



## OCCUPATIONAL HEALTH AND SAFETY NEWSLETTER

Air Canada Pilots Association | Association des pilotes d'Air Canada

### Cabin Air Quality and “Fume Events” Update

#### Occupation Health and Safety - Newsletter #01

January 11, 2012

Fellow pilots,

Over time, the OHS Committees of ACPA have received progressively more reports and information related to “fumes events.” In view of the information available to us, we think that some clarification is required with respect to the following:

- The possible sources of “fumes”;
- The contents of “fumes”;
- The potential health effects for pilots and other aircraft occupants exposed to fumes; and
- The QRH checklists available to us and the importance of donning masks and landing ASAP as per the QRH when the situation warrants.

#### **Fume Events, What Are They?**

The Oxford Dictionary defines “Fumes” as: *“a gas or vapour that smells strongly or is dangerous to inhale”*.

From an informal survey, ACPA OHS has also found that many pilots may not be cognisant of the possible sources and potential toxicity of smoke or fumes. Smoke or fume contents are completely dependent on the material being leaked or decomposed by pyrolysis(1), heat, pressure, etc. The contents of smoke or fumes are not always easy for humans to identify as harmful with our senses. Be aware that toxic substances may or may not be visible and can produce a range of odours from none to very pungent. Some components of fumes or smoke may be benign but any exposure to smoke or fumes has the capacity to be toxic depending on its contents and concentrations.

Recently, there has been considerable information, media attention, and CUPE-OHS bulletins related to cabin air quality. To adapt this background to the evolving knowledge about cabin air quality and oil fumes from the bleed air systems we would like you to take into account the following.

In the past, the “old sweaty socks” odour was usually blamed on the coalescer bags or HEPA filters (that are filtering only re-circulated air). Changing the filters may or may not have cured the smell. However, the explanation still satisfied many of us and mostly, while annoying, the odour was rarely perceived as threatening or toxic. In view of accumulating scientific evidence, we have been enlightened that although the offending scent is usually compared with human related aromas, like “a gym bag”, “old dirty socks” and similar distasteful fragrances, the odour could be the result of the release into the aircraft air of Organic Acids. Organic Acids themselves are irritants, but the larger concern is the accompanying components of synthetic engine oils either in their original state or decomposed through “pyrolysis.”(1).

You may ask yourself, isn't the oil confined to the engine? On a healthy engine in good condition it will be. The problem is the possibility of a leak, even a very minor leak, or ingestion in the engine or APU compressor area forward of the bleed air pick-up point. This is usually caused by a seal failure or premature wearing of the forward oil seal in the engine or APU. There have also been cases of APU ingestion of oils or hydraulic fluids from ahead of the APU intake. In any of the cases, the air being conducted through the bleed system will then be contaminated with chemicals that will be conveyed in the air conditioning system thus causing the occupants of the aircraft to inhale these chemicals in original or decomposed state.

Such a fluid leak when ingested into the bleed air system will create a "fume event." Other potential products ingested may include de-ice fluid or engine wash but these products are usually phase of flight or location specific and easily identified. Other potential sources for fume events could be the APU, electrical motors, bushings and bearings, hydraulic fluids, air cycle machine bearing oil, all of which could also contaminate the cabin air, and would also contain potentially harmful contents.

### **Potential Health Effects**

We want to stress that under normal operating conditions, i.e. no fluid leaks or oil ingestion occurring, aircraft manufacturers assure us the cabin air is "considered safe."(9).

Most jet engine oils and hydraulic fluids have much the same contents. The two fluids in use at Air Canada are the following:

- EXXON MOBIL JETOIL II (2) is the aviation jet engine oil in use at Air Canada and includes a number of additives. Of particular interest is the 1-3% portion consisting of "TRICRESYL PHOSPHATE"(TCP).(2)(3). TCP is an organophosphate (OP) and is used due to its excellent anti-wear and flame resistant qualities in high temperature environments.
- SKYDROL LD4 Fire Resistant Hydraulic Fluid (4). The additive of interest is "DIBUTYL PHENYL PHOSPHATE"(DPP)(4)(5). At 20-30% content it is also an organophosphate (OP).

Some organophosphates (OP) in specific doses are carcinogens and neurotoxins, among other characteristics. Some OP are also used in various forms in chemical weapons or pesticides. Organophosphates, in specific doses, can create acute symptoms that are possibly incapacitating depending on individual physiological differences and contact dosages. Acute symptoms may include "*nausea, vomiting, diarrhea, excessive sweating, weakness, muscle twitching, blurred vision, chest pain, salivation, lacrimation (tearing), excessive coughing and flacid paralysis.*"(6) Symptoms can vary considerably from person to person and it is not unheard of for symptoms to present themselves hours or days later. However if contaminates do enter the bleed air flow, the short term health effects are well known to the medical community and are damaging to the respiratory and neurological body systems.

Some synthetic oil components are odourless therefore making it possible to have vapours without smell or visual cues, and the following symptoms may be indicative of a fume event in the absence of other signs. Possible physical symptoms may include dizziness, headaches, disorientation, euphoria, mood swing, skin irritation, burning eyes/nose/throat, metallic taste, confusion, lack of coordination/balance, nausea, increased heart rate, tingling of the extremities or respiratory problems. If the above symptoms are present in more than one person, using your professional experience and good judgement, then you may be experiencing a fume event with no visible or olfactory indications and you should follow your QRH procedures.

The long term effects of synthetic oil fume inhalation is still under investigation and we hope to have definitive answers soon. More research is required. The contentious issue in the scientific community appears to center around whether there are enough toxins in fume events to produce long term health effects. However, the International Programme on Chemical Safety (IPCS) of the World Health Organization (WHO) states *“because of considerable variation among individuals in sensitivity to TOCP, it is not possible to establish a safe level of exposure.”* (7)(8). The long term toxic effects of the organophosphate Tricresyl Phosphate (TCP) and its symptoms are well documented. Whether it is cumulative low doses or a larger single dose, TCP’s toxic effects are *“considered major hazards to human health.”*(7).

Some experts and research support that regular low level exposure to toxins, or possibly an exposure to a significant fume event is capable of causing long term symptoms. The long term symptoms may also be related to the fact that some people have a higher sensitivity to specific toxins. Keep in mind that not all humans react the same way to contaminants. An acknowledged example of this is with tobacco use that kills a proportion of inhalers while others continue a normal life. The challenge is rather similar with synthetic oil related fumes. It takes decades of accumulated data before science can prove a causal link. In the OHS world, we prefer to follow the “principle of precaution” when a serious doubt is present. None of us want to be at the receiving end of a bio-chemical experiment.

To summarise the smell of old dirty socks should generate the same level of intervention from the crew as, for example, a release of chemicals from badly packaged dangerous goods or smoke from burning material. This is consistent with the fact that they share the same QRH checklist. The objective is to raise the awareness of our members to include the decomposed synthetic oil fumes and their tell tale odours as dangerous.

An example of the evolution of knowledge regarding synthetic oil fumes is that a few months ago, one of our IFS crew used their “right to refuse dangerous work (RTR)” when confronted with an old socks odour. Following the investigation, the TC OHS officer concluded that a danger was present and confirmed the validity of the crew decision to refuse dangerous work. It should be noted that every RTR is evaluated on its own merits, case by case, and one determination of dangerous work will not guarantee the next.

The flight attendant’s OHS Committee recently issued a newsletter on the subject, so in the case of a fume event, you may expect the cabin crew to be more anxious about fumes than they were previously. If involved in a case where a crew member exercises his “right to refuse dangerous work”, it would be prudent to review the material available in the FOM and to involve flight operations management (duty pilot) and an OHS Committee member if at all possible.

### **What can be Done?**

We collectively have a number of avenues available to reduce our risk of exposure to this serious hazard. Sharing information is a start. There is a limit to the Committee’s capacity to disseminate information if we are not aware of the full situation. As mentioned previously in newsletters, the OHS Committees are dependent on the number and the quality of the reports filed by the pilots to fully understand the scope of the issue at hand.

Numerous ACPA members are known to have suffered from acute short term effects and have come back to the line following brief absences. In addition, at least two ACPA members are currently being evaluated by subject matter experts for possible long term consequences of exposure to organophosphates. We are all hoping that with medical intervention any affected members will regain their medicals.

**We would like to know if there are other pilots who have experienced short or long term effects of exposure. We would also like to know if there are pilots who have been exposed and who have not experienced health effects.** Please get in touch with the OHS Committees. Also, if exposed, fill out the appropriate paperwork to document the level of hazard and to protect your rights in the future. ASRs are not forwarded to the OHS Committee, and they are not a sufficient way to document a personal exposure to a potentially toxic substance.

The required forms are:

- The Air Canada “Health & Safety Concern Forms” ACF-32
- The Air Canada “Employee Accident / Incident Statement” ACF32-5

Both of the above forms can be found on ACAeronet by following:

- My flt ops
- PQRM or FCR
- OHS on the left menu

ACF32 or ACF32-5 as appropriate

### **What is being done at ACPA?**

A **well documented presentation** was made to the MEC this fall by one of our colleagues who is currently undergoing testing for possible organophosphates toxins and by the ACPA OHS Committee. The presentation was well received by the MEC.

Both the ACPA OHS and Joint OHS Committees decided to build their knowledge base and to start sharing the available information with the pilots. The Committees also agreed to improve the level of awareness of our managers when dealing with fume events.

Hopefully, in the future, the situation will be improved by using oils with a smaller proportion of toxic additives. Companies are currently working on the development of vapour eliminating air filters and/or detectors of the presence of dangerous contaminants onboard. As yet, none of the above is commercially available. We have been informed that more accessible medical testing should be available soon to properly diagnose those affected. We are also hopeful that in the near future, a formal training package will be available to all pilots.

The “fumes” checklist of our QRH is adequate, and it should be used promptly if there are indications of fumes in the aircraft. The alternative is the possibility of very serious health consequences in addition to the hazard of crew incapacitation in flight.

### **Further Information**

You are welcome to contact any OHS Committee member for additional information.

The ACPA OHS Committee members are not in a position to verify or endorse the material presented in the following websites, but we encourage you to educate yourself further while using your professional experience to guide you. You will find more information on aerotoxicity at:

You might also want to review the MSDS sheets for Mobil JetOilII and Skydrol LD4 Fire Resistant Hydraulic Fluid. These are available on Aeronet. Search: MSDS.

## **References**

1. "Pyrolysis" is a chemical decomposition of a substance through the action of heat. Pyrolysis involves the simultaneous change of chemical composition and physical phase, and is irreversible. International Fire Service Training Assoc. Essentials of Fire Fighting. 4<sup>th</sup> Edition.
2. Mobil Jet Oil II. ExxonMobil MSDS 18 May2008.
3. Tricresyl Phosphate (TCP). MSDS. JT Baker® MSDS #: T5161 04/11/2011
4. SKYDROL LD4 Fire Resistant Hydraulic Fluid. Solutia Canada Inc. 05/09/2008
5. DIBUTYL PHENYL PHOSPHATE"(DPP). CAS# 2528-36-1
6. Chris Koroneos. Air Canada Manager, Industrial Hygiene.  
Email Response Nov 10 2008 Re: Chemical Question. APU Oil Ingestion.
7. Tricresyl Phosphate. Environmental Health Criteria A110.  
International Programme On Chemical Safety (IPCS) ©.WHO Geneva 1990.
8. TOCP is Tri- o-cresyl phosphate. TOCP is an isomer of Tricresyl Phosphate (TCP). (3)
9. Boeing Corporation. Boeing.com. Commercial Cabinair Environment Facts

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