5. Review of Accident Data

Review of railroad accidents provides an indication of the potential risk and consequences of sudden incapacitation of the employee while performing a safety critical function. Five sources of accident and casualty data were examined: NTSB railroad accident reports, FRA Accident/Incident data, FRA Illness/Injury data, FRA Employee-on-Duty Fatality reports, and FRA survey data on use of prescription and over-the-counter drugs.

5.1 NTSB Reports

Review of NTSB accident reports for the period 1989 to 2003 identified a total of eight rail accidents in which the medical condition of the operator was either related to the cause of the accident or put the operator at risk of sudden incapacitation. Five of these accidents involved Class 1 or commuter railroads and the remaining three involved rail transit operations. Table 18 summarizes the railroad accidents and Table 19 summarizes the transit accidents.

5.1.1 Railroad Accidents Investigated by NTSB

From 1989 to 2003, NTSB accident investigations have revealed two cases in which medical condition of a crew member was the probable cause of the accident. In two other accidents, NTSB believed medical condition was related to probable cause, but not the probable cause itself. In a fifth case, the NTSB discovered undiagnosed medical conditions in the process of conducting its investigation. While the medical conditions were not directly linked to the probable cause of the accident, they did create a safety risk.

On November 15, 2001, Canadian National/Illinois Central Railway (CN/IC) southbound train 533 and northbound train 243 collided near Clarkston, Michigan. Train 533 continued through a stop indication before proceeding onto the mainline track, while train 243 was operating on a proceed signal on the single main track when the trains collided. Both crewmembers of train 243 were fatally injured, while the two crewmembers of train 533 sustained serious injuries. The total cost of the accident was approximately $1.4 million. The NTSB determined that the probable cause of the accident was the train 533 crewmembers' fatigue, which was primarily due to the engineer's untreated and the conductor's insufficiently treated obstructive sleep apnea.

The second occurrence in which medical condition of the operator was directly linked to probable cause involved a head-on collision between two commuter trains. NTSB attributed the accident to the failure of the engineer to perceive correctly a red signal aspect because of his diabetic eye disease and resulting color vision deficiency. The engineer failed to report a vision problem during annual medical examinations. Contributing to the accident was the contract physician's use of an eye examination not intended to measure color discrimination. The engineers on both trains and one passenger were killed, and there were a total of 158 injuries, ten of which were serious. Total cost was estimated at $3,328,624 (Secaucus, NJ, February 9, 1996).

Two accidents occurred in which the NTSB believed medical condition was related to probable cause, but not probable cause in itself. The first involved the collision of two freight trains due to the failure of one engineer to stop at the stop signal because he was asleep, distracted, or inattentive. The NTSB investigation discovered that the engineer had not been medically

Table 18. Railroad accidents investigated by NTSB (1989-2003)

Report Number	Location and Date	Description	Probable Cause	Related Medical Issue
NTSB/RAR-02/04	Clarkston, MI November 15, 2001	Collision of two Canadian National/Illinois Central Railway Trains	Failure to stop at signal due to crewmembers' fatigue	Engineer's untreated and conductor's insufficiently treated obstructive sleep apnea
NTSB/RAR-97/01	Secaucus, NJ February 9, 1996	Near Head-On Collision and Derailment of Two New Jersey Transit Commuter Trains	Failure of engineer to perceive correctly a red signal aspect	Operator's diabetic eye disease and resulting color vision deficiency
NTSB/RAR-91/02	Sugar Valley,GA August 9, 1990	Collision and Derailment of Norfolk Southern Train 188 with Norfolk Southern Train G-38	Failure of engineer to stop because he was asleep, distracted, or inattentive	Engineer and crew members being treated for hypertension and/or diabetes. Not known or monitored by railroad's medical department
NTSB/RAR-93/02/SUM	Palatka, FL December 17, 1991	Derailment of Amtrak Train 87, Silver Meteor	Failure of engineer to maintain full attention to train location and failure to slow for speed restriction	Engineer's combination of prescription and over-the-counter medications, illness, and poor sleep
NTSB/RAR/01/04	Syracuse, NY February 5, 2001	Rear-End Collision of National Railroad Passenger Corporation (Amtrak) Train P286 with CSX Freight Train Q620 on the CSX Railroad	Engineer's inattention to the operation of his train, which led to his failure to comply with the speed limit	Minor visual changes and/or mild cognitive dysfunction resulting from unrecognized and untreated diabetes

examined in 5 years, a violation of company rules, which required a medical examination every 2 years. He and his three other crew members were being treated for hypertension and diabetes, diseases that were not being monitored by the railroad's medical department. Of the seven collective crew members on both trains, both conductors and one engineer were fatally injured. The trainmen on both trains, and the other engineer received minor injuries. The total cost was estimated at $1,260,680 (Sugar Valley, GA, August 9, 1990).

The second accident in which medical condition was related to probable cause was linked to inattention of the engineer, not maintaining full awareness of the train location, and failing to slow for the speed restriction in enough time to turn the curve. As a result, the train derailed and struck two homes and blocked off a local street. It was later discovered that the engineer had taken a number of over-the-counter and/or prescription medications days before, and the night before the accident. One conclusion drawn by the NTSB was that carrier reliance on its employees to contact physicians about "questionable medication use" requires the employees to interpret the term "questionable," which may be beyond the capability of employees. Eleven people sustained serious injuries and 50 received minor injuries. Total damage was estimated at $1.4 million (Palatka, FL, December 17, 1991).

Finally, there was one accident in which medical condition was not directly linked to probable cause, but later led to investigations which revealed unknown medical conditions of the operator. A rear-end collision of a passenger train with a freight train was caused by the engineer's inattention to the operation of his train, which led to his failure to recognize the speed limit. The

physical condition of the engineer at the time of the accident was not believed to significantly affect his ability to perceive and respond to the signals or properly control the train. However, during post accident medical evaluations, the engineer told examining physicians that he had been experiencing symptoms of diabetes for several months including burning of his feet and increased thirst, but did not alert the railroad or his physician. The NTSB stated that in general the engineer may have been suffering from some minor visual changes and even some mild cognitive dysfunction as a result of his unrecognized and untreated diabetes. The accident resulted in injuries to all four crew members and 58 of the passengers. Damages totaled $280,600 (Syracuse, NY, February 5, 2001).

5.1.2 Rail Transit Accidents

Although the FRA is statutorily excluded from regulating urban rapid transit operations (that are not connected to the general railroad system of transportation), accidents involving this type of rail operation were a part of the accident review because the consequences of sudden operator incapacitation are similar to those for railroad operations.

On August 15, 2000 a light rail vehicle accident involved a train failing to stop at an airport station, continuing through, and striking a hydraulic bumping post at the end of the track, ultimately derailing. Seventeen of the 22 people on the train (including the operator) were injured, although none of the injuries were life-threatening. The NTSB stated that the probable cause was the operator's severe fatigue, resulting from undiagnosed obstructive sleep apnea. The estimated cost of the accident was $935,000 (Baltimore, MD).

The use of illicit drugs by an operator was the probable cause of a similar transit accident. Impairment due to the use of cocaine caused the engineer of a light rail vehicle to run a stop light before it struck a bumping post at the end of the track. Eighteen of 26 people (including the operator) were injured – five of them seriously. The estimated cost of the accident was $924,000 (Baltimore, MD, February 13, 2000).

A third transit accident involved the collision of one train into a second standing train. This was reportedly due to the failure of management and board of directors to fully understand and address the design features and incompatibilities of the automatic train control system before establishing it as the standard operating mode at all times. As a result of the investigation however, it was discovered that the engineer was taking Tylenol 3 which contains codeine, as well as a number of other over-the-counter cold medications. The train operator's medical records contained no documentation of a warning of possible side effects or interactions with other medications. The Safety Board was concerned with the medical office that permitted the train operator to use Tylenol 3 while on duty. The operator of the train was killed in the accident. The train's two passengers were uninjured. Total damages were estimated between $2.1 and $2.6 million (Gaithersburg, MD, January 6, 1996).

5.2 FRA Accident/Incident Data

The data in Table 20 and Table 21 was drawn from the FRA accident/incident database. The information retrieved from the database was limited to those accidents indicating that the physical condition of the employee was the cause of the accident. The FRA codes the physical condition of the employee as follows: H101 – impairment of efficiency or judgment because of drugs and alcohol; H102 - incapacitation due to injury or illness; H103 – employee restricted in

Table 19. Rail transit accidents investigated by NTSB (1989-2003)

Report Number	Location and Date	Description	Probable Cause	Related Medical Issue
NTSB/SIR-01/02	Baltimore, MD August 15, 2000	Light Rail Vehicle Accident at Baltimore-Washington International Airport Transit Station	Failure to stop train before it struck bumping post	Severe fatigue of operator resulting from undiagnosed obstructive sleep apnea
NTSB/SIR-01/02	Baltimore, MD February 13, 2000	Light Rail Vehicle Accident at Baltimore-Washington International Airport Transit Station	Failure to stop train before it struck bumping post	Operator impairment by illicit and/or prescription drugs
NTSB/RAR-96/04	Gaithersburg, MD January 6, 1996	Collision of Washington Metropolitan Area Transit Authority Train T-111 with Standing Train at Shady Grove Passenger Station	Failure of management and board of directors to fully understand incompatibilities of automatic train control system before establishing it as the standard operating mode at all times	Operator was using Tylenol 3, which contains codeine, while on duty. No education program in place for employees in safety-critical positions dealing with the use and effects of medications

work or motion; H104 – employee asleep; or H199 – employee physical condition, other. Only accidents containing these codes were examined. The comment field in the database was reviewed to help identify the cause of the operator's condition.

Of the 50 FRA reportable accidents since 1989 with primary causes tied to employee physical condition, six are linked to drug and alcohol use, one was the result of a diabetic coma, 42 were categorized as "employee asleep" – with one being a blackout, and finally one was a blackout due to high blood pressure – categorized as "employee physical condition/other." From the information available in the database, it is unclear whether the incidents listing "employee asleep" as the primary cause were a direct result of a medical condition, or simply due to lack of sleep.

Of these 50 incidents, only three can be positively tied to medical condition of the employee (one diabetic coma and two blackouts). The NTSB did not investigate any of these accidents.

Of the 31 FRA reportable accidents since 1989 with secondary cause tied to employee physical condition, 17 are linked to drug and alcohol use, one was from incapacitation due to injury or illness, nine were categorized as "employee asleep," and four were categorized as "employee physical condition/other." From the information available in the database, it is unclear whether the incidents listing "employee asleep" as the secondary cause were a direct result of a medical condition, or simply due to lack of sleep.

None of these 31 incidents can be positively tied to medical condition of the employee. The NTSB did not investigate any of these accidents.

Table 20. FRA Accidents/Incidents due to employee physical condition by primary cause code (1989-2003)

FRA Cause Code	Definition	Number of accidents/incidents	Nature of Condition
H101	Impairment of efficiency or judgment because of drugs or alcohol	6	1 due to alcohol 1 due to cocaine 4 unclear
H102	Incapacitation due to injury or illness	1	Diabetic Coma
H104	Employee asleep	42	1 blackout 41 fell asleep[16]
H199	Employee physical condition/other	1	Blackout due to high blood pressure
Total		**50**	

5.3 FRA Injury and Illness Data

The data in Table 22 was retrieved from the FRA Injury/Illness data base. This information was limited to those accidents indicating that the probable reason for injury/illness was due to either impairment from substance use (Circumstance Code 07), or impairment related to physical condition or fatigue (Circumstance Code 08). Only injuries/illnesses containing these codes were examined.

Of the 975 FRA reportable injury/illness reports since 1997 linked to substance use or physical condition and fatigue, five were positively related to medical condition, 30 were questionably related, and the remaining 940 are incomplete or unclear. The five reports that were directly connected to medical condition include three substance abuse cases, one seizure, and one heart attack. Those reports considered questionably related to medical condition listed the following causes: sleep; asthma attack; blurred vision; degenerative disk disease; disintegrated ligaments; chest pains; emotional stress; and the aggravation of a pre-existing condition – including elbow/arm/shoulder, back, knee, and groin related injuries. Nine hundred forty reports lacked sufficient information to link the injury/illness to a medical condition.

[16] It is not possible to determine whether sleep resulted from a medical condition or fatigue.

Table 21. FRA Accidents/Incidents due to employee physical condition by secondary cause code (1989-2003)

FRA Cause Code	Definition	Number of accidents/incidents	Nature of Condition
H101	Impairment of efficiency or judgment because of drugs or alcohol	17	4 due to alcohol; one conductor found to be taking Rx Tricor (cholesterol), and Lipracore (blood pressure) 1 due to cocaine 12 unclear
H102	Incapacitation due to injury or illness	1	Unclear
H104	Employee asleep	9	Operator fell asleep[17] In one of these cases, conductor was found to be taking Rx Lotrel, and Propel (for blood pressure)
H199	Employee physical condition/other	4	Unclear
Total		**31**	

5.4 FRA Employee-on-Duty Fatalities

In January 2003, the FRA began collecting data on employee-on-duty fatalities.[18] This data is separate from both FRA accident/incident data as well as injury/illness data. From January to December 2003, 20 of 36 total employee-on-duty fatalities were a result of medical condition. Seventeen were caused by a heart attack, one from a stroke, one from illness, and one undetermined cause. All but two of these medically caused fatalities involved personnel holding positions with safety-sensitive functions. Sixteen of these were caused by heart attacks, and two were undetermined. From January to October of 2004, 10 of 22 employee-on-duty fatalities were the result of a medical condition; all suffered a fatal heart attack. Eight of the 10 worked in jobs with safety-sensitive functions. Although these individual fatalities did not lead to accidents, the potential for catastrophe existed. These figures shed further light on the prevalence of potentially incapacitating medical conditions in the industry.

[17] It is not known whether sleep was due to medical condition or fatigue

[18] Data available at http://www.fra.dot.gov/Content3.asp?P=1425.

5.5 Use of Performance Degrading Drugs

In April 2002, FRA regional investigators began to administer post-accident prescription/ over-the-counter (OTC) drug questionnaires to those involved in accidents attributed to human factors causes. The information is self-report, and is separate from any drug/alcohol testing that may be conducted. Individuals involved voluntarily report any prescription/OTC drug use, and may choose not to report. Between April 9, 2002 and July 30, 2004 there were 78 regionally investigated, human factors caused accidents, involving 175+[19] individuals, in which prescription/OTC questionnaires were voluntarily completed. Of this group, there were 15 accidents involving 17 employees who were taking prescription/OTC drugs that had the potential to affect alertness and/or cognitive ability. (Table 23 provides a summary of these individuals). Fifteen of these employees held safety-sensitive positions at the time of the incident, one was a track inspector, and a second position was unlisted. In the same timeframe there were an additional 27 human factors caused accidents in which prescription/OTC questionnaires were not completed. From the available data, it is not possible to determine how many employees were involved in these additional accidents. (FRA Office of Safety, personal communication, August 3, 2004). Based on the available data, approximately 10 percent of the employees involved in human factors accidents were taking drugs that had the potential to degrade performance.

[19] Four of the 78 accidents were refusals to report, so did not list the number of employees. One accident report is currently incomplete.

Table 22. FRA Injury and Illness Reports for which operator impairment was probable reason (1997-2003)

Link between Medical Condition and Injury/Illness	Medical Condition	Number	Probable Reason (Circumstance Code)
Clear	Substance Abuse	3	07[20]
	Seizure	1	08[21]
	Heart Attack	1	08
Questionable	Sleep	1	08
	Asthma Attack	1	08
	Blurred Vision	1	08
	Degenerative Disk Disease	1	08
	Disintegrated Ligaments	1	08
	Chest Pains	1	08
	Emotional Stress/ Work Stress	2	08
	Aggravation of Pre-Existing Condition:	22	08
	• Arm/Shoulder/Elbow	3	
	• Back	12	
	• Knee	4	
	• Groin	3	
Incomplete	Unclear or Unknown	940	Unclear
Total		**975**	

[20] 07 - impairment due to substance use

[21] 08 - impairment due to physical condition or fatigue

Table 23. Use of prescription and over-the-counter medications by employees involved in human factors accidents (April 9, 2002 – July 30, 2004)

Accident Type	Position	Medication(s)
Impact w/ injury (head on collision)	Engineer	Rebetol 1200mg 2xday Peginterfron Alfazb 1xweek
Major - Fatality	Engineer	Rx Flexaril daily on/off 3yrs Rx Zanaflex daily
Major - $1 M	Engineer	Rx Vicprofen 200/75 as needed
Major - Fatality	Engineer	Rx Zoloft 50 mg (depression)
Impact w/$150,000	Position unlisted	Rx Lithobid 1200 mg Rx Lorazepan 1 mg Rx Celexa 20 mg
RCL switching collision	Foreman	Antihistamine/day Ambien 3xweek
Impact w/$150,000	Brakeman	Rx Darvocet 100/650 tab daily for 3 weeks
	Engineer	Rx Effexor XR 75 mg daily for 3 months
Major – Fatality	Track Inspector	OTC Sleeping pill
	Switchman	Rx Prozac 40 mg daily Rx Thorazapan since 1998 as needed, last taken 2 days before
Impact w/ Injury	Dispatcher	Rx Klonopin 3xday for dizziness since 1992 and now taking Paxil since 2000
Impact w/ Injury	Conductor	Rx Effexor 1 daily for 3 months
Fatal Train Incident	Engineer	Rx Atrovane .5 mg anti-psychotic daily Rx Seroguel 2.5 mg anti-psychotic (dealing with fatality)
Impact w/ Injury	Engineer	Rx Zoloft 100 mg daily
Impact w/$150,000	Engineer	Rx Ambien 10 mg as needed (2xmonth) less than a year Rx Adderall 10 mg as needed (20xmonth) less than a year
Major - Fatality	Engineer	Bupro 100mg
Impact with Injury	Engineer	Cylert 10mg for ADD