



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

January 11, 2022

Michelle Watters, MD, PhD, MPH
Medical Officer

A. ACCIDENT: RRD21LR009 – Louisiana, Missouri

Accident Type: Struck by train movement
Location: Dyno Nobel, Inc., Louisiana, MO
Date: April 7, 2021
Time: 3:30 p.m. CDT
Carrier: BNSF Railway (BNSF)
Train: Train BNSF Local 387

B. GROUP IDENTIFICATION

Michelle Watters, MD, PhD, MPH
Medical Officer
National Transportation Safety Board

Theodore Aquino, DO, MBA, MSPH, FACOEM
Chief Medical Officer
BNSF Railway

C. ACCIDENT SUMMARY (from Preliminary Report¹)

On April 7, 2021, at 3:30 p.m. local time, a BNSF Railway (BNSF) conductor was killed while dropping off and picking up cars in an industry facility outside of Louisiana, Missouri. The train, BNSF Local 837, consisted of two locomotives, 21 cars, and a modified flat car. The train crew consisted of one engineer, one conductor, and one brakeman. Immediately before the accident, the engineer was moving the train southeast on a Dyno Nobel, Inc. industrial track at a speed less than 9 mph with the conductor controlling the movement with the engineer by radio while standing on the ground. The brakeman was riding the north side of the eighth railcar. Preliminary information indicates that during the movement, radio communication between the conductor and the locomotive engineer ceased. The engineer stopped the movement, at which point the brakeman observed the conductor lying on the ground next to the rail on the south side of the car.

¹ NTSB Preliminary Report: Railroad – RRD21LR009. Adopted 5/4/21. Available at: [Preliminary Report - Railroad: BNSF Railway Employee Fatality \(ntsb.gov\)](#)

D. DETAILS OF INVESTIGATION

1. Purpose of Study

This investigation was performed to evaluate the BNSF Local 837 train crew (conductor, engineer, and brakeman) for any medical conditions, use of medications/illicit drugs, or the presence of any toxins.

2. Methods

BNSF occupational health records and Federal Railroad Administration (FRA) post-accident testing² toxicology reports for the conductor, engineer, and brakeman were reviewed. The autopsy report, personal medical records, and Federal Aviation Administration (FAA) Forensic Sciences Laboratory³ toxicology report for the conductor were reviewed. Other pertinent scientific and regulatory issues were reviewed.

3. Relevant regulation and protocols

a. Federal Regulation

Per the Code of Federal Regulations, locomotive engineers and railroad conductors are required to meet or exceed vision and hearing standards (49 CFR parts [240.121](#) and [242.117](#), respectively). The vision and hearing requirements for engineers and conductors are comparable. For distant vision, acuity must be at least 20/40 in each eye and together either with or without corrective lenses, field of vision must be at least 70 degrees in the horizontal median for each eye, and color vision must allow recognition and differentiation of the colors of railroad signals. The person's hearing acuity must meet or exceed the following threshold: the person does not have an average hearing loss in the better ear greater than 40 decibels (dB) at 500, 1000, and 2000 hertz (Hz) with or without use of a hearing aid. FRA regulations do not require any other medical evaluation, testing, or any review of medical conditions and medications in use.

b. BNSF Medical Protocols

In accordance with federal regulations described above, BNSF requires engineers and conductors to triennially undergo a medical evaluation in connection with initial certification and re-certification (Title 49 CFR Parts 240 and 242).

In addition to the regulatory requirements, BNSF includes guidance on medical conditions in the company safety rules, which state: "All employees are responsible to ensure their personal medical condition does not interfere with their ability to safely perform their duties. Employees with medical conditions (such as uncontrolled diabetes, high blood pressure, sleep disorders including apnea, visual impairment, hearing impairment, etc.) that may adversely affect their ability to work safely must inform their medical practitioner of their job duties. The medical provider must then determine if any prescribed treatment including medication will impair the employee from safely performing their job duties. The employee

² As part of FRA's post-accident toxicology testing, Quest laboratory performed initial testing on urine specimens for amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, MDMA/MDA, methadone, opiates/opioids, phencyclidine, tramadol, brompheniramine, chlorpheniramine, diphenhydramine, doxylamine, and pheniramine and blood specimens for ethyl alcohol. Confirmatory testing was performed on any compounds that screened positive.

³ The FAA Forensic Sciences Laboratory tests specimens for over 1,300 compounds including toxins, prescription and over-the-counter medications and illicit drugs; information about these compounds can be found at the Drug Information Web Site (<https://jag.cwsami.jccbi.gov/toxicology/>).

must also notify their personal physician/medical provider if prescribed treatment and/or medication is affecting their ability to safely perform their job duties.”⁴

E. FINDINGS

1. Conductor

The conductor was 56 years old at the time of the accident.

a. BNSF Occupational Medical Records and Historical Drug Test Records

According to his occupational medical records from BSNF, the conductor underwent a post offer exam in June 1996 that included a series of questions about previously diagnosed medical conditions, review of recent medication use, evaluation of vital signs, hearing and vision tests, a urine dip test for sugars and protein, and a physical examination. He reported no medication use or medical conditions. The conductor was found medically qualified.

There was an occupational medical report of a medical leave for a work-related right knee injury in November 2016, the conductor returned to work in December 2016. The conductor also had two days of trauma leave in November 2007.

The conductor had periodic hearing and vision testing performed every three years since 2007; prior to 2007, he had testing in September 1997 and April 1999. On his most recent hearing questionnaire in January 2018, he reported taking unspecified prescription medications. His vision at the January 2018 required him to wear glasses for distance vision. Starting with his January 2010 hearing test, he was reported to have a high pitch hearing loss in his left ear.

Historical drug testing records were provided by BNSF for the conductor that included pre-employment urine drug testing in May 1996 and reasonable cause alcohol and urine drug testing in January 2018. The conductor had random alcohol and urine drug testing in August 2015, January 2016, November 2016, September 2017, and twice in October 2020; he also had a random alcohol test in October 2018. All the conductor’s historical alcohol and urine drug testing results were negative.

b. Autopsy

According to the autopsy report from the Coroner’s Office, Pike County, Missouri, the cause of death of the conductor was blunt force trauma to the neck secondary to a railroad accident. The medical examiner reported that the conductor was obese and had an enlarged heart (740 grams), 70% atherosclerosis in his right coronary artery, and 60% atherosclerosis in his left anterior descending coronary artery.

c. Personal medical records

Primary care medical records for the conductor were obtained for the three years prior to the accident. The conductor’s most recent visit was on 3/3/21, his prior visit was one year earlier on 2/18/20. Records showed he was 71 inches tall and weighed 277 pounds; he had a body mass index (BMI) of around 38 kilograms per square meter.⁵ The conductor had multiple medical conditions and complaints including:

⁴ BNSF TY&E (Train Yard and Engine) Safety Rules. S-1.2.12 Medical Conditions – January 1, 2015.

⁵ BMI is calculated from body weight and height. BMI of 18.5 to less than 25 is considered normal weight. BMI of 25 to less than 30 is considered overweight. BMI of 30 to less than 40 are considered obese. A BMI 40 or greater is

- High blood pressure. He was being treated with hydrochlorothiazide, losartan, and metoprolol. His reported his blood pressures as running 150s to 160s over 100-105, so the medication amlodipine was added to his treatment plan.
- Type 2 diabetes with peripheral neuropathy, hyperglycemia, and previous foot ulcers. His most recent hemoglobin A1C was 7.1% on 2/14/19.⁶ He had stopped taking any medications to treat diabetes, so semaglutide (commonly marketed as Rybelsus) was prescribed.
- Peripheral neuropathy. On physical exam, he was noted to have decreased sensation to touch in his toes. He had been prescribed and had been taking vitamin B12.
- Foot ulcers. At the March 2021 visit, a callus was noted on his left foot, but no abscesses or ulcers. At his office visit in February 2020, he was referred to a podiatrist who noted ulcers and calluses on both feet, left worse than right, and cellulitis in his left foot. He was prescribed antibiotics.
- High cholesterol. The conductor had discontinued his previous medication and was prescribed rosuvastatin at the March 2021 visit.
- Coronary artery disease. The conductor denied chest pain. It was noted that the conductor had a heart catheterization study in May 2013 which showed 80% stenosis in a small coronary diagonal branch; medical management was recommended.
- Joint pain/osteoarthritis. At visits in 2018 and 2019, he received steroid injections for knee pain. He was taking daily high dose aspirin and at the recent visit was prescribed high dose acetaminophen.
- Mild depression. The conductor was categorized as having moderate depression severity on the patient health questionnaire screening (PHQ-9) at the March 2021 visit.⁷ He reported trouble falling or staying asleep nearly every day; feeling tired or having little energy and feeling down, depressed, or hopeless more than half the days; and feeling bad about himself, having little interest or pleasure in doing things, and trouble concentrating for several days in the past two weeks. The conductor refused counselling or medication.
- Nocturnal hypoxemia. The conductor had an overnight pulse oximetry⁸ study performed on 10/15/18. He had complained of having a lot of fatigue at his 9/13/18 office visit. The study showed the conductor had oxygen saturation at or below 88% for 48.6 minutes, or about 10% of the evaluation period; his lowest oxygen saturation was 62%. His health care provider informed the conductor that he met the criteria for starting overnight oxygen (oxygen saturation at or below 88% for 5 minutes or more) and that he should have a sleep study performed; the conductor refused both. At the March 2021 office visit, the conductor said he was agreeable to oxygen and was prescribed 2 liters of oxygen for nighttime use; he refused a sleep study and said he would not wear Bi-Pap.

considered extremely obese. [National Institutes of Health (NIH). U.S. National Library of Medicine (NLM). [Overweight: MedlinePlus Medical Encyclopedia](#) Last updated 10/5/21.]

⁶ Hemoglobin A1C is a measure of the percentage of hemoglobin molecules that have a glucose molecule attached to them. The test measures the average blood glucose over the past three months. Above 6.5% indicates diabetes; for diabetic individuals, often the A1C goal is below 7.0%. [NIH. NLM. [A1C: MedlinePlus](#) Last updated 5/5/21.]

⁷ The PHQ-9 is an instrument used by clinicians to identify depression in their patients. The depression module has nine criteria that are scored as “0” (not at all) to “3” (nearly every day during the past two weeks.) Total scores between 10-14 indicate moderate depression. [See: Kroenke, K, RL Spitzer, JBW Williams. 2001. The PHQ-9. Validity of a brief depression severity measure. *Journal of General Internal Medicine* 16(9):606-613.]

⁸ A pulse oximetry test involves wearing a small electronic sensor that measures oxygen, usually on a fingertip. Normal oxygen saturation ranges between 95% to 100%. [NIH. NLM. [Pulse Oximetry: MedlinePlus Medical Test](#) Updated 7/27/21.]

d. Toxicology

The conductor's FRA post-accident blood alcohol and urine drug testing were negative. FAA Forensic Sciences Laboratory toxicology testing detected the high blood pressure medications amlodipine, losartan, and metoprolol in the conductor's blood and urine. These medications are not considered impairing.⁹ Toxicology testing performed for the Coroner's Office, Pike County, Missouri, detected the high blood pressure medication amlodipine, caffeine, and cotinine (an indicator of tobacco and nicotine usage) in the conductor's cardiac blood.

2. Engineer

The engineer was 38 years old at the time of the accident.

a. BNSF Occupational Medical Records and Historical Drug Test Records

According to his occupational medical records from BSNF, the engineer underwent a post offer exam in January 2012 that included a series of questions about previously diagnosed medical conditions and prescription medication use, evaluation of vital signs, and hearing and vision tests. He reported no prescription medication use or medical conditions. The engineer was found to be qualified with the restriction that corrective lenses were required.

There was a return to work full duty documentation for the engineer's three week absence starting in May 2014 for a non-work related injury to his fifth left finger.

Periodic hearing and vision testing were performed every three years; the engineer passed all hearing tests and required corrective lenses for distant vision. On his most recent hearing questionnaire in December 2020, he reported taking no prescription medications.

Historical drug testing records were provided by BNSF for the engineer that included pre-employment hair and urine drug testing in January 2012 and reasonable cause alcohol and urine drug testing in August 2018. He had random alcohol testing in August 2013, March 2016, August 2018, March 2020, September 2020, and December 2020; he had random urine drug testing in March 2016, March 2020, and September 2020. All the engineer's historical alcohol and urine and hair drug testing results were negative.

b. Toxicology

The engineer's FRA post-accident blood alcohol testing was negative; his urine drug testing was positive for the sedating over-the-counter antihistamine/sleep-aid doxylamine at 614.7 nanograms per milliliter (ng/mL).¹⁰ Doxylamine is one of the ingredients in the product marketed as Nyquil.¹¹

⁹ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs. Amlodipine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=128>
Losartan. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=151>
Metoprolol. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=171>

¹⁰ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs. Doxylamine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=53>

¹¹ National Institutes of Health (NIH). U.S. National Library of Medicine (NLM). [DailyMed - VICKS NYQUIL COLD AND FLU NIGHTTIME RELIEF- acetaminophen, dextromethorphan hydrobromide, and doxylamine succinate capsule, liquid filled \(nih.gov\)](#) Updated 12/3/21.

3. Brakeman

The brakeman was 46 years old at the time of the accident.

a. BNSF Occupational Medical Records and Historical Drug Test Records

According to his occupational medical records from BSNF, the brakeman underwent a post offer exam in December 2005 that included a series of questions about previously diagnosed medical conditions and prescription medication use, hearing and vision tests, and a functional capacity evaluation. The brakeman received an evaluation of his left knee because of his arthroscopic surgery in 1992. He reported no prescription medication use or medical conditions. The engineer was found to be qualified without restrictions.

Periodic hearing and vision testing were performed about every three years; the brakeman passed all hearing tests and required no glasses for distant vision. On his most recent hearing questionnaire in December 2018, he reported taking no prescription medications.

Historical drug testing records were provided by BNSF for the brakeman that included pre-employment hair and urine drug testing in November 2005 and December 2005, respectively. He had reasonable cause alcohol and urine drug testing in October 2011, March 2012, and September 2018. The brakeman had random alcohol testing in August 2015, July 2017, September 2018, October 2018, and February 2019; he had random urine drug testing in January 2014 and October 2018. All the brakeman's historical alcohol and urine and hair drug testing results were negative.

b. Toxicology

The brakeman's FRA post-accident blood alcohol testing was negative; doxylamine was detected in his blood at 56.3 ng/mL and in his urine at 7,275.2 ng/mL.

F. SUMMARY OF MEDICAL FINDINGS

The 56-year-old male conductor was medically certified for his duties but was required to wear corrective lenses. Starting with his January 2010 hearing test, he was reported to have a high pitch hearing loss in his left ear. According to BNSF occupational medical records, the conductor was off work for a work-related right knee injury in November 2016 and had two days of trauma leave in November 2007. All the conductor's historical alcohol and urine drug testing results were negative.

According to the autopsy report, the cause of death of the conductor was blunt force trauma to the neck, secondary to a railroad accident. The medical examiner reported that the conductor was obese and had an enlarged heart (740 grams), 70% atherosclerosis in his right coronary artery, and 60% atherosclerosis in his left anterior descending coronary artery.

Based on personal medical records, the conductor's most recent visit to his primary care doctor was one month prior to the accident in March 2021. At that visit, he was 71 inches tall and weighed 277 pounds with a body mass index of 38 kilograms per square meter. The conductor was being treated for high blood pressure with hydrochlorothiazide, losartan, metoprolol, and amlodipine; diabetes with semaglutide; peripheral neuropathy with Vitamin B12; high cholesterol with rosuvastatin; and joint pain/osteoarthritis with aspirin and acetaminophen. He had a history of foot ulcers, but no current ulcers. The conductor had coronary artery disease; a heart catheterization study in May 2013 showed 80% stenosis in a small coronary diagonal branch. No surgical intervention was advised. The conductor's depression screening categorized him as

having moderate depression severity; he refused counselling or medication. The conductor had a history of nocturnal hypoxemia. His overnight pulse oximetry study in October 2018 showed oxygen saturation at or below 88% for about 10% of the evaluation period; his lowest oxygen saturation was 62%. In 2018, he refused a sleep study and overnight oxygen; at his March 2021 office visit, the conductor agreed to and was prescribed oxygen for nighttime use. He refused a sleep study and a positive airway pressure device.

The conductor's FRA post-accident blood alcohol and urine drug testing were negative. The FAA Forensic Sciences Laboratory toxicology testing detected amlodipine, losartan, and metoprolol in his blood and urine. Toxicology testing performed by the Coroner's Office, Pike County, Missouri, detected the high blood pressure medication amlodipine, caffeine, and cotinine in the conductor's cardiac blood.

The 38-year-old male BNSF engineer was medically certified for his duties but was required to wear corrective lenses. His FRA post-accident blood alcohol testing was negative; his urine drug testing was positive for the over-the-counter antihistamine/sleep-aid doxylamine at 614.7 ng/mL.

The 46-year-old male BNSF brakeman was medically certified for his duties. His FRA post-accident blood alcohol testing was negative; doxylamine was detected in his blood at 56.3 ng/mL and in his urine at 7,275.2 ng/mL.