National Transportation Safety Board
Office of Research and Engineering
Washington, DC 20594

RRD23FR002

MEDICAL

Specialist's Factual Report

May 9, 2023

TABLE OF CONTENTS

A. ACCIDENT

Location: Beaumont, Texas
Date: October 28, 2022

B. MEDICAL SPECIALIST

Specialist: Turan Kayagil, MD, FACEP
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

1.0 Purpose

This investigation was performed to evaluate the fatally injured conductor and the uninjured engineer for medical conditions, the use of substances, and the presence of toxins.

2.0 Methods

The conductor's occupational health records and selected personal medical records from his primary care provider were reviewed. The conductor's autopsy report was reviewed, as were his NMS Labs postmortem toxicology report and his Federal Railroad Administration (FRA) post-accident toxicology report. At the request of the National Transportation Safety Board (NTSB), the Federal Aviation Administration (FAA) Forensic Sciences laboratory also performed toxicological testing on postmortem specimens from the conductor; these results were reviewed.

The engineer's FRA post-accident toxicology report was reviewed, as were records from his most recent occupational health evaluation.

Selected NTSB investigator reports and relevant regulation and medical literature were also reviewed.

D. FACTUAL INFORMATION

1.0 Conductor

1.1 Occupational Health Records

According to the 65-year-old male conductor's occupational health records, as part of his pre-employment process, he completed a confidential medical history

questionnaire for his employer on May 9, 2018.[1] On this questionnaire, he responded "yes" to questions of whether he had ever had numbness of his extremities, heart disease, diabetes, stroke, high or low blood pressure, and rotator cuff injury. He provided comments that indicated his numbness was associated with diabetes, his heart disease was angina (chest pain caused by the heart muscle not getting enough blood), his stroke was mild, and his rotator cuff injury had been treated with two surgeries. He indicated that he did not have any other long-term health problems or adverse physical conditions, and that he did not have any restrictions or limitations upon his physical activities. The questionnaire did not ask about medication use.

According to the reviewed occupational health records, the conductor underwent a pre-employment medical evaluation for the position of switchman on May 14, 2018. For this evaluation, the conductor underwent vision and hearing testing, a physical examination, a functional capacity evaluation (technician-observed performance of certain walking, climbing, squatting, lifting, pushing, and pulling tasks), and limited laboratory tests (a complete blood count and a urinalysis). At the time of his pre-employment physical examination, he was 72 inches tall and weighed 271 pounds (corresponding to obesity). His blood pressure was 140/80 (somewhat elevated). The technician who performed the conductor's functional capacity evaluation found that the conductor was able to complete the evaluation tasks, appeared to have normal gross coordination, and did not appear to fatigue easily. The conductor was medically cleared as fit for switchman duties with no restrictions. His laboratory results were reported the next day and were remarkable only for a small amount of glucose (a finding which may be related to elevated blood sugar in diabetes). A notation on the laboratory report indicated that the results had been reviewed, that the conductor should follow up with his primary care doctor, and that he was okay to work.

Reviewed occupational health records indicated that the conductor underwent recurrent vision and hearing testing during his employment. His most recent occupational vision and hearing testing was on May 26, 2022; he was cleared for switchman duty based on the results. Vision testing documentation did not include documentation of visual fields; otherwise, the documented vision testing and audiometry results met federal standards for conductors.[2] The conductor's previous

[1] This questionnaire was an employer-specific form related to the "Second Injury Fund." As explained on the questionnaire, the Second Injury Fund, established by state and federal laws, is designed to encourage employers to hire and retain persons who have suffered a prior injury or have a pre-existing medical condition. If such an employee later suffers an on-the-job injury, and the effects of this injury are made worse by the employee's pre-existing injury or condition, the employer may be eligible for reimbursement from the Second Injury Fund. To be granted such a request, the employer would need to show that it had knowledge of the employee's prior accidents, injuries, and medical conditions. The conductor's employer could use the questionnaire to do so. The employer stated on the questionnaire that, for individuals applying for employment, "we may also use the information in this form to help determine your ability to perform the essential functions of your job."

[2] FRA medical fitness standards for conductors consist of vision and hearing requirements that must be met by conductors prior to each certification/recertification (49 Code of Federal Regulations § 242.117).

vision and hearing testing (which he also had passed) had been in May 2021 and had included visual fields that had met federal standards for conductors.

1.2 Primary Care Records

According to records from the conductor's primary care provider, the conductor's most recent primary care visit was on April, 6, 2022, for routine follow up of his chronic medical conditions. At that time, his documented medical history included obesity, type 2 diabetes, hyperlipidemia, hypertension, chronic kidney disease, recurrent moderate major depressive episodes, and prior stroke with hemiplegia. The conductor was noted to smoke ½ pack of cigarettes per day. His medications were documented as aspirin (an over-the counter anti-inflammatory medication commonly used to reduce cardiovascular risk), atorvastatin (a prescription medication that can help control cholesterol and lower cardiovascular risk), vitamin D3, pantoprazole (a prescription stomach acid suppression medication), lisinopril (a prescription medication used to control high blood pressure), semaglutide (sometimes marketed as Ozempic, a prescription diabetes medication for once-weekly injection), insulin degludec (sometimes marketed as Tresiba, a prescription long-acting insulin injection for once-daily use to help control blood sugar in diabetes), and sertraline (a prescription antidepressant).[3] Sertraline is discussed in D.1.4.4 below; the other above medications are not generally considered impairing.

At the most recent primary care visit, the provider documented that the conductor reported he had been doing well with no new acute problems and had been taking his medications routinely with no side effects. The provider documented that the conductor's diabetes was without complication, that he was checking his blood sugars daily and had values in the normal range, and that he denied associated symptoms, including dizziness, blurry vision, and foot numbness.[4] The provider documented that the conductor's depression was doing well on sertraline and that his mood and affect were normal; no active psychiatric symptoms were documented. The documented sertraline dose was a common starting dose for depression and had not been adjusted since at least August 2020, based on reviewed records which went back as far as a June 2021 visit. The provider at the most recent visit

[3] Previously filled prescriptions for albuterol (a prescription inhaled medication commonly used as needed for asthma and bronchospasm, filled by the conductor in December 2020) and tizanidine (a potentially sedating prescription muscle relaxer, prescribed to the conductor for back pain and filled in August 2021) were also noted as having been reviewed by the visit provider. There was otherwise no indication that the conductor was actively using these two medications or that he had ongoing problems with breathing or back pain.

[4] The provider documented that the conductor's daily home blood sugars were in the low 100 mg/dL range, with a 7-day average of 121 mg/dL and a 90-day average of 108 mg/dL. For many adults with diabetes, recommended pre-meal blood sugars are between 80 and 130 mg/dL, and recommended peak after-meal blood sugars are less than 180 mg/dL. The provider noted that the most recent hemoglobin A1c (HbA1c) was 8.7% and needed to be re-checked. HbA1c is an indirect measure of a person's average blood sugar over approximately the preceding 3 months; generally, HbA1c of less than 7% indicates control of diabetes.

documented that the conductor walked normally, had normal strength and coordination, and had an otherwise normal physical examination apart from obesity and elevated blood pressure.[5] The provider did not recommend any medication adjustments.

1.3 Autopsy

Forensic Medical Management Services performed the conductor's autopsy at the request of the Justice of the Peace, Precinct 6, Jefferson County, Texas. According to the autopsy report, the conductor's cause of death was transections of the aorta due to blunt force trauma of the torso, and his manner of death was accident. His heart was enlarged, with hypertrophy of both cardiac ventricles. His heart weight was 650 grams (upper limit of normal heart weight is roughly 593 grams for a male of the conductor's body weight of 291 pounds at autopsy).[6] The thicknesses of the left cardiac ventricle wall, intraventricular septum, and right cardiac ventricle wall were 2.4 cm, 2.3 cm, and 0.6 cm, respectively (upper limits of normal are roughly 1.6 cm, 1.8 cm, and 0.6 cm, respectively).[6] Coronary artery disease was present, including 65% narrowing of the proximal left anterior descending coronary artery, 60% narrowing of the proximal left circumflex coronary artery, and 30% narrowing of the proximal right coronary artery by plaque. The appearance of the heart muscle was unremarkable. There were diffuse severe atherosclerotic plaques with focal ulceration involving the ascending and descending aorta. The kidneys showed chronic changes typical of high blood pressure. The remainder of the autopsy did not identify other significant natural disease.

1.4 Toxicology

1.4.1 NMS Labs Toxicology Results

NMS Labs performed toxicological testing of postmortem specimens from the conductor at the request of Forensic Medical Management Services.[7] This testing identified sertraline at 270 ng/mL and its metabolite desmethylsertraline at 370 ng/mL in heart blood. Caffeine and cotinine were also detected in heart blood.[8] Vitreous chemistry was unremarkable, with no vitreous glucose detected.

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[5] The conductor was 70 inches tall, weighed 288 pounds, and had a blood pressure of 160/82.

[6] Kitzman DW, Scholz DG, Hagen PT, Ilstrup DM, Edwards WD. Age-related changes in normal human hearts during the first 10 decades of life. Part II (maturity): a quantitative anatomic study of 765 specimens from subjects 20 to 99 years old. *Mayo Clin Proc*. 1988;63(2):137-146. doi:10.1016/s0025-6196(12)64946-5.

[7] Tested-for substances are available from the NMS Labs website at Test Code 8042B. Confirmation testing was performed for sertraline and desmethylsertraline. Vitreous chemistry was also performed.

[8] Caffeine and cotinine were reported based on screening results without secondary confirmation.

1.4.2 FRA Toxicology Results

The conductor underwent FRA post-accident toxicological testing, performed by CTR Laboratories. This testing did not identify any tested-for substances.[9]

1.4.3 FAA Toxicology Results

At the request of the NTSB, the FAA Forensic Sciences laboratory performed toxicological testing on postmortem specimens from the conductor.[10] This testing detected sertraline and its metabolite desmethylsertraline in liver and kidney tissue. Atorvastatin was also detected in liver and kidney tissue. No blood, urine, or vitreous was available for FAA testing.

1.4.4 Descriptions of Detected Substances

Sertraline is a prescription antidepressant medication of the selective serotonin reuptake inhibitor (SSRI) class. Sertraline commonly is used to treat depression, and may also be used to treat a variety of other conditions.[11] Major depression can cause cognitive impairment, with potential adverse effects on reaction, memory, attention, problem solving, and task switching.[12] By contrast, sertraline has low potential to cause cognitive or psychomotor impairment, and may improve such impairment in individuals with major depression.[13,14,15] Sertraline's side effects may include dizziness and drowsiness, and the drug typically carries a warning that users should not drive,

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[9] The conductor's FRA toxicology report listed tested-for substances in blood as amphetamine, barbiturates, benzodiazepines, cannabinoids, cocaine, MDMA/MDA, methamphetamine, methadone, opiates/opioids, phencyclidine, tramadol, sedating antihistamines (brompheniramine, chlorpheniramine, diphenhydramine, doxylamine, and pheniramine), and ethanol.

[10] The FAA Forensic Sciences laboratory has the capability to test for around a thousand substances including toxins, prescription and over-the-counter medications, and illicit drugs. Some of these substances are listed at https://jag.cami.jccbi.gov/toxicology.

[11] National Institutes of Health National Library of Medicine. Zoloft. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=fe9e8b7d-61ea-409d-84aa-3ebd79a046b5. Updated January 15, 2023. Accessed May 4, 2023.

[12] Snyder HR. Major depressive disorder is associated with broad impairments on neuropsychological measures of executive function: a meta-analysis and review. *Psychol Bull*. 2013;139(1):81–132. doi:10.1037/a0028727.

[13] Hindmarch I. The behavioural toxicity of the selective serotonin reuptake inhibitors. *Int Clin Psychopharmacol*. 1995;9 Suppl 4:13-17. doi:10.1097/00004850-199501004-00002.

[14] Paul MA, Gray G, Lange M. The impact of sertraline on psychomotor performance. *Aviat Space Environ Med*. 2002 Oct;73(10):964-70.

[15] Rosenblat JD, Kakar R, McIntyre RS. The cognitive effects of antidepressants in major depressive disorder: a systematic review and meta-analysis of randomized clinical trials. *Int J Neuropsychopharmacol*. 2015;19(2):pyv082. doi:10.1093/ijnp/pyv082.

operate heavy machinery, or do other dangerous activities until they know how the drug affects them.[11] Desmethylsertraline is a metabolite of sertraline.

Atorvastatin is a prescription medication that can help control cholesterol and lower cardiovascular risk.[16] Caffeine is a central nervous system stimulant that is commonly ingested, including in coffee, tea, soft drinks, and chocolate; it is also an ingredient in certain anti-drowsiness medications and headache medications. Cotinine is a metabolite of nicotine, which is a chemical that is found in tobacco products, electronic cigarette liquid, and certain smoking cessation aids. Atorvastatin, caffeine, and nicotine/cotinine are not generally considered impairing.

2.0 Engineer

2.1 Occupational Health Records

The 64-year-old male engineer's most recent occupational vision and hearing testing was on March 15, 2022; he was cleared for switchman duty based on the results, which met federal standards for engineers.[17]

2.2 Toxicology

The engineer underwent FRA post-accident toxicological testing, performed by CTR Laboratories. This testing did not identify any tested-for substances.[18]

E. SUMMARY OF MEDICAL FACTS

1.0 Conductor

The 65-year-old male conductor had obesity, type 2 diabetes, hyperlipidemia, hypertension, chronic kidney disease, a history of moderate major depressive episodes, and prior stroke. He had been cleared for switchman duty, with his most recent occupational vision and hearing testing on May 26, 2022. The conductor's most recent visit to his primary care provider was April 6, 2022, for routine follow up

[16] National Institutes of Health National Library of Medicine. Lipitor. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=c6e131fe-e7df-4876-83f7-9156fc4e8228. Updated December 1, 2022. Accessed May 4, 2023.

[17] FRA medical fitness standards for engineers consist of vision and hearing requirements that must be met for a person to be currently certified as a locomotive engineer (49 Code of Federal Regulations § 240.121).

[18] The engineer's FRA toxicology report listed tested-for substances in urine as amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, MDMA/MDA, methadone, opiates/opioids, phencyclidine, tramadol, and sedating antihistamines (brompheniramine, chlorpheniramine, diphenhydramine, doxylamine, and pheniramine). Additionally, blood was tested for ethanol.

of his chronic medical conditions. At that time, he reported doing well with no acute problems and taking his medications routinely with no side effects. The provider documented that the conductor's diabetes was being treated with semaglutide and insulin degludec injections without complications, and that the conductor denied any dizziness, blurry vision, or foot numbness. The provider documented that the conductor's depression was doing well treated with sertraline and that he had a normal mood and affect; no active psychiatric symptoms were documented. The documented sertraline dose was a common starting dose for depression and had not been recently adjusted. The provider documented that the conductor walked normally, had normal strength and coordination, and had an otherwise normal physical examination apart from obesity and elevated blood pressure.

According to the conductor's autopsy report, his cause of death was transections of the aorta due to blunt force trauma of the torso, and his manner of death was accident. His heart was enlarged, with hypertrophy of both cardiac ventricles. Moderate multivessel coronary artery disease was present. There were diffuse severe atherosclerotic plaques with focal ulceration involving the ascending and descending aorta. The kidneys showed chronic changes typical of high blood pressure. The remainder of the autopsy did not identify other significant natural disease.

The conductor's postmortem toxicology testing identified sertraline and its metabolite desmethylsertraline in heart blood, liver tissue, and kidney tissue. Atorvastatin was detected in liver and kidney tissue, and caffeine and cotinine were detected in heart blood. Vitreous chemistry was unremarkable, with no vitreous glucose detected.

2.0 Engineer

The 64-year-old male engineer's most recent occupational vision and hearing testing was on March 15, 2022; he was cleared for switchman duty based on the results, which met federal standards for engineers. His FRA post-accident toxicological testing did not identify any tested-for substances.

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