



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

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A. ACCIDENT: CEN19FA120; Lake, MS

On April 13, 2019, about 0015 central daylight time (CDT), a Piper PA28-180 airplane, N4890L, registered to the pilot, was destroyed when it impacted terrain following an in-flight breakup near Lake, Mississippi. The private pilot sustained fatal injuries. Dark night instrument meteorological conditions prevailed in the area with thunderstorms, lightning, and rain. No flight plan was filed. The personal flight was being conducted under the provisions of *Federal Code of Regulations* Part 91. The flight originated at 1106 from the Picayune Municipal Airport (MJD), Picayune, Mississippi, and its intended destination was the Ackerman Choctaw Airport (9M4), Ackerman, Mississippi.¹

B. GROUP IDENTIFICATION

No group was formed for the medical evaluation in this accident.

C. DETAILS OF INVESTIGATION

1. Purpose

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

2. Methods

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

¹ Summary taken from this accident's National Transportation Safety Board Aviation Accident Preliminary Report, originally published May 9, 2019.

3. Findings

a. FAA Medical Case Review

According to the FAA medical case review, the 33-year-old male pilot had his last aviation medical examination on May 10, 2018. At that time, he reported 3 total civilian flight hours. He was 70 inches tall and weighed 150 pounds. He reported no active medical conditions or medication use. No significant issues were identified, and he was issued a third-class medical certificate without limitation.

b. Autopsy

The Mississippi State Medical Examiner's Office performed the pilot's autopsy. According to the autopsy report, the cause of death was massive blunt force trauma, and the manner of death was accident. Due to the severity of the pilot's injuries, his brain was not available for examination. The autopsy did not identify any significant natural disease.

c. Toxicology

The FAA Forensic Sciences Laboratory identified methamphetamine, amphetamine, buprenorphine, norbuprenorphine, and naloxone in multiple specimens from the pilot.² The table below shows the level of each identified substance in each type of specimen.

	cavity blood	liver tissue	lung tissue	kidney tissue	spleen tissue	muscle tissue	heart tissue	gastric fluid
methamphetamine	827	1175	3230	686	735	190	593	760
amphetamine	103	215	431	81	103	18	62	79
buprenorphine	1046	117	37	275	62	3	19	209
norbuprenorphine	318	190	233	115	77	D ³	31	49
naloxone	79	16	2	21	4	-	-	9

Table: Concentrations (ng/mL, ng/g) of substances (rows) by specimen type (columns)⁴

d. Descriptions of Detected Substances

Methamphetamine is a central nervous system (CNS) stimulant drug. Amphetamine is a metabolite of methamphetamine, and is also a CNS stimulant. Both methamphetamine and amphetamine are available as prescription drugs used to treat attention deficit disorder (ADD), attention deficit hyperactivity disorder (ADHD), narcolepsy, and occasionally obesity; each may also be a metabolite of certain other medications. Methamphetamine and amphetamine are Drug Enforcement Agency (DEA) Schedule II controlled substances, with a high potential for abuse and dependence. At low doses used

² The FAA Forensic Sciences Laboratory tests specimens for over 1,300 compounds including toxins, prescription and over-the-counter medications, and illicit drugs; information about these compounds can be found at the Civil Aerospace Medical Institute WebDrugs website (<http://jag.cami.jccbi.gov/toxicology>).

³ D = detected but not quantified.

⁴ The toxicology report did not distinguish between nanograms per milliliter (ng/mL) and nanograms per gram (ng/g), which are equivalent units at water density.

as part of appropriate medical treatment, the drugs may improve reaction time, cognitive function, and fatigue, but may cause people to make higher-risk choices. At higher doses, the drugs may have a variety of impairing effects on psychomotor function, cognition, and perception. The drugs typically carry warnings that they may impair the ability to engage in potentially hazardous activities such as driving a motor vehicle. Such impairment can result from drug or withdrawal effects.^{5,6,7} Both methamphetamine and amphetamine are considered “do not issue/do not fly” medications by the FAA.⁸

In addition to being used medicinally, methamphetamine and amphetamine are frequently produced illicitly and abused recreationally by ingestion, snorting, smoking, rectal insertion, or injection. Seeking an intense euphoric effect, abusers typically use much higher doses than are used medicinally. Consequently, methamphetamine blood levels can sometimes be used to distinguish abuse from medicinal use. In living people, methamphetamine blood levels above 200 ng/mL generally represent abuse (there is no evidence that levels above this improve task performance), whereas typical levels seen with medicinal use are between 20 ng/mL and 50 ng/mL.⁵

Effects from methamphetamine/amphetamine abuse follow a typical pattern. An abuser may experience early psychological effects including euphoria, excitation, exhilaration, rapid ideas and speech, increased sex drive, restlessness, hallucinations, delusions, psychosis, sleeplessness/reduced tiredness, an increased feeling of alertness, a heightened sense of wellbeing, a feeling of increased physical strength, and poor impulse control. Early physiologic effects may include rapid heart rate, increased blood pressure, increased breathing rate, elevated temperature, dry mouth, abdominal cramps, twitching, dilated pupils, faster reactions, and increased strength. Later, as initial drug effects wear off, an abuser may experience dysphoria, restlessness, agitation, itching, nervousness, paranoia/hypervigilance, irritability,

⁵ Couper FJ, Logan BK. Drugs and human performance fact sheets. Washington, DC: National Highway Traffic Safety Administration; 2014 (revised). DOT HS 809 725.

⁶ National Institutes of Health National Library of Medicine. Methamphetamine hydrochloride. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=f31f580f-1f08-4a0f-b078-0b9e3308f712>. Updated August 15, 2019. Accessed June 18, 2020.

⁷ National Institutes of Health National Library of Medicine. Amphetamine sulfate. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=79b9db39-7cdc-5607-f0ce-ac2a2cfd59d5>. Updated March 1, 2020. Accessed June 18, 2020.

⁸ An open prescription for any DEA controlled substance is disqualifying for FAA medical certification, and pilots should not fly while using any such substance. Pilots are prohibited from commanding an aircraft if they know or have reason to know of any medical condition that would make them unable to operate the aircraft in a safe manner, or if they are using any drug that affects their faculties in any way contrary to safety. [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/go/dni>. Updated February 21, 2019. Accessed July 17, 2020.] [Office of the Federal Register. 14 CFR 61.53. Electronic Code of Federal Regulations. https://www.ecfr.gov/cgi-bin/text-idx?node=se14.2.61_153. Updated July 15, 2020. Accessed July 17, 2020.] [Office of the Federal Register. 14 CFR 91.17. Electronic Code of Federal Regulations. https://www.ecfr.gov/cgi-bin/text-idx?node=se14.2.91_117. Updated July 15, 2020. Accessed July 17, 2020.]

anxiety/nervousness, aggressive/violent impulses, diminished coordination, hallucinations, delusions, scattered thoughts, psychosis, fatigue, and drug craving. Measuring an abuser's blood drug level does not help distinguish whether the person is experiencing early versus late effects.⁵

Buprenorphine (also known by the trade name Subutex) is a prescription medication commonly used to treat opioid dependence. It acts selectively on opioid receptors, blocking opioids while also producing limited opioid-like effects. Buprenorphine can itself be addicting and may be abused; it is a DEA Schedule III controlled substance. It can also be sedating, and typically carries a warning that it may impair the mental or physical abilities required for the performance of potentially dangerous tasks such as driving or operating machinery. Buprenorphine has been associated with serious and fatal suppression of breathing and consciousness, usually when misused.^{9,10} Norbuprenorphine is an active metabolite of buprenorphine.¹¹

Buprenorphine is often taken under the tongue in the form of a tablet or strip that contains naloxone in a 1:4 ratio with buprenorphine. The combination of buprenorphine and naloxone is also known by the trade name Suboxone. Naloxone (also known by the trade names Narcan and Evzio) is an opioid-blocking drug. Given by injection, nose, or breathing tube, naloxone can treat acute opioid overdose. However, taken under the tongue, naloxone generally has little to no effect, because only a small fraction of it enters the bloodstream. Naloxone's inclusion in buprenorphine products is intended to discourage people from abusing the products by dissolving and injecting them; injecting naloxone can interfere with euphoric effects of injected buprenorphine and can cause unpleasant withdrawal symptoms in regular opioid users. However, some people still inject/abuse buprenorphine even when mixed with naloxone.^{10,12,13} Regardless of whether it is combined with naloxone, buprenorphine is considered a "do not issue/do not fly" medication by the FAA.⁸ Naloxone itself is not generally considered impairing.

⁹ National Institutes of Health National Library of Medicine. Buprenorphine HCl. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=1bf8b35a-b769-465c-a2f8-099868dfcd2f>. Updated November 6, 2019. Accessed June 17, 2020.

¹⁰ Strain E. Pharmacotherapy for opioid use disorder. In: Post TW, ed. UpToDate. Waltham, MA: UpToDate Inc. <https://www.uptodate.com/contents/pharmacotherapy-for-opioid-use-disorder>. Updated April 17, 2020. Accessed June 17, 2020.

¹¹ Federal Aviation Administration Civil Aerospace Medical Institute. Norbuprenorphine. Forensic Toxicology's WebDrugs. <http://jag.cami.jcabi.gov/toxicology/DrugDetail.asp?did=280>. Updated January 16, 2019. Accessed June 17, 2020.

¹² National Institutes of Health National Library of Medicine. Narcan. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=724df050-5332-4d0a-9a5f-17bf08a547e1>. Updated October 7, 2019. Accessed June 17, 2020.

¹³ National Institutes of Health National Library of Medicine. Buprenorphine and naloxone. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=47236a95-ba0b-4f6a-b406-858cab726df>. Updated December 16, 2019. Accessed June 17, 2020.

D. SUMMARY OF MEDICAL FINDINGS

At his last aviation medical examination on May 10, 2018, the 33-year-old male pilot reported 3 total civilian flight hours. He reported no active medical conditions or medication use. He was issued a third-class medical certificate without limitation.

The Mississippi State Medical Examiner's Office performed the pilot's autopsy. According to the autopsy report, the cause of death was massive blunt force trauma. The autopsy did not identify any significant natural disease.

Toxicological testing by the Federal Aviation Administration (FAA) Forensic Sciences Laboratory identified several substances, at the following concentrations in nanograms per milliliter (ng/mL) or nanograms per gram (ng/g). Methamphetamine: 827 in cavity blood, 1175 in liver, 3230 in lung, 686 in kidney, 735 in spleen, 190 in muscle, 593 in heart, and 760 in gastric fluid. Amphetamine (a metabolite of methamphetamine): 103 in cavity blood, 215 in liver, 431 in lung, 81 in kidney, 103 in spleen, 18 in muscle, 62 in heart, and 79 in gastric fluid. Buprenorphine: 1046 in cavity blood, 117 in liver, 37 in lung, 275 in kidney, 62 in spleen, 3 in muscle, 19 in heart, and 209 in gastric fluid. Norbuprenorphine (a metabolite of buprenorphine): 318 in cavity blood, 190 in liver, 233 in lung, 115 in kidney, 77 in spleen, 31 in heart, and 49 in gastric fluid; norbuprenorphine was also detected in muscle. Naloxone: 79 in cavity blood, 16 in liver, 2 in lung, 21 in kidney, 4 in spleen, and 9 in gastric fluid.