



## SICK FROM SMOKE/FUMES ONBOARD? WHAT YOU NEED TO KNOW AND WHAT YOUR DOCTOR NEEDS TO KNOW

The outside air that gets supplied to the cabin and flight deck is “bled” off either the aircraft engines or an auxiliary engine called the APU. Because of design and maintenance issues, engine oil/hydraulic fluid from the engines/APU/aircraft systems sometimes contaminate the ventilation air. The oil/fluid is decomposed by the very high temperatures in the engines/APU (250-950°F), and the contaminated supply air is then delivered (unfiltered) to the cabin/flight deck. If this happens during your flight, you will likely know when this happens because you will notice an unpleasant odor may be apparent, occasionally accompanied by visible smoke/fumes. The fumes contain a complex mixture of chemicals, including carbon monoxide (assuming system temperature > 450°F), toxic organophosphates, and irritant compounds such as acrolein, formaldehyde, and aromatic amines. **All of the documents referenced in this bulletin are available at:** <http://ashsd.afacwa.org/docs/practical.htm>

Print these documents and either carry them with you OR download them and keep them on your smart phone, so that you have them with you when you need them. Bring them to any medical appointments, including the ER/urgent care clinic, if you think/know you breathed these fumes and you feel sick:

1) Safety data sheet for the engine oil at your airline;<sup>1</sup>

If you think/know you breathed engine oil fumes, inform your doctor that aviation engine oils used on commercial aircraft contain 1-6% tricresyl phosphates (TCPs), and many contain 1-5% phenyl-1-naphthylamine, per the product safety data sheets. Initial symptoms of TCP exposure can include stomach cramps, muscle weakness, and flu-like symptoms, which can be followed by delayed problems with memory, speech, balance, and headaches, for example. These symptoms can develop during the days or weeks after breathing the fumes.

2) Safety data sheet for the hydraulic fluid at your airline;<sup>1</sup> and

If you think/know you breathed hydraulic fluid fumes, inform your doctor that they contain tributyl phosphates, and various phenyl phosphates, carboxylates, and epoxides, depending on the specific product. Hydraulic fluid fumes are especially irritating to the respiratory system.

3) FAA-funded Health Care Providers’ Guide (written by a doctor; provides information on the potential to breathe oil//hydraulic fluid fumes on aircraft, the chemical compounds in the fumes, and reported symptoms).

To AFA’s knowledge, there is no blood test specific to either oil or hydraulic fluid fumes. Some scientists have published papers on the preliminary stages of research to develop blood tests specific to some of the additives in aviation engine oils, but no test is yet finalized. **In the meantime, there are some blood tests that may be helpful:**

<sup>1</sup> Make sure your doctor understands that the SDS does not explicitly describe health hazards associated with inhaling oil or hydraulic fluid heated to high temperatures, so the health hazard warnings on the SDS are incomplete.

- Oil and hydraulic fluid fumes can contain carbon monoxide (CO), so discuss whether a **carboxyhemoglobin** (CO-Hg) blood test is necessary. Report to your doctor how long it has been (hours) since you breathed the fumes, and whether or not you have taken oxygen since then. Your CO-Hg levels will likely normalize within hours of an incident, and even faster if you took oxygen. The effects of exposure to CO are more intense in-flight than on the ground because you are in a reduced oxygen environment. CO clears from your body relatively quickly, but the associated symptoms can persist, so it is important for your doctor to know that the fumes can contain CO.
- Tell your doctor that red blood cell cholinesterase (also called "acetyl cholinesterase") is a poor indicator of TCP exposure. Ask your doctor to **test the level of plasma cholinesterase (PChE; also called "serum cholinesterase" or "butyl cholinesterase")** in your blood. Classically, TCP exposure may cause a depression in PChE level, followed by a "rebound effect" a week or more after the event. The time scale is difficult to predict, so multiple measurements over time and careful interpretation of the test results are necessary. Your doctor also needs to know that there are documented reasons why some people have depressed levels of PChE to begin with, putting them more at risk of toxic effects during an incident. For example, menstruation, pregnancy, and specific medical conditions have been associated with reduced PChE.
- Ask your doctor if it would be suitable to test your **serum C-reactive protein**. This is a blood marker of inflammation; see <http://www.ncbi.nlm.nih.gov/pubmed/17389175> and there is some evidence that exposure to organophosphate chemicals (like the TCP additives in engine oil) can cause levels to increase.

Currently, doctors rely largely on **medical tests that show damage or malfunction**. The doctor can then assess whether or not your test results are consistent with exposure to a heated mist of engine oil or hydraulic fluid. For example:

If you have breathing problems, a doctor can examine your respiratory system and perform lung function tests.

If you have memory or concentration problems, a neuropsychologist can administer specific tests, both to assess and document any problems, and to determine suitable therapies.

If you have tremors, speech, or balance problems, a neurologist can assess and document the problems, probably with some combination of a physical exam and a brain scan. A SPECT scan may be suitable to assess damage caused by exposure to organophosphates.

If you suffer from depression or anxiety after an event (whether due to brain damage from the chemicals or simply as a reaction to being ill), a psychiatrist may be helpful in assessing your symptoms and helping you to manage them.

If you have symptoms, see a doctor as soon as possible to make sure that there is an official record and you meet any workers' compensation requirements. It is helpful to keep a written record of your symptoms over time. For any visible symptoms (such as a rash or tremor), take videos or photographs. Keep a copy of all documents and keep a record of every related phone call. If you have more questions or need documentation to give to your doctor, contact Judith Anderson at AFA's Air Safety, Health, & Security Department at 206-932-6237 or [Judith@AFAnet.org](mailto:Judith@AFAnet.org).