NATIONAL TRANSPORTATION SAFETY BOARD

OFFICE OF RAILROAD, PIPELINE & HAZARDOUS MATERIAL INVESTIGATIONS

WASHINGTON, D.C.

FACTUAL ACCIDENT REPORT

Accident No.:	DCA-12-FR-003
Location:	Amarillo, Texas
Date:	January 09, 2012
Time:	11:09 a.m., Central Standard Time
Railroad	BNSF Railway
Property Damage:	$150.00
Injuries:	0
Fatalities:	1
Type of Accident:	Employee Fatality

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Date: November 14, 2012

Party Participants

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Synopsis

On Monday, January 09, 2012 at about 11:09 a.m. central standard time (CST)[1], a BNSF Railway (BNSF) welding foreman was struck by a Loram Maintenance of Way, Inc.[2] J6 rail grinding machine and fatally injured on yard track #1805 near Amarillo, Texas. The Loram crewmembers said that the welding foreman gave a reverse movement[3] hand signal to the machine operator, then at the last minute decided to remove a derail from the rail head without having the machine stopped first. When the operator realized that the welding foreman was in the gage of the track, he could not stop the equipment in time and struck the welding foreman and dislodged the derail from the track structure.

The Loram crew operated and maintained the J6 rail grinding machine. The crew worked for Loram and consisted of a Superintendent Field Operations/equipment operator, a Safety Coordinator[4], a general laborer, and a crew chief. The crew chief was getting parts for the equipment and was not present at the time of the accident.

The BNSF track maintenance crew consisted of the welding foreman, who was the roadway worker in charge[5] of the rail grinder at the time of the accident and a laborer[6]. The laborer was not present at the time of the accident. He had called the welding foreman earlier and said that he was going to be late because of personal issues.

The weather at the time of the accident was about 37˚ Fahrenheit and clear. The wind speed and direction was 3.5 to 5.8 mph to the northeast.

The Accident

The Investigation

The investigation information and documentation was provided by the BNSF, Loram and the Federal Railroad Administration (FRA) who investigated the accident from the accident site or conducted employee interviews or obtained information at the request of this NTSB investigator.

Circumstances Prior to the Accident

The Loram crew started their day on January 09, 2012 when they left the hotel at about 6:00 a.m. and arrived at the J6 rail grinding machine at about 6:30 a.m. After the initial job briefing in the truck, the operator started the machine. The crew then had a more thorough job briefing alongside the rail grinder. They also conducted a walk around inspection of the

[1] All times are recorded as central standard time
[2] Loram Maintenance of Way, Inc. will be referenced as Loram in this report.
[3] When the reverse movement was made the equipment traveled in the geographically westward direction.
[4] He was not a routine crewmember and this was the first day of a two day safety audit.
[5] Roadway worker in charge means a roadway worker who is qualified in accordance with 49CFR214.353 for the purpose of establishing on-track safety for roadway work groups.
[6] The BNSF laborer's duties would be to basically perform work tasks as directed by the welding foreman.

equipment. After finishing their inspection and while waiting on the BNSF employee to arrive they prepared the machine for operation by adding deicer to the water tanks.

The BNSF crew arrived at the J6 rail grinding machine on January 9, 2012 at about 7:30 a.m. They started their work day with a job briefing which lasted for 1-1/2 to 2 hours. The briefing was conducted in the cab of the grinder which was located on yard track #0604 in the Amarillo south yard, approximately 1-1/2 miles from the location of the accident. The attendees at the job briefing were three BNSF employees, the welding foreman and two supervisors; a welding supervisor, the foreman's immediate manager, and a roadmaster, the Engineering Department manager responsible for the track maintenance of the territory. The four Loram employees were also in attendance, the superintendent/operator, the general laborer, the Safety Coordinator and crew chief. Neither the welding supervisor nor roadmaster signed the safety briefing document as neither was going to accompany the rail grinder for the day's work.

The work day was to include grinding rail in a series of switches between mileposts 334 and 308 on the Red River Valley (RRV) Subdivision. Their first switch to work on was located at milepost 334; which was within a mile of the accident location.

The safety briefing was led by the welding foreman with involvement by others during the briefing. The items covered at the job briefing were as follows;

Safety expectations
Rules compliance
Involve everyone
Conducting good briefings
Understanding track charts, timetables and authorities
Reviewed BNSF stretching exercises
Discussed fire safety
Emergency contact information reviewed
Audited BNSF welding foreman truck
Discussed lock out tag out
Discussed work plan for the day
Checked portable radios and laptop & recorded serial numbers
Talked a lot about communication and to let the supervisor know if anything is needed

The two BNSF supervisors departed as well as the Loram crew chief. After some time the machine started making its way out of the yard tracks and onto the lead track that would take it east towards East Tower. While leaving the yard tracks the BNSF employee had to open and close several derails and switches before entering track #1805, and passed hand signals to the operator to move and stop the machine. After traveling down track #1805 they arrived at East Tower.

BNSF radio recordings were confirmed by on site investigators that the welding foreman had spoke with the yardmaster prior to leaving his yard location and moving the equipment eastward on yard track #1805 toward main track #2 of the RRV subdivision.

Accident Scenario

After the crew stopped the J6 rail grinder at East Tower, the welding foreman contacted the train dispatcher to get authority to enter the main track. He was given track and time on the RRV Subdivision and relayed the limits of this authority to the Loram crew which were also located in the cab of the J6 rail grinder. The welding foreman then dismounted the J6 rail grinder, unlocked and opened the derail "off position" for the rail grinder to enter the main track from yard track #1805. The welding foreman used hand signals and had the machine operator move the equipment past the derail. The trailing end of the rail grinder stopped about 32.5 feet past the derail. After the equipment stopped, the welding foreman restored the derail to the derailing "on position" and secured the derail with its lock. The welding foreman had noticed a hydraulic leak as the rail grinder passed, and walked along the ground to the control cab to alert the machine operator. The welding foreman, the machine operator and the general laborer evaluated the leak and decided to return the rail grinder back to the yard for repairs.

Upon evaluation of the leak, it was determined that the welding foreman would have to "clear up" the authority with the dispatcher and return the equipment back into the yard to make necessary repairs as the leak was too severe to continue onto the work location planned on the RRV subdivision. The operator stated that he and welding foreman discussed that the derail would have to be removed to allow for their reverse movement while they were still on the ground. The operator also stated that he and welding foreman walked along the northerly side of the grinder on the ground to the west end of the grinder where the operator then climbed onto the grinder and walked into the cab of the grinder. The next time the operator saw the welding foreman was after he had gotten into the J6 cab and the welding foreman was standing northwest of the grinder between tracks #1805 and #5299. While the operator was going to the cab of the grinder, the general laborer took point position on the grinder at the extreme west end of the grinder and was visible to the operator in the cab as well as to the welding foreman on the ground.

Shortly after the operator entered the cab, the welding foreman gave a hand signal to the operator to make a westbound movement. Loram management stated that during post accident interviews of their personnel, it was communicated to them that the operator sounded the horn prior to backing up the rail grinder. The operator stated that he saw the welding foreman step across the north rail of track #1805 in a southerly direction and due to the physical configuration of the grinder was no longer able to have visual contact. At that time either the operator had already started backing up or just started backing up.

The general laborer stated that he was on the point (westerly) end of the grinder in sight of the operator and observing the movement. He said that he did have visual contact with the welding foreman from the time a signal was given to make the westbound move until the grinder struck the welding foreman. The general laborer said that after the welding foreman gave a hand signal to proceed west; the welding foreman walked in a southerly direction across the north rail into the middle of track #1805, to the derail on the south rail, crouched down with his back to the rail grinder and proceeded to unlock and remove the derail from the south rail to allow westward movement.

The general laborer stated that he was aware of the rail grinder moving west and that the welding foreman was foul of the movement, but believed that the operator would stop short of the derail. The operator stated he immediately took action to stop the grinder once he saw the welding foreman in his camera[7]. It is not known at what point the operator saw the welding foreman in his camera or how far the distance was from first sight of welding foreman as to the distance from the grinder. However, based upon tests that were performed after the incident, the main camera on the grinder pointing in a westerly direction (or in the direction of the westbound movement) provided a sight distance of approximately 18-feet as measured to the west end of the grinder. At 18-feet from the grinder you can see the toes of the work boots of an individual standing there, but no higher until you get closer to the grinder.

Once the general laborer realized the rail grinder may not be able to be stopped short of the welding foreman, he started to yell for him to get out of the way. As best as he could tell, the welding foreman never heard him. He assumed that due to the noise of the rail grinder's engine and the hearing protection that the welding foreman was wearing, plus the welding foreman had his back to the grinder as the grinder was approaching and there was no body movement to indicate that the attempt to alert was ever heard. He stated that welding foreman, while in the middle of the rails, proceeded to unlock and attempted to remove the derail when he was struck by the rail grinder and was fatally injured.[8] See Figure 1 for a side view of the Loram J6 rail grinder.

Figure 1
Side View of the Loram J6 Rail Grinder

[7] It should be noted that there are several cameras, which do not record their images, on the rail grinder that are used when in the grinding or work mode so the operator knows when to sequence the grinding operations.
[8] The FRA did not write any violations in regards to this fatal accident.

Location of the Accident and Description of the Track

The employee fatality occurred in Amarillo, Texas on the BNSF Red River Valley Subdivision of the Texas Division at milepost 334.7, on track #1805. For the direction of the reverse westward movement the track curved to the right. The curve was a compound curve that changes from a 5°19' to a 3°00' back to a 5°30' to a 3°30' to a 5° to a 3°45' to a 1°30' to a 5°08' to a 3°54'. The track grade was 0.12 percent. A gravel road was adjacently located to the south. See Figure 2, for an overhead view of the accident area at the derail.

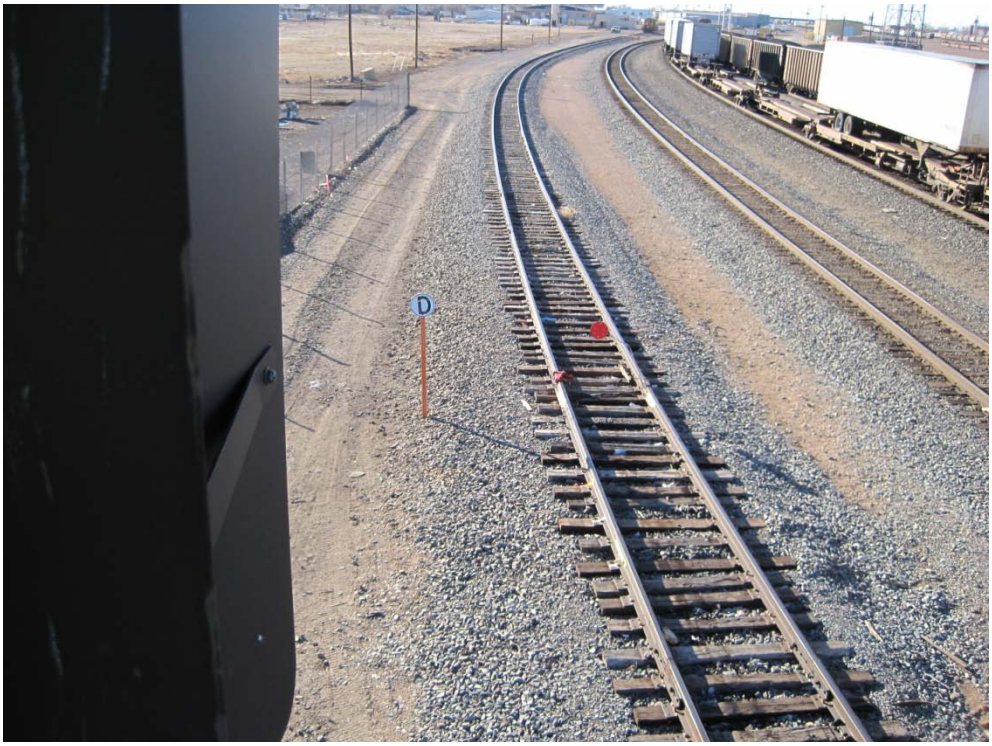
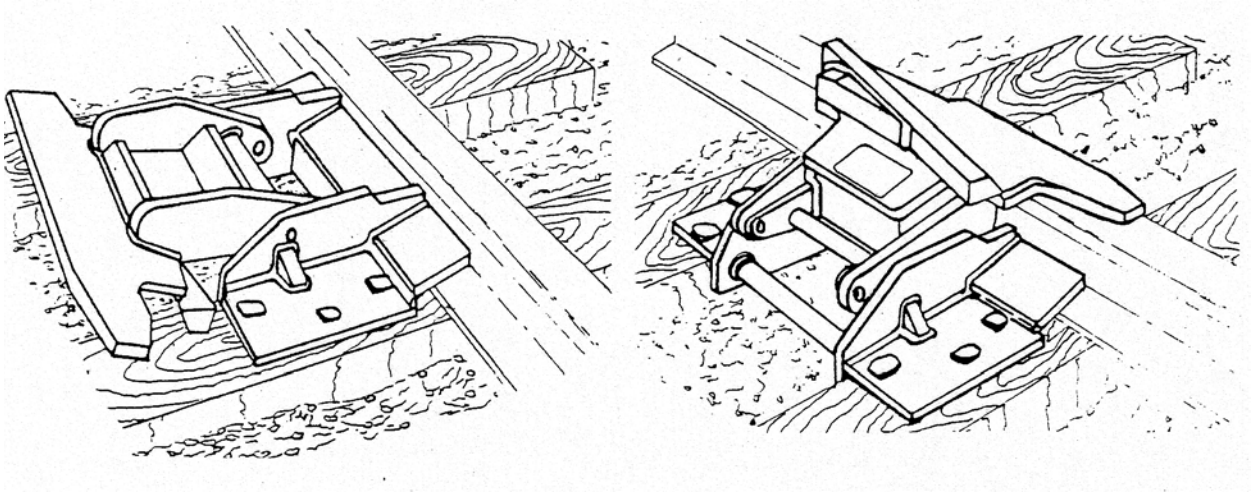


Figure 2
Overhead Westward View of Track #1805, and the Derail

The derail[9] involved in the accident was called right hand hinged derail. The derail functions by lifting the flange of the wheel up and deflecting it laterally to drop the wheel clear of the rail head, on the field side of the track. Movement of the rolling equipment is halted by the wheels becoming imbedded in the track ballast. The hinged derail was fastened to the ties with six inch cut spikes. The derail block is lifted by hand in a vertical semi-circle on and off the rail head. See Figure 3, for the hinged derail involved in this accident, and the diagram below to see the off and on positions.

[9] A derail is a device designed to limit the movement of railroad rolling stock into areas where they could cause personal injury or damage to other equipment and structures.

Figure 3
Photograph of the Hinged Derail Involved in the Accident



Hinged Derail off the Rail

Hinged Derail on the Rail

Personal Information

The BNSF welding foreman was 57 years of age. His duties were to act as the BNSF employee in charge and to pilot/escort[10] the Loram rail grinder while traveling and working on BNSF property. The welding foreman had more than ten years of experience working with rail grinders and based upon information from the BNSF; the welding foreman would exercise his seniority rights to bid in on these machines when they were in his area.

The welding foreman was hired by the BNSF on October 28, 1975 in the Bridge and Building department and on July 27, 1981 he was awarded a job as a maintenance welder foreman.

Before the BNSF welding foreman was designated as able to perform the duties of a roadway worker, he had to be trained as required in the following regulations:

§ 214.343 Training and qualification, general.

(a) No employer shall assign an employee to perform the duties of a roadway worker, and no employee shall accept such assignment, unless that employee has received training in the on-track safety procedures associated with the assignment to be performed, and that employee has demonstrated the ability to fulfill the responsibilities for on-track safety that are required of an individual roadway worker performing that assignment.

(b) Each employer shall provide to all roadway workers in its employ initial or recurrent training once every calendar year on the on-track safety rules and procedures that they are required to follow.

(c) Railroad employees other than roadway workers, who are associated with on-track safety procedures, and whose primary duties are concerned with the movement and protection of trains, shall be trained to perform their functions related to on-track safety through the training and qualification procedures prescribed by the operating railroad for the primary position of the employee, including maintenance of records and frequency of training.

(d) Each employer of roadway workers shall maintain written or electronic records of each roadway worker qualification in effect. Each record shall include the name of the employee, the type of qualification made, and the most recent date of qualification. These records shall be kept available for inspection and photocopying by the Federal Railroad Administrator during regular business hours.

[10] He completed and passed training and qualification of roadway workers who provide for the on-track safety of groups of roadway workers through establishment of working limits.

§ 214.353 Training and qualification of roadway workers who provide on-track safety for roadway work groups.

(a) The training and qualification of roadway workers who provide for the on-track safety of groups of roadway workers through establishment of working limits or the assignment and supervision of watchmen/lookouts or flagmen shall include, as a minimum:

(1) All the on-track safety training and qualification required of the roadway workers to be supervised and protected.

(2) The content and application of the operating rules of the railroad pertaining to the establishment of working limits.

(3) The content and application of the rules of the railroad pertaining to the establishment or train approach warning.

(4) The relevant physical characteristics of the territory of the railroad upon which the roadway worker is qualified.

(b) Initial and periodic qualification of a roadway worker to provide on track safety for groups shall be evidenced by a recorded examination.

The following table shows the dates of roadway worker training, recurrent training, and scores for the BNSF welding foreman:

Satisfies 49CFR 214.353 and .343
Satisfies 49CFR 214.343

Course Type	Course completion date	Passed	Score
2011 mw operating rules requalification	10/10/2011	P	97
mw fra part 213, 2006 requalification	10/14/2010	Not Rated	97
2010 safety leadership	02/17/2010	P	0
mow safety rules-electronic review	01/07/2010	P	0
roadway workers protection review - engr	01/07/2010	P	0
2010 mw operating rule requalification	01/11/2010	Not Rated	88
2009 safety leadership	02/12/2009	P	0
mow safety rules-electronic review	01/08/2009	P	0
roadway workers protection review - engr	01/08/2009	P	0
mw operating rules requalification 2009	01/07/2009	Not Rated	81
mw operating rules 2008 requalification	01/11/2008	Not Rated	100
mw operating rules 2007 requalification	01/11/2007	Not Rated	92
operation: track awareness	01/10/2007	P	0

operation: track awareness	09/15/2006	P	0
mw operating rules 2006 requalification	05/23/2006	Not Rated	91
operation: track awareness	03/10/2006	P	0
roadway workers protection review - engr	03/10/2006	P	0
operation: track awareness	02/17/2006	P	0
operation: track awareness	02/17/2006	P	0
roadway workers protection review - engr	02/17/2006	P	0
roadway workers protection review - engr	02/17/2006	P	0
mw operating rules 2005 requalification	01/07/2005	Not Rated	94
operation: track awareness	01/05/2005	P	0
roadway maintenance machine safety	01/05/2005	P	0
mw operating rules 2004 requalification	01/08/2004	Not Rated	100
roadway workers protection review - engr	01/07/2004	Not Rated	0
mw 2003 rules requalification	08/29/2003	Not Rated	80
mw operating rules & territory familiar	09/10/2002	Not Rated	80
roadway worker safety	10/19/2001	P	0
mw rules 2001	10/04/2001	Not Rated	88
roadway worker safety	05/22/2000	P	0
roadway worker safety	04/27/1999	P	0
mw operating rules	02/18/1999	Not Rated	88
on-track safety	02/19/1998	P	0

Welding Foreman's Discipline Record

On January 22, 2002 the welding foreman received a formal reprimand for backing a vehicle over a derail in the derailing position on January 16, 2002.

Welding Foreman's Personal Injury Record

The welding foreman sustained a non-reportable injury to his face on November 17, 1983. On December 4, 1986, he sustained a reportable injure to his left thumb. On December 2, 2003, he sustained a non-reportable injury to his right knee. On April 13, 2011, the welding foreman asserted that he sustained noise induced hearing loss in both ears. However, an audiogram did not indicate a Standard Threshold Shift in hearing loss per § 225.3[11].

[11] § 225.3: Occupational hearing loss means a diagnosis of occupational hearing loss by a physician or other licensed health care professional, where the employee's audiogram reveals a work-related Standard Threshold Shift (STS) (i.e., at least a 10-decibel change in hearing threshold, relative to the baseline audiogram for that employee) in hearing in one or both ears, and the employee's total hearing level is 25 decibels or more above audiometric zero (averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS.

Welding Foreman Sleep/Wake/Work History

On January 3, 4, and 5, 2012, the welding foreman worked from 7:00 a. m. to 3:30 p.m. with a 30-minute lunch break. On January 6th, he worked from 7:00 a.m. to 5:30 p.m. with a 30-minute lunch break. He was off on his rest days January 7th and 8th. On Monday January 9th, he went on duty at 7:00 a.m.

Loram Personal Information

The Loram Machine Superintendent, Field Operations was 50 years of age. His duty included the supervision of workers engaged in the operation of railway maintenance machines, the ability to work on and troubleshoot equipment operational problems, manage the operational aspects of the equipment and ensure administration and compliance of all Loram and railroad policy/procedures. In addition, he operated the J6 rail grinder at the time of the accident. In 2007, Loram purchased the switch and crossing rail grinding division of Tangent Rail, where he had worked for about 20 years. He has worked for Loram for the past five years as a Superintendent on a Loram switch and crossing rail grinder which included the J6.

The Loram general laborer was 22 years of age. He began his employment on July 11, 2011 as a general laborer for Loram. He was providing movement protection on the J6 rail grinder at the time of the accident.

The Loram Safety Coordinator was 35 years of age. He began his employment on November 29, 2010 as a Safety Coordinator. The Safety Coordinator is responsible for managing the Operations Behavioral Risk Improvement Program and for conducting field crew and machine safety inspections to ensure compliance with Loram safety rules and regulations. He said that he was in Amarillo at this time to conduct a routine safety audit of the J6 rail grinder and crew. At the time of the accident the Safety Coordinator was located in the middle of the cab on the east side of the control stand.

The Loram Crew Chief was 42 years of age. He began his employment on January 22, 2009. The Crew Chief responsibilities included assisting the Superintendent in the daily operation and maintenance of railway maintenance machines. At the time of the incident, he was getting parts for the equipment and was not on site at the time of the accident.

Loram Training and Qualification, General

Loram periodically tests its field employees on their safety and operations rules. In addition, Loram employees are tested according to the procedures of each railroad on which they work. All three J6 field personnel were tested on both BNSF and Loram rules at the startup meeting in Kansas City on January 5th and 6th, 2012. The Safety Coordinator, because he is not a field employee, but rather an employee in Loram's Safety Department, did not take the Loram test. There was no passing/failing score on the Loram tests. Instead, after the test was given and scored, each question was discussed, including which was the correct answer and why, and an explanation of why the other answers are incorrect. Their scores are as follows: the

Superintendent/Operator: 76 percent; the General Laborer: 72 percent; and the Crew Chief: 76 percent.

The three Loram operating employees attended the January 5th and 6th meetings and were tested on the BNSF Safety and Operations rules to be in compliance with Roadway Worker 214 Subpart C regulations during those meetings. The Safety Coordinator took the BNSF Safety and Operations rules online course on January 6th. The Safety Coordinator had previously taken Roadway Worker training in January 2011, which would have kept him qualified through December 31, 2012. He took the training again on February 24, 2012. This BNSF training was conducted by Loram[12]. All four Loram employees scored a 100 percent.

The training syllabus and test questions for the January startup meetings were reviewed. It was noted that neither the syllabus nor the test questions include the critical operating rules that governed the J Series grinder movement, specifically: Point Protection Rules 11.22 and 11.18; and Signal Movement Rule 11.33. Postaccident, Loram agreed to include these critical rules in their training program. See the Subheading for Loram's "*Method of Operation"* for rule details on pages 18 and 19 of this report.

Loram Postaccident Actions for Operating Rules

During the investigation, it was suggested to Loram to modify their operating rule training and testing procedures to include the critical operating rules for J Series grinder movement. Loram said that they added a Specialty Grinder topic to their Operating Rule book. Employees will be tested on these rules and be required to follow these operating procedures when working with J series equipment.

Loram Employees Sleep/Wake/Work History

On Friday, January 6, 2012 the three Loram operating employees assigned to the switch grinder traveled from Kansas City, MO to Amarillo, TX, approximately 600 miles, which took about 10 hours to drive. On Saturday, January 7th, the three crew members worked for about 4 hours on the rail grinding equipment doing maintenance. The Safety Coordinator traveled to Amarillo on Saturday. All four crew members were off on Sunday, January 8th. On Monday January 9th, the four Loram crewmembers met at 6:00 a.m. to begin work.

Medical and Pathological Information

Toxicological Test Results

The autopsy report showed that samples of blood, urine and vitreous fluid were taken from the fatally injured welding foreman. Caffeine and metoprolol[13] were identified in the blood specimens. Other than these two findings, examination of the specimens did not reveal any

[12] Both the BNSF and Loram training/testing were not a joint BNSF and Loram exercise; only Loram participation.
[13] Metoprolol is used alone or in combination with other medications to treat high blood pressure. It also is used to prevent angina (chest pain) and to improve survival after a heart attack.

positive findings of toxicological significance. In addition, samples were required for toxicological testing in accordance with federal regulations stipulated in §219.201 and §219.207. The results of these required tests showed that no drugs or alcohol were identified.

All four of the Loram employees were toxicologically tested for drugs and alcohol. The four individual breathalyzer test results were negative for alcohol. Urine samples were also collected and no illicit drugs were identified in the provided samples.

Emergency Response

After the rail grinder stopped, the operator immediately proceeded to make emergency notification which was received by the train crew of the BNSF 8825 who in turn toned 911 to the BNSF dispatcher for emergency medical services[14]. The general laborer, who had just completed CPR class in Kansas City the week before, went to the welding foreman to check for pulse and perform CPR/first aid. No pulse was detected.

The Amarillo police report[15] showed the accident occurring on January 9, 2012 at 11:09 a.m. The police officer arrived on scene at 11:13 a.m., and checked for vital signs. No body movement or pulse was detected. The Fire Department arrived as the police officer was checking for vital signs and AMS arrived on scene at 11:16 a.m. At 11:20 a.m., the police officer was told that the patient was deceased.

Injuries

The autopsy said that the welding foreman sustained fatal blunt force injuries of the torso.

Meteorological Information

The weather at the time of the accident was about 37˚ Fahrenheit and clear. The wind speed and direction was 3.5 to 5.8 mph to the northeast.

Damage

The BNSF reported $150.00 as cost to reinstall the derail and straighten the steel sheeting on the Loarm machine.

Equipment Information

The machine is referred to as a J Series rail grinder with a specific Loram designation of "J6". The machine was originally built by Jackson Jordan in the late 1988. With the dust collection buggies, the machine is 80' long, 10 feet wide and weighs around 112,000 lbs. The

[14] About the same time the Safety Coordinator called 911 from his cell phone.
[15] Case #2012-0500780

overall dimensions fall within the industry standard "C" plate clearances. This model grinder consists of 20 grinding heads.

The rail grinder was equipped with a BNSF HLCS device and a BNSF company radio. The HLCS device is a safety overlay system which alerts the operator of the equipment when they are approaching the end of their on-track authority limits and both the operator and the BNSF dispatcher if the equipment exceeded the end of their on-track authority limits. The rail grinder has a Loram radio immediately next to the operator's chair. The general laborer had in his possession a Loram portable radio while acting as the point person for the reverse move. The welding foreman had two BNSF portable radios and those were found in his truck after the accident.

The BNSF party member said that the contract between Loram and the BNSF has verbiage that requires the equipment to be compliant with federal regulations. After the accident occurred, the equipment was inspected by the BNSF, Loram and the FRA and was found to be in compliance with the regulations.

The following regulations explain the audible warning devices for on-track roadway maintenance machines:

§ 214.511 Required audible warning devices for new on-track roadway maintenance machines.

Each new on-track roadway maintenance machine shall be equipped with:

(a) A horn or other audible warning device that produces a sound loud enough to be heard by roadway workers and other machine operators within the immediate work area. The triggering mechanism for the device shall be clearly identifiable and within easy reach of the machine operator; and

(b) An automatic change-of-direction alarm which provides an audible signal that is at least three seconds long and is distinguishable from the surrounding noise. Change of direction alarms may be interrupted by the machine operator when operating the machine in the work mode if the function of the machine would result in a constant, or almost constant, sounding of the device. In any action brought by FRA to enforce the change-of-direction alarm requirement, the employer shall have the burden of proving that use of the change-of-direction alarm in a particular work function would cause a constant, or almost constant, sounding of the device.

§ 214.513 Retrofitting of existing on-track roadway maintenance machines; general.

(a) Each existing on-track roadway maintenance machine shall have a safe and secure position with handholds, handrails, or a secure seat or bench position for each roadway worker transported on the machine. Each position shall be protected from moving parts of the machine.

(b) By March 28, 2005, each existing on-track roadway maintenance machine shall be equipped with a permanent or portable horn or other audible warning device that produces a sound loud enough to be heard by roadway workers and other machine operators within the immediate work

area. The triggering mechanism for the device shall be clearly identifiable and within easy reach of the machine operator.

(c) By March 28, 2005, each existing on-track roadway maintenance machine shall be equipped with a permanent illumination device or a portable light that is securely placed and not hand-held. The illumination device or portable light shall be capable of illuminating obstructions on the track ahead for a distance of 300 feet under normal weather and atmospheric conditions when the machine is operated during the period between one-half hour after sunset and one-half hour before sunrise or in dark areas such as tunnels.

§ 214.517 Retrofitting of existing on-track roadway maintenance machines manufactured on or after January 1, 1991.

In addition to meeting the requirements of §214.513, after March 28, 2005 each existing on-track roadway maintenance machine manufactured on or after January 1, 1991, shall have the following:

(a) A change-of-direction alarm or rearview mirror or other rearward viewing device, if either device is feasible, given the machine's design, and if either device adds operational safety value, given the machine's function. In any action brought by FRA to enforce this requirement, the employer shall have the burden of proving that neither device is feasible or adds operational safety value, or both, given the machine's design or work function.

(b) An operative heater, when the machine is operated at an ambient temperature less than 50 degrees Fahrenheit and is equipped with, or has been equipped with, a heater installed by the manufacturer or the railroad.

(c) The light weight of the machine stenciled or otherwise clearly displayed on the machine, if the light weight is known.

(d) Reflective material, or a reflective device, or operable brake lights.

(e) Safety glass when its glass is normally replaced, except that replacement glass that is specifically intended for on-track roadway maintenance machines and is in the employer's inventory as of September 26, 2003 may be utilized until exhausted.

(f) A turntable restraint device, on machines equipped with a turntable, to prevent undesired lowering, or a warning light indicating that the turntable is not in the normal travel position.

Loram Postaccident Actions to Retrofit Equipment

Loram party member said that they upgraded[16] all grinding machines with center cabs to allow the employee positioned on the leading end of the machine at the “point person station” with the following features:

[16] The J6 upgrades were completed about two weeks after the accident and all the other grinding machines were upgraded within two months.

(1.) Install fixed position color travel cameras at both ends of the machine. The travel camera field of view (F.O.V.) will overlap the sequence camera F.O.V. An additional monitor will be installed at the operator counsel dedicated to the travel cameras.

(2.) Install an "Alert" horn button. This will be tied into the machine travel horn circuit in series with the units mounted at the 4 corner ladders.

(3.) Install a "Machine Stop" button. This feature will give the point person the ability to "kill" the engine at these stations. (Tests have shown 100' stopping distance at 10 MPH and 12 feet at 3 MPH with carriages down.)

In addition, Loram agreed to publish a "Safety Advisory" and notify other suppliers of specialty equipment, similar to that of the J Series grinder, of the changes they made to the equipment as lessons learned. Included in this Safety Advisory were the circumstances of the accident and the changes Loram made in the training and testing procedures of their Operating Rules.

Method of Operation

The welding foreman duties were to act as the BNSF employee in charge and to pilot/escort the Loram rail grinder while traveling and working on BNSF property. His training for this position included BNSF Maintenance of Way Safety and Operating Rules.

Pertinent Operating and Safety Rules

BNSF Maintenance of Way Safety Rules:

- S-1.1 – Job Safety Briefing - briefing should have included information related to:
  - Moves to be made
  - Potential hazards, such as derail position
  - Type of signals to be used, and if hand signals, expectations that machine operator should stop if employee providing signals disappears from view

- S-13.1.2 – Signals – pertinent parts:
  - Do not give the signal to move locomotives, cars, or other equipment until persons and equipment are clear of the movement.
  - Position yourself so that your signal can be clearly seen.
  - Stop all movement if you lose visual contact with the person giving the signal, unless radio communication is being used instead of hand signals.
  - Make sure everyone understands other signals you may use.

- S-13.1.3 – Tracks – pertinent parts:
  - When crossing tracks, do not cross in front of approaching equipment, unless you are sufficiently ahead of the equipment to cross safely.

- Fouling track, do not walk between rails or foul the track, except when duties require and proper protection is provided.

BNSF Maintenance of Way Operating Rules:

- 1.1 – Safety – pertinent parts:
  - Conduct a job safety briefing with individuals involved:
    - Before beginning work
    - Before performing new tasks
    - When working conditions change

- 5.3.2 – Giving Signals
  - Employees who give signals must:
    - Make sure signals can be plainly seen.
    - Give signals clearly so they can be understood.
    - Give signals on the engineer's or operator's side of the track when practical.

- 5.3.3 – Signal Disappearance
  - If a person disappears who is giving the signal to back or shove, or the light being used disappears, the backing or shoving movement must stop.

- Glossary – Escort - An employee familiar with the territory and assigned by the employee in charge to assist the movement of equipment operated by employees, contractors, or other outside personnel unfamiliar with the territory.

Applicable Loram Rules

Loram Operating Rules state: "At Loram, safety is of primary importance. Loram is committed to the safety of its employees, railroad personnel, and the public and ensuring no serious incident occurs. The Loram Operating Rules have been put in place for your protection. Use of other operating practices is prohibited. Following the Loram Operating Rules, including those specified below, will ensure safe operations even when other on-track personnel make mistakes."

Point Protection:

Only Loram employees can operate Loram equipment. Likewise, only a Loram employee may provide point protection for a Loram operator. Point protection is required in the circumstances in Loram Operating Rule 11.22, as well as whenever the operator has obstructed vision.

- 11.22 – For all non-front cab controlled machines, a Loram employee must be positioned on the leading end of the equipment when:

  (a) Traveling through yards, sidings, or into back tracks, to confirm that switches, derails, interlocks and frogs are properly lined for the movement; or

(b) Grinding, digging or ditching over or by a track side warning detector or other related equipment to confirm the location of the railroad equipment to the operator.

(c) It is the operator's responsibility to notify a Loram employee to provide point protection. If a Loram employee is not in proper position, the machine must be stopped. On ballast and grade equipment, the employee may be on the ground.

A point person is responsible for maintaining constant communication with the operator to warn of obstructions and direct movements. For example, a Loram point person is responsible for ensuring compliance with the following Loram Operating Rule when a Loram operator is unable to personally ensure compliance:

11.18 – Employees must ensure that switches and derails near the equipment have been properly lined by railroad personnel for movement.

The Loram operator, point person and every other affected person must have mutual understanding of planned moves:

- 6.1(b) – Teamwork is essential to safety. Everyone involved in a particular project must know what moves are going to be made when working as a group.

Signaling Movement

Unless the Loram operator has clear line of sight for the movement, only a Loram employee may signal a movement to the Loram operator. A point person must signal every movement with a positive confirmation that the path is clear. When movements are signaled to the operator, they must be made in accordance with the following Loram Operating Rules:

- 11.33 – When moving equipment in response to hand signals, if the employee or light giving signals disappears from view, it must be regarded as a stop signal.

- 16.8 – When radio is being used in lieu of hand signals, both the direction and distance to be traveled must be given. Movement must be stopped in one-half the distance specified unless additional instructions are received. When movement is being controlled by radio communication, loss of contact with the person directing the movement must be regarded as a signal to stop.

Standing on and Crossing Tracks

- 9.2 – Employees must expect the movement of trains, engines, cars or other equipment at any time, on any track, in either direction.

  (a) Employees must not stand on the track in front of an approaching engine, car or other moving equipment.

- 9.3 - Employees are prohibited from:

  (a) Walking, standing, or being foul of tracks except when required in the performance of duty and protected by appropriate on-track safety,

  (b) Crossing tracks immediately in front of moving equipment,

  (m) Passing within 30 feet from the ends of standing cars, engines, and equipment on any track.

Applicable Federal Regulation

§ 240.104; Criteria for determining whether movement of roadway maintenance equipment or a dual purpose vehicle requires a certified locomotive engineer; (a) "A railroad is not required to use a certified locomotive engineer to perform the following functions: (i) Being operated in conjunction with roadway maintenance and related maintenance of way functions, including traveling to and from the work site;"

Oversight

BNSF Oversight

The rail grinding machine was being operated by a contractor employed by the BNSF. The Loram equipment and crew worked under the direction of the BNSF welding foreman. The day of the accident started out with an inclusive job briefing[17], with the BNSF expectations of their requirements being adhered to by the welding foreman and Loram crew. The roadmaster[18] and the welding supervisor[19] attended the job briefing. One of the primary duties of the roadmaster and the welding supervisor was to oversee the process, the work and workers during the execution of the work involved. This oversight duty is routine and not normally documented when conducted during the days' work; unless discipline is necessary for failure to comply with the rules and regulations. The welding foreman had no recent record of discipline for failure to comply with the rules and regulations.

Loram Oversight

Loram had a Safety Coordinator on board the equipment at the time of the accident. The Safety Coordinator is responsible for managing the Operations Behavioral Risk Improvement Program and for conducting field crew and machine safety inspections to ensure compliance with Loram safety rules and regulations. He said that he was in Amarillo at this time to conduct a routine safety audit of the J6 rail grinder and crew. At the time of the accident the Safety Coordinator was located in the middle of the cab on the east side of the control stand.

[17] The topics covered are shown in the Circumstances Prior to the Accident Sub-Heading.
[18] The roadmaster is a front line supervisor that has an assigned line segment for maintenance.
[19] The welding foreman's direct supervisor.

FRA Oversight

This accident occurred in Region 5[20]. For the first eight months of 2012, the FRA conducted 2,777 separate inspections on work groups for Roadway Worker regulation compliance in Region 5. During the inspections the FRA recorded 82 defects and recommended 11 violations for regulation non-compliance. However, the FRA does not collect data that would correlate the data by type of gang, employee craft or equipment.

Tests and Research

Field Measurements, Observations and Survey

Based upon a BNSF survey of the scene and information collected after the incident, the rail grinder came to a stop to check for leaking hydraulic oil approximately 32.5-feet east of the derail on track #1805. This distance would be measured from the derail to the westerly end of the rail grinder. The rail grinder making the reverse movement went 18.5-feet past the derail as measured from the derail west to the west end of the rail grinder.

The onsite investigation revealed that the derail had been struck by the cowcatcher on the switch grinder and the derail was dislodged from the ties that it was mounted on. Impact marks present on the cowcatcher and the derail are consistent with the derail having been in the half thrown or approximately vertical position at the time of impact.

Rail Grinder Cameras

There are several cameras, which do not record their images, on the rail grinder that are used when in the grinding or work mode so the operator knows when to sequence the grinding operations. Based upon tests that were performed after the incident, the main camera on the grinder pointing in a westerly direction (or in the direction of the westbound movement) provided a sight distance of approximately 18-feet as measured to the west end of the grinder. At 18-feet from the rail grinder you can see the toes of the work boots of an individual standing there, but no higher until you get closer to the grinder.

Stopping Distance Test

The following data is a summary of stopping distance test of the Loram rail grinder; unit J6.

- All tests were made near milepost 192 on the Red River Valley Subdivision, Texas Division, on the morning of February 7, 2012
- The Loram J6 rail grinder has the ability to move in multiple modes
- Four different modes were tested with one test repeated

All tests were performed as follows:

- Machine at stop with a mark 31 feet in advance of the west end of the machine; simulating the estimated distance from machine to derail.

[20] The FRA field is comprised of eight Regions and Region 5 includes Texas.

- Machine then accelerates westward until operator can see mark on the onboard monitor; the operator then initiates a stop.
- Measurements were made relative to the location of mark of simulated derail; this mark is referred to as the "derail".
- Maximum speed was determined by use of a K-15 radar gun; model K 15-K, and calibrated using a 50 mph K band tuning fork.

Test 1: the machine in high idle, travel mode; the machine stopped 11 feet prior to passing the derail, and attained a maximum speed was 2.1 mph.

Test 2: the machine in high gear, high idle, grind mode; the machine stopped 14 feet past the derail, and attained a maximum speed was 3.5 mph.

Test 3: the machine in low gear, high idle, grind mode; the machine stopped four feet past the derail, and attained a maximum speed was 4.5 mph.

Test 4: the machine in travel mode, low gear, high idle; the machine stopped 10 feet prior to passing the derail, and attained a maximum speed of 3.9 mph.

Test 5: a repeat of Test 2 with the machine in high gear, high idle, grind mode; the machine stopped 15 feet past the derail and attained a maximum speed of 3.6 mph.

Portable Electronic Device

The welding foreman had a cellular phone which was found in the Loram rail grinder after the accident. The coroner advised that there was no cell phone or radio attached to or contained in the welding foreman's clothing. No communication device of any nature was found in or around the track area before or after the equipment was moved from the accident scene.

Additional Data/Information

FAMES

On April 24, 2009, the FRA invited railroad labor and management representatives to Washington, D.C., to form an ad-hoc committee to review roadway worker fatalities which occurred since January 1997. Additionally, the Committee was tasked with reviewing roadway worker fatalities at highway-rail grade crossings that are not classified as RWP events. The Committee became known as the Fatality Analysis of Maintenance-of-way Employees and Signalmen (FAMES)[21]. FAMES is a voluntary, consensus-based Committee focused on identifying risks, trends, and factors impacting roadway worker safety. FAMES will periodically issue findings and recommendations based upon its review of available safety data. The Committee's activities are focused on education and prevention. The findings and recommendations of FAMES are separate from the regulatory process.

To date, FAMES analyzed available data from 39 roadway worker accidents that occurred between January 1997 and the end of 2011, in which 41 roadway workers perished. In

[21] Information provided by the Fatal Accidents Involving Roadway Workers-In-Charge and Lone Workers publication; March 9, 2012 & May 21, 2012.

the study, 12 fatally injured roadway workers were roadway workers–in-charge (RWIC) or Lone Workers responsible for establishing on-track safety. This represents 29% of the 41 fatalities. In 9 of the 12 fatalities, the RWIC was providing on-track safety for a roadway work group. In 3 of the 12 fatalities, the Lone Worker was responsible for determining and establishing their own on-track safety. One of the 3 Lone Workers was using Individual Train Detection (ITD) at the time of the accident.

All 12 of the RWIC fatalities occurred on signalized controlled track. In 11 of the 12 cases, an adjacent track was present. Four of the fatalities occurred on an adjacent track where no OTS was established. Train strikes were involved in 9 cases; and the 3 other cases involved strikes with on-track equipment. In 6 of the 12 cases, at least one Roadway Maintenance Machine (RMM) was present. In 6 cases, there was evidence that the on-track safety briefing was not held or was missing critical information.

Analysis indicates that the 12 fatally injured workers were familiar with the tasks being performed and may have been focused on work processes such as detailed inspection, measurement, checking track alignment, trouble-shooting, or observing machine operation. Noise and reduced visibility due to the presence of RMM(s) (e.g., tampers, regulators) or other on-track equipment near the worksite may have interfered with the detection of approaching trains and equipment.

FAMES Recommendations:

☐ Experience is no substitute for compliance with on-track safety procedures.

☐ Neither RWICs nor members of a roadway work group (two or more workers engaged in a common task) may use Individual Train Detection as a form of on-track safety on any track.

☐ If the work requires oversight and supervision from an RWIC, the RWIC must not be assigned or assume the duties of Watchman/Lookout.

☐ Where an Exclusive Track Occupancy authority exists only for the track being worked on, roadway workers cannot foul an adjacent track without establishing on-track safety.

☐ On-track safety briefings should emphasize the risks associated with RMM movements and address items such as noise, machine spacing, obstructed visibility, and proper communications whenever roadway workers are working near RMM(s).

☐ Every roadway worker must make sure that on-track safety is established and understood prior to fouling a track.

☐ Every roadway worker has a duty to warn other roadway workers and employees fouling an unprotected track to move to the clear.

☐ Lone Workers may use Individual Train Detection only to perform routine inspection and minor correction work outside the limits of a manual interlocking, a controlled point, or a remote controlled hump yard facility. Lone workers are reminded to use a higher level of on-track safety whenever Individual Train Detection is deemed insufficient.

☐ Activities which require an RWIC to multi-task can introduce a higher level of distraction. Those activities which may distract the RWIC from his on-track safety responsibilities should be mitigated. Consideration should be given to delegating responsibilities.

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