

Aircraft cabin fumes: an aviation safety issue

by

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The contamination of aircraft cabin air by engine oil or hydraulic fluid leaks is a serious aviation safety problem — for both crew and passengers. As a result of short and long-term exposure to these contaminants, crew members may suffer from a wide range of symptoms which, in turn, affect crew performance during flight. Thus, the safety of those on board the aircraft and the general community is put at risk.

Despite the growing volume of information — some dating back to the 1950s — it is only in recent years that this issue has received attention. However, there is strong resistance by the aviation industry to accept that the inhalation of toxic fumes (due to contamination of the aircraft air supply) could be hazardous, or may result in safety risks and short or long-term health effects. Indeed, some sectors of the industry have denied that OHS is their responsibility.

While industry and some airlines have said that fumes in the cabin air supply are simply a “comfort” issue, several recent developments would indicate that this is, in fact, a health and aviation safety issue. For example, in 2001 a mandatory airworthiness directive (AD) was issued for the BAe 146 (an AD is issued by the aviation regulator when an unsafe condition is considered to exist), based on a manufacturer service bulletin which required an inspection of engine oil seals, auxiliary power units and airconditioning packs in the aircraft for signs of oil contamination. The bulletin reported that although oil leaks and cabin/flight deck smells and fumes may have been considered to be a “nuisance” in the past, from now on they must be regarded as a “potential threat to flight safety, not just a nuisance”. Also, flight crews are now advised to use oxygen if fumes are present in the aircraft (previously, it was recommended that oxygen be used only if smoke or fire were present, that is, the term “fumes” has been added to the safety checklists for such situations).

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In addition, the 1999 Australian Senate Inquiry into air safety and cabin air quality in the BAe 146 reported that oil fumes are a health and safety issue.¹ Although this is supported by aviation legislation, it is often ignored or misinterpreted by industry. At the Senate hearings, one aircraft manufacturer advised that its criterion of safety was centred on there being no fatalities for “technical reasons”. That is, incidents and fatal accidents that have been caused by pilot error, pilot impairment, bad weather, and so on would not be considered as a safety problem, whereas those caused by aircraft technical faults would. Further, the safety focus in the use of the criterion was just about deaths resulting from this type of technical defect.

Aviation regulatory framework

Although Australian aviation regulations clearly cover aircraft defects, reporting, maintenance, and the health/fitness of crew for duty, it is obvious that the system is not working. There has been little attempt by the aviation regulators to ensure compliance with particular requirements of aviation safety legislation. The Australian Civil Aviation Safety Authority (CASA) has advised that, as an aviation safety regulator, it is concerned with the short to medium-term effects on aviation safety. Since CASA regards fumes/air quality as a longer-term OHS issue which is outside its area of expertise, it does not view the problem as a significant aviation safety issue. This has implications for other industries where safety is part of other organisational responsibilities (for example, mining) and suggests a conflict of interest to the detriment of safety.

However, the Australian regulations stipulate that crew members must not fly if their ability to perform their duties is impaired or is likely to be impaired by illness or injury (however minor). Also, crew members must not fly if they suffer from or are likely to suffer from fatigue or illness which may affect judgment or performance to the extent that safety may be impaired. Moreover, CASA has advised that “smoke, toxic or noxious fumes in the aircraft are considered a major defect” and must be reported.

In 1965, United States Federal Aviation Regulation 25.831 was developed. This internationally accepted airworthiness ventilation standard states that:

“(a) Under normal operating conditions and in the event of any probable failure conditions of any system which would adversely affect the ventilating air, the ventilation system must be designed to provide a *sufficient amount of uncontaminated air to enable the crew members to perform their duties without undue discomfort or fatigue* and to provide reasonable passenger comfort.

(b) Crew and passenger compartment air must be *free from harmful or hazardous concentrations of gases or vapors.*” (Emphasis added)

The requirements of this regulation must be met for an aircraft to fly.

Fume occurrences

Ansett has reported that one “odour event” in every 66 flights was recorded in the mandatory aircraft defect log in 1992 (a total of 418 reports); this was reduced to one in every 131 flights (168 reports) in the first six months of 1999.¹ Ansett has also stated that odour events were a “very rare occurrence”, with the number of reports dramatically reducing by 1999; however, with a fleet of 13 BAe 146 aircraft flying up to five to six sectors per day, this is one incident every day or two.

There have been a vast number of fume odour occurrences reported to date, including: over 800 Australian discretionary BAe 146 occurrence reports during 1991–2000; 212 reports of “tainted” cabin air from one operator during 1996–1999; 227 reports of contamination from 36 other operators during 1985–2000 (30 involved impairment of crew capacity); and 93 UK Boeing 757 pilots reporting 1,667 fume events on the flight deck (with 80 believing that the source was oil contamination of the air supply). As a result of these and other data on fume occurrences being presented at the Senate Inquiry, the Rural and Regional Affairs and Transport

References Committee found strong evidence of under-reporting. Clearly, the aviation regulatory framework in relation to fumes/air contamination is not working.

Although CASA has advised that the air contamination problem is a health issue and not a safety issue, the Senate Committee found that the two were linked. In addition, CASA has stated that the problem should be addressed by the State OHS bodies (despite aircraft crossing State borders), while the WorkCover Authorities believe that it is CASA's responsibility. Despite flight crews continuing to ask CASA and WorkCover/NOHSC to take an active role with regard to this health and safety issue, all have essentially declined. However, this problem is not unique to Australia. In the United Kingdom, the Civil Aviation Authority advised the House of Lords Inquiry that, while it is responsible for air safety, it does not address the long-term effects of flying (even in relation to flight crew); indeed, the UK Health and Safety Executive has no active responsibilities in relation to the health of passengers or crew.

The oil

During the Senate Inquiry into BAe 146 cabin air quality, Ansett stated that "the source of the odours has been identified as predominantly Mobil Jet Oil II leaking past oil seals in the engines and/or auxiliary power unit into the airconditioning system". This was supported by the statement from British Aerospace that "reports of cabin air odours ... have predominantly been determined to be due to minor systems failures such as leaks from oil seals on the aircraft engines or the auxiliary power unit".

Mobil Jet Oil II is a synthetic aviation oil containing around 3% tri-cresyl phosphate (containing some neurotoxic ortho-cresyl phosphates), 1% phenyl-alpha-naphthylamine (a known sensitiser), beta-naphthylamine (a category 1 carcinogen) and other substances. Current data suggest that the toxicity of the ortho-cresyl phosphate isomer contained in the oil is underestimated by a factor of at least 30,000 times.²

The material safety data sheet states that the oil is safe under "normal conditions of use", but goes on to say that "repeated breathing or skin contact of oil mist can cause nervous system defects". The manufacturer, Mobil, views oil contamination of an aircraft's air supply as an "abnormal" event. Additionally, there is no agreement at the present time as to which toxicological standards should apply to the unique environment of aircraft which have low humidity and reduced cabin pressure.³

Aerotoxic syndrome

The most common symptoms experienced by aircrew exposed to engine oil emissions include dizziness, nausea, disorientation, fatigue, chronic headache, chest pain, breathing difficulties, lethargy, confusion and tremors. Although disliked by the aviation industry, the term "aerotoxic syndrome" was proposed in 1999 to describe the cluster of symptoms observed among aircrew in relation to contaminated air supply. A recent review undertaken by the National Academy of Science criticised the use of the term and advised that the reported symptoms used in a number of studies showed little commonality. However, on closer review of the actual studies, this claim is misleading. For example, terms such as chest pains, pain on deep breathing, shortness of breath, and difficulty breathing may show "little commonality" but they are everyday terms to non-medical individuals. A list of standard medical terms should be developed and used to establish commonality in self-reported symptoms.

Interestingly, after reviewing an extensive amount of information on rates of incidents and symptoms reported by aircrew, the Senate Committee accepted the use of the term aerotoxic syndrome. In addition, it proposed that aircraft contamination was responsible for short and medium-term health effects, with possible links to long-term effects (this was understood by the Committee as being of at least 20 years' duration) requiring further review.

Some airlines have accepted that short-term symptoms may be linked to fumes from engine leaks,

but such effects were considered as acceptable in operational terms. However, as this contravenes the aviation — and possibly other — regulations it must not be allowed to continue.

What needs to be done

The Senate Committee's report, which was released in October 2000, found that the aviation legislation was being ignored and made eight clear recommendations.¹ However, the Government failed to respond until late-June 2002.⁴ Although recognising the problems faced by the aviation industry, the Government has failed to implement the recommendations, stating that enough has been done and that international bodies and a CASA-led references committee will study overseas developments. From a safety perspective, this response is inadequate.

Clearly, much more needs to be done. Greater attention must be paid to the increasing volume of data and service bulletin reports which document the air contamination and oil leakage problems. Such data also acknowledge that the engine/auxiliary power unit seals may not be as efficient at certain stages of operation and will only be rectified when new designs are available. This cannot be ignored. Future investigations and medical and scientific research must be independent of vested interests, must be of a higher standard than produced by industry to date, and must be supported by OHS personnel and an accurate,

extensive range of medical tests. The aviation regulations and aircraft design standards must be complied with. Finally, industry should be willing to review its position with regard to the evidence. It is only then that aircrew will be protected from both the toxic exposures and from action that may be taken by the airlines following the reporting of oil fumes (such as dismissal or demotion).⁵

References

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