

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA22LA213

MEDICAL

Specialist's Factual Report

October 6, 2022

A. ACCIDENT

Location: Huntsville, Alabama
Date: 5/1/2022
Time: 17:05 Local
Airplane: Vans RV7; N1218B

B. MEDICAL SPECIALIST

Specialist Michelle Watters, MD, PhD, MPH
National Transportation Safety Board, RE-1
Washington, DC

C. DETAILS OF THE INVESTIGATION

Purpose

This investigation was performed to evaluate the pilot for medical conditions, the use of medications/illicit drugs, and the presence of toxins.

Methods

The Federal Aviation Administration (FAA) medical certification file and the pilot's post-event medical records and FAA toxicology report¹ were reviewed. Other relevant medical and regulatory issues were reviewed.

D. FACTUAL INFORMATION

1.0 Pilot

1.1 FAA Medical Certification File

According to the FAA medical certification file, at the time of the accident, the 48-year-old male pilot had a medical certificate with the limitation that he must have available glasses for near vision; the medical certificate had expired for second class, but was valid for third class. At the time of the most recent exam (7/7/20), the pilot was 70 inches tall and weighed 160 pounds. He reported having 1,300 total flight hours. He reported taking no medications and having no medical conditions. No significant medical concerns were identified.

¹ The FAA Forensic Sciences Laboratory has the capability to test for more than 1,300 substances including toxins, common prescription and over-the-counter medications, and illicit drugs. <https://jag.cami.jccbi.gov/toxicology/>

1.2 Post-event Medical Records

Post-event medical records were obtained for the pilot. He was admitted to the hospital on 5/1/22 with the diagnoses of acute respiratory failure and facial and cervical fractures. Hospital clinical laboratory testing of his admission blood was positive for ethanol at 0.225 grams per deciliter (gm/dL). The pilot was discharged from the hospital on 5/16/22.

1.3 Toxicology

Toxicology testing performed by the FAA Forensic Sciences laboratory toxicology detected ethanol in the pilot's hospital admission blood serum at 0.172 gm/dL and his urine at 0.267 gm/dL. The concentration of ethanol in blood collected 3 hours after admission was 0.118 gm/dL. Five substances indicating the use of cannabis products were detected in his urine, three were also found in his blood.

Ethanol

Ethanol is a social drug commonly consumed by drinking beer, wine, or liquor. Ethanol acts as a central nervous system depressant; it impairs judgment, psychomotor functioning, and vigilance. Effects of ethanol on aviators are generally well understood; it significantly impairs pilot performance, even at very low levels.² While the acute effects of ethanol can vary depending on an individual's frequency of use, body weight, and tolerance, in general, at blood ethanol concentrations as low as 0.02 gm/dL there is relaxation and some loss of judgment and at 0.05 gm/dL there is further degradation of judgment, psychomotor functioning, and alertness. At blood ethanol concentrations above 0.10 gm/dL, there is prolonged reaction time, altered perception of the environment, lack of coordination, slowed thinking, and mood and behavioral changes. Above 0.15 gm/dL, individuals may have significant loss of muscle control and major loss of balance.³ FAA regulation Section 91.17 (a) prohibits any person from acting or attempting to act as a crewmember of a civil aircraft (1) within 8 hours after the consumption of any alcoholic beverage and (4) while having an alcohol concentration of 0.04 or greater in a blood or breath specimen.⁴

Ethanol is water soluble, and after absorption it quickly and uniformly distributes throughout the body's tissues and fluids. The distribution pattern parallels water content and blood supply of the tissue. On average, ethanol concentrations in plasma and serum samples are 11% higher than whole blood. Post-absorption, the

² Cook, C.C.H. 1997. Alcohol and aviation. *Addiction* (Abingdon, England). 92(5):539-555.

³ Centers for Disease Control and Prevention. Blood Alcohol Concentration (BAC). <https://www.cdc.gov/motorvehiclesafety/pdf/bac-a.pdf>. Accessed 8/15/21

⁴ National Archives. eCFR- Code of Federal Regulations. Current as of 8/5/22. Available at: [eCFR :: 14 CFR 91.17 -- Alcohol or drugs](https://www.ecfr.gov/current/title-49/chapter-I/subchapter-B/part-91/subpart-F/section-91.17).

alcohol concentration in urine is larger than blood by about 25%. There is a one to two hour delay in the balance between urine and blood.^{5,6}

Cannabis

The marijuana plant (*Cannabis species*) contains chemicals called cannabinoids; delta-9-tetrahydrocannabinol (delta-9-THC) is the primary psychoactive cannabinoid compound. Delta-8-THC is also psychoactive but less potent than delta-9-THC and is naturally found in the cannabis plant but at low concentrations. THC's mood-altering effects include euphoria and relaxation. In addition, marijuana causes alterations in motor behavior, time and space perception, and cognition. Significant performance impairments are usually observed for at least 1-2 hours following marijuana use, and residual effects have been reported up to 24 hours.⁷

THC is rapidly metabolized but the rate of metabolism is not linear and depends on the means of ingestion (smoking, oil, and edibles), potency of the product, frequency of use, and user characteristics. The primary metabolite of delta-9-THC, 11-hydroxy-delta-9-THC, is equally psychoactive, but is rapidly metabolized to the non-psychoactive metabolite delta-9-THC-COOH. Delta-8-THC-COOH is the inactive metabolite of delta-8-THC. THC is fat soluble, so is stored in fatty tissues and can be released back into the blood long after consumption. So, while the psychoactive effects may last a few hours, THC can be detected in the body for days or weeks. Very little THC is excreted in urine. Instead, THC-COOH can be found in urine days to weeks after the last use of the drug. Thus, both blood and urine test results do not necessarily reflect recent use and cannot be used to prove that the user was experiencing effects of the drug at the time of testing.^{8,9}

Cannabidiol (CBD) oils are also derived from *Cannabis sativa*. While CBD has some medicinal effects, CBD is not associated with the psychoactive effects of THC. The primary metabolite of CBD is 7-COOH-CBD; the CBD metabolite, 7-OH-CBD, is detected in lesser concentrations.¹⁰ Products containing concentrated amounts of

⁵ Penetar, DM, JF McNeil, ET Ryan, and SE Lukas. 2008. Comparison among plasma, serum, and whole blood ethanol concentrations: Impact of storage conditions and collection tubes. *Journal of Analytical Toxicology* 32(7):505-510.

⁶ Ioan, BG, V Jitaru, R Damian, and SI Damian. 2015. Study on the relationship between the concentration of ethanol in the blood, urine, and vitreous humor. *Rom J. Leg Med* 23:211-216.

⁷ National Highway Traffic Safety Administration. April 2014 (revised). Drugs and Human Performance Fact Sheets. Cannabis/Marijuana.

<https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drugshumanperformfs.pdf>

⁸ Compton, R. July 2017. Marijuana-Impaired Driving - A Report to Congress. (DOT HS 812 440). Washington, DC: National Highway Traffic Safety Administration.
<https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf>

⁹ Tagen, M and LE Klumpers. 2022. Review of delta-8-tetrahydrocannabinol (Δ^8 -THC): Comparative pharmacology with Δ^9 -THC. *British Journal of Pharmacology* 179:3915-3933.

¹⁰ Perez-Acevedo, AP, et alia. 2020. Disposition of cannabidiol metabolites in serum and urine from healthy individuals treated with pharmaceutical preparations of medical cannabis. *Pharmaceuticals* 13:459; doi:10.3390/ph13120459.

delta-8-THC are typically manufactured from CBD. Unlike medical marijuana, CBD products do not require medical certification to be purchased or consumed. To be legally sold, CBD oils must have a delta-9-THC content below 0.3%.¹¹ However, because of lack of regulation and oversight, there is variability of CBD and THC levels in these products. Thus, consumption of CBD products can result in positive urine drug screening for marijuana.^{12,13}

E. SUMMARY OF MEDICAL FACTS

The 48-year-old male pilot held a medical certificate with the limitation that he must have available glasses for near vision; the medical certificate had expired for second class but was valid for third class. He reported taking no medications and having no medical conditions. Post-event medical records show the pilot was admitted for acute respiratory failure and facial and cervical fractures. He was discharged from the hospital after 15 days (5/16/22).

Ethanol was detected in toxicology testing of hospital admission blood at 0.225 gm/dL, admission serum at 0.172 gm/dL, admission urine at 0.267 gm/dL, and blood collected 3 hours post-admission at 0.118 gm/dL. Five substances indicating the use of cannabis products were detected in his urine, three were also found in his blood.

Submitted by:

Michelle Watters, MD, PhD, MPH
Medical Officer, RE-1

¹¹ Some states include the concentration of delta-8-THC as part of the 0.3% limit on THC content in CBD products.

¹² Food and Drug Administration (FDA) [5 Things to Know about Delta-8 Tetrahydrocannabinol - Delta-8 THC | FDA](#) Accessed 8/17/22.

¹³ VanDolah, HJ, BA Bauer, and KF Mauck. 2019. Clinician's guide to cannabidiol and hemp oils. *Mayo Clinic Proceedings*. 94(9):1840-1851. doi: 10.1016/j.mayocp.2019.01.003. Epub 2019 Aug 22.