

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



Medical Factual Memorandum for Record

December 29, 2023

A. CASE

NTSB ID: CEN22FA288
Location: Blackwell, Texas
Date: June 26, 2022

B. MEDICAL SPECIALIST

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

C. DETAILS

1.0 Description of Review

For purposes of evaluating the pilot for potentially impairing substances and potentially impairing medical conditions, the above Medical Specialist reviewed the following sources of medical information, along with selected relevant regulation, medical literature, and investigator reports.

- Final Federal Aviation Administration (FAA) medical case review
- Autopsy report (including NMS Labs toxicology) – pilot
- FAA Forensic Sciences Laboratory toxicology report – pilot

2.0 Summary of Medical Facts

The 41-year-old male pilot's last aviation medical examination was April 19, 2022. At that time, he was 71 inches tall and weighed 252 pounds. He reported no medication use and no active medical conditions. He was issued a second-class medical certificate without limitation.

South Plains Forensic Pathology, Lubbock, Texas, performed the pilot's autopsy at the request of the Nolan County Judge. According to the pilot's autopsy report, his cause of death was blunt force injuries of the torso. The autopsy identified mild multivessel coronary artery disease. The heart was described as enlarged, with mild concentric hypertrophy of the left cardiac ventricle. Heart weight was 455 grams (normal heart weight is roughly 420-550 grams for a male of the body weight 252 pounds).¹ The remainder of the autopsy examination, including of the heart, did not identify other significant natural disease.

At the request of South Plains Forensic Pathology, NMS Labs performed postmortem toxicological testing of iliac blood from the pilot. Results for delta-9-THC and carboxy-delta-9-THC were not reported. No other tested-for substances were detected.²

Postmortem toxicological testing by the FAA Forensic Sciences Laboratory identified delta-9-THC in urine and at 3.5 ng/mL in heart blood. 11-hydroxy-delta-9-THC was detected in urine but not in heart blood. Carboxy-delta-9-THC was detected in urine and at 9.4 ng/mL in heart blood.

Delta-9-THC is the primary psychoactive chemical in cannabis, including marijuana and hashish. Delta-9-THC may be inhaled or ingested recreationally by users seeking mind-altering effects. It may also be used medicinally to treat illness-associated nausea and appetite loss. Psychoactive effects of delta-9-THC vary depending on the user, dose, and route of administration, and may impair motor coordination, reaction time, decision making, problem solving, and vigilance.^{3,4} Delta-9-THC is a federally controlled substance, and the FAA considers it unsuitable

¹ 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.

² The NMS Labs report listed tested-for substances as: amphetamines, barbiturates, benzodiazepines, buprenorphine/metabolite, cannabinoids, cocaine/metabolites, fentanyl/acetyl fentanyl, methadone/metabolite, methamphetamine/MDMA, opiates, oxycodone/oxymorphone, phencyclidine, acetone, ethanol, isopropanol, and methanol. According to the toxicology report, cannabinoid confirmation testing was performed, but was cancelled for delta-9-THC and carboxy-delta-9-THC due to an interfering substance, so results for those substances were not reported. 11-hydroxy-delta-9 THC was not detected at a reporting threshold of 1 ng/mL.

³ Couper FJ, Logan BK. Drugs and Human Performance Fact Sheets. National Highway Traffic Safety Administration. DOT HS 809 725. April 2014 (Revised). <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drugshumanperformfs.pdf>. Accessed December 22, 2023.

⁴ Compton RP. Marijuana-Impaired Driving: A Report to Congress. National Highway Traffic Safety Administration. DOT HS 812 440. July 2017. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf>. Accessed December 22, 2023.

for flying, regardless of state cannabis laws.^{5,6,7} 11-hydroxy-delta-9-THC is a psychoactive metabolite of delta-9-THC, and carboxy-delta-9-THC is a non-psychoactive metabolite of 11-hydroxy-delta-9-THC.³

A person's instantaneous blood concentration of delta-9-THC does not directly predict that person's impairment.^{3,4} Acute impairing effects of delta-9-THC typically last at least 1-2 hours after use, with return to baseline within about 3-7 hours, although some residual effects may persist longer, and the duration of acute effects may be increased at higher doses or when used orally.^{3,8} An occasional user's blood delta-9-THC concentration may fall to a very low or undetectable level within hours after smoking, whereas a frequent user's blood delta-9-THC concentration may remain detectable for days or weeks of abstinence, while delta-9-THC stored in fatty

⁵ Federal Aviation Administration. Guide for aviation medical examiners: pharmaceuticals (therapeutic medications) do not issue - do not fly. Federal Aviation Administration website. https://www.faa.gov/ame_guide/pharm/dni_dnf. Updated July 10, 2023. Accessed December 22, 2023.

⁶ Federal Aviation Administration. Aeromedical factors. In: *Pilot's Handbook of Aeronautical Knowledge*. FAA-H-8083-25C. Oklahoma City: United States Department of Transportation, Federal Aviation Administration, Airman Testing Standards Branch, AFS-630; 2023. https://www.faa.gov/sites/faa.gov/files/19_phak_ch17.pdf. Accessed December 22, 2023.

⁷ Federal Aviation Administration. Controlled substances and CBD products. Guide for Aviation Medical Examiners. https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/media/Controlled_Substances_and_CBD_Products.pdf. Updated May 25, 2022. Accessed December 22, 2023.

⁸ McCartney D, Arkell TR, Irwin C, McGregor IS. Determining the magnitude and duration of acute Δ9-tetrahydrocannabinol (Δ9-THC)-induced driving and cognitive impairment: a systematic and meta-analytic review. *Neurosci Biobehav Rev*. 2021;126:175-193. doi:10.1016/j.neubiorev.2021.01.003.

tissues redistributes into blood.^{3,9 - 12} Delta-9-THC and its metabolites have modest potential for postmortem redistribution.^{13,14,15}

Submitted by:

Turan Kayagil, MD, FACEP
Medical Officer

⁹ Huestis MA. Human cannabinoid pharmacokinetics. *Chem Biodivers*. 2007 Aug;4(8):1770-804. doi: 10.1002/cbdv.200790152.

¹⁰ Bergamaschi MM, Karschner EL, Goodwin RS, et al. Impact of prolonged cannabinoid excretion in chronic daily cannabis smokers' blood on per se drugged driving laws. *Clin Chem*. 2013;59(3):519-526. doi:10.1373/clinchem.2012.195503.

¹¹ Spindle TR, Cone EJ, Schlienz NJ, et al. Acute pharmacokinetic profile of smoked and vaporized cannabis in human blood and oral fluid. *J Anal Toxicol*. 2019;43(4):233-258. doi:10.1093/jat/bky104.

¹² Vandrey R, Herrmann ES, Mitchell JM, et al. Pharmacokinetic profile of oral cannabis in humans: blood and oral fluid disposition and relation to pharmacodynamic outcomes. *J Anal Toxicol*. 2017;41(2):83-99. doi:10.1093/jat/bkx012.

¹³ Hoffman MA, Trochta A, Gary RD, Fitzgerald RL, McIntyre IM. An evaluation of postmortem concentrations of Δ9-tetrahydrocannabinol (THC) and 11-nor-9-carboxy-Δ9-tetrahydrocannabinol (THCCOOH). *Forensic Sci Int*. 2020;315:110414. doi:10.1016/j.forsciint.2020.110414.

¹⁴ Holland MG, Schwoppe DM, Stoppacher R, Gillen SB, Huestis MA. Postmortem redistribution of Δ9-tetrahydrocannabinol (THC), 11-hydroxy-THC (11-OH-THC), and 11-nor-9-carboxy-THC (THCCOOH). *Forensic Sci Int*. 2011;212(1-3):247-251. doi:10.1016/j.forsciint.2011.06.028.

¹⁵ Lemos NP, Ingle EA. Cannabinoids in postmortem toxicology. *J Anal Toxicol*. 2011;35(7):394-401. doi:10.1093/anatox/35.7.394.