SUMMARY FOR FE-04-06
SELECTED AND POSSIBLE CONTRIBUTING FACTORS

SELECTED FACTORS

Railroad: Lake Superior & Ishpeming Railroad Company (LSI)
Location: Palmer, Michigan
Region: 4

Month: April
Date: April 2, 2006
Time: 6:30 a.m., EST

Data for Fatally Injured Employee(s)

Conductor
51 years old
11 years of service
Last rules training: March 23, 2006
Last safety training: March 22, 2006
Last physical: Oct. 7, 1999
Last relevant efficiency test: None in previous three years

Data for All Employees (Craft, Positions, Activity)

Craft: Transportation and Engine

Positions:

Tilden Mine Assignment Crew
Conductor
Locomotive Engineer
Student Locomotive Engineer

Activity

Switching

EVENT

A Conductor was fatally injured when struck by on-track equipment during a switching operation.

SUMMARY FOR FE-04-06 CONTINUED

POSSIBLE CONTRIBUTING FACTORS

PCF No. 1

The Conductor fell off the car he was riding during a switching operation. Analysis of the train's event recorder revealed a decrease in speed from 9 ½ to 8.2 mph just prior to the fatal incident, which could have caused slack action on the east end of the train, possibly causing the Conductor to lose his hold on the car he was riding.

PCF No. 2

The Locomotive Engineer failed to comply with Federal regulations regarding radio communications when he failed to stop the switching movement after receiving unclear communications from the Conductor.

PCF No. 3

Of the seven Conductors randomly interviewed during the investigation, six stated they routinely rode inside the end sills of ore cars. However, railroad records clearly indicated no safety observations were conducted by railroad management for compliance with railroad safety rules regarding this activity.

PCF No. 4

Railroad management failed to adequately monitor radio transmissions for compliance with railroad operating rules and Federal regulations.

PCF No. 5

At and near the accident site, taconite pellets (imperfectly round balls of iron ore, about ½ inch in diameter), created unstable footing for the Conductor and may have contributed to the fatal incident.

PCF No. 6

Visibility at the time of the incident was not optimum. It was still dark, as sunrise did not occur until 6:28 a.m. There were mercury vapor lights on poles located in line about 225 feet apart. The line of poles was about 30 feet to the south of the site. In addition, there were two flood lights on the top of the pellet bin nearby. Although there was artificial lighting on 30 foot poles and atop a nearby ore bin, all attached reports indicate that the darkness prevented a clear and visible work area.

REPORT: **FE-04-2006**

RAILROAD: Lake Superior & Ishpeming Railroad Company (LSI)

LOCATION: Palmer, Michigan

DATE & TIME: April 2, 2006; 6:30 a.m., EST

EVENT[1]: A Conductor was fatally injured when struck by on-track equipment during a switching operation.

EMPLOYEE:	Craft:	Transportation and Engine
	Occupation:	Conductor
	Age:	51
	Length of Service:	11 years
	Last Rules Training:	March 23, 2006
	Last Safety Training:	March 22, 2006
	Last Physical:	Oct. 7, 1999
	Last Relevant Efficiency Test:	None in Previous Three Years

CIRCUMSTANCES PRIOR TO THE ACCIDENT

The crew of the 11 p.m. Tilden Mine assignment reported for duty at the Eagle Mills, Michigan crew welfare building on April 1, 2006, at 11 p.m., EST. The crew comprised a Conductor, Locomotive Engineer, and Student Locomotive Engineer. All had been off duty at least 16 hours prior to that date and time. The three crew members held a job safety briefing at about 11 p.m., where they discussed the work to be done that evening**.** Neither the Locomotive Engineer nor the Student Locomotive Engineer took any exception to their fellow crew member's condition nor their fitness for duty.

The LSI Railroad utilizes a daily "Mark Up Board" wherein train and engine service employees request the assignment they desire for the following day. The assignments are then assigned according to employees' seniority. In the above sense, there are no "Regular Assignments" on the LSI. All three of the above employees were aware on March 31, 2006, that they would be working at 11 p.m.on April 02, 2006. The Conductor, Locomotive Engineer, and Student Locomotive Engineer had 11, 8, and 7 years experience, respectively. The LSI is a small

[1] "Event" is defined as "occurrence that immediately precedes and directly results in the fatality." Possible contributing factors are identified in the following report and attached summary.

railroad with only 28 train and engine service employees. Therefore, they each had worked the Tilden Mine assignments many times, and were very familiar with the assignment as well as the physical characteristics of the trackage.

The crew made several switching movements at Eagle Mills Yard, made a trip to the Tilden Mine, located in Palmer, Michigan, and returned to Eagle Mills. At about 4 a.m., EST, on April 2, 2006**,** the crew coupled to 120 ore empties. The crew ascertained that the brakes were set and released on the rear car, and they departed at about 4:30 a.m. on the westward trip to Tilden Mine. The distance between Eagle Mills Yard and Tilden Mine is 7.7 miles. The Student Locomotive Engineer operated the train from Eagle Mills to Tilden Mine. The crew members had two locomotives, LSI 3003 and SI 3000. The 3003 was facing west, and the 3000 was facing east.

They pulled onto the "Main Line" at Tilden Mine. The Conductor uncoupled the 60 head cars, and they moved these 60 cars to pocket number one. At this time, the Locomotive Engineer relieved the Student Locomotive Engineer as the operator of the engine consist. He was now operating from the LSI 3000, which was the east locomotive, the locomotive closest to the cars. They then pulled the remaining 60 cars to the west, and stopped west of the west switch of the south stockpile track.

Both locomotives were equipped with a radio, and both worked properly. The Conductor carried a portable radio equipped with a remote microphone in the pocket of his overalls. He had the remote microphone affixed to his clothing in the collar area. The Conductor's radio worked properly.

The Tilden Mine yard consists of 10 tracks, which basically run east and west, both compass direction and railroad direction. The fifth track from the south is the south stockpile track. The south stockpile track is 3,712 feet long. The grade is about 1.4 percent descending from west to east. There is a slight curve to the right (the south) about in the middle of the track. Near the east end of the curve, on the north side of the track, began a stockpile of taconite pellets, which are an imperfectly round ball of iron ore, about one-half inch in diameter. This material creates an unstable surface underfoot because of the product's unique "marble like" configuration. This pile of taconite continued to the east end of the track where the ground is flat, and completely covered with these pellets.

The weather was clear, with 10 miles visibility, the temperature was about 28° F, and the wind was out of the southwest at about 5 mph. It was still dark out at the time of the accident. Sunrise was 6:28 a.m. There were mercury vapor lights on poles located in line about 225 feet apart. The line of poles was about 30 feet to the south of the south stockpile track. In addition, there were two flood lights on the top of the pellet bin nearby. The footing was poor, due to taconite pellets covering the ground. Although there was artificial lighting on 30 foot poles and atop a nearby ore bin, all attached reports indicate that the darkness prevented a clear and visible work area.

THE ACCIDENT

The crew's intention was to shove these 60 cars up to, but not couple onto, the standing cars on the east end of the track. After stopping west of the west south stockpile track switch, the Conductor lined the switch for the south stockpile track. He then radioed the Locomotive Engineer that it was OK to shove ahead 120 car lengths. He added the words, "I'm with you." The Locomotive Engineer stated that this meant that the Conductor was on the cars, prepared to shove ahead. At this point, the locomotives were on the west end, and the leading car of the shoving movement was the east car. The shoving movement would be from west to east. The crew referred to this as a "Shove ahead," because the locomotive that the Locomotive Engineer was operating was headed east. The east car of the 60 cars was LSI 1507. The "A" end was east.

The Locomotive Engineer began to shove east. According to the event recorder on locomotive LSI 3000, the time was 6:20 a.m. The Locomotive Engineer was at the controls of locomotive LSI 3000, on the right hand side of the locomotive in the direction of movement. This was the south side of the locomotive. The Student Locomotive Engineer was seated on the fireman's side of locomotive LSI 3000, on the left hand side in the direction of movement. This was the north side of the locomotive.

The next radio transmission from the Conductor was that there were 50 car lengths to go. The Locomotive Engineer acknowledged that transmission. The next radio transmission from the Conductor was that there were 15 car lengths to go. The Locomotive Engineer felt that this transmission came too soon after the "50 car lengths to go" transmission. He didn't feel he had traveled that far yet. Cognizant of this, the Locomotive Engineer continued shoving about six more car lengths, and attempted to call the Conductor on the radio. There was no response, and he tried to call him again. Still, he continued shoving the cars. Again he received no response, and finally stopped the movement. After stopping, the Locomotive Engineer attempted to call the Conductor several more times on the radio. He received no response. According to the event recorder on locomotive LSI 3000, the time of the stop was 6:25 a.m. The event recorder on locomotive LSI 3003 depicted the stop at 6:20 a.m.

The Locomotive Engineer got off the locomotive, and walked easterly along the cars, on the north side. He saw the Conductor's hard hat lying on the north side. He then crossed over to the south side, because he was nearing the stockpile of ore pellets on the north side. As he reached the end of the cars, he found the Conductor lying (more or less wedged) between the wheels of the east truck of the east car, LSI 1507. The Conductor's head and upper torso were north of the north rail, and the rest of his body between the rails. They were not severed, which strongly suggests his body was pushed by the rail car truck frame. The Locomotive Engineer checked the Conductor for a pulse. There was none. A Tilden Mine employee called the Student Locomotive Engineer on the radio and requested he call an ambulance. The Student Locomotive Engineer radioed the LSI Eagle Mills Yard to call an ambulance. Emergency responders arrived quickly, and the Conductor was pronounced dead at 6:35 a.m.

POST-ACCIDENT INVESTIGATION

The investigation determined that no one, mine workers or LSI employees, witnessed the accident. Therefore, the exact location of the deceased prior to the accident will remain unknown. Evidence at the scene and investigative theorems were used to determine the probable location and cause of the accident.

At the time of the incident, the deceased was wearing an orange reflective safety vest, zipped up. Under the vest he wore a wool-lined Carhart jacket. Under the jacket he had a fleeced flannel shirt jacket. Under the jackets, he wore denim Carhart bib overalls. He wore Red Wing steel-toed work boots, with a definite heel. He was wearing ear plugs and hard hat liner when he was found.

At a point about 558 feet west of where the deceased was found, there were two impressions in the taconite pellets between the rails. These impressions may represent where the Conductor's feet or knees hit the ground. However, there is no conclusive evidence of that. A piece of watch band was laying north of the north rail and about four feet to the east of the impressions. Next, between the rails, was a portable radio with remote microphone. Next, north of the north rail, was a pair of safety glasses. Next, between the rails, was a lantern. Next, between the rails, was a switch key. Next, about 10 feet north of the north rail, was a hard hat. Next, north of the north rail, was a watch face. Lastly, north of the north rail, was a glove. The distance between the two imprints and the glove was about 88 feet. Throughout the area where the above items lay were several pieces of body tissue.

From the point where the above items were found to where the deceased was found, there was a rut in the ore pellets on either side of the north rail. These marks might be described as a "furrow" and were consistent with the deceased's body becoming wedged between the wheels and pushed along by the moving car the entire distance. The locations of the personal items, worn or carried by the deceased previously mentioned, are consistent with his body movement.

FRA conducted an inspection of the two locomotives and 60 cars involved in the shoving movement. That inspection revealed a total of 51 defects. There were 12 Freight Car Safety Standards exceptions, 26 Locomotive Safety Standards exceptions, 10 Safety Appliance Standards exceptions, and three Brake System Safety Standard exceptions. One of the Safety Appliance exceptions was on LSI 1507, the car that the Conductor was presumably riding, but not known for sure. That exception was a side handhold bent inward, on the "A" end of the car, on the right side. The side handhold measured a 1-inch clearance, and the minimum clearance allowed is two inches, preferably two and one-half inches.

In conjunction with the interviews of the surviving employees, FRA completed a Circadian Rhythms Questionnaire. Later, a Schedule Worksheet was completed for the two surviving employees. A Schedule Worksheet was also completed for the deceased.

FRA also completed a "Prescription and Over-The-Counter-Drugs" Questionnaire for the two surviving employees. The completed questionnaires were sent to FRA's Drug and Alcohol Program Manager, and are not attached to this report.

LSI employees field-tested the radio equipment involved in the incident. The radios tested were the radios on locomotives LSI 3000 and LSI 3003, and the portable handset used by the deceased. All tested as working properly. LSI had all three radios tested by an outside communications company, and no problems were found with any of them.

Two LSI managers conducted a behavior and appearance check on the two surviving employees for impairment signs and symptoms of impairment. This check was done on April 2, 2006 at 8:50 a.m. Everything appeared normal for both employees, and the observance was recorded on a Cliffs Michigan Mining Company "Drug and Alcohol Test for Cause Checklist." (The LSI Railroad is owned by Cleveland Cliffs.)

The south stockpile track was constructed of 132-pound jointed rail, with even joints. The ties were steel. LSI took elevation measurements of the north and south rail of the south stockpile track. The measurements were taken from a point 30 feet east of where the Conductor was found, and extending west, 765 feet.

A post-mortem examination of the deceased's remains was conducted on April 3, 2006. The Cause of Death was depicted as "Cervical fracture and massive abdominal/pelvic trauma, secondary to train accident." The Manner of Death was depicted as "Accidental."

The deceased's remains were tested in accordance with 49 CFR Part 219, Subpart C, Post-Accident Toxicological Testing. The results were negative. Due to confusion, lack of familiarity with Subpart C, Post-Accident-Toxicological Testing, and the trauma of the moment, LSI managers made a number of errors in conjunction with the testing of the two surviving crew members. However, these errors did not affect the post-accident toxicological testing's findings, which were all found to be negative. Specifics about testing procedures follow: FRA testing kits were not used for the urine collection or shipment of the urine specimens. However, the urine specimens were shipped to the laboratory used by FRA for Post-Accident Toxicological Testing. Form FRA F 6180.74 (Federal Railroad Administration Post-Accident Testing Blood/Urine Custody and Control Form) was not used for the surviving crew members. No blood specimens were collected from the surviving crew members. Both the urine tests and breath tests for the surviving crew members were negative.

Analysis and Conclusions

Although the handling of the toxicological testing required by Federal regulations under Subpart C, Post-Accident Toxicological Testing was not in full compliance with these requirements, the results were negative for the three employees tested, which included the deceased. Drug and/or alcohol impairment was not a factor in this incident.

The Conductor was born on Sept. 8, 1954. He was employed by LSI on June 8, 1994 as a laborer on the ore dock. On Oct., 14, 1999, he transferred to the Mechanical Department. On July 25, 2004, he transferred into train service. He had no discipline record. He had sustained two personal injuries. On Nov. 15, 1998, he pulled a muscle, and on March 7, 2001, he had sore ribs. There is a record of one operational test for the Conductor during the period of 2004, 2005, and 2006 up to April 2. That test was on Jan.11, 2006.

The Locomotive Engineer was born on Oct. 3, 1953. He was employed by LSI on April 22, 1998, but had worked about 20 years on other railroads prior to coming to LSI. He went into engine service in 1999. He passed his vision and hearing tests to enter into engine service. On June 30, 2005, he was given a 30-day suspension for failure to comply with instructions. There is a record of one operational test for the Locomotive Engineer during the period of 2004, 2005, and 2006 up to April 2. That test was on Jan. 30, 2006.

The Student Locomotive Engineer was born on Oct. 15, 1976. He was employed by LSI on May 3, 1995 as a summer laborer. He was hired full time on Jan. 20, 1999. He was promoted to Conductor on Oct. 3, 2003, and entered engine service in March, 2006. There is a record of two operational tests for the Student Locomotive Engineer during the period of 2004, 2005, and 2006, up to April 2. Those tests were on June 30, 2005, and January 13, 2006.

Examination of records for 2004, 2005, and 2006 revealed that all three employees had received periodic training and testing on operating rules. All three achieved passing scores on the above tests. Also, all three had received training and passed various examinations in conjunction with Locomotive Engineer training. In addition to the above training and testing of the employees involved, LSI also provided documentation of various "Safety Blitzes," such as fire extinguisher training, CPR training, and records of Job Safety Briefings which are required by the railroad of all train crews as they come on duty. There is no evidence to suggest that the employees involved in this accident lacked training or qualifications.

FRA reviewed the LSI operational testing records provided by the railroad for years 2004, 2005, and 2006, which included April 2, 2006, the day of the accident. In 2004, there were 21 tests conducted on 19 employees. In 2005, there were 21 tests conducted on 23 of the 28 Train and Engine Service Employees. In October 2005, a new Transportation Manager came to the LSI, and placed more emphasis on the operational testing program. The records for 2006 indicate that 46 employees were observed between Jan. 4, 2006 and April 2, 2006. There were no failures.

Some of these observations were conducted on employees more than once, which is understandable given the number of employees employed by the railroad. Notwithstanding, the LSI records indicate that only six observations were conducted for compliance with getting on or off engines or cars, and no observations for riding the end sills of rail cars. Of the seven Conductors randomly interviewed during the investigation, six stated they routinely rode inside the end sills of ore cars. In fact, the new Efficiency Test Form implemented by the new Transportation Manager has a specific observation for this safety rule. The observation is listed under *C Tests - Train Crew Observation Tests,* and is indicated as TT #12 pg 31 - Riding Equipment - Part D. Yet, LSI records clearly indicate

no safety observations were conducted for compliance with this safety rule in any manner. This lack of management oversight for conducting safety observations may be a possible contributing factor to this accident.

Furthermore, the radio procedure utilized by the Locomotive Engineer during the shoving movement may not have been in compliance with Federal regulations, specifically, 49 CFR Part 220.49. The regulations require that "If the instructions are not understood, the movement shall be stopped immediately..." The engineer stated two times that he did not think he had shoved the rail cars that far during the shoving movement. The first time from 120 cars to 50 cars, and then 50 cars to 15 cars in such a short time span. Clearly, the instructions from the deceased to the Engineer were questionable at the time of the radio transmissions. However, the Engineer continued to shove the cars. Moreover, he continued shoving the cars after two unsuccessful attempts to contact the deceased by radio. Finally, after no response from the deceased, the Locomotive Engineer stopped the movement.

The efficiency testing data provided by the LSI indicates that during 2004, 2005, and 2006, there were no failures related to radio procedures. The LSI operating rule for monitoring of the radio is indicated as GCOR Rules 2.0, 2.20. Again, this lack of management oversight for monitoring radio transmissions for compliance with LSI rules as well as Federal regulations may be a possible contributing factor to this accident.

The Circadian Rhythms Questionnaire for the surviving employees did not reveal any issues which contributed to this accident. The Schedule Worksheets for the three employees documented that during the 10 days preceding the accident, the deceased had worked six shifts. During the same 10 days, the Locomotive Engineer had worked four shifts, and the Student Locomotive Engineer had worked eight shifts. Based upon the above, there is no evidence that fatigue played a role in this accident.

The Locomotive Engineer commented that the Conductor seemed tired that evening. However, neither the Locomotive Engineer nor the Student Locomotive Engineer took any exception to the Conductor's fitness for duty or alertness that evening.

Both locomotives were equipped with Bach-Simpson event recorders. There is a difference of four minutes and nine seconds between the times for each locomotive. In addition, prior to the LSI acquiring the locomotives, a modification had been made to cause the diesel to burn cleaner. That modification involved how rapidly the throttle position increased the speed of the diesel. Later, LSI had Bach-Simpson install the event recorders. Because of that modification, Bach-Simpson told LSI that the throttle position data would be compromised. As a result, the only throttle positions that are depicted in the data for these locomotives is zero, one, 7, 8, and a?(Question Mark). In addition, the event recorders used do not show distance traveled. Because LSI does not operate over 20 mph, a distance requirement is not required. Nevertheless, the data for the two locomotives coincides for the most part. During the last eastward move, the speed reached a maximum of 11.8 mph. Because of the grade, that speed was reached with little or no throttle. In fact, the Locomotive Engineer used three applications of the train brakes, and periodic applications of the locomotive brakes to control the speed.

Analysis of the data from the event recorder of locomotive LSI 3000 indicated that at 06:23:47 the speed decreased from 9 ½ mph to 8.2 mph. This decrease in speed may have caused slack action on the east end of the train. The computation of distances based upon the speed and the time elapsed, suggest the slack action occurred about 617 feet from where the Conductor was found, and about 49 feet prior to where it is believed the Conductor hit the ground. (NOTE: this computation is not precise.) This slack action may have caused the Conductor to lose his hold on the car.

The LSI took elevation measurements of the south stockpile track. From those measurements, cross level variances were extrapolated. There were no FRA exceptions to cross level.

There was one safety appliance defect on the LSI 1507, insufficient side handhold clearance. This was the car that the Conductor was presumably riding. There is no evidence that this defect contributed to the accident.

APPLICABLE RULES

LAKE SUPERIOR & ISHPEMING RR CO
SAFE WAY MANUAL

MARCH 2001

REVISED JULY 2005

T-2Close Clearances

Departmental Safety Rules:

a. Always face in the direction of movement when riding cars, equipment, and locomotives
b. Stop movement and dismount before passing close clearances or other obstructions

T-7 Getting On and Off and Riding Cars, Equipment & Locomotives

Departmental Safety Rules:

a. Always face cars, equipment, and locomotives when mounting or dismounting.
b. Never step on the sliding center sill or cushion underframe device of any car. Keep off couplers and their components.
c. Always mount and dismount cars, equipment, and locomotives from the side, using the sill step and side ladder.
d. Mount and dismount moving cars, equipment, and locomotives only when permitted by special instructions or in an emergency.
e. Do not occupy the roof of cars.

T-12 Slack Action

Departmental Safety rules: none

Recommended work practices:

a. Always be prepared for unexpected movement due to slack action when riding on cars, equipment, and locomotives.
b. Remain seated when possible.

LAKE SUPERIOR & ISHPEMING RAILROAD COMPANY
TIMETABLE NO. 12
AND
SPECIAL INSTRUCTIONS
(INCLUDING GENERAL INSTRUCTIONS)
EFFECTIVE 12:01 AM APRIL 3, 2005
(EASTERN TIME)

D. **Getting on or off Cars and Engines:**

1. When practical to do so, employees must board or leave moving engines and cars on the engineer's side. Getting on or off engines or cars moving at any unsafe speed is prohibited.
**********(Indicates missing portions)
5. When riding steps or ladders of any equipment, have a firm grip with one hand before releasing the other hand.

H. **On or about Engines, Cars or Trains:**

3. When train is moving in yards or any place where it is known that it is likely to stop, reduce speed, or when slack action may occur, employees must have firm hand and foot holds and, if possible, must be seated in engines to avoid injury from sudden starts, lurches, or jerks.

5. Employees are prohibited from riding:

B. On draw bars, brake beams, truck side frames, and brake wheels at any time. Employees may ride on end ladders and end sills of ore cars which are equipped with an air hose above the draw bar only for the purpose of controlling the movement through the use of air brakes.

6. When using ladders on cars or engines, employees must:

A. Face the equipment.
B. Keep feet turned slightly sideways.

C. Place maximum portion of ball of foot on ladder rung.
D. Hold body close to ladder.
E. Grasp a SEPARATE grab iron with EACH hand.