NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

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Chief Medical Officer

A. ACCIDENT: WPR19IA030; Bakersfield, CA

On November 23, 2018, about 1733 Pacific standard time, the pilot of a Cessna 208B, N781FE, became incapacitated after he reached the airport run-up area at Meadows Field Airport (BFL), Bakersfield, California. The airline transport pilot received minor injuries and the airplane was not damaged. The airplane was owned by FedEx Corporation and operated by Westair, Inc. under the provisions of Title 14 Code of Federal Regulations Part 135 as an on-demand, scheduled cargo flight. Visual meteorological conditions (VMC) prevailed, and an instrument flight rules flight plan was filed for the cross-country flight that was destined for Ontario, California.

According to the pilot, he notified the company of his arrival at the airport at 1610 and taxied the airplane to the FedEx ramp located at the southeast corner of the airport. He met with FedEx personnel who loaded boxes into the upper cargo area of the airplane. The pilot counted a total of about 41 large boxes, totaling about 36 kg of dry ice among the shipping containers. A FedEx dangerous goods representative approved the shipment as the dry ice weight furnished by the shipper was below the company's operating limit of 76 kg, a weight limitation provided by FedEx for the shipment of dry ice specifically as cargo onboard its Cessna 208B airplanes. He did not open the shipping containers. After the loading was completed, the pilot finished his paperwork and started the airplane at 1729. While taxing to runway 30R the pilot felt "strong sleepiness" accompanied by difficulty breathing. He stopped the airplane at the runway run-up area and closed his eyes.

After the pilot failed to respond to air traffic controllers for 25 minutes, a firefighter illuminated the cockpit and observed an occupant with his head rolled back and his mouth open. The firefighter placed wheel chocks in front of the main landing gear tires to prevent the airplane from advancing. Following several unsuccessful attempts to get the pilot's attention, the firefighter administered a sternal rub, which caused the pilot to move. The firefighter engaged the fuel cutoff to shut down the engine and subsequently disengaged the electrical system. During this time the pilot became more conscious, but

his speech was unintelligible. However, moments later the pilot was able to demonstrate to the firefighter that he was coherent by answering a series of relatable questions. The pilot exited the airplane on his own and was transported to the hospital by an ambulance.

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 FAA blue ribbon medical file, post incident medical treatment records, post incident toxicology test findings, pre-incident personal medical records, and the investigators' reports were reviewed. Relevant regulatory and medical literature were also evaluated.

   FAA Blue Ribbon Medical File

   According to the FAA medical case review, the 59 year old male pilot had applied for a medical certificate on 1/20/2018 (the most recent exam before the incident). At that time, he reported no medical conditions and no use of medications to the FAA. No significant physical abnormalities were identified, and he was issued a second class medical certificate without limitations.

   After the incident, on 12/2/2018, the pilot reapplied for a medical certificate and supplied additional information regarding his post incident medical evaluation. At that time, he reported having been diagnosed with Valley Fever (a fungal lung infection common in the Southwest also known as coccidiomycosis), as well as an extensive cardiology evaluation following the incident. More information is documented below. At the time, the pilot reported a total of 13,410 flight hours and was issued a second class medical certificate limited by the requirement that he wear corrective lenses.

   Toxicology

   Toxicology testing performed on blood obtained during the pilot's initial medical care by the FAA's Forensic Sciences Laboratory identified fluconazole in blood and plasma. No other tested-for substances were identified.[1]

[1] The laboratory at FAA Forensic Sciences Laboratory has the capability to test for more than 1300 substances including toxins, common prescription and over-the-counter medications as well as illicit drugs. See: http://jag.cami.jccbi.gov/toxicology/default.asp?offset=0 for a complete listing.

Personal Medical Records Pre-Incident

According to medical records obtained from the pilot's pulmonologist, the pilot was diagnosed in June 2018 with Valley Fever. He had been admitted to the hospital, diagnosed, and begun on treatment with fluconazole (a prescription antifungal drug also marketed with the name Diflucan).[2] It is not generally considered cognitively impairing. He continued to take the antifungal for the next many months. Follow up testing in October 2018 showed marked improvement in the lung findings of infection by CT scanning. At that time the plan was for another follow up CT in December 2018 to ensure resolution of the infection, with antifungal treatment to continue in the meantime.

Post Incident Medical Treatment Records

According to the records from the treating hospital, the pilot was awake and alert and neurologically normal when he arrived at the emergency department. His initial evaluation identified some transient changes in his EKG that raised a concern for ischemia. As a result he was admitted and underwent extensive testing including a CT scan of the head/brain that was unremarkable, a cardiac catherization that showed no evidence of coronary artery disease, an echocardiogram that showed no abnormalities of the valves or other structures, vascular dopplers were negative for any plaque in the carotid arteries, and extensive laboratory testing that did not identify any abnormalities.

On 12/5/2018, the pilot underwent an outpatient review of events with his cardiologist whose final diagnosis was that the signs and symptoms the pilot had as well as results of medical testing all pointed to a diagnosis of carbon dioxide poisoning from dry ice in the plane as the cause of the incident. Excess inhaled carbon dioxide is rapidly exhaled (within minutes) down to normal levels when breathing regular air.

Carbon Dioxide Poisoning

Carbon dioxide (CO_2) is an odorless colorless gas that normally makes up about 0.04% of dry air. This translates to 250-350 ppm in outdoor air at sea level. CO_2 is about 1.5 times heavier than other components of air and will tend to fill lower spaces first. Levels in reasonably well ventilated indoor spaces may reach up to 1000 ppm. As carbon dioxide levels in air rise, oxygen is displaced and no longer as available to anyone inhaling the air. As CO_2 levels climb above 1000 ppm, people will begin to experience a combination of symptoms of low oxygen and intoxication with CO_2 - drowsiness, poor concentration, increased rate and perceived effort of breathing, headaches, and nausea may begin. As inhaled levels continue to

[2] National Institutes of Health. US National Library of Medicine. DailyMed. Fluconazole. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=5590e3fc-b9a1-4863-9420-900bf437a3cc Accessed 5/28/2019.

climb over 5000 ppm, coma and eventually death will ensue. At higher inhaled levels, negative effects occur more rapidly.

Dry ice is frozen CO_2. The surface temperature of a block of dry ice is –109 degrees Fahrenheit. At regular atmospheric pressures, it does not undergo transformation into a liquid state, but sublimates directly into a gas. This makes it useful as a method for keeping perishable items cold during transport. However, as another result of its properties, it must be stored in containers that allow the gas to escape or risk the possibility of an explosion. There are numerous reports of people being exposed to dry ice in poorly ventilated areas who have died as a result of exposure to the resulting low oxygen/high CO_2 environments.[3]

D. SUMMARY OF MEDICAL FINDINGS

The 59 year old male pilot had reported no chronic medical conditions and no use of medications to the FAA as of his last medical examination prior to the incident. He held a valid second class medical certificate.

According to his report and personal medical records, the pilot had been diagnosed in June 2018 with Valley Fever, a fungal lung infection also known as coccidiomycosis. He had been admitted to the hospital, diagnosed, and begun on treatment with fluconazole (a prescription antifungal drug also marketed with the name Diflucan). It is not generally considered impairing. He continued to take the antifungal for the next many months. Follow up testing in October 2018 showed marked improvement in the lung findings of infection by CT scanning.

According to the records from the treating hospital, the pilot was awake and alert and neurologically normal when he arrived at the emergency department on 11/23/2018, the day of the incident. His initial evaluation identified some transient changes in his EKG that raised a concern for ischemia. As a result he was admitted and underwent extensive testing including a CT scan of the head/brain that was unremarkable, a cardiac catherization that showed no evidence of coronary artery disease, an echocardiogram that showed no abnormalities of the valves or other structures, vascular dopplers were negative for any plaque in the carotid arteries, and extensive laboratory testing that did not identify any abnormalities.

On 12/5/2018, the pilot underwent an outpatient review of events with his cardiologist whose final diagnosis was that the signs and symptoms the pilot had on the day of the incident as well as results of medical testing all pointed to a diagnosis of carbon dioxide poisoning from dry ice in the plane as the cause of the event.

[3] Kris Permentier, Vercammen S, Soetaert S, and Schellemans C. Carbon dioxide poisoning: a literature review of an often forgotten cause of intoxication in the emergency department. International Journal of Emergency Medicine 2017;10:14.