: - *Show CRM Video 8–Assertive-less*



ASK: “Was the engineer using the assertiveness techniques that we’ve been discussing?”



SUGGESTED SCRIPT: “The engineer was using proper assertiveness techniques. He began questions with ‘I’ for example, ‘I sure wish we got some more air before we started,’ and he asked questions to address his issues, ‘Are you sure that switch is lined up?’



ASK: “Did it help?”



SUGGESTED SCRIPT: “Not really. The conductor just was not listening. In this case, crewmembers must use increased levels of assertiveness to maintain safe operations. Ultimately, you are responsible for your own safety and your need to ensure that you are safe out there on the job. If, after using the various assertive techniques discussed, your fellow crew member still does not ‘get it,’ you should state an objection clearly and take appropriate actions to divert an accident or injury.”

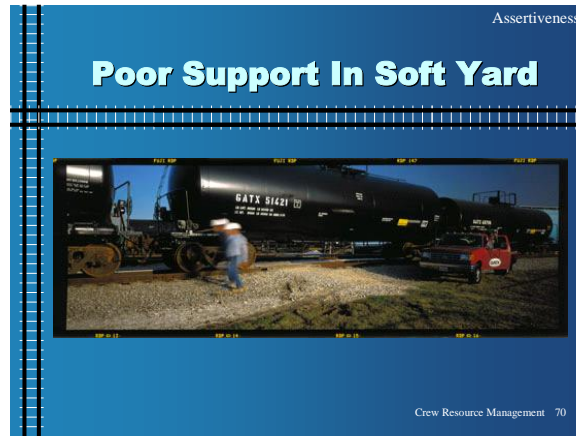
“Let’s look at a scenario involving a lack of assertiveness.”

Next Slide



** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To go into more depth on the poor support in soft yard scenario.*



SCENARIO: POOR SUPPORT IN SOFT YARD

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Poor Support in Soft Yard” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Poor Support in Soft Yard” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



SUGGESTED SCRIPT: “That is the end of module 6, assertiveness; let’s review what we talked about today.”

Next slide



** Facilitator Notes*

Review

Review of Each Module

- Introduction
- Technical Proficiency
- Situational Awareness
- Communication
- Teamwork
- Assertiveness

Crew Resource Management 73



OBJECTIVE OF SLIDE: *To review each module.*

Introduction

SUGGESTED SCRIPT: “So let’s take a moment and review each module. The first module was the **Introduction** where we defined what we mean by CRM. We defined CRM as ‘a crew’s effective use of all available resources to achieve safe and efficient train operations.’ We broke this definition out and talked about what we mean by a crew. We defined crew as, ‘any group of people working at tasks designed to accomplish a common mission, goal, or objective.’ We talked about how a crew is not just your immediate work group or elemental team, but it can also be an interactive team, which occurs when two or more elemental teams work together. An example is when a train crew, an MOW crew, and a dispatcher have to work together to move a train through a work area safely.”

“We talked about how CRM started in the airline industry and has since moved into other high consequence team industries. We then talked about the Butler, IN accident that caused NTSB to recommend CRM for the rail industry. We then looked at some accident statistics and talked about how for the last 10 years, human error has been the number one cause of accidents in the rail industry. We then saw that all crafts in the mechanical track are potentially at risk on the railroad, so everyone in this room has something to gain from practicing good CRM. We then talked about the Swiss cheese model of accident prevention and saw that although there are many factors that contribute to an accident, each of you, working together and practicing good CRM techniques is the last line of defense in accident prevention.”

Technical Proficiency

SUGGESTED SCRIPT: “The second module was technical proficiency. This module was short, and we discussed the three elements of technical proficiency, including knowing your equipment, knowing your procedures, and skilled performance. We then talked about the importance of evaluating the technical proficiency of your fellow crewmembers because there are always new employees and new rules and procedures.”





Situational Awareness

SUGGESTED SCRIPT: “The third module was situational awareness. Here we talked about our perceptions of the situation and how this might differ from the reality of the situation. We talked about how, by communicating with our fellow crewmembers, we can come up with a team perception of the situation, which is usually closer to the reality of the situation than any individual crewmember’s perception. We talked about different environmental, and personal cues, and questioning the validity of those cues. We talked about some steps you can take to maintain situational awareness, as well as steps to regain situational awareness if it is lost. In this module we also talked about fatigue and how it affects our situational awareness. By practicing good CRM techniques and working together as a team, we can often counteract the effects of fatigue.”



Communication

SUGGESTED SCRIPT: “The fourth module was communication. We talked about one-way versus two-way communication, and how communication should be two-way whenever possible to ensure understanding. We talked about other modes of communication and how new technologies, although they might be advantageous for some tasks, may affect the amount of information that is communicated. Lastly, we talked about steps to take when conducting a job briefing, as well as how to be an active participant in a job briefing.”



Teamwork

SUGGESTED SCRIPT: “Module five was teamwork. Here we talked about the advantages of team decisionmaking as well as how to deal with and resolve conflict. We talked about the causes and effects of conflict, as well as some conflict resolution techniques that will allow you to strive for a win-win (or consensus) solution.”



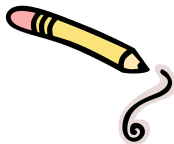
Assertiveness

SUGGESTED SCRIPT: “The last module was assertiveness. Here we talked about how to be assertive by asking questions, not attacking the individual, and controlling your emotions.”



SUGGESTED SCRIPT: “Let’s look at some of the benefits some other industries have seen from CRM training.”

Next Slide



** Facilitator Notes*

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Review

CRM Benefits

- **Continental Airlines** (trained approximately 2/3 of maintenance workforce in CRM)
 - 66% decrease in ground damage costs
 - 27% fewer occupational injuries
- **Maersk** (after 4 years of CRM and human factors training)
 - 33% reduction in accidents
 - 15% decrease in insurance premiums as a result

Crew Resource Management 72



OBJECTIVE OF SLIDE: *To show participants some results of CRM training from other industries.*



SUGGESTED SCRIPT: “Does practicing CRM techniques make the workplace safer? Well, it has in other industries that are similar to the railroad industry.”



REFER TO SLIDE AND EXPAND: “Continental Airlines trained approximately 2/3 of its maintenance workforce in CRM. Afterwards, there was a 66 percent decrease in ground damage costs, and 27 percent fewer occupational injuries within that workforce. Similarly, Maersk, a shipping company, trained its employees in CRM. After 4 years of CRM and human factors training they saw a 33 percent reduction in accidents, which resulted in a 15 percent decrease in insurance premiums.”



SUGGESTED SCRIPT: “We’ve already discussed how airline safety and other fields have used CRM to improve their safety by reducing human factors errors. CRM works. It does create a safer work environment.”

Next Slide



** Facilitator Notes*

Review

CRM Benefits

- **Benefits**
 - Increased worker **safety** (saved lives, reduced lost work injuries, fewer equipment failures, reduced fatigue-related accidents)
 - Improved performance (avoid costly errors)
- **Costs**
 - Will require changes in the railroad culture
 - Ongoing training and evaluation program
 - Organizational commitment to see as many errors as possible eliminated

Crew Resource Management 73



OBJECTIVE OF SLIDE: *To have participants see some real-life results of CRM.*



SUGGESTED SCRIPT: “Again, CRM is about safety. The main **benefit** is increased worker safety. It can save lives, reduce lost work injuries, lead to fewer equipment failures, and reduce fatigue-related accidents.”

“There are however **costs**. First, it will require changes in the railroad culture. For a long time, workers have thought about their jobs as individuals rather than as team functions. Additionally, management, labor, and regulators have often been at odds, resulting in conflict and miscommunication in the workplace. This needs to be improved if CRM is to be fully effective.”

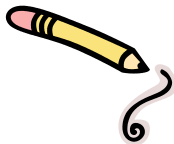
“Second, it will require an ongoing training and evaluation program. I mentioned at the beginning of the program that CRM is not a short-term accident-reduction program, and it is not just this course today. CRM has to be part of the ongoing training here, including the evaluation program. It will take some time to implement, as well as have an effect on safety and accidents.”

“Lastly, it will take an organizational commitment to see as many errors as possible eliminated. The organization has to support it, and it does.”

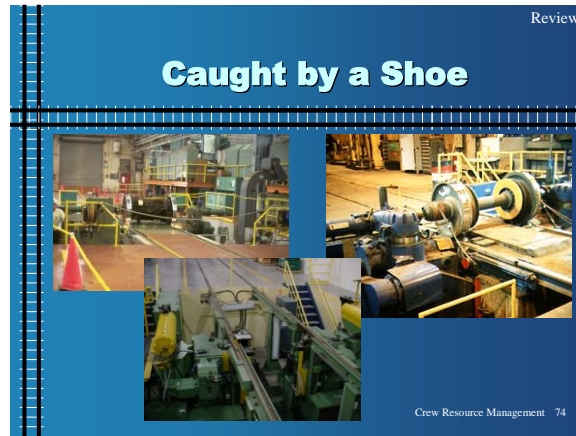


SUGGESTED SCRIPT: “Let’s examine one final scenario in which you will identify the CRM skills failures.”

Next Slide



** Facilitator Notes*



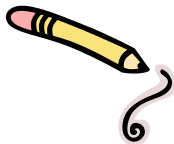
OBJECTIVE OF SLIDE: *To give participants a final scenario that involves all of the elements of CRM discussed during the training.*



SCENARIO: CAUGHT BY A SHOE

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Caught by a Shoe” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Caught by a Shoe” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

End of Presentation



** Facilitator Notes*



Rail Crew Resource Management

Mechanical Track Facilitator's Scenario Guide

Includes possible answers and discussion notes for Rail CRM Pilot Course.

Scenarios Presented During Pilot Rail CRM Testing

Mechanical Track

Introduction

NS Student Engineer at Butler, Indiana
Car Inspector Parks on Hump Track
In the Dark
Carman Hit by Cars

Technical Proficiency

Second Day Back

Situational Awareness

Dangerous Dumper

Communication

No Blue Flag Protection

Teamwork

EOTD Application Without Blue Flag Protection

Assertiveness

Poor Support In Soft Yard

Final

Caught by a Shoe

NS Student Engineer at Butler, Indiana

Source:	NTSB Report: NTSB NTSB/RAR-99/02 (Full NTSB report can be found on “CRM disk 1 ...”)
Training Track Application:	<ul style="list-style-type: none"> • Transportation–Introduction to CRM
CRM Principles Covered:	<ul style="list-style-type: none"> • Situational Awareness • Technical Proficiency • Organizational Pressures • Communication
Employees Involved in Accident:	<ul style="list-style-type: none"> • Engineer; NS & Conrail • Conductor; NS & Conrail • Student Engineer; NS
Railroad:	Norfolk Southern Corporation and Consolidated Rail Corporation
Train:	NS - 255L5; Conrail - TV 220
Location:	Butler, IN
Accident Date and Time:	March 25, 1998, about 4:48 AM CST
Type of Accident:	Collision
Fatalities/Injuries:	NS conductor killed, NS engineer, and student engineer sustained minor injuries
Property Damage:	NS damages - \$187,000 to equipment, \$18,000 to track and signals, and \$59,000 to cargo Conrail damages - \$314,000 to equipment, \$33,500 to track and signals, and \$4,700 to cargo

Facilitator Notes:

This accident can be used to depict all the various elements of CRM, technical proficiency, situational awareness, communications, teamwork, and assertiveness.

The Incident

The accident occurred just before 5:00 in the morning. The weather was cold, about 35 ° F, the visibility was unrestricted at about 10 miles, and there was a slight wind out of the NW that had no effect on the accident.

The southbound Norfolk Southern Corporation (Norfolk Southern)² train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio. The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple, stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

Conrail

The Conrail train proceeded into the interlocking according to the signal system and with the authority of the controlling dispatcher.

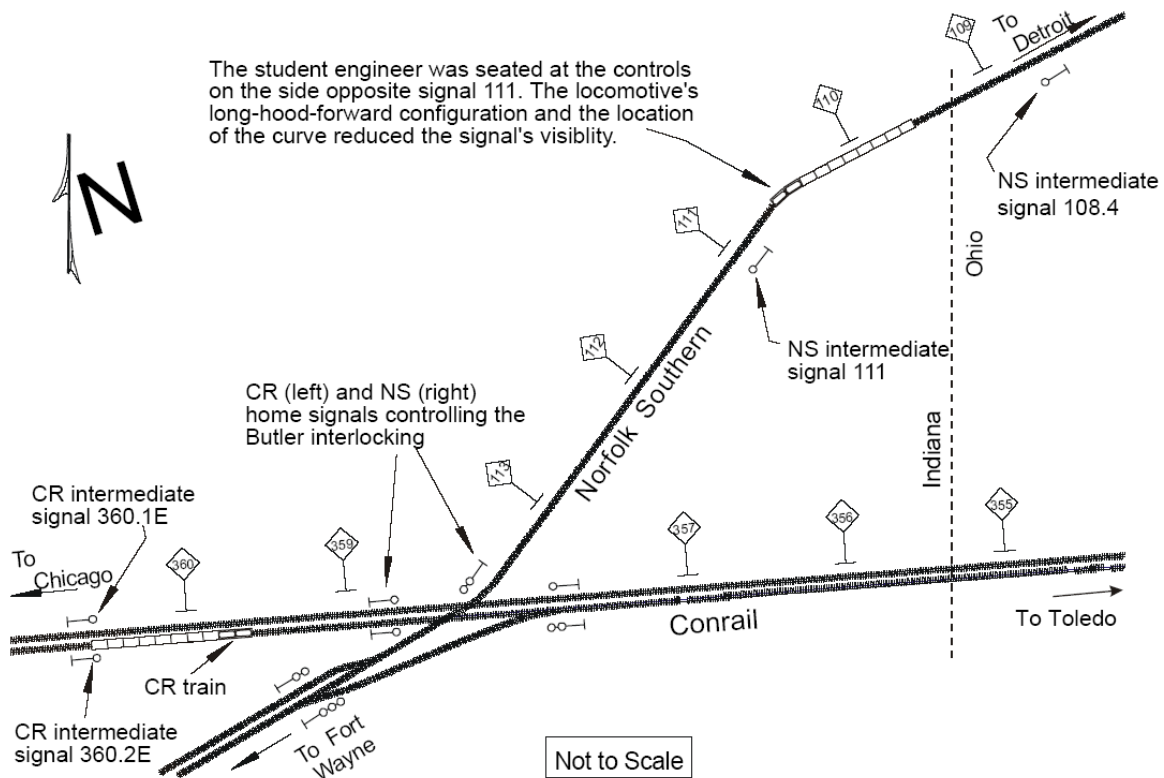


Figure 1 Conrail (CR) and Norfolk Southern (NS) signals in area of Butler interlocking

Norfolk Southern

On an uneventful trip from Peru to Detroit, two days previous, the conductor of the crew instructed the student engineer that it was the practice of the (*this*) crew not to call clear signals (a Norfolk Southern Rules violation, Rule 34 requires all signals to be clearly called.)

On the night prior to the accident, at 11:35 p.m., the Norfolk Southern crewmembers, an engineer, a student engineer, and a conductor, reported for duty at the Detroit Terminal. After reading their orders and clearing them with the train dispatcher, the crewmembers boarded the two-unit locomotive consist at the round house and proceeded to their train in the Triple Crown facility. The train, consisting of 85 loaded road-railer type cars, departed the facility about 2:30 a.m., after crewmembers had performed the required air brake tests.

After leaving the terminal area, about 2:35 a.m. and about 114 miles northeast of the accident, the engineer turned over the train's operation to the student engineer. The train continued southwest toward Fort Wayne. The student engineer reported nothing unusual about the train's handling before the accident.

The locomotive was being operated with the long-hood-forward, with the student engineer seated at the controls on the right side of the lead locomotive; the conductor and engineer were seated on left side, with the engineer in the forward seat and the conductor directly behind him in the rear seat. The engineers operating position visibility to the left side of the locomotive is limited when it is being operated in this mode. The student said that he had never been formally trained in long-hood-forward operation and had operated in this mode only once before, on the trip with the same crew from Peru, Indiana, to Detroit, Michigan, that concluded the day before the accident.

The student engineer said that the conductor and engineer did not call clear signals. The engineer agreed that the conductor had told the student upon going on duty at Peru that it was the practice of the crew not to call clear signals. Norfolk Southern operating rule 34 requires that crewmembers "call," or orally communicate, all signals encountered.

The student engineer said that the engineer and conductor both started reading what he thought were paperback books shortly after 3:00 a.m., about 30 minutes after departing Detroit. Two paperback books were found on the floor of the lead locomotive after the accident. The student engineer also said that about 30 minutes to an hour before the collision, the conductor or the engineer turned off the overhead light on the left side of the control compartment. The student said that he left the light on above his position to better observe the controls. The student was unsure how long the light was out on the other side of the cab, stating "It could have been a half-hour, it could have been an hour. I don't know." He said that during the time the light was off, he did not talk to the engineer or the conductor or hear them talking to each other. He was unable to state with certainty whether the engineer or the conductor was asleep while the light was out, only that no communication occurred between himself and the other crewmembers during that time.

The student engineer said that as he approached Butler, intermediate signal 108.4 was displaying a clear indication, which he radioed over the road channel. He did not see signal 111, the next intermediate signal on the left side of the track and the last intermediate signal before the home signal at milepost (MP) 113.9, Butler interlocking. Locomotive event recorder data

indicated that the train was traveling approximately 60 mph (the maximum speed) as it passed signal 111. According to the student engineer, when it seemed the train had gone too far without encountering signal 111, he asked the conductor and engineer about the signal location. He said that he began slowing the train as the stop signal at Butler interlocking became visible and that "...Howard [the conductor] was coming across, and we saw it together; actually, and he said it [the home signal] was all red." The student engineer said he was already in dynamic braking and was applying more air brake when he heard the air brakes go into emergency. He said that he thought the engineer had applied the emergency brake using the valve on the left side of the cab. The student then placed the automatic brake valve handle in the emergency position.

The Accident

As the Norfolk Southern train approached Butler interlocking, the student engineer stated that he realized a collision was imminent when he saw the other train going across the crossing. He said he shouted, "We've got to get out of here" twice and turned to leave by the door behind his position. The conductor was the first to exit, followed by the student. The engineer stated that he saw both the conductor and student exit before he exited behind them.

The student stated that as he went down the locomotive stairwell and saw the proximity of the oncoming train, he jumped, landing in some water. The student could not recall whether the conductor jumped but did recall him being on the platform. The engineer stated the conductor was out of sight when he exited the cab and jumped from the locomotive.

Tasks

1. What are some of the factors that led up to this accident?

Possible Answers:

- The conductor's instructions at Peru, circumventing Rule 34, "Call all signals."
- When the engineer turned over the trains operation to the student after departure of the Detroit area.
- When the student was assigned to a new territory without any previous training in the equipment to be used.

Discussion: Organizational and peer pressure resulted in the student engineer not being assertive to call into question the stated practice of not calling "Clear" signals in this crew.

Organizational because this is a qualified and experienced conductor being trained as an engineer. He is fully aware that you go where you are assigned.

Peer because this student knows that you do not make friends in the labor union by pointing out rule violators without a substantial backing from other employees.

After the engineer turned over the train to the student, several points occurred where a loss of situational awareness appears to be evident. When the student observes the conductor's side overhead light turned off, he accepts the situation without comment and loses awareness that he may not have any back-up for signals that are not clear.

When he passes intermediate 108.3 showing a clear, the student is unaware that intermediate 111 is ahead on the left just past the left-hand curve. Furthermore, he is unaware that this signal has had some problems in the recent past and has a reported trouble code against it.

2. What was the fatal error that caused this accident?

Possible Answers:

- Missed the intermediate signal at MP 111.
- Long-hood-forward operation causing limited visibility of signals on the left side of the track.

Discussion: The fact that the student was unfamiliar with both the territory and the operation of long-hood-forward leads to a conclusion that lack of technical proficiency exists with regard to the student in this accident.

The fact that the intermediate signal for the critical interlocking is located on the left side of the track, past a left-hand curve, on territory where long-hood-forward equipment is operated brings into question the technical proficiency of the signal engineering departments placement.

Assigning a student to an unfamiliar territory on equipment he has not had any formal training with leads to questioning the technical proficiency of the crew callers in this instance.

3. What action(s) could the student engineer have taken to avoid this accident situation?

Possible Answers:

- He could have insisted on complying with NS Rule 34 (i.e., call all signals).
- He could have engaged the engineer in conversation while operating the locomotive on the run from Detroit to Fort Wayne.

Discussion: What are some issues that may have inhibited the student from taking assertive action discussed?

4. What do you think should be done to protect the employee from being unduly exposed to this type of situation in the future?

Possible Answers:

- Have the rest of the crewmembers agree to work together as a team to ensure that the signals are read (interpreted) correctly. This will support the teamwork concept already trained for.
- Ask for a review of the rules that the train is to be operated under for the trip. Make sure the whole team views the situation the same and that it is viewed as reality not fantasy.

Discussion: Teamwork is a vital component of several individuals working on the same job together.

Car Inspector Parks on Hump Track

Source:	FRA 2002 Fatalities Report No. FE 28-02 (Full report can be found on "CRM disk 1 ...")
Training Track Application:	Mechanical (covered in the introduction before participants are introduced to CRM modules)
CRM Principles Covered:	<ul style="list-style-type: none"> • Situational Awareness • Communication • Teamwork • Assertiveness
Employees Involved in Accident:	<ul style="list-style-type: none"> • Car Inspector (51 yrs. old / 29 yrs service) • Engineer of Yard Assignment Y33614 • Crew of Train No. Q5124 • Inbound Lead Car Inspector • Hump Yard Master • Hump Foreman
Railroad:	CSX Transportation, Incorporated
Employee Craft:	Maintenance of Equipment
Location:	Cincinnati, Ohio
Accident Date and Time:	November 15, 2002; 5:20 a.m., EST
Type of Accident:	(Example: Collision, Derailment)
Fatalities/Injuries:	Car Inspector Fatally Injured
Property Damage:	NA

Facilitator Notes:

- A Terminal Superintendent Bulletin was issued ordering train directors, in the future, to announce the shove of a hump cut on the car inspector's radio channel.

The Incident

South Road and East Open Track

On Nov. 14, 2002, the Outbound Lead Car Inspector went on duty at 11 p.m. at CSX's Queensgate Yard, in Cincinnati, Ohio. On Nov. 15, 2002, the Lead Car Inspector received instructions to do a set-and-release air brake test on CSX Train No Q54115. He was informed Q54115 would be stopped on the east open track, where he could have access to the rear of the train. He drove his CSX pick-up truck south on the "south road" to a location where he could position himself for observation of the rear car of Q54115. The south road was a straight, 1-paved lane, oriented generally north and south. The east open track, where he would be doing his work, was immediately next to the east side of the south road, and receiving yard Track No. R8 was immediately to the west. The east open track and Track No. R8 were parallel to the south road in most of the yard.

When Train No. Q54115 stopped on the east open track, the rear car of the train was north of the Outbound Lead Car Inspector's position on the south road, thus the Outbound Lead Car Inspector has driven farther south than he needed to. He backed his truck north on the South road and backed onto the cart path crossing on Track No. R8. Thus, he was facing the east open track.

The engineer of Yard Assignment Y33614, another hump assignment working in the area, was moving Locomotives CSXT 2414 and CSXT 1054 from the hump crest to the car shop lead track, and then going to lunch. He observed the truck back onto the cart path crossing and remain there for about a minute. He did not see the truck leave the crossing, and left the immediate area before the accident occurred. It is not known how long the truck remained on the crossing.

Track No. R8

After reaching its destination, inbound Train No. Q51214, which was 4,829 feet long, was left standing on receiving yard Track No. R8, waiting to be humped. The crew of Train No. Q5124 had coupled two locomotives to the south end of the cars on Track No. R8, and was preparing to shove them north over the hump. An Auto Carrier, the car on the north end of train, was standing south about half the length of an auto carrier (47 feet) south of the cart path crossing that crossed Track No. R8 near the north end.

Lights mounted on towers illuminated the receiving yard. Visibility of a freight car was several hundred feet when viewed in open areas on a night with similar weather conditions. In areas with rail equipment nearby on both sides (between cars), visibility was reduced. At the time of the accident, it was dark and cloudy. The temperature was 46° F.

At about 5:19 a.m. on Nov. 15, 2002, the crew of Yard Assignment Y33514 received instructions from the Train Director to start shoving Track No. R8 toward the hump. The Engineer was operating Train No. Y33514's locomotives manually and the movement toward the hump was a blind shove. When the north car on Track No. R8, Auto Carrier TTGX 976118, reached the cart path crossing, it struck the Outbound Lead Car Inspector's truck on the passenger side and started shoving it north on Track No. R8. The event recorder download from Locomotive CSXT 2415 indicated it was moving at 4 mph at the time of the accident.

Radio broadcast transcripts indicated that at about 5:20 a.m., the Outbound Lead Car Inspector called on the Car Inspector's radio channel (20) to stop the movement on Track No. R8. This transmission was heard by the Inbound Lead Car Inspector, who phoned the Hump Yard Master. The Hump Yard Master monitored a different radio channel. The Hump Yard Master called the Hump Foreman and notified him to stop the movement on Track No. R8. At about 5:21 a.m., the Hump Foreman notified the Engineer on Train No. Y33514 to stop, and he took immediate action to do so.

Before the shoving movement came to a stop, the Car Inspector's truck was shoved about 360 feet north of the cart path crossing before coming to rest upside-down, underneath the north end of TTGX 976118, and was on fire. The Car Inspector was severely injured and ejected from the vehicle about 20 feet south of where it came to rest. The Cincinnati Fire Department, Cincinnati Police Department, and Hamilton County Coroner responded to the accident. At 9:45 a.m., the Coroner pronounced the Car Inspector dead and transported his body from the accident site.

Tasks

1. Was the car inspector aware of the situation?

Possible Answers:

- No

Discussion: We can assume that the car inspector was not aware he was parked on an active track.

2. What was the car inspector's perception of the situation?

Possible Answers:

- Perception of the situation was that there were going to be no trains on Track No. R8.

Discussion:

3. Was the car inspector working alone, or were there any other employees out there that could have helped him or communicated to him about his situation?

Possible Answers:

- He was working by himself, but others were there who could have been used as a resource, including the engineer of Yard Assignment Y33614, who saw the car inspector essentially park on the cart path, but did not say anything.

Discussion: Everyone works together on the railroad as a big interactive team. We need to watch out for each other.

4. What could the engineer of Yard Assignment Y33614 have done to make the car inspector more aware of the situation?

Possible Answers:

- Could have communicated with the car inspector

Discussion: He could have communicated with the car inspector using the radio or another method to inform him that he was parked on an active track.

5. What are some of the reasons that the car inspector parked on the tracks?

Possible Answers:

- Did it that way every time before.
- Did not realize where he was.

Discussion: It is possible that the car inspector parked on those tracks many times before, and there were never trains running on it. Questioning our past experience and assumptions can help us be more aware of the situation. It is also possible that the car inspector did not realize he was parked on the track or thought he was parked on another track. You need to be aware of your surroundings and where you are at all times, especially in an environment like a railroad yard.

6. What are some of the reasons the engineer of yard assignment Y33614 did not communicate with the car inspector?

Possible Answers:

- Did not want to embarrass the car inspector.
- Wanting to get to lunch?
- On a different radio channel.

Discussion: There are a variety of reasons we do not communicate or are not assertive when we need to be. Sometimes individuals react negatively when others question their actions

and behaviors, and perhaps the engineer did not want to embarrass or challenge the car inspector's behavior (parking on the tracks), even though he thought it was unsafe. We all need to learn to be assertive at the appropriate times.

7. Did you see positive communication in this scenario?

Possible Answers:

- Communication after the car inspector's vehicle was hit.

Discussion: The first communication was the outbound lead car inspector calling on the car inspector's radio channel (20) to stop the movement on Track No. R8. This transmission was heard by the inbound lead car inspector, who phoned the hump yardmaster. The hump yardmaster monitored a different radio channel. The hump yardmaster called the hump foreman and notified him to stop the movement on Track No. R8. At about 5:21 a.m., the hump foreman notified the engineer on Train No. Y33514 to stop, and he took immediate action to do so. Many teams work on different radio channels; thus when those teams need to communicate, additional steps are needed and must be planned for.

In the Dark

Source:	FRA 1997 Fatalities Report No. FE 03-97 (Full report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Mechanical • Transportation (Yard Operations)
CRM Principles Covered:	<ul style="list-style-type: none"> • Introduction • Technical Proficiency • Situational Awareness • Teamwork
Employees Involved in Accident:	<ul style="list-style-type: none"> • Carman (42 years old/ 16 years of experience) • Crew of Train G-25 • Crew of Train M-98 • Mechanical Department Supervisor
Railroad:	Norfolk Southern Railroad (NS)
Employee Craft:	Maintenance of Equipment
Location:	Macon, Georgia
Accident Date and Time:	Jan. 19, 1997 - 6:40 a.m., EST
Type of Accident:	Carman struck by train
Fatalities/Injuries:	One fatality
Property Damage:	Unknown

Facilitator Notes:

Toxicology samples were obtained from the deceased carman, engineer, and conductor of Train No. M-98 and were tested under the authority of 49 CFR Part 219, Subpart C. Results of all tests were negative.

Activity:

Establishing Blue Flag protection and switching.

PCF No. 1:

The carman fouled track adjacent to two tracks involved in the assignment, and he was struck by moving equipment.

PCF No. 2:

The carman wore dark clothing and left his hand-held light in the truck.

PCF No. 3:

Train M-98's engineer neither sounded the bell nor illuminated the locomotive headlight as required by the railroad's Operating Rule No. 17. He was a repeat offender, having been cited during a December 1996 safety audit for not having the locomotive headlight illuminated.

PCF No. 4:

Vision and hearing were impaired for Train M-98's engineer and carman. The pole-mounted light at the site was diminished to almost total darkness when the two locomotive consists passed the switch to Tracks 2 and 3 at the same time. The sound from the locomotives of Train G-25 in close proximity to the carman may have masked the sound of the approaching locomotives of Train M-98.

PCF No. 5:

The yardmasters in the towers, who had regularly attempted to notify all affected parties of yard movements when possible, did not provide such a notification in this instance.

PCF No. 6:

The car inspector's regular shift was 7 a.m. to 3 p.m. He reported for duty at 11 p.m. and worked the shift in overtime status. Fatigue may have decreased his alertness on the tracks.

PCF No. 7:

Just before the incident, the conductor of Train M-98 was controlling the northward movement of the locomotives from one of the locomotive cabs. His view of the track in the direction of movement was obstructed by the long hood end of the locomotive he was riding.

The Incident**Circumstances Prior to the Accident**

The Carman reported for duty in the forwarding yard at 11:00 p.m., the evening prior to the accident, at NS's Brosnan Yard in Macon, Georgia. His regularly assigned shift was 7 a.m. to 3 p.m. He was working this shift in overtime status. The Mechanical Department Supervisor assigned him to the south end Blue Flag protection job and instructed him to go to the south end of the yard and leave the Blue Flag protection in place on Tracks Nos. 3 and 6 after the Train Crew of Train No. G-25 had completed its move on each of those two tracks. The tracks in the south yard extended northward and southward and were numbered one through nine, beginning from Thoroughfare No. 2. The yard lighting in the area of the accident consisted of a single pole light, east of the accident area, and located between Track No. 9 and the East Levy Road. The ambient temperature at the time of the accident was 28° F. No atmospheric condition limited visibility. The FRA report diagram of the accident location is shown on next page.

The Carman drove the company-owned truck southward on the East Levee Road to the south end of the forwarding yard, and upon arrival, parked the vehicle near a light pole. From the point at which he parked the truck, he had to cross Tracks Nos. 9, 8, and 7 to get to his Blue Flag assignment. Upon completing the Blue Flag requirements for Track No. 6, the Carman crossed over to the switch leading to Tracks Nos. 2 and 3. He stood beside the switch while he was waiting for the locomotives of Train No. G-25 to exit the south end of Track No. 3.

Train No. G-25 was a local freight train that originated in Savannah, Georgia at 7 p.m. on Jan. 18, 1997. The Crew comprised an Engineer and a Conductor who had completed their statutory off-duty periods prior to reporting for duty. This Train Crew performed local switching duties between Savannah and Macon, and arrived at Macon Junction at 3:55 a.m. on Jan. 19, 1997.

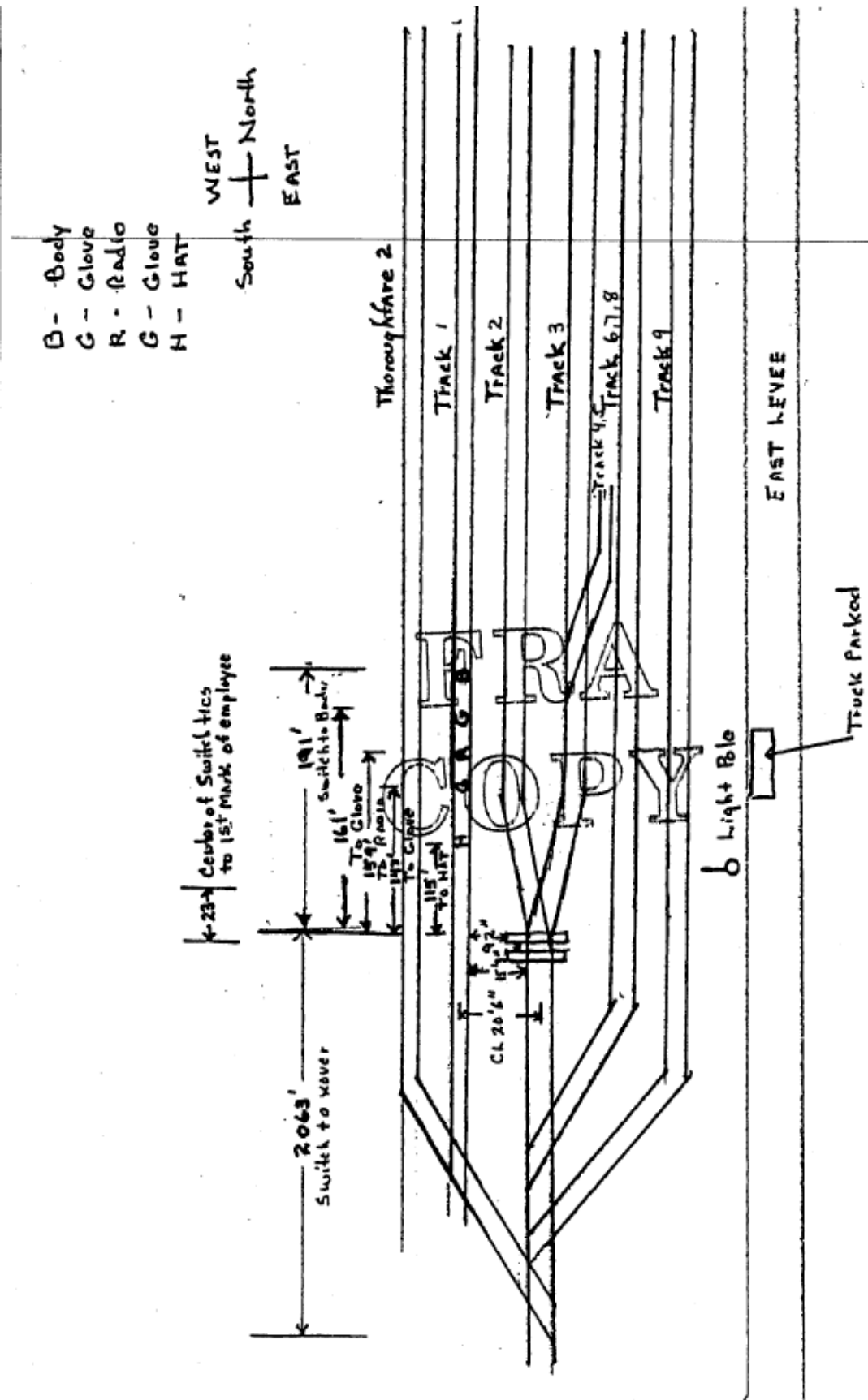
This train remained at Macon Junction until 5:50 a.m. when the Yardmaster in the North Tower at Brosnan Yard instructed his Crew to pull through Track No. 6, make a cut, and shove the remainder of the train onto Track No. 3.

The locomotives for Train No. M-98 were being backed onto Track No. 1, to couple to the train simultaneously as the Crew of Train No. G-25 was moving its train onto Track No. 3.

The Carman was last observed by the Conductor of Train No. G-25 standing west of the switch for Tracks Nos. 2 and 3, as the Conductor uncoupled the locomotives from the cars that remained on Track No. 3. The Carman and Conductor waved to each other at this time, and according to the Conductor, everything appeared to be normal. The locomotives for Train No. M-98 were moving northward on Track No. 1 during the time of the Conductor's observation.

Train No. M-98 was a southbound freight train originating at Macon on the day of the accident. The Crew of this train comprised an Engineer and a Conductor who had completed their statutory off-duty periods prior to reporting for duty. They went on duty at the engine terminal at 6 a.m. on Jan. 19, 1997. The Crew of this train received instructions to depart the engine terminal at 6:25 a.m. They proceeded southward on Thoroughfare No. 2 to the switch for the south crossover to the forwarding yard.

When the locomotives arrived at the south end of the forwarding yard lead, the Yardmaster in the North Tower instructed the Crew to back onto Track No. 1 and couple its three locomotive consist to its train. This Crew was backing northward with the three light locomotives onto Track No. 1.



The Accident

As the Carman was standing near the switch between Tracks Nos. 2 and 3, waiting for the locomotives of Train No. G-25 to pull southward out of the track, the locomotives of Train No. M-98 were passing him, moving northward on Track No. 1. For an undetermined reason, the Carman apparently fouled Track No. 1 and was struck by the locomotives of Train No. M-98 as they moved northward. The body of the Carman was discovered by the Crewmembers of Train No. G-09 as the train pulled southward out of Track No. 2 at approximately 6:55 a.m., and they notified the Main Tower of their discovery via radio. There were no eye witnesses to the accident.

The Bibb County Medical Center Emergency Medical Service (EMS) arrived at the accident site, and an EMS paramedic pronounced the Carman dead at 7:16 a.m. The cause of death was multiple blunt and crush injuries with the trunk of the body transected. The Bibb County Coroner declared the manner of death as an accident.

Post-Accident Investigation

The company truck assigned to the Carman for this tour of duty was found parked near the switches leading to the forwarding yard. The Carman had left his hard hat, safety glasses, and hand-held, battery-powered light on the seat of the truck. He was apparently attempting to perform his assigned duties while utilizing illumination supplied by the pole-mounted light in the yard near his location.

Re-enactment of the circumstances surrounding this accident revealed that it was dark when the accident occurred, and the Carman would have been dependent on the lighting generated from the pole-mounted light since he did not have his hand-held light with him. The re-enactment also demonstrated that if both train's locomotive consists were passing the switch to Tracks Nos. 2 and 3 at the same time, illumination from the pole-mounted light would have been diminished to the point that a person standing near the switch would have been in almost total darkness. The noise from both locomotive consists may have made it impossible to hear the audible warning (bell) from Train No. M-98.

The Carman was wearing layered clothing with a stocking-type cap and a hooded sweatshirt at the time of the accident. His outer clothing was dark in color. It is unknown if the stocking cap and hooded sweatshirt he was wearing at the time had reduced his ability to hear. He also had gloves and a radio with him. His gloves and radio were found in the gage of the track north of the point of impact. His transected body was found approximately 191 feet north of the switch to Tracks Nos. 2 and 3. His upper torso was found in the gage of Track No. 1, while his lower portion was found outside the gage of the east rail.

Evidence observed on Locomotive NW 6143 of Train No. M-98 indicated that it had passed over the Carman's body. The Engineer was operating from the control stand from the west side of the south unit (NW 8067). The locomotive consist was moving northward onto Track No. 1 to couple to its train. The Conductor was controlling the northward movement of the locomotives from the cab of Locomotive NW 6143; he was seated on the west side. The Conductor's view of the track in the direction of movement was hampered by the long hood end of Locomotive NW 6143.

There is conflicting information over whether the headlight was illuminated in the direction of movement. The Engineer of Train No. M-98 stated that he usually turned on the headlight at each end of the locomotive consist prior to departing the engine terminal. During an interview, he recalled not having to turn on the headlights because they were already illuminated. However, the Engineer and Conductor of Train No. G-25 stated that they did not observe an illuminated headlight on Train No. M-98's rear unit, nor did they hear the bell being sounded as they passed it. The investigation revealed that the Engineer on Train No. M-98 had been cited during a Safety Audit performed on Dec. 30, 1996 at Brosnan Yard for not having his locomotive headlight illuminated as required by Operating Rule No. 17.

Analysis of the speed/event recorder data removed from the locomotives indicated that Train No. M-98's locomotives made the reverse move onto Track No. 1 at approximately 6:40 a.m.

According to those with whom the deceased had worked during the night, the shift had been a routine tour until the Carman was given his last assigned flagging duty for the night. The majority of the mechanical force agreed that the Yardmasters in the towers habitually had attempted to notify all affected parties of yard movements whenever possible; however, no one could recall hearing a notification of this movement.

Additionally, the Carman was standing in darkness and did not have a hand-held light with him. Nor was he wearing any reflective equipment that would have enabled the Crew of Train M-98 to be aware of his presence. The sound from the locomotives of Train No. G-25 in close proximity to the Carman may have masked the sound of the approaching locomotives of Train M-98, leaving him unaware of their approach to his location.

Tasks

1. What were some factors that contributed to this incident?

Possible Answers:

- Environmental factors, including night time, cold weather, poor lighting.
- Improper equipment, including carman did not have his radio, hard hat, or flashlight with him.
- No headlight or bell from Train M-98.
- Loss of situational awareness.
- Lack of communication between yardmaster and carman.

Discussion: See PCFs identified by FRA in facilitator's notes section at the beginning of this scenario.

2. Who made up the crew (interactive team) that needed to work together to ensure that these moves were completed safely?

Possible Answers:

- Yardmaster
- Carman
- Crew from Train G-25
- Crew from Train M-98 locomotive consist

Discussion:

3. What are some actions that the carman could have taken to protect himself?

Possible Answers:

- Carry his radio so that he would be more aware of train movements. (Even though M-98's move was not announced by the yardmaster, most movements were, and he would have certainly been more informed.)
- Carry his flashlight and wear his hard hat (reflectorized) so that he would be more visible.
- Look and check area with flashlight before fouling any track.
- Do not depend on pole mounted light to provide proper illumination for job site.

Discussion:

4. What are some actions the train crews could have taken to potentially prevent this accident?

Possible Answers:

- The conductor of train G-25 saw the carman and waved to him. He could have alerted the other train crew or brought up his location to the yardmaster if he thought it was important to do so.
- The engineer of train M-98 could have made sure that the headlights on the rear of the locomotive consist were on and the bell was ringing during his move.
- The conductor of train M-98 was controlling the movement of the locomotive consist from a position where he was unable to see forward and right. Therefore he would likely have been unable to see the carman foul the track even under better lighting conditions.

Discussion:

5. What role could fatigue have played in this accident?

Possible Answers:

- Time of day (dark, cold, etc).
- Carman was working on an overtime status, not his normal shift.
- Could have affected the carman's decisionmaking ability.

Discussion:

Carman Hit by Cars

Source:	FRA 1998 Fatalities Report No. FE 31-98 (Full report can be found on "CRM disk 1 ...")
Training Track Application:	Mechanical (covered in the introduction before participants are introduced to CRM modules)
CRM Principles Covered:	<ul style="list-style-type: none"> • Situational Awareness • Teamwork • Communication
Employees Involved in Accident:	<ul style="list-style-type: none"> • Carman (56 yrs. old / 31 yrs service) • Engineer of Yard Assignment Y33614 • Crew of Train No. Q5124 • Inbound Lead Car Inspector • Hump Yard Master • Hump Foreman
Railroad:	Illinois Central Railroad Company (IC)
Employee Craft:	Maintenance of Equipment
Location:	Baton Rouge, Louisiana
Accident Date and Time:	Nov. 18, 1998, 12:15 p.m., CST
Type of Accident:	Carman hit by cars in yard
Fatalities/Injuries:	Car Fatally Injured
Property Damage:	NA

Facilitator Notes:

The Incident

On Nov. 18, 1998, the Carman reported for a scheduled 8-hour shift at the Baton Rouge Yard. This work shift was scheduled for 7 a.m. - 3 p.m., his regular shift. The Carman had performed an outbound inspection and initial terminal train air brake test on LLL 44-18, a local Union Pacific train to be operated to Livonia, Louisiana. He had conducted the initial terminal train air brake test on Tracks Nos. 5 and 14. The UP Crew had doubled the train from Track No. 5 to Track No. 14. Then the Carman performed an end-of train device (EOT) test.

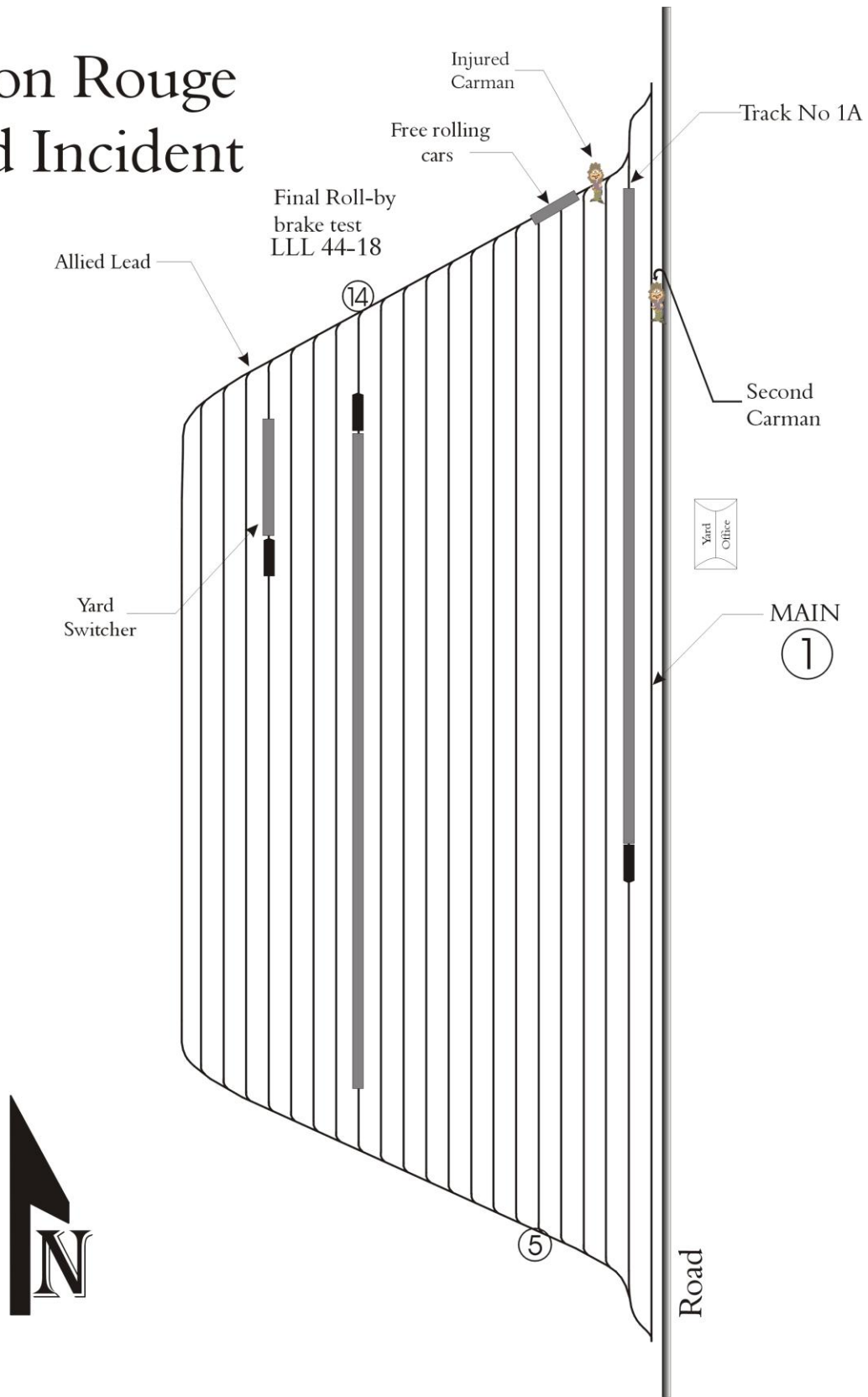
The EOT was armed, and the Carman was en route to the north end of the yard to perform a roll-by inspection of the train air brake release. He and the other Carman working with him in the yard were to board auto transportation, provided by the Yardmaster, to the north end of the yard. The Carman was proceeding on foot in a generally east-northeast direction across the yard to meet the other Carman and board their transportation. During this time, the other Carman, who was performing a roll-by inspection of the train air brake release for outbound train LBRGE (Local Baton Rouge to Geisner, Louisiana), was standing between the main track and the road, north of the Yard Office and south of the Allied lead. Train LBRGE was proceeding southbound on Track No. 1A.

A Yard Crew was switching cars from the switching lead onto various tracks as dictated by its switch list. This was a south-to-north movement with approximately six cars remaining to be switched. The Carman was walking perpendicular to their switching movements and could clearly observe the Crew's activity. The weather at the time of the accident was fair, with a temperature in the low 80's.

The Carman stepped into the gage of the lead track, between switches for Tracks Nos. 2 and 3, was struck by two rail cars rolling free on the lead track on his right rear side, and was knocked face down between the rails. His left arm and shoulder apparently were positioned on the rail as the first of two loaded covered hopper cars struck him and the L4 wheel ran over his body, severing his left arm and shoulder. The force of the impact caused his hard hat to land on the end deck of the car, beneath the slope sheet. The Carman stood up and walked approximately 40 feet southward after the accident and then collapsed. The Yard Conductor saw him at this location as he fell down. The Conductor and Brakeman attempted to aid the Carman and summoned help using their radio. There were no witnesses to the actual impact and amputation.

A call was made to 911 at approximately 12:15 p.m., and emergency medical services arrived at the scene a short time later. The Carman was transported by ambulance to Baton Rouge General Hospital where he was pronounced dead at 1 p.m.

Baton Rouge Yard Incident



Tasks

1. Was the carman aware of the hazards of working in the yard?

Possible Answers:

- Yes. He was aware of it because he had been doing it for 31 years.

Discussion: Because the carman had been working in the yard for such a long period of time, he was definitely aware of the hazards involved.

2. How many times had the carman probably crossed the tracks in this manner in his career?

Possible Answers:

- Tens of thousands of times.

Discussion:

3. Was the carman aware of this particular situation?

Possible Answers:

- No

Discussion: The carman was not aware that the cars were moving on the track he was crossing.

4. What was the carman's perception of the situation?

Possible Answers:

- Perception was that no cars were moving on the track he was crossing.

Discussion:

5. What are some of the problems with doing things so often that they become second nature?

Possible Answers:

- One becomes complacent. This complacency, can lead to a loss of situational awareness. Events do not play out the exact same way every time.

Discussion:

Second Day Back

Source:	FRA 1997 Fatalities Report No. FE 10-97 (Full report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Mechanical
CRM Principles Covered:	<ul style="list-style-type: none"> • Technical Proficiency • Situational Awareness • Teamwork
Employees Involved in Accident:	<ul style="list-style-type: none"> • Carman (55 years old/ Two years, nine months of experience) • Foreman • Yardmaster • Another Carman
Railroad:	Consolidated Rail Corporation (CR)
Employee Craft:	Maintenance of Equipment
Location:	Newark, New Jersey
Accident Date and Time:	March 21, 1997, 7:15 p.m., EST
Type of Accident:	Carman struck and killed by train
Fatalities/Injuries:	One fatality
Property Damage:	Unknown

Facilitator Notes:

Post-accident interviews revealed that the switch crewmembers were unaware that their train had struck the carman. He was found 45 minutes later, after the other car inspector, who had tried to reach the fatally injured carman by radio, had initiated a search.

The New Jersey State Toxicology Laboratory at the Edwin H. Albano Institute of Forensic Science performed post-accident blood and urine toxicology tests. The test results were negative. Post-accident toxicology testing was also performed under FRA authority by Northwest Toxicology Inc. at Salt Lake City, UT. The results of those tests were also negative. The New Jersey State Medical Examiner's autopsy report indicated the cause of death was multiple blunt force injuries.

PCF No. 1:

Carman failed to maintain proper vigilance for moving railroad equipment while fouling unprotected track.

PCF No. 2:

Little experience and rustiness with job: The fatally injured car inspector had less than 3 years service with the railroad, of which 1 year and 8 months was spent as an extended absence to recover from a shoulder injury sustained on the job. He had returned to work the day before.

The car inspector was previously employed as a brakeman by the New Jersey Transit Rail Operations (passenger trains only) from January 10, 1994 to September 16, 1994.

Along with the other employees, he received a routine job briefing conducted by the carman's supervisor (foreman).

PCF No. 3:

Due to the right-hand curvature of Tracks No. 7 and 8, engineer for Job YPOI-31 could not see the end of the leading car from the locomotive cab. Four cars and the locomotive were enroute to couple to a tank car when the carman was struck. In addition, it was dark in the area, with no artificial lighting available.

The Incident**Circumstances Prior to the Accident**

At 3 p.m., on Friday, March 21, 1997, a Conrail (CR) employee (deceased) reported for his regularly assigned duties as a Car Inspector (Carman) on the 3 p.m. to 11 p.m. shift at the railroad's Oak Island Yard in Newark, New Jersey. The Carman had returned to work the previous day (Thursday, March 20) following an extended absence from work due to an on-the-job shoulder injury he had sustained on July 17, 1995. Including this extended absence from work, his total experience with CR was two years, nine months. The Car Inspector had previously been employed as a Brakeman by the New Jersey Transit Rail Operations (passenger trains only) from Jan. 10, 1994 through Sept. 16, 1994. Following a routine job briefing conducted by the Carman's Supervisor (Foreman), he began his normal work activities. Please see the attached diagram of the Oak Island Yard to better visualize the accident scene and the chain of events that led up to the accident.

At approximately 6:30 p.m., the Carman and a co-worker were assigned to inspect 72 cars for outbound Train OIAL-7, located on Track No. 7 in the receiving yard. The receiving yard was a clear, open area with tracks running in an east/west timetable direction. There was an access road parallel to Track No. 7 to the south side and an adjacent track (Track No. 8) to the north. As instructed, the two Carman proceeded to the receiving yard by truck and, after applying Blue Signal protection to both ends of Track No. 7, began walking the cars from opposite ends of the track and on opposite sides of the cars. The Carman began walking eastbound between Tracks Nos. 7 and 8 while his co-worker walked westbound along the access road. At approximately the mid-way point of the 72-car train, the two Carman met one another and, following a brief conversation, continued their inspection. At some point after the two Carman resumed their inspection, the co-worker heard a locomotive pass his location traveling eastward on Track No. 8.

On the day of the accident, the Crew for Switch Job YPOI-31 at Conrail's Oak Island Yard reported for duty at 3:45 p.m. The Crew comprised an Engineer, Conductor, and Brakeman. At approximately 6:45 p.m., the Switch Crew received instructions from the Yardmaster to couple onto four cars located near the west end of Track No. 8 and shove them to a coupling with a tank car located near the east end of the track. The Conductor proceeded on foot to the east end of Track No. 8 to position himself at the tank car, while the Brakeman stayed with the locomotive to couple the four cars at the west end of the track. After coupling to the four cars and releasing the handbrakes, the Brakeman returned to the locomotive and positioned himself in the Fireman's seat opposite the Engineer (south side). The Engineer contacted the Conductor by radio and informed him that they were shoving the four cars eastward toward him. The locomotive headlight was on dim, and the bell was ringing. The shoving movement was made at an estimated speed of between 5 and 10 mph. The weather at the time of the accident was clear and cold with a temperature of 40° F. It was dark at the time of the accident (7:15 p.m.). There was no artificial lighting in the area.

The Accident

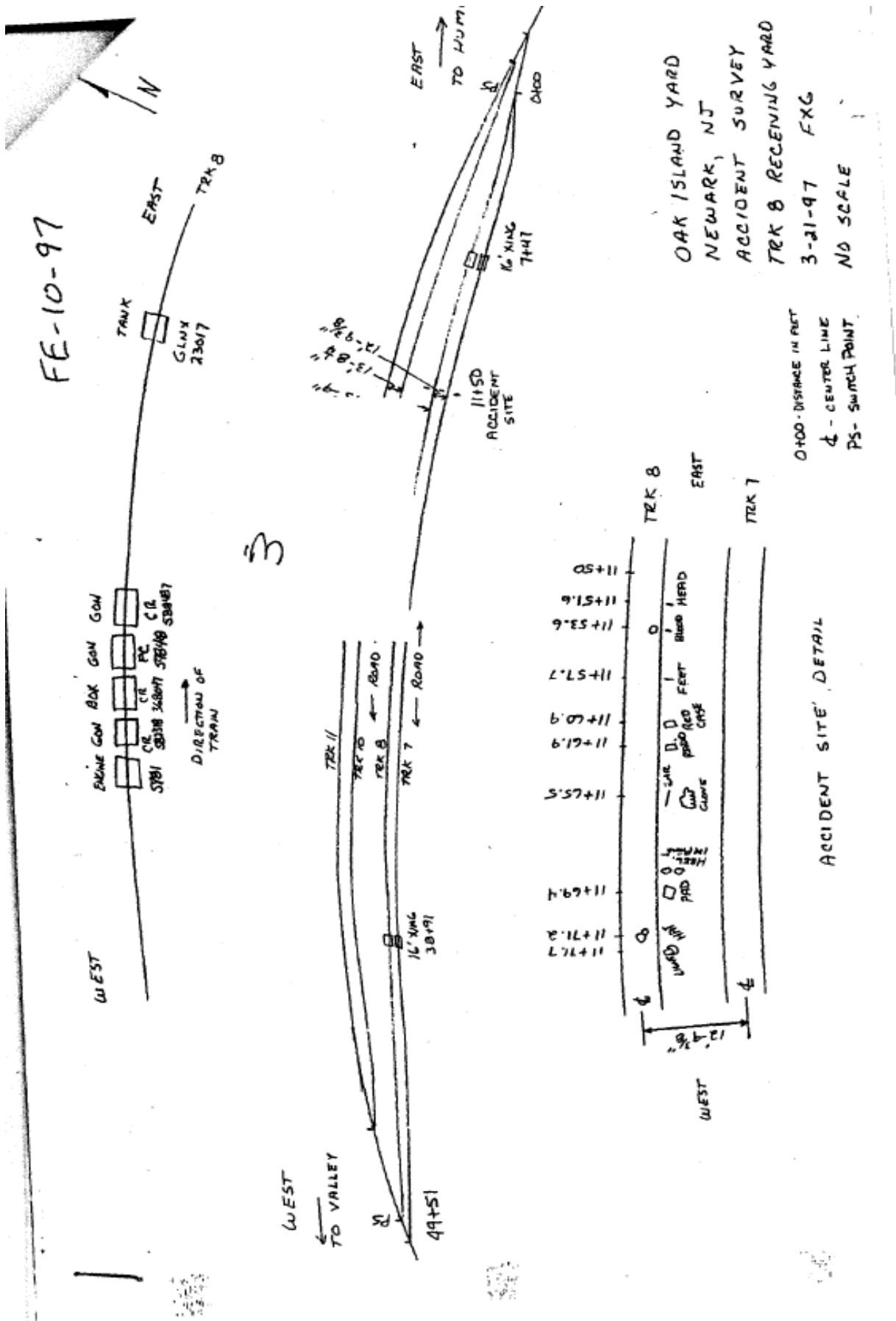
There were no eye-witnesses to the accident. Upon reaching the west end of the 72 cars on Track No. 7, the co-worker attempted several times to contact the Carman by radio. Receiving no answer, he began walking eastward toward the opposite end of the track in search of the Carman. At some point, he radioed the Foreman to inform him of the missing employee. The Foreman notified the Yardmaster to stop all train movements in the yard, and he and another Carman proceeded to the receiving yard to assist in the search.

At approximately 8:00 p.m., the Carman was found fatally injured lying between Tracks Nos. 7 and 8. Evidence indicates that the Carman was struck in the back and left shoulder by the moving equipment traveling east on Track No. 8. His right arm was severed above the elbow by the wheels of the passing equipment. While awaiting the arrival of the emergency responders from University Hospital in Newark, NJ, the Foreman performed CPR to no avail.

Post-Accident Investigation

Federal Railroad Administration (FRA) investigators inspected the equipment involved and found no defective conditions that would have contributed to the cause of the accident. There were no lading or other protruding parts of the cars which could have struck the deceased. No exceptions were taken to the condition of the locomotive. A re-enactment of the shoving movement was conducted the following day to determine at what point an individual located on the ground between Tracks Nos. 7 and 8 could be seen from the locomotive cab. Due to the right-hand curvature of Tracks Nos. 7 and 8, the end of the leading car could not be seen from either side of the locomotive cab during the backward shoving move.

Post-accident interviews revealed that the Engineer and the Brakeman were unaware that the equipment had struck the Carman. The Conductor, who was positioned at the west end of the tank car awaiting the arrival of the shoving movement, did not see the accident either.



Tasks

1. What were some factors that contributed to this incident?

Possible Answers:

- Carman had been out for 1 year and 8 months before the incident recovering from a shoulder injury.
- Carman had little experience before his extended absence.
- Mechanical department supervisor gave a routine job safety briefing to the carman and his co-worker despite the carman's recent return.
- Carman fouled the adjacent track.
- Curvature of the adjacent track did not allow good vision from the locomotive cab of the shoving move on track 8.

Discussion: See PCFs identified by FRA in Facilitator's notes section at the beginning of this scenario.

2. Who made up the crew (interactive team) that needed to work together to ensure that these moves were completed safely?

Possible Answers:

- Yardmaster
- Mechanical Department Supervisor
- Carmen
- Crew for Switch Job YPOI-31

Discussion:

3. What are some actions that the carman could have taken to protect himself?

Possible Answers:

- Remain clear of the adjacent track, be more vigilant to notice moving trains.
- Ask for a more detailed job briefing if the routine briefing was unclear.
- Illuminate a flashlight or some other device to let the train crew know his location.

Discussion:

4. What are some actions the train crews could have taken to potentially prevent this accident?

Possible Answers:

- Post the brakeman at the rear of the shoving move consist rather than in the locomotive cab.
- Have the conductor posted at a better location to observe the moving train and the adjacent area.
- Be more vigilant in operating on a track adjacent to one that has been blue flagged.

Discussion:

5. What are some elements of technical proficiency that could have played a role in this incident?

Possible Answers:

- The FRA report stated that the carman was probably rusty on his procedural and equipment knowledge after his long recovery from injury.
- The carman's experience level was very low. Only 2 years and 9 months with 1 year and 8 months on recovery leave and approximately eight months as a brakeman at a passenger railroad.
- Did the co-worker or the supervisor query the experience level of the carman or take steps to make sure that he was capable of completing his assigned work in the yard under night time conditions?

Discussion:

Dangerous Dumper

Source:	FRA 2002 Fatalities Report No. FE 24-02 (Full report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Mechanical (Situational Awareness)
CRM Principles Covered:	<ul style="list-style-type: none"> • Technical Proficiency • Situational Awareness • Communication • Teamwork
Employees Involved in Accident:	<ul style="list-style-type: none"> • Carman A • Carman B
Railroad:	Illinois Central Railroad, a subsidiary of Canadian National Railroad
Employee Craft:	Maintenance of Equipment
Location:	Stevens Point, Wisconsin
Accident Date and Time:	September 19, 2002; 10:55 p.m., CST
Type of Accident:	Explosion
Fatalities/Injuries:	Carman A fatally injured
Property Damage:	Unknown

Facilitator Notes:

Probable Contributing Factor No. 1

Just before the incident, the fatally injured carman was leaning over the freight car's defective cylinder, holding a pair of pliers with the nut, while the seriously injured carman was attempting to weld the nut in place. Investigators concluded that before the explosion, one of the carmen had cleaned the piston head with Penray Gum-solve, a highly flammable substance. The welding process provided the source of ignition necessary to cause a fatal explosion.

The investigators' conclusions were supported by testing all rags in the area, the two carmen's clothing, and the cylinder for levels of substances such as Acetone, Toluene, and Xylene found in Gum-solve. Levels were very high.

Note

As a result of the post-accident investigation's findings, CN implemented a policy requiring that all defective side dump cars with air cylinders were to be repaired by a private contractor in Winnipeg, Canada.

The Incident

Circumstances Prior to the Accident

For the purpose of the identification in this report, Carman A was fatally injured, and Carman B was seriously injured.

On Sept. 19, 2002, two Carmen reported for duty at approximately 6:30 a.m. at CN's Wisconsin Central Division, Stevens Point, Wisconsin car shop. The two Carmen were assigned to work on Track No. 5 in the car shop. Their shift began at 7 a.m., at which time a 10-minute safety briefing was conducted with the reading of the safety rule of the day. The two Carmen then went to work.

The Accident

After repairing a couple of freight cars, the Carmen spotted air-actuated, side dump car No. CN 56034 for repair. One of the air dump cylinders had to be removed from the car to repair broken bolts in the cylinder head. The connection lug that attached the cylinder to the side of the car sat on top of the cylinder and was held in place by four ½-inch by 2-inch bolts. While Carman B removed the bolts that secured the air dump cylinder to the car, Carman A obtained a fork lift to safely handle the air cylinder. The cylinder was lifted away from the car with the fork lift and moved to a location between Tracks Nos. 4 and 5 inside the car shop.

The Carmen placed the cylinder on blocks to avoid damage to the air pipe on its bottom. They discovered that three of the four bolts that attached the small cylinder head to the car were broken and the other one was missing. In order to remove the broken bolts from the cylinder the Carmen would weld a nut onto the remaining portion of the broken bolt in the cylinder so that a wrench could be used to turn the bolt. The Carmen were attempting for the second time to weld a nut to the broken portion of one of the three broken bolts because the nut had come off the broken bolt on their first attempt.

Carman A was leaning over the cylinder holding the nut with a pair of pliers, and Carman B was attempting to weld the nut in place. As Carman B started to weld the nut, an explosion occurred within the cylinder, causing the large portion of the 2-stage cylinder to rapidly move upward. Carman A was struck in the upper chest and head with the large portion of the cylinder. The impact threw him against dump car; he bounced off the car and came to rest between Tracks Nos. 4 and 5 next to a building support beam and large floor fan. Carman B was struck in the face and was found hunched near the west truck of the dump car with facial bleeding. The first responder to the accident scene was the Stevens Point Police, followed shortly by the Stevens Point Fire Department EMT team. Carman A was transported to Saint Michael's Hospital where he was pronounced dead at 11:15 a.m. by the Portage County Coroner.

Post-Accident Investigation

The car had been bad-ordered for a broken connection lug assembly on the top of one of the pistons used to tilt the car to dump the load. CN 56034 was equipped with four 2-stage, air dump cylinders, two on each side near the ends of the car. The 2-stage air dump cylinders comprised a housing approximately 39 inches tall by 32 inches in diameter. Inside the cylinder were two pistons, a large one and a smaller one. As air pressure was introduced into the cylinder housing, the larger piston deployed first to a height of two feet. Then the smaller piston deployed also to a height of two feet, to complete the dumping cycle of the car. The connection lug that attached the cylinder to the side of the car sat on top of the small piston and was held in place by four ½-inch by 2-inch bolts. On this particular cylinder, three of the four retaining bolts were broken and the fourth bolt was missing.

According to statements of employees in the vicinity, the first attempt at welding on the broken bolt failed, so the two Carmen attempted to re-weld another bolt or nut to the broken portion. At this time, an explosion occurred. According to the other employees in the area, the explosion sounded like a shotgun blast, and one employee working on the next track thought that a freight car had fallen off its jacks.

During an investigation of the accident site, investigators found an aerosol spray can of carburetor and fuel injector cleaner (Penray Gum-solve) on the brake step of the side dump car. On September 25, FRA viewed the air cylinder and accident site. Close examination of the connection lug cap revealed an accumulation of grease and oil on the bottom side that attached to the small piston head. They examined the top of the small piston which was found to be completely grease and oil free. This indicated the piston head had been wiped clean with rags and some sort of solvent.

During the interviews, a Carman who was working on adjacent Track No. 4 stated that he smelled something like paint or paint thinner. He said he was going to complain because he was very sensitive to these type of vapors. If indeed the solvent was used to clean the piston head, the one missing open bolt hole would have allowed the excess solvent to enter the cylinder chamber. Thus, the vapors would have had an enclosed area in which to accumulate and create a hazardous situation. In this case, when the second attempt was made to weld on the piston head, a spark would have entered the cylinder chamber through the open bolt hole and caused an explosion to force the large piston upwards.

All the rags in the area, the two Carman's clothing, and the cylinder along with the mate cylinder on the same side of the car were examined by an independent laboratory for contaminants that could have caused the explosion.

The initial Portage County Coroner's report stated that along with blunt trauma injuries to Carman A, there were first and second degree burns to his head along with singed hair. This would indicate that an explosion had occurred.

On Dec. 20, 2002, the results of the tests were reviewed. The MIG welder and argon tank that was used for welding the nut on the broken bolt had been analyzed and found to be normal. The contents of the Penray Gum-solve (Gum-solve) cans were analyzed, along with the rags and clothing found at the accident site. The contents of both the suspect can of Gum-solve found on the car's crossover platform and an exemplar can of Gum-solve. The major ingredients of Gum-solve are Acetone, Toluene, and Xylene.

The findings of the comparison analysis of the failed cylinder and the exemplar cylinder were that residue in the failed cylinder had 300 times the level of Toluene compared to the exemplar cylinder. The failed cylinder had nine times the Acetone levels and 200,000 times the level of Xylene. The failed cylinder also had 60,000 times the level of Ethyl-benzene, and the exemplar cylinder had none. In addition, the rags and clothing from the site were also found to have the same ingredients from the Gum-solve on them.

In conclusion, the use of Penray Gum-solve on the side dump air cylinder resulted in the solvent entering the enclosed cylinder where it began vaporizing. The welding process on the cylinder's piston provided the source of ignition which caused the vaporized Gum-solve to combust, and the cylinder to extend rapidly, causing the fatality and injury to the Carman. This also would be consistent with the statement of the Carman working on the adjacent track that he smelled something which caused him irritation. The vapors from the Gum-solve are heavier than air. The Carman was working in a pit on the next track near the location where the two Carman had placed the air cylinder. The vapors hugged the ground and caused him to experience irritation. In interviews, Carman B consistently denied that he used or saw Carman A use the Gum-solve.

The toxicological tests on Carman A were negative.

Tasks

1. What was the critical error?

Possible Answers:

- The carmen used a flammable solvent in proximity to welding on the job.
- Not plugging the missing bolt hole in the cylinder before either using the solvent to clean the work area or prior to initiating the welding process.

Discussion:

2. What did the two carmen think the situation was regarding the use of Gum-solve to the task they were working on?

Possible Answers:

- That the solvent was not dangerous if it cleaned up all the visible solvent and residue.
- There was no danger from lingering solvent odor.

Discussion:

3. What conditions were present that led the carmen to develop their perception of the situation to be safe to use the Gum-solve?

Possible Answers:

- There was no prohibition to using the Gum-solve.
- The Gum-solve was readily available in the work place.
- They had previously used Gum-solve in circumstances similar to the current situation (i.e., they used Gum-solve to clean materials that were to be welded and had not had adverse consequences).

Discussion:

4. What cues existed that the carmen could have used to alter their perception of the situation?

Possible Answers:

- There were only three bolts in the head bracket retaining the cylinder to the car, should have been aware that there could be a trap area for the solvent they were using. Any accumulation of the highly flammable solvent would be a problem, recognized in the fact that the carmen cleaned up the solvent before continuing their work.

Discussion:

5. What other CRM principles do you think were not effectively applied in this scenario?

Possible Answers:

- Technical proficiency: Carman B did not effectively evaluate his co-worker's safe work habits since he stated in the After-Accident-Interviews that he did not observe the use of the Gum-solve, indicating that he understood the potential hazardous characteristic in using the solvent in the task being performed.

Discussion:

No Blue Flag Protection

Source:	FRA 2002 Fatalities Report No. FE 11-02 (Full report can be found on “CRM disk 1 ...”)
Training Track Application:	<ul style="list-style-type: none"> • Mechanical (Communication)
CRM Principles Covered:	<ul style="list-style-type: none"> • Communication • Situational Awareness • Teamwork
Employees Involved in Accident:	<ul style="list-style-type: none"> • Car Inspector (52 years old / 25 years service) • Car Inspector • Yard Crew • Yard Master
Railroad:	Delaware and Hudson Railway Company (subsidiary of the Canadian Pacific Railroad)
Employee Craft:	Maintenance of Equipment (MOE)
Location:	Binghamton, New York
Accident Date and Time:	April 9, 2002; 8:15 p.m., EST
Type of Accident:	(Example: Collision, Derailment)
Fatalities/Injuries:	Car Inspector fatally injured by rolling car
Property Damage:	NA

Facilitator Notes:

The Incident

The fatally injured Car Inspector reported to work at 1 p.m., following 16 hours off duty, the injured Car Inspector reported for duty at 3 p.m., following 16 hours off duty and the Yard Master reported for duty at 3 p.m., following 16 hours off duty. The yard crew (Locomotive Engineer, Conductor, and Brakeman) reported for duty at 3:59 p.m. The Locomotive Engineer had 10 hours, 20 minutes off duty after working 12 hours; the Conductor stated he had received the proper rest; and the Brakeman had been off duty for 16 hours.

At approximately 7:50 p.m., the Conductor of the yard crew received instructions from the yard Master (via the switch list) to switch 35 cars located on the No. 2 Runner Track. After switching 25 cars on Yard Tracks Nos. 2 through 15, which are used for switching freight cars and classifying outbound trains, the crew determined that the 26th car (CTX 14344) was a “bad order” car which was to go to track No. 16, which was used for storing “bad order” cars destined for the car repair facility and to perform minor repairs.

At approximately 8 p.m., the Yard Master telephoned the fatally injured Car Inspector, who was performing inbound and outbound inspections, and instructed him to replace a coupler knuckle on car SAN 505, located on Track No. 16. A short time later, the fatally injured Car Inspector departed the trailer en route to Track No. 16. The injured Car Inspector, who was also performing inbound and outbound inspections, arrived to assist the fatally injured Car Inspector. When working on equipment, Car Inspectors are to provide themselves with blue flag protection as specified by DH Operating Rules and 49 CFR, Part 218, Subpart B. However, neither of the Carman put up blue flag protection or assured that each remotely and/or manually controlled switch was lined against movement to the track on which they were working and locked with an effective locking device.

The area on Track No. 1, around car SAN 505 (the car they were to replace a couple knuckle) was dimly lit. Weather conditions at the time of the accident were overcast, with scattered rain showers. The temperature was 46° F.

At approximately 8:20 p.m., the yard crew shoved and released Tank Car CITX 14344 south en route to Track No. 16. The car was released at 4 to 5 mph, approximately 359 feet from the switch controlling access to Track No. 16. When rolling freely down Track No. 16, the black tank car could not be heard. At the time the Tank Car CITX 14344 was released, the fatally injured Car Inspector was replacing the coupler knuckle on the south end of car SAN 505, and the injured Car Inspector was holding the coupling lever.

The free rolling car impacted the north end of standing Car SAN 505, causing it to roll south. The impact knocked the fatally injured car inspector to the ground, and the car rolled over him severing both legs. The injured Car Inspector was knocked clear, but sustained injuries to his face, shoulder, and back.

The injured Car Inspector contacted the Yard Master via radio to report the accident and requested medical assistance. Emergency responders arrived at the scene at approximately 8:30 p.m., but were unable to save the life of the fatally injured Car Inspector.

Tasks

1. What was the critical event or error?

Possible Answers:

- Failure to put up blue flag protection.
- Failure to assure that each remotely and/or manually controlled switch was lined against movement to the track on which they were working and locked with an effective locking device.

Discussion: The critical event was that the car inspectors did not put up blue flag protection indicating that they were working on a car on that track. They also failed to assure that each remotely and/or manually controlled switch was lined against movement to the track on which they were working and locked with an effective locking device.

2. What type of miscommunication contributed to this accident?

Possible Answers:

- Blue flag protection is basically a way to communicating to other members of your interactive team that you are working on a section of track.
- Not putting up blue flag protection is basically not communicating.

Discussion: Putting up a blue flag is a non-verbal method of communication. It indicates to members of your team that you are working on a section of the track. When you do not use non-verbal methods of communication, you are not communicating at all.

3. In this scenario, what is the relationship between communication and situational awareness?

Possible Answers:

- Communication essentially increases one's situational awareness. It makes a team member's perception of the situation more in line with the reality of the situation.

Discussion: By communicating via blue flag protection, you are making others' perception of the situation closer to the reality of the situation. Because there was no blue flag protection, the yard crew perception of the situation (there was no one on the track) was incorrect.

4. Where there any more missed opportunities for communication by anyone in this scenario?

Possible Answers:

- The train master knew the location of the car inspectors and the assignment of the yard crew. He could have communicated the position and activity of the other groups to each other.

Discussion: The train master knew the location of the car inspectors and the assignment of the yard crew. It is possible that he could have communicated the position and activity of the other groups to each other.

5. Identify other CRM principles that were violated in this scenario.

CRM PRINCIPLES
Situational Awareness
Teamwork

EOTD Application without Blue Flag Protection

Source:	FRA 1997 Fatalities Report No. FE 23-97 (Full report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Mechanical
CRM Principles Covered:	<ul style="list-style-type: none"> • Technical Proficiency • Situational Awareness • Teamwork
Employees Involved in Accident:	<ul style="list-style-type: none"> • Carman (53 years old/ Twenty-nine years, seven months of experience) • Another Carman (Co-worker) • Yardmaster • Two Train Crews
Railroad:	St. Lawrence & Hudson Railway (A subsidiary of Canadian Pacific and formerly known as the Delaware and Hudson)
Employee Craft:	Maintenance of Equipment
Location:	Binghamton, New York
Accident Date and Time:	July 24, 1997, 3:50 a.m., EST
Type of Accident:	Carman struck and killed by train
Fatalities/Injuries:	One fatality
Property Damage:	Unknown

Facilitator Notes:

Activity:

Inspecting cars, air brake tests, applying EOTD, and switching at the same time.

PCF No. 1

The fatally injured carman did not provide blue signal protection while working on railroad equipment to protect himself from the unexpected switching movement to outbound Train269, during Switching Job YBHS-66. He had flagged Track No. 5 for car inspections, but he displayed no blue signals at either end of the cars on the No. 1 runner, which would have alerted the switching crew of his intentions before applying the EOTD.

PCF No. 2

The switching crew was unaware of the carman's presence. The fatally injured carman had received training in the proper application of blue signal protection in March 1995 and March 1996; however, he had been disciplined in the past for not applying the blue flag rule.

The Incident

Circumstances Prior to the Accident

On Wednesday, July 23, 1997, a St. Lawrence & Hudson Car Inspector (Carman) reported for his regularly assigned duties working the 10 p.m. to 8 a.m. shift (10-hour shift) at the railroad's East Binghamton Yard in Binghamton. The yard's 17 tracks were geographically aligned east/west and were south of the railroad's two freight main lines which were designated from north to south as No. 2 Runner and No. 1 Runner, respectively. The railroad's timetable direction was north/south with timetable north being the west end of the yard and timetable south being the east end of the yard.

At approximately 3:15 a.m. on July 24, the Carman and a Co-Worker were informed by the on-duty Yardmaster that two tracks were ready to be used. Outbound Train 268 was waiting for an air brake test on Track No. 4, and 46 cars for outbound Train 270 were ready to be inspected on Track No. 5. After obtaining an additional end-of-train (EOT) device from the shop and placing it into the Carman's company vehicle (known as a "mule"), the two Carman proceeded to opposite ends of the yard. The Carman locked and flagged the east end of Track No. 5 while his Co-Worker did the same on the west end. After connecting the ground air to the end of the west car, the Co-Worker began walking eastward, inspecting the south side of the cars on Track No. 5 (Train 270) while the Carman performed the brake test on Train 268 on Track No. 4. After completing the brake test, the Carman was to join his Co-Worker and help finish inspecting the cars on Track No. 5.

At 3:35 a.m., the Co-Worker overheard the Carman's radio transmission informing the Crewmembers of Train 268 that the brake test was complete and that they were "OK to depart." He noted the time in his notebook. As Train 268 began pulling westward, its departure was temporarily interrupted by a cut of cars fouling the yard's Track No. 1 switch. Continuing his inspection of Track No. 5, the Co-Worker reached the easternmost car and noticed the Carman's vehicle parked next to the No. 1 Runner.

On July 23, 1997, the Crew for East Binghamton Yard Switcher Job YBHS-66 (also known as 6R), reported for duty at 11:59 p.m. The 3-person Crew consisted of a Locomotive Engineer, Conductor, and Brakeman. At approximately 3 a.m. on July 24, the Crew received instructions to make up Train 269 on the No. 1 Runner. After performing several switching moves, during which they classified cars according to the switch list provided by the Yardmaster, the Crewmembers pulled 19 cars westward out of Yard Track No. 1, leaving 14 cars in the track and fouling the switch. They then shoved the cars eastward onto the No. 1 Runner and coupled to four cars they had previously left on the west end of the track. After coupling to the standing four cars, they shoved the entire cut of 23 cars eastward to spot them at the ground air plant. After stopping, the Brakeman instructed the Engineer to pull ahead (westward), believing that the head five were to go back to Yard Track No. 1. After pulling ahead, the Conductor radioed the Brakeman, informing him that all the cars were to remain on the No. 1 Runner. The Brakeman stopped the movement and instructed the Engineer to shove back (eastward) to the original position at the ground air plant. This completed the make up of Train 269, except for the outbound power, which was still at the engine house. The Crew uncoupled the locomotives and

returned to Yard Track No. 1 where they shoved the cars they had left fouling the switch into the clear, allowing Train 268 to depart the yard off Track No. 4.

The Accident

There were no eyewitnesses to the accident. It is believed that the Carman attempted to apply the EOT device to the rear of the east end car (TTAX 554144) on the No. 1 Runner prior to the completion of the switching moves being made by YBHS-66. At some point during a shoving move eastward, the Carman was evidently knocked to the ground and rolled over by the wheels of the moving equipment.

After noticing the Carman's vehicle, the Co-Worker proceeded to the No. 1 Runner and discovered the fatally injured Carman beneath the wheels of the fifth car from the east end of the train. He contacted the Yardmaster by radio. The Yardmaster then called emergency responders at approximately 4:17 a.m. Emergency responders included the local sheriff's department, fire department, and EMS technicians. The local Coroner pronounced the victim dead at the scene and established the time of death as 3:50 a.m. The Coroner then ordered the body transported to a local hospital for autopsy.

(Please see the attached diagram of Binghamton Yard to better visualize the accident scene and chain of events that led up to the fatality.)

Post-Accident Investigation

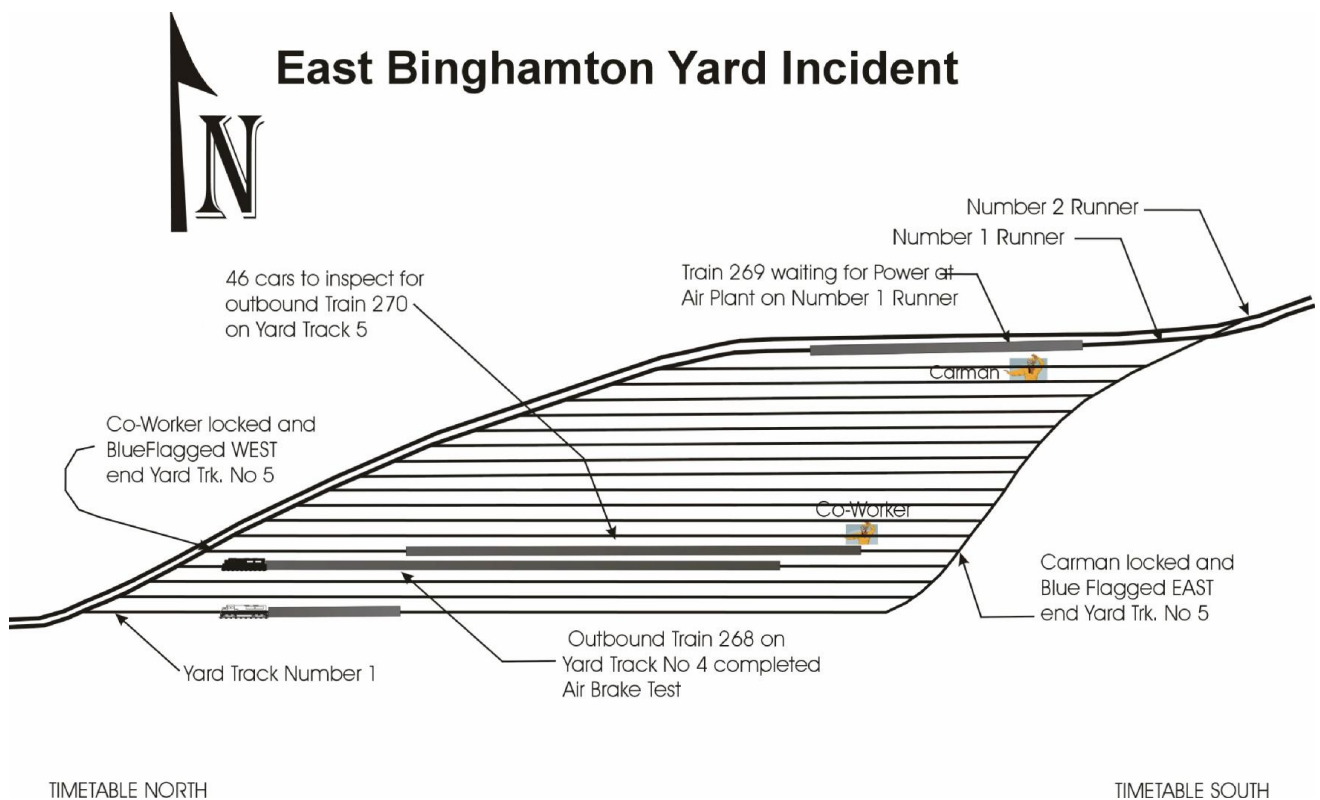
Post-accident interviews were conducted with individuals having direct knowledge of the accident. The involved equipment was inspected for compliance with applicable safety regulations with no conditions noted which would cause or contribute to the cause of the accident. The EOT device was found positioned on the coupler of the east end car of the train without the air hose connected. The investigation disclosed that no Blue Signals were displayed at either end of the cars on the No. 1 Runner.

Documentation indicated that the Carman had received training in the proper application of Blue Signal protection in March 1995 and March 1996; however, he had been disciplined in the past for not applying the Blue Flag rule. The Carman's portable radio and flashlight were found in the vehicle and were working as intended. The YBHS-66 Crew was unaware of the presence of the Carman working on the No. 1 Runner. Results of mandatory post-accident toxicology testing of the Carman's remains were negative. Cause of death as determined by autopsy was, "Compression injury of lower thorax with multiple internal injuries."



Satellite View of East Binghamton Yard

Source: <http://broomegis.co.broome.ny.us>



Schematic of East Binghamton Yard Accident (Not to Scale)

Source: TTI-developed graphic based upon FRA Report

Tasks

1. What critical event occurred that set up this accident?

Possible Answers:

- Carman did not provide blue flag protection on No. 1 Runner while installing EOTD.
- Carman installed EOTD after finishing air brake test on train 268 rather than proceeding to inspect the north side of train 270 on Track No. 5.
- Carman did not notify the yardmaster, his co-worker, or the train crew of his intention to install the EOTD to the cars on No. 1 Runner.

Discussion: See PCFs identified by FRA in Facilitator's notes section at the beginning of this scenario.

2. The FRA report does not state that a formal job briefing between the two carmen was conducted; however, it does state that there was an understanding between them as to what actions each was going to take to get trains 268 and 270 ready for movement. What action did the carman take that disrupted the expected pattern?

Possible Answers:

- He left his expected work pattern to install the EOT device on the cars on the No. 1 Runner rather than inspecting the north side of train 270 on track 5.

Discussion:

3. What actions could the carmen have taken to alert his co-worker and other team members of his actions?

Possible Answers:

- He could have established blue flag protection on the No. 1 Runner.
- He could have made a radio call to notify his co-worker, the yardmaster, and the train crew of his intention to install the EOTD.
- He could have continued with his expected work pattern.

Discussion:

4. What cue caused the co-worker to suspect that something had gone wrong with the carman?

Possible Answers:

- He noticed that the carman's vehicle (mule) was not where he expected it to be.
- He could not reach the carman by radio.

Discussion:

5. Were any other CRM principles violated during this scenario?

Possible Answers:

- Answers will vary by class.
- Potential answers include communication between the yardmaster and carmen, carmen and train crews, etc.; technical proficiency of the carman; and assessment of the weather conditions.

Discussion:

Poor Support In Soft Yard

Source:	FRA 2002 Fatalities Report No. FE 07-02 (Full report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Mechanical (Assertiveness)
CRM Principles Covered:	<ul style="list-style-type: none"> • Assertiveness • Situational Awareness • Teamwork • Communication • Technical Proficiency
Employees Involved in Accident:	<ul style="list-style-type: none"> • Carman 1 • Carman 2 • Carman 3
Railroad:	Norfolk Southern Corporation
Employee Craft:	Maintenance of Equipment
Location:	Frankfort, Indiana
Accident Date and Time:	March 6, 2002, 1:40 p.m., EST
Type of Accident:	(Example: Collision, Derailment)
Fatalities/Injuries:	Carman
Property Damage:	

Facilitator Notes:

PCF No. 1

A re-enactment of the incident revealed that carman 1 was in an unsafe position between a jacked freight car and the partially removed freight car truck.

PCF No. 2

Railroad operating rules required that jacks be securely placed for this type of work. However, the blocking under the jack, on the north side of the tank car, was pressed into the ballast (stones) and soil, allowing the tank car to shift off the jacks.

PCF No. 3

Extreme temperature fluctuations, from 4° F 3 consecutive days before the incident and up to 51° F at the time of the incident, caused the ground to thaw from a frozen state and allowed the blocking to sink into the ballast. Subsequently, the jacks and car shifted.

The Incident

Circumstances Prior to the Accident

For the purpose of identifying the Carmen involved, Carman 1, 2, and 3 will be used. Carman 1 was fatally injured.

On March 6, 2002, Carmen 1 and 2 reported for duty at approximately 6:45 a.m., at NS's South Yard in Lafayette, Indiana. Carmen 3 reported for duty at approximately 6:30 a.m. After their morning stretching exercises, the Carmen reviewed the safety rule of the day and the incident report. The Lead Carman laid out their work assignments for the day. Carman 1 was to proceed to the east yard in Lafayette, Indiana to repair a locomotive. Carmen 2 and 3 would inspect and repair freight cars in the south yard. Carman 1's next assignment was to go to Frankfort, Indiana to repair defective freight cars with Carmen 2 and 3. The three Carmen loaded two pairs of wheels on the repair truck. Carman 1 drove the repair truck to Frankfort while Carmen 2 and 3 followed in a pick-up truck. They stopped en route for lunch about 11 a.m.

They arrived at Frankfort at approximately 11:40 a.m. Carman 1 proceeded to the west end of Track 14 to establish Blue Signal Protection. The other two Carmen took care of the Blue Signal Protection at the east end of Track 14. Carman 1 proceeded to repair a crossover platform on a boxcar. The two other Carmen repaired a covered hopper, and then helped Carman 1 finish repairing the box car.

The Carmen separated a tank car (GATX 1367), which carried a load of coconut oil, from the rest of the cut of cars by using the power winch on the repair truck. Once they had separated the tank car, the Carmen positioned wood blocking on the ballast on the east end of the car and placed chock blocks under the wheels on the west end. They placed hydraulic jacks on the blocks, lifted the tank car by the jacks, and removed the freight car's truck to change the truck's wheels. The car was lowered to rest on the jacks. The truck was disassembled. At this time, Carman 3 took the pick-up truck to obtain parts to repair the truck. After Carman 3 returned, Carman 2 took the pick-up truck to retrieve another part. The new truck components were applied to the truck. After reassembling the truck, the car was again lifted. As the truck was being placed under the car, Carman 1 noticed a broken truck bolster side-bearing cage on the b-end right side of the truck. Carman 1 told Carmen 2 and 3 to stop the truck with the No. 2 wheel axle positioned under the coupler of the car. He stated that this was to protect the car if it dropped. The side-bearing cage was removed and, while in process of replacing the bolts, Carman 1 positioned himself between the truck bolster and the No. 2 wheel axle toward the north side of the truck side. The reason was they had problems holding the bolt in the truck bolster in order to secure the side-bearing cage.

The temperature was 51° F.

The Accident

After securing the side-bearing cage, Carman 1 attempted to move from between the axle and the truck bolster. Carman 3 saw the car start to move and shouted to Carman 1, "LOOK OUT!" Before Carman 1 could move, the tank car shifted, crushing him against the right No. 2 wheel. Both Carman called to Carman 1, but received no response. Carman 3 called to the Yard Clerk on the radio and requested an ambulance and then left in the pick-up truck to guide the ambulance to the accident site. The Frankfort Fire Department EMT unit was the first to arrive on the scene. Carman 1 was pronounced dead at the scene by the Clinton County Coroner.

Post-Accident Investigation

A re-enactment of the incident revealed that Carman 1 was in an unsafe position between a jacked freight car and the partially removed freight car truck.

Prior to the incident, the blocking under the jack, on the north side of the tank car, was pressed into ballast (stones) and soil. Extreme temperature fluctuations (from 4° F on March 3 through March 5 to 40° F on the afternoon of March 6 when the incident occurred) caused the ground to thaw from a frozen state and allowed the blocking to sink into the ballast. Subsequently, the jacks and car shifted, crushing the Carman.

Following the accident/incident, the deceased was tested for drugs and alcohol. The tests were negative.

Tasks

1. Who was in charge of this work team?

Possible Answers:

- Carman 1. He stayed with the work while the other carmen were sent on errands. Responsibility is indicated by not allowing subordinates to be alone at the job site.

Discussion:

2. What was the critical event in this incident?

Possible Answers:

- Carman 1 was in an unsafe position working in a pinch-point location between the car and the truck wheel.
- Setting the jack on blocking that was set on soft ground was unsafe because the ground allowed the blocking to be compressed into the soil and ballast.
- Working under a jacked piece of equipment in the field. The truck should have been rolled back out from under the car. There was room to do this as the car had not been moved since the previous repair of the wheelset.

Discussion:

3. What could have been done by the team members to prevent the critical event from occurring?

Possible Answers:

- The team did not observe the operating rules for safe working conditions by securely setting the blocking under the jacks.
- Any of the carmen could have driven a tell-tale shaft into the ground next to the blocking to observe if the blocking shifted to any degree throughout the work period.

Discussion:

4. What was the team leader's level of technical performance in this incident? Did he know and follow all the rules applicable to safely carry out this job?

Possible Answers:

- He did not block the wheels on the end of the car that was not jacked up. Furthermore, he did not check to ensure the security of the blocking. He appeared to be a conscientious leader, but he did not cover all the aspects by holding a job briefing before the critical error incident.

Discussion:

Caught by a Shoe

Source:	FRA 2002 Fatalities Report No. FE 06-02 (Full report can be found on “CRM disk 1 ...”)
Training Track Application:	<ul style="list-style-type: none"> • Mechanical (Final Scenario)
CRM Principles Covered:	<ul style="list-style-type: none"> • Technical Proficiency • Situational Awareness • Communications • Teamwork • Assertiveness
Employees Involved in Accident:	<ul style="list-style-type: none"> • Fatally injured Machinist • Machinist co-worker
Railroad:	Metro-North Commuter Railroad Company
Employee Craft:	Maintenance of Equipment
Location:	New Haven, Connecticut
Accident Date and Time:	March 5, 2002 6:30 p.m., EST
Type of Accident:	Crushing accident between machinery and work piece.
Fatalities/Injuries:	New machinist
Property Damage:	Unknown

Facilitator Notes:

PCF No. 1

The fatally injured machinist only had 5 months experience in the wheel true shop and had not been paired with his co-worker often enough to create familiarity with one another's work habits.

PCF No. 2

The railroad had not made available to employees standard written procedures regarding repositioning equipment in the building. In addition, the fatally injured employee did not receive formal training.

PCF No. 3

Investigators found that the plywood windscreens on the ends of the pit area prohibited employees from observing each other during the moves, inconsistent with railroad operating rules.

PCF No. 4

The location of the idler roller control valve required employees to foul equipment to operate the valve. Investigators believed that the fatally injured employee activated the valve while the equipment still was rolling and just before being pinned.

PCF No. 5

The fatally injured machinist's co-worker was in overtime status when the job had begun; he therefore could have been too fatigued to alertly watch out for the machinist's safety.

The Incident**Circumstances Prior to the Accident**

On March 5, 2002, at 3:55 p.m., the MNCR Machinist reported for his regularly assigned shift (4 p.m. to midnight) at the railroad's equipment maintenance facility in New Haven, Connecticut. His assignment was to work with a co-worker (another Machinist) on the wheel true machine housed in Building No. 2 (a.k.a. "wheel mill"). The co-worker was working overtime after having completed his regular 8 a.m. to 4 p.m. shift. The two Machinists were assigned to reprofile (a.k.a. "true") the No. 1 wheels on MU Locomotive No. 8820 and the No. 2 and No. 3 wheels of MU Locomotive No. 8821. Building No. 2, located west of the railroad's main maintenance shop, was a permanent metal building with a single track running east/west through it. The wheel true machine was housed in a concrete pit area located in the center of the building. The pit had plywood windscreens at the east and west ends of translucent lexan windscreens on the north and south sides.

The routine procedure for Machinists assigned to the wheel true machine was to reposition locomotives onto, and off of, the wheel true machine as needed. The workers used two devices to reposition the equipment on the wheel true machine: 1) a capstan and rope, and 2) a winch and cable. The capstan was a rotation cylindrical device which was operated electrically and moved by connecting a rope with a hook attached to one end of the equipment and wrapping the rope around the rotating capstan, thereby moving the equipment into proper position on the wheel true machine. The electrically operated winch could be utilized similarly. When either device was used, visual and audible warning devices were activated to warn workers of the movement. These warning devices were located both inside and outside of the building.

At the time of the accident the Machinist had completed their work on the Locomotive No. 8820, and were in the process of repositioning the No. 3 wheels of Locomotive No. 8821 onto the truing machine. The weather at the time of the accident was cold and clear. The outside temperature was 28° F.

The Accident

Prior to the accident, the fatally injured Machinist was participating in the movement of the equipment, and as was the customary practice, was to place a wooden chock on the rail to stop the equipment when the No. 3 wheel was properly positioned on the machine. He was positioned on the north side of the equipment in the wheel true pit near the control panel. The other Machinist was positioned at the electrically driven capstan approximately 55 feet from the control panel area. From this position, he was unable to see the Machinist at the control panel due to the plywood wind screen.

As the equipment began to roll, the Machinist operating the capstan shouted "free roll" to warn the Machinist in the pit. He released the tension on the rope and dropped it. As the locomotive moved onto the machine's idler rollers, the Machinist heard the idler rollers sliding into place as the equipment stopped moving. At this time, he heard moaning sounds from his co-worker in the pit. He looked between the side of the locomotive and plywood windscreen and observed the injured Machinist who was pinned between the wheel true machine's axle centers and the locomotive's third rail shoe. The Machinist immediately telephoned the Shop Foreman and told him to call "911." He then attempted to move the locomotive to free the pinned Machinist. When the equipment moved off the injured Machinist, he fell to the floor. He was alert and responsive, but complained of breathing difficulty.

The first person to arrive on the scene, an MNCW employee trained in emergency response, administered first aid. EMS personnel from American Medical Response and personnel from the New Haven Fire Department responded. The injured employee was transported by ambulance to Yale New Haven Hospital where he succumbed to his injuries at 7:25 p.m.

Post-Accident Investigation

FRA's investigation included the following: an inspection of the equipment and work area; interviews with co-workers and supervisors; and review of employee qualifications, training, and method of operation. The track inside the wheel true building was inspected by FRA. The track met or exceeded the requirements of Federal Track Safety Standards for "Class 1" track, 49 CFR Subpart C, Track Geometry, Section 213.63. The north rail had a 1-inch profile (depression) about 19 feet west of the wheel milling machine, and a 1 3/4-inch profile (rise) in the north rail at the center of the wheel milling machine.

FRA investigators concluded that the movement had been conducted in compliance with Federal regulations concerning blue signal requirements (49 CFR, Part 218.29). They also concluded, however, that the fatally injured railroad employee had failed to remain clear of moving equipment and had placed himself in an unsafe position during the movement of equipment.

The fatally injured employee, who had just five months experience working in the wheel true shop, had received no formal training other than "on-the-job" training provided by co-workers. FRA found no written standard procedures available to employees regarding proper procedures to be followed in repositioning equipment in the building. The employee and his co-worker had not worked together often and were unfamiliar with one another's work habits.

Investigators found that the plywood windscreens on the ends of the pit area prohibited employees from observing each other during the moves, inconsistent with MNCW Safety Rule No. 9176. The location of the “idler roller control valve” required employees to foul equipment in order to operate the valve. Indications are that the fatally injured employee activated the valve while the equipment was still rolling and just prior to being pinned.

The railroad took the following remedial actions:

- Removal of the east and west end plywood windscreens;
- Removal of the capstan and winch from service;
- Placement in service of a shuttle wagon (remote control car mover);
- Implementation of a formal wheel true training program in May 2002;
- Development of formal training program for movement equipment; and
- Redesign (including relocation) of the wheel true's idler roller control valve, to allow employees to operate the wheel true without fouling the equipment.

Toxicology testing was conducted by Chief Medical Examiner's office of the State Of Connecticut. All test results were negative.

Tasks

1. What CRM principles could have been better applied in this incident?

Possible Answers:

- Technical Proficiency
- Teamwork
- Communications
- Assertiveness
- Situational Awareness

2. List examples of technical proficiency that could have helped to avoid this incident.

Possible Answers:

- Neither machinist could visually observe the other while moving the equipment, a rule violation.
- The machinist in the wheel truing machine pit was not clear of the machinery.
- The fatally injured machinist was between the machine tool and the work piece when he set the machine in motion.

Discussion:

3. List examples of situational awareness that could have helped to avoid this incident.

Possible Answers:

- Did not anticipate the third rail shoe being in interference with the position of the machinist in the pit.
- Did not recognize the hazardous position that the employee was required to be in to secure the locomotive with chocks and activate the wheel truing machine's idler roller control valve caused the employee to foul the machinery and the work piece.

Discussion:

4. List examples of communications that could have helped to avoid this incident.

Possible answers:

- The machinist controlling the capstan move of the locomotive did not clearly tell the new employee that he was working overtime and that they might need to exercise added caution during machine operations and equipment moves.

Discussion:

5. List examples of teamwork that could have helped to avoid this incident.

Possible Answers:

- The injured machinist could have asked for assistance with placing the chock to stop the free rolling locomotive.
- The experienced machinist could have discussed the move in detail with the inexperienced machinist and determined from cues whether he understood the exactness of the separate tasks needed to safely perform the job assigned.

Discussion:

6. List examples of assertiveness that could have helped to avoid this incident.

Possible Answers:

- The inexperienced machinist should have sought a laborer assistant in the pit for locomotive moves.
- The experienced machinist could have demanded that the shields be removed while locomotive free rolling moves were undertaken in order to observe activity until the inexperienced machinist demonstrated a high degree of proficiency with setting the chock to stop the locomotive.

Discussion: