



Aircraft Cabin Air Conference 2017

Air Accident Investigation Findings and Recommendations

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Air Accident Investigation Findings and Recommendations

Limitations...

- **Most contaminated air events are never reported**
- **Of those reported most are never investigated by air accident investigation teams**
- **Of those investigated, investigators often lack the resources or subject matter expertise**

Air Accident Investigation Findings and Recommendations

12/2010 - BFU 5x018-10

“According to the Commission Regulation (EC) 996/2010 and the Law Relating to the Investigation into Accidents and Incidents Associated with the Operation of Civil Aircraft, the BFU can only investigate cases relevant for aviation safety.”

These include fire or smoke on board, occurrences which force the flight crews to don their oxygen masks and any flight crew incapacitation during the flight.

Observation of odours, or smoke, irritations or headaches only becomes part of an investigation if they originate from fire or incapacitation.”

Impairment ?

Air Accident Investigation Findings and Recommendations

Australia – 1997 to 2003

ATSB Key comments and findings 1/2

- Possible safety deficiency
- Crews acting contrary to emergency procedures - potential for incapacitation
- Delay in using O2 as fumes events become 'routine' in the thinking of some operating crew and awareness of the possible risks may have diminished as a result
- Initial actions should be use of O2 - emergency check list
- Reluctance of crews to report to employer - fear of reprisals
- Fumes not reported in tech log/verbal handover only



Air Accident Investigation Findings and Recommendations

Australia – 1997 to 2003

ATSB Key comments and findings 2/2

- Implications of LT health effects for crew and passengers to be researched
- Fumes can be intermittent
- Maintenance difficulty in identifying source / residual contamination
- Lack of advice provided to crew after possible exposure to fumes
- Must be addressed by regulators to ensure cont airworthiness



Air Accident Investigation Findings and Recommendations

Australia - 1999

BASI Occurrence: 199702276, BAe 146-300, VH-NJF

The Bureau of Air Safety Investigation (ATSB) recommends that:

- R990052 - ... address deficiencies that permit the entry of fumes into the cockpit and cabin areas of BAe146 aircraft...
- R990053 - ...investigate failures within the engine that result in fumes entering the cockpit and cabin areas of BAe146 aircraft.



Air Accident Investigation Findings and Recommendations

Sweden - 1999

The SHK recommended that Swedish Civil Aviation Administration and others:

- RL 2001:41e R1– Immediate use of the oxygen mask selected to 100 %
- RL 2001:41e R2– Crews and aircraft actions post event
- RL 2001:41e R3– International database is established
- RL 2001:41e R4– Research into the jet oils and their effects on humans



Air Accident Investigation Findings and Recommendations

UK – 1997 to 2013

AAIB Key comments and findings 1/3

- The problem of fumes in the cabin is not new and is currently the subject of much industry discussion.
- Fumes from engine oils and hydraulic fluids is occurring in the cabin and flight deck on numerous aircraft types.
- Inconsistent reporting is thought to have affected the quality of the evidence.
- Ground runs at higher engine power settings may be needed to identify the source of the smoke or fumes. (R)
- No means of rapidly ascertaining the source of the smoke was available to the crew.



Air Accident Investigation Findings and Recommendations

UK – 1997 to 2013

AAIB Key comments and findings 2/3

- Smoke protection for passengers is not a requirement on public transport aircraft.
- Smoke or fumes in the flight deck or passenger cabin present the crew with a potentially hazardous situation, which requires prompt action.
- Early donning of oxygen masks can reduce the effects of fumes, whenever they are suspected.
- Experience shows that pilot's well-being and judgment can be affected by exposure to engine oil fumes.



Air Accident Investigation Findings and Recommendations

UK – 1997 to 2013

AAIB Key comments and findings 3/3

- The regulations JAR 25.831, JAR-APU-210, JAR-E-510 and JAR-E-690, all deal with unacceptable levels of contamination of the bleed air, but do not provide details of toxic contamination that is deemed as unacceptable.
- The regulations put the onus on the system design for clean air, with little requirement placed on the constituents of the lubricating oils so as not to be harmful to, or affect, the occupants of aircraft.
- There was a lack of general information available on potential contaminants of the bleed air by engine oil, and their effects on human physiology.



Air Accident Investigation Findings and Recommendations

UK – 1997 to 2013

AAIB Bulletin: 7/2007 G-CPET – October 2006 – Boeing 757

- During the descent, both crew members began to feel disorientated and found that they had to concentrate hard to carry out their normal duties. At this point the commander began to feel ‘confused’.
- The flight crew expressed concern that neither had detected the slow degradation in their performance as this only became fully apparent after they had donned oxygen masks and began to recover.



Air Accident Investigation Findings and Recommendations

UK – 1997 to 2013

The AAIB issued the following Safety Recommendations:

Safety Recommendations 2007

It is recommended that the FAA/EASA consider requiring, for all large aeroplanes operating for the purposes of commercial air transport, a system to enable the flight crew to identify rapidly the source of smoke by providing a flight deck warning of smoke or oil mist in the air delivered from each air conditioning unit.

RENEWED THE CALL IN 2009



Air Accident Investigation Findings and Recommendations

UK - 2001

The AAIB 2001 Safety Recommendation not to be forgotten:

Suspicion of unhealthful cabin air – Pilots to use of oxygen masks selected to 100% oxygen

Maintenance and modification on the BAe 146 / Boeing 757 which shall ensure that oil by-products cannot accumulate in the air-conditioning system and pollute the cabin air.



Air Accident Investigation Findings and Recommendations

Iceland - 2009

Icelandic comments and findings

Serious Incident - Smoke in flight deck and cabin, engine shut down and an emergency landing

Boeing - Due to the fact that the flight deck filled up with smoke almost instantaneously, with reduced visibility to flight instruments, **investigate the possibility of installing smoke warning system in the bleed air ducting** of the Boeing 757-200 airplane, to allow the flight crew to take preventive action prior to smoke propagating into the flight deck.



Air Accident Investigation Findings and Recommendations

Irish - 2010

Irish AAIU comments and findings

The DAA (Dublin airport Authority) should review the response procedures to ensure that **passengers and crew are not unduly detained in a potentially toxic environment, following cabin air quality events.**

(IRLD2010014)

Air Accident Investigation Findings and Recommendations

Spain - 2013 - 2016

Spanish CIAIAC - comments and findings

CIAIAC- A-008/2013 (based on a Boeing 757 incident)

RECC 15/2016 – ICAO monitors international actions to determine real impact on human health & take safety actions as necessary



Air Accident Investigation Findings and Recommendations

Germany – 2010 to 2014

German BFU comments and findings 1/2

- Both pilots were impaired in their capability to perform.
- First officer's blood sample “is positive for exposure to tri-ortho-cresyl phosphate”.
- Verification of toxic substances (e.g.: TCP/TOCP) not possible.
- Crews insecure in reporting contaminated air events.
- **In very few cases the safety margin was reduced** such that a high accident probability - in terms of the legal definition - existed.
- Certification does not cover all contaminated air substances.



Air Accident Investigation Findings and Recommendations

Germany – 2010 to 2014

German BFU comments and findings 2/2

- There were clear indications of health impairments in terms of occupational health for flight and cabin crew.
- Events caused comfort limitations for occupants but posed no danger.
- No standardized reporting & recording system for contaminated air events. (R)
- EASA implement demonstration of certification compliance of CAQ – prevent permanent adverse health effects and aircraft, engine & APU type certifications do the same. (R)



Swiss MD 11-1996

The report notes that the crew had initially assessed that an unusual odour and smoke on the flight deck had originated from the air conditioning system. In fact, there was a fire spreading above the ceiling in the fuselage. Damage from the fire resulted in a loss of control and the aircraft impacted the sea around 20 minutes after the odour was first noticed.



Air Accident Investigation Findings and Recommendations

Swiss Key comments and findings 1/2

Swiss – 2005 to 2015

- Aircraft released for service (several flights), even with defect not rectified.
- The copilot was limited in his capability of acting during the approach and landing due to the effects of fumes.
- The commander did not don his oxygen mask.

CAUSE:

- These fumes were caused by an oil leak as a result of a bearing damage in engine No. 1. The indicators for impending bearing damage were not correctly interpreted before the incident.
- The serious incident is attributable to the fact that on approach to Zurich Airport the cockpit filled with fumes which caused a toxic effect, leading to a limited capability of acting of the copilot.



Air Accident Investigation Findings and Recommendations

In Summary – Repeated Calls...

- Checklists - Immediate use of O2 100% if air is suspected to be contaminated.
- Plan of action for crew & aircraft immediately after landing.
- International database to collate events.
- Research on effects of oils & human health.
- Detection systems.
- Higher power setting ground runs to help fault identification.
- Demonstrate CAQ compliance during certification - to prevent permanent adverse health effects.





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THANK YOU