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UNITED STATES DEPARTMENT OF THE INTERIOR
AVIATION MANAGEMENT

AVIATION ACCIDENT PREVENTION BULLETIN

No. 05-02

February 3, 2005

Subject: Carbon Monoxide (CO)

Area of Concern: Exposure to Carbon Monoxide Poisoning

Distribution: Aviation Operations

Discussion: Carbon monoxide (CO), a by-product of incomplete combustion, is a colorless, odorless gas that is toxic, even in very small quantities. Carbon monoxide combines with the blood (red blood cells) to form carboxyhemoglobin (COHb). The bond between carbon monoxide and the blood is much stronger (200 times stronger) than the blood's bond with oxygen. This means that when you're exposed to a little CO it lasts a long time and continuous exposure (like in an aircraft in flight) can cause a deadly build up of carbon monoxide in the blood, which prevents your blood from carrying as much oxygen.

Carbon monoxide is a leading cause of a form of hypoxia known as hypemic hypoxia. Hypemic hypoxia disrupts the blood's ability to pick up oxygen. Anything that aggravates hypoxia will also aggravate CO poisoning (high altitude operations, certain drugs, smoking); and anything that reduces hypoxia will also reduce the effects of CO poisoning (descending to a lower altitude, using 100% oxygen, not smoking).

Although the effects vary from person to person, a carboxyhemoglobin level of only 20% can cause a headache, a state of confusion, dizziness, and visual disturbances, which can impair a pilot's performance. As the concentration of CO in the blood increases the victim loses the ability to recognize what is happening as they go from dizziness to unconsciousness, and if the exposure is concentrated enough or long enough, death can occur.

In an aviation environment carbon monoxide can come from a variety of sources. But, one of the most frequent is from the cabin heater. Carbon monoxide can also come from air leaks between the engine compartment and the cockpit, cracks in the exhaust system, or other sources.

Since you can't see or smell carbon monoxide it's difficult to identify the subtle onset of CO poisoning. Fortunately, technology has provided a solution to help us detect the presence of carbon monoxide and prevent CO poisoning with the development of carbon monoxide detectors. Several CO detectors are on the market and are currently being used successfully in DOI aircraft. The DOI-AM Alaska Regional Office Maintenance shop is currently installing a panel mounted CO detector in fleet aircraft in Alaska, while two additional carbon monoxide monitors with digital readouts are being used to measure actual CO levels in fleet aircraft used in the Lower 48.

If you're already using a CO detector, the bottom line is how much carbon monoxide is too much? Although charts are available that identify CO exposure levels and the associated effect of those exposure levels, the maximum exposure limit appears to vary depending upon which regulatory agency is being cited. The last article referenced on the second page of this bulletin mentions that the EPA, OSHA, the FAA, Underwriter's Laboratories and some fire departments all have slightly different standards regarding a maximum CO limit. However, keep in mind that FAR Part 23 Airworthiness Standards: Normal, Utility, Acrobatic, Commuter Category Airplanes (the rules under which most of our aircraft are certificated today), specifically Part 23.831(a) Ventilation, states, "Each passenger and crew compartment must be suitably ventilated. Carbon monoxide concentration may not exceed one part in 20,000 parts of air". This equates to 50 parts CO per million, and this is the carbon monoxide concentration that we should not exceed while conducting aviation operations.

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Discussion: (Continued)

Since CO detector technology is relatively new and regulations are few, you can expect that this Aviation Accident Prevention Bulletin may be updated in the future as additional information becomes available.

For more information on CO poisoning and CO detectors see the following references:

FAA Advisory Circular 20-32B (Carbon Monoxide (CO) Contamination in Aircraft – Detection and Prevention), http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/6574B652EC1CB67D862569AD007773EF?OpenDocument

Carbon Monoxide Detectors, AVWEB November 9, 2003, Mike Busch, http://avweb.com/news/aeromed/186016-1.html

CO Experts Model 2004, Aeromedix.com,
http://www.aeromedix.com/?_siteid=aeromedix&_sessid=62185b97eda7c1c299faa90b9000820d&action=sku&sku=coex

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