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Carbon Monoxide in Pilots and Passengers in General Aviation Merrill Field, Anchorage

The Epidemiology Office, with the support of the Federal Aviation Administration (FAA), initiated a major investigation approximately two years ago to describe the epidemiology of general aviation accidents. During our investigation, we identified several fatal crashes that were caused by carbon monoxide poisoning. In order to identify the extent to which pilots and passengers are exposed to carbon monoxide while flying, we initiated an investigation of carbon monoxide in pilots and passengers in general aviation.

We arranged for pilots and passengers who landed at Merrill Field on Saturday, March 2 and Sunday, March 3 to have blood samples taken for carboxyhemoglobin determinations. A short questionnaire, completed on all participants, included information about type of aircraft, duration of flight, and smoking status of the pilot and passengers. The study was totally voluntary.

On March 2-3, 1985, 95 pilots and passengers from 56 aircraft were tested. One pilot was tested twice; he flew the same aircraft both days. Of the 95 individuals we tested, 9 were smokers, 86 were non-smokers. Excluding the smokers, 9 individuals whose carboxyhemoglobin levels exceeded 2.5% COHb were identified from 7 different aircraft (Figure 1). The 7 aircraft in which non-smoking pilots or passengers had elevated carboxyhemoglobin levels are listed in Table 1, along with duration of the flight and the actual levels of carboxyhemoglobin among the occupants. None of the 9 non-smokers with elevated COHb levels had another identifiable source of CO exposure.

Smokers had carboxyhemoglobin levels considerably higher than non-smokers. In six aircraft, other non-smokers in the aircraft had normal carboxyhemoglobin levels. One pilot who was a smoker had a low COHb level (0.8%). No one smoked during his flight. Two pilots who were smokers flew alone; their COHb levels (4.0%, 4.3%) were lower than the COHb levels of the five other smokers who shared aircraft with non-smokers who had normal COHb levels.

The pilots of the 7 suspect aircraft were notified of their results by telephone and were advised to have their aircraft checked by a qualified mechanic. One pilot discovered that his exhaust manifold was improperly attached, causing exhaust leaks at the gaskets. This individual's plane had major mechanical work 80 hours prior to his being tested. The pilot also used a carbon monoxide detecting disc that had turned positive during his 40 minute flight from Wasilla to Anchorage.

Of 55 different aircraft in this investigation, 7 (12.7%) appeared to be exposing the occupants to increased levels of carbon monoxide. In fact, the level of carbon monoxide in the cockpits of these aircraft must have been extremely high in order for carboxyhemoglobin levels to be elevated after flights of such short duration.

The carboxyhemoglobin levels in non-smokers seen in this investigation (2.7 - 6.45% COHb) would not be expected to cause acute symptoms or noticeable impairments traditionally described at much higher levels of carboxyhemoglobin (greater than 10-20% COHb). However, these levels most likely were due to acute elevation of carboxyhemoglobin among the affected individuals. Their performance might have been noticeably impaired only if an emergency occurred, placing maximum demands on judgment, rapid neuromuscular activity, and sensory orientation and coordination.

Many incidents have been described in which experienced pilots, known to be both skilled aviators as well as conservative in judgment, have been involved in aircraft crashes where judgment has seemed to have been unexpectedly poor or where actions have seemed inexplicable. Was carbon monoxide at fault? This investigation certainly raises the possibility that carbon monoxide poisoning may be a more frequent contributor to aviation crashes than previously recognized. Certainly additional work needs to be carried out to verify and to extend the findings of this initial investigation. In the meantime, we recommend that all pilots and aviation mechanics pay particular attention to their aircraft's exhaust and heating systems.

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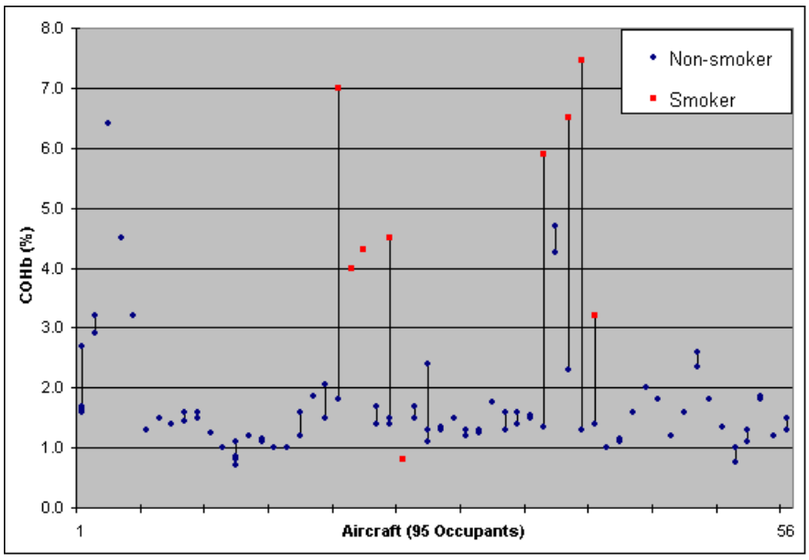
CARBON MONOXIDE IN PASSENGERS AND PILOTS IN CIVIL AVIATION
MERRILL FIELD
MARCH 2-3, 1985

AIRCRAFT WITH POSITIVE RESULTS

AIRCRAFT	DURATION OF FLIGHT (MIN.)	PILOT'S COHb (%)	PASSENGER'S COHb (%)
CESSNA 185	45	2.7	1.7, 1.6, 1.75, 1.65
ARCTIC TERN	180	4.25	4.7
CESSNA 170	60	3.2	2.9
CESSNA 170	120	6.45	
PIPER PA-12	175	4.5	
CESSNA 170B	40	3.2	
PIPER PA-20	90	2.6	2.35

Figure 1


8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
COHb (%)
Non-smoker
Smoker
1
Aircraft (95 Occupants)
56