

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR22FA264

MEDICAL

Specialist's Factual Report

April 27, 2023

A. ACCIDENT

Location: Seguin, Texas
Date: 7/22/2022
Time: 18:45Local
Airplane: Piper PA-28-235; N8542W

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 case review, the pilot's autopsy report, and FAA Forensic Sciences Laboratory toxicology report¹ were reviewed. Other relevant medical and regulatory issues were reviewed.

D. FACTUAL INFORMATION–PILOT

1.0 FAA Medical Case Review

According to the FAA medical case review, at the time of the accident, the 66-year-old male pilot held a third class FAA medical certificate with the limitation that he must have available glasses for near vision. His most recent FAA medical certification exam was on 4/27/22 and at that time he reported he had accrued 3,626 total flight hours. He was 72 inches tall and weighed 214 pounds. He reported taking sildenafil for erectile dysfunction and atorvastatin for high cholesterol; he also reported having hay fever.

¹ The FAA Forensic Sciences Laboratory has the capability to test for more than 1,000 substances including toxins, common prescription and over-the-counter medications, and illicit drugs.
<https://jag.cami.jccbi.gov/toxicology/>

2.0 Autopsy

According to the autopsy report prepared for the Guadalupe County Justice of the Peace by the Travis County Medical Examiner's Office, Austin, Texas, the pilot's cause of death was blunt force injuries, and the manner of death was accident. No significant natural disease was identified by the medical examiner.

3.0 Toxicology

Toxicology testing performed by the medical examiner's office detected ethanol in the pilot's chest blood at 0.08 grams per deciliter (gm/dL), but not in his vitreous fluid. The primary major psychoactive compound of cannabis, tetrahydrocannabinol (THC), was detected in the pilot's chest blood at 13 nanograms per milliliter (ng/mL). THC's psychoactive metabolite, 11-hydroxy-THC (11-OH-THC), was detected in his chest blood at 5.4 ng/mL. The pilot's urine was presumptively positive for cannabinoid. Cetirizine and acetaminophen were also detected in his chest blood.

No ethanol was detected in the pilot's urine in the toxicology testing performed by the FAA Forensic Sciences Laboratory. Putrefaction was noted on tissue samples. The FAA laboratory detected delta-9-THC in the pilot's lung tissue at 4.3 nanograms per gram (ng/gm), but not in his urine. 11-OH-THC was detected in his urine but not in his lung tissue. The inactive metabolite of THC, delta-9-THC, carboxy-delta-9-THC (THC-COOH), was detected in the pilot's lung tissue at 3.2 ng/gm and in his urine at 43 ng/mL. The antihistamine cetirizine was detected in the pilot's urine at 315 ng/mL and in his liver tissue at 66 ng/gm. Acetaminophen, the high cholesterol medication atorvastatin, the erectile dysfunction medication sildenafil, its metabolite desmethylsildenafil, the allergy medication loratadine, and its metabolite desloratadine were detected in the pilot's liver tissue; all but loratadine were also detected in his urine. These six compounds are generally considered non-impairing.²

Ethanol

Ethanol is a social drug commonly consumed by drinking beer, wine, or liquor. It acts as a central nervous system depressant; it impairs judgment, psychomotor functioning, and vigilance. Ethanol is water soluble, and after absorption it quickly and uniformly distributes throughout the body's tissues and fluids. The distribution

² FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs.

Acetaminophen. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=2>

Atorvastatin. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=212>

Sildenafil. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=219>

Desmethylsildenafil. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=136>

Loratadine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=150>

Desloratadine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=379>

pattern parallels water content and blood supply of the tissue. Post-absorption, the alcohol concentration in vitreous fluid and urine are larger than blood by about 12% and 25%, respectively. There is a one-to-two-hour delay in the balance between vitreous fluid or urine and blood. Ethanol can be produced after death by microbial activity often in conjunction with other alcohols; vitreous fluid, and to a lesser extent urine, does not suffer from postmortem production to any significant extent.^{3,4} Extensive trauma increases the spread of bacteria and raises the risk of ethanol production after death.⁵

Cannabis

The marijuana plant (*Cannabis species*) contains chemicals called cannabinoids; delta-9-tetrahydrocannabinol (delta-9-THC) is the primary psychoactive cannabinoid compound. THC's mood-altering effects include euphoria and relaxation. In addition, use of cannabis causes alterations in motor behavior, time and space perception, and cognition. Significant performance impairments are usually observed for at least 1-2 hours following cannabis use, and residual effects have been reported up to 24 hours.⁶ A study of 14 frequent and 11 occasional users found that cannabis significantly impaired psychomotor function up to 3.5 hours after smoking, although more impairment was reported in occasional smokers.⁷ An aircraft simulator study of nine currently active pilots given one cigarette containing 20 milligrams of THC found the majority continued to have some degree of impairment 24 hours after smoking while only one had awareness of the drug's effects.⁸

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. Concentrations of THC peak at the end of smoking and are usually below 5 ng/mL at three hours. Peak concentrations are often 100 to 200 ng/mL. The primary metabolite of THC, 11-hydroxy-THC, is equally psychoactive, but is rapidly metabolized to the non-psychoactive metabolite THC-COOH. THC is fat soluble, so is stored in fatty tissues and can be released back into the blood long after consumption. So, while the

³ Canfield, DV, TC Kupiec, and EF Huffine. July 1992. Postmortem alcohol production in fatal aircraft accidents. U.S. Department of Transportation. FAA. Washington, D.C. Report # DOT/FANAM-92/24.

⁴ 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.

⁵ Kugelberg, FC and AW Jones. 2007. Interpreting results of ethanol analysis in postmortem specimens: a review of the literature. *Forensic Science International* 165(1):10-29.

⁶ National Highway Traffic Safety Administration. April 2014 (revised). Drugs and Human Performance Fact Sheets. Cannabis/Marijuana. [809725-drugshumanperformfs.pdf \(nhtsa.gov\)](https://www.nhtsa.gov/document/809725-drugshumanperformfs.pdf)

⁷ Desrosiers, NA, JG Ramaekers, E Chauchard, DA Gorelik, and MA Huestis. 2015. Smoked cannabis' psychomotor and neurocognitive effects in occasional and frequent smokers. *Journal of Analytical Toxicology* 39:252-261.

⁸ Leirer, VO, JA Yesavage, and DG Morrow. 1991. Marijuana carry-over effects on aircraft performance. *Aviation Space and Environmental Medicine* 62(3):221-7.

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.^{9,10}

Cetirizine

Cetirizine is a second-generation antihistamine used to relieve hay fever and allergy symptoms. It is available over the counter, commonly marketed as Zyrtec. Although designed to be less sedating, cetirizine does have some sedating properties. FAA provides guidance on wait times before flying after using this medication; post-dose observation time is 48 hours and the medication is not for daily use.^{11,12}

E. SUMMARY OF MEDICAL FACTS

The 66-year-old male pilot held a third class FAA medical certificate with the limitation that he must have available glasses for near vision. At his most recent FAA medical certification exam on 4/27/22, he reported taking sildenafil for erectile dysfunction and atorvastatin for high cholesterol; he also reported having hay fever. According to the autopsy, the pilot's cause of death was blunt force injuries, and the manner of death was accident. No significant natural disease was identified.

Toxicology testing detected ethanol in the pilot's chest blood at 0.08 grams per deciliter (gm/dL), but not in his vitreous fluid or urine. Tetrahydrocannabinol (THC) was detected in the pilot's chest blood at 13 nanograms per milliliter (ng/mL) and lung tissue at 4.3 nanograms per gram (ng/gm), but not in his urine. 11-hydroxy-THC (11-OH-THC) was detected in his chest blood at 5.4 ng/mL and urine, but not in his lung tissue. Carboxy-delta-9-THC (THC-COOH) was detected in the pilot's lung tissue at 3.2 ng/gm and in his urine at 43 ng/mL. The antihistamine cetirizine was detected in the pilot's chest blood, urine at 315 ng/mL, and in his liver tissue at 66 ng/gm. The generally non-impairing substances acetaminophen, atorvastatin, sildenafil, desmethylsildenafil, loratadine, and desloratadine were detected in the pilot's urine and/or liver tissue; acetaminophen was also detected in his chest blood.

⁹ 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>

¹⁰ 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.

¹¹ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs. Cetirizine.
<https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=131>

¹² FAA. Updated 10/26/22. [AllergyAntihistamineImmunotherapyMedication.pdf \(faa.gov\)](#)

Submitted by:

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