

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR22FA021

MEDICAL

Specialist's Factual Report

November 3, 2023

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A. ACCIDENT

Location: Dunsmuir, California
Date: October 20, 2021

B. MEDICAL SPECIALIST

Specialist Turan Kayagil, MD, FACEP
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Washington, DC

C. DETAILS OF THE INVESTIGATION

1.0 Purpose

This investigation was performed to evaluate the pilot for potentially impairing substances and potentially impairing medical conditions.

2.0 Methods

The Federal Aviation Administration (FAA) medical case review and the pilot's autopsy and toxicology reports were reviewed. Selected investigator reports and relevant regulation and medical literature were also reviewed.

D. FACTUAL INFORMATION

1.0 FAA Medical Case Review

According to the FAA medical case review, the 71-year-old male pilot's last aviation medical examination was on March 16, 1999. At that time, he reported 200 total civilian flight hours. He was 70 inches tall and weighed 251 pounds. He reported no medication use or active medical conditions. No significant issues were identified, and he was issued a third-class medical certificate with a limitation.¹ This medical certificate subsequently expired.

2.0 Autopsy Report

The pilot's autopsy was performed by a pathologist contracted by the County of Siskiyou Office of the Sheriff/Coroner, Yreka, California. According to the pilot's autopsy report and a supplemental report from the Office of the Sheriff/Coroner, the

¹ According to the FAA medical case review, although the certificate limitation was not specifically described in FAA records, the records indicated that pilot required corrective lenses.

pilot's cause of death was exsanguination and his manner of death was accidental. The autopsy did not identify significant natural disease. The brain was not examined.

3.0 Toxicology

3.1 FAA Toxicology Results

The FAA Forensic Sciences laboratory performed toxicological testing of postmortem specimens from the pilot.² This testing detected diphenhydramine in urine and at 174 ng/mL in heart blood. Famotidine was detected in heart blood and urine. Hemoglobin A1c (HbA1c) was elevated at 8.6%.³ Glucose was measured at 5 mg/dL in vitreous and 1051 mg/dL in urine.⁴

3.2 Descriptions of Detected Drugs

Diphenhydramine is a sedating antihistamine medication widely available over the counter in multiple sleep aids and cold and allergy products. Diphenhydramine can cause cognitive and psychomotor slowing and drowsiness. It often carries a warning that it may impair performance of tasks like driving and operating heavy machinery.^{5,6,7} In one driving simulator study, a single dose of diphenhydramine impaired driving ability more than a blood alcohol level of 0.1 g/dL.⁸ The FAA states

² 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.

³ HbA1c is an indirect measure of a person's average blood sugar over approximately the preceding 3 months. HbA1c of 6.5% or higher indicates diabetes. In diabetes, HbA1c of less than 7% generally indicates good control of blood sugar.

⁴ According to [the FAA Forensic Sciences Laboratory's website](#), the laboratory considers glucose (sugar) levels in vitreous and urine to be abnormal if above 125 mg/dL and 100 mg/dL, respectively. The choice of these values is discussed in FAA Aerospace Medicine Technical Report [DOT/FAA/AM-00/22](#).

⁵ National Institutes of Health National Library of Medicine. Benadryl Allergy Liqui-Gels. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bfeae100-e2d1-4607-be3b-2d9b15cd4f7f>. Updated May 17, 2023. Accessed November 3, 2023.

⁶ 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 November 3, 2023.

⁷ Moskowitz H, Wilkinson CJ. *Antihistamines and Driving-Related Behavior: A Review of the Evidence for Impairment*. National Highway Traffic Safety Administration. DOT HS 809 714. May 2004. <https://www.nhtsa.gov/sites/nhtsa.gov/files/antihistamines20text.pdf>. Accessed November 3, 2023.

⁸ Weiler JM, Bloomfield JR, Woodworth GG, et al. Effects of fexofenadine, diphenhydramine, and alcohol on driving performance: a randomized, placebo-controlled trial in the Iowa Driving Simulator. *Ann Intern Med*. 2000;132(5):354-363. doi:10.7326/0003-4819-132-5-200003070-00004.

that pilots should not fly within 60 hours of using diphenhydramine, to allow time for it to be cleared from circulation.^{9,10}

Typical treatment concentrations of diphenhydramine in a living person's plasma are about 25 ng/mL to 100 ng/mL, with the drug's concentration in plasma typically being about 1.3 times the concentration in whole blood. The typical elimination half-life of diphenhydramine is about 3-14 hours.^{11,12} Diphenhydramine may exhibit postmortem redistribution which can cause the drug's concentration in heart blood (central blood) to increase after death. The postmortem central-to-peripheral blood diphenhydramine concentration ratio may range from below 1 to above 20 depending on the individual case.¹³

Famotidine is an over-the-counter stomach acid suppression medication.¹⁴ It is not generally considered impairing.

E. SUMMARY OF MEDICAL FACTS

The 71-year-old male pilot's last aviation medical examination was on March 16, 1999. At that time, he reported no medication use or active medical conditions. No significant issues were identified, and he was issued a third-class medical certificate, which subsequently expired.

The pilot's autopsy was performed by a pathologist contracted by the County of Siskiyou Office of the Sheriff/Coroner, Yreka, California. According to the pilot's autopsy report and a supplemental report from the Office of the Sheriff/Coroner, the

⁹ 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 November 3, 2023.

¹⁰ Federal Aviation Administration. Allergy - antihistamine & immunotherapy medication. Guide for Aviation Medical Examiners. https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/media/AllergyAntihistamineImmunotherapyMedication.pdf. Updated October 26, 2022. Accessed November 3, 2023.

¹¹ Federal Aviation Administration Civil Aerospace Medical Institute. Diphenhydramine. Forensic Toxicology's WebDrugs. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=50>. Updated January 16, 2019. Accessed November 3, 2023.

¹² Schulz M, Schmoldt A, Andresen-Streichert H, Iwersen-Bergmann S. Revisited: therapeutic and toxic blood concentrations of more than 1,100 drugs and other xenobiotics. *Crit Care*. 2020;24(1):195. doi:10.1186/s13054-020-02915-5.

¹³ Han E, Kim E, Hong H, et al. Evaluation of postmortem redistribution phenomena for commonly encountered drugs. *Forensic Sci Int*. 2012;219(1-3):265-271. doi:10.1016/j.forsciint.2012.01.016.

¹⁴ National Institutes of Health National Library of Medicine. Pepcid AC Original Strength. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=54f4086f-e443-4e7e-8c7e-94e152e1c256>. Updated March 27, 2023. Accessed November 3, 2023.

pilot's cause of death was exsanguination and his manner of death was accidental. The autopsy did not identify significant natural disease. The brain was not examined.

The pilot's postmortem toxicological testing detected the potentially sedating antihistamine medication diphenhydramine in urine and at 174 ng/mL in heart blood. The over-the-counter stomach acid suppression medication famotidine was detected in heart blood and urine; famotidine is not generally considered impairing. Hemoglobin A1c (HbA1c) was elevated at 8.6%. Glucose was measured at 5 mg/dL in vitreous and 1051 mg/dL in urine.

Submitted by:

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