



ICAO

## Cir 344-AN/202

# Guidelines on Education, Training and Reporting Practices related to Fume Events



Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION





| ICAO

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INTERNATIONAL CIVIL AVIATION ORGANIZATION

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# TABLE OF CONTENTS

	<i>Page</i>
<b>GLOSSARY .....</b>	<b>(v)</b>
<b>Chapter 1. Introduction .....</b>	<b>1</b>
1.1 Background .....	1
1.2 Purpose .....	1
1.3 Scope .....	2
<b>Chapter 2. Basic education .....</b>	<b>3</b>
2.1 General.....	3
2.2 Content of educational material.....	3
2.3 Sources and types of on-board fumes .....	3
2.4 Odour descriptors.....	5
2.5 Potential for impairment.....	5
2.6 Procedures to apply in fume events .....	6
2.7 Reporting of fume events .....	6
<b>Chapter 3. Training.....</b>	<b>7</b>
3.1 General.....	7
3.2 Flight crew .....	7
3.3 Cabin crew .....	8
3.4 Aircraft maintenance technicians.....	9
3.5 Management personnel.....	9
<b>Chapter 4. Standardized reporting.....</b>	<b>11</b>
4.1 Use of standardized reporting processes .....	11
4.2 Goal of event reporting .....	11
4.3 Types of reporting systems .....	11
4.4 Standardized reporting .....	12
Appendix to Chapter 4: Standardized smoke and fumes reporting form.....	<b>13</b>
<b>Chapter 5. Methods to troubleshoot potential air supply system-sourced fumes .....</b>	<b>16</b>
5.1 General.....	16
5.2 Use of the smoke and fumes reporting form.....	16
5.3 Troubleshooting.....	16
<b>Chapter 6. Event Investigation .....</b>	<b>18</b>
6.1 General.....	18
6.2 Content of the investigation .....	18



# GLOSSARY

## Explanation of Terms

*Note.— The terms contained herein are used in the context of this circular. They have no official status within ICAO.*

**Auxiliary power unit (APU).** A gas-turbine powered unit that provides on-board electrical power and compressed ventilation air, independent of the aircraft propulsion engines.

**Contaminant.** An airborne constituent that may reduce air quality.

**Disinfectants.** Chemical or physical agents used to control or kill infectious agents on a surface or in or on baggage, cargo, containers, conveyances and goods.

**Disinsectants.** Chemical agents used to control or kill insects.

**Engine bleed air.** Air extracted from the compressor stages of gas turbine propulsion engines and auxiliary power units.

**Environmental control system.** The equipment in an aircraft used to pressurize, ventilate, air condition or humidify the aircraft. It includes cabin-supply airflow control, temperature control, pressure control, distribution, recirculation and filtration.

**Fume(s).** Odorous, gaseous compounds which are not visible.

*Note. — In the context of this circular, fumes and odours are deemed to be synonymous, and the term “fume(s)” includes both fumes and odours.*

**Recirculated air.** Air from the aircraft passenger cabin that is reused as part of the air supply.

**Smoke.** The product of burning materials made visible by the presence of small particles.





# Chapter 1

## INTRODUCTION

### 1.1 BACKGROUND

1.1.1 Various types of fumes, smoke, haze and mist may contaminate the cabin and flight deck air supply system. Outside air may be contaminated with engine oil, hydraulic fluid, engine exhaust, ground service vehicle exhaust, fuel, de-icing fluid or ozone. Recirculation fans are another potential source of contaminated air. Also, electrical systems and cabin items such as carry-on baggage, galley equipment and food items, lavatories, cleaning products, disinfectants and disinsectants may contaminate the cabin and/or flight deck air.

1.1.2 Of all of these potential contaminants in the cabin and flight deck, particular concerns have been raised regarding the negative impact on flight safety when crew members are exposed to oil or hydraulic fluid fumes or smoke, and experience acute symptoms in flight. Due to the potential flight safety implications, it is beneficial to provide guidance and instructional material to enable crew members to promptly recognize and respond to suspected air supply system-sourced fumes, as well as to enable aircraft maintenance technicians (AMT) to identify the source of the contaminants and to correct the issue.

1.1.3 At the 38th Session of the Assembly of the International Civil Aviation Organization (ICAO), the International Transport Workers' Federation (ITF) and the International Federation of Air Line Pilots' Associations (IFALPA) invited the Technical Commission to consider the flight safety implications of crew member exposure to oil fumes sourced to the aircraft air supply system. ITF and IFALPA also requested the ICAO Council to develop guidance material to improve awareness and training of flight crew, cabin crew and AMT related to the management of fume events.

1.1.4 The Technical Commission agreed with the intent of the ITF/IFALPA proposal and recommended that the Council review the proposal to develop guidance material. An ad hoc working group composed of subject matter experts from the International Air Transport Association (IATA), ICAO, the International Coordinating Council of Aerospace Industries Associations (ICCAIA), IFALPA, and the ITF was subsequently tasked with development of the guidance material.

### 1.2 PURPOSE

1.2.1 This circular provides guidance to States to support the development of relevant advisory material for operators to provide suitable awareness and/or training to flight crew, cabin crew and AMT to enable them to prevent, recognize and respond to the presence of fumes, particularly aircraft air supply system-sourced fumes. The content of this circular is intended to complement relevant national regulatory requirements.

1.2.2 There may be implications to flight safety from exposure to oil or hydraulic fluid fumes sourced to the aircraft air supply system if crew members are either impaired or incapacitated during a flight. Therefore, there is an expected flight safety benefit to preventing the occurrence of fume events or reducing occupant exposure to fumes should they occur. Each aviation professional group (i.e. flight crew members, cabin crew members, AMT) has a specific role in recognizing and responding to fumes, particularly to those that are air supply system-sourced. Most of the

recommended guidance included in this circular is role-specific. However, basic education regarding oil or hydraulic fluid fumes contaminating the aircraft air supply system is recommended for all stakeholders, including the operator's relevant management personnel.

### **1.3 SCOPE**

1.3.1 The scope of the guidance is limited to reporting, as well as education and training of flight crew, cabin crew and AMT to enable them to prevent, recognize and respond to the presence of fumes, particularly aircraft air supply system-sourced engine or auxiliary power unit (APU) oil or hydraulic fluid fumes. Operators may already be addressing content similar to the education and training material presented in this circular as part of their existing programmes. In such cases, operators may conduct a gap analysis based on the content of this circular and determine which additional elements should be included to enhance education, training and reporting related to fume events.

1.3.2 This circular does not address occupational health issues; nor does it address on-board exposure to smoke or fire. The circular neither replaces nor supersedes existing national regulations.

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## **Chapter 2**

### **BASIC EDUCATION**

#### **2.1 GENERAL**

2.1.1 The content of this chapter is applicable to the following groups of aviation professionals: flight crew, cabin crew, AMT and relevant management personnel. It outlines the recommended content of basic educational material for all personnel. The combination of this educational material and the group-specific training outlined in Chapter 3 is intended to ensure that personnel are able to recognize and respond adequately to the presence of on-board fumes.

2.1.2 In some instances, fume events may impair crew members and could potentially impact the safe operation of the aircraft. Therefore, flight and cabin crew members should be able to recognize, characterize, respond to, and report fume events. AMT should be able to conduct preventive maintenance as per the operator's approved maintenance schedule as well as perform troubleshooting after suspected on-board exposure to air supply system-sourced fumes.

#### **2.2 CONTENT OF EDUCATIONAL MATERIAL**

2.2.1 The operator should address the following:

- a) sources and types of on-board fumes;
- b) odour descriptors to recognize the presence of oil and hydraulic fluid fumes;
- c) potential for impairment;
- d) procedures to apply in fume events; and
- e) reporting of fume events.

2.2.2 Detailed guidance on each of these topics is presented in sections 2.3 to 2.7.

#### **2.3 SOURCES AND TYPES OF ON-BOARD FUMES**

2.3.1 Personnel should know that fumes in the cabin and/or flight deck can be sourced to:

- a) the ventilation supply air; and
- b) items in the cabin and/or flight deck.

2.3.2 The ventilation air supply system can distribute contaminants that are either internal to the aircraft systems (e.g. engine oil, hydraulic fluid) or external to the aircraft itself (e.g. exhaust, de-icing fluid, fuel, ozone). Items in the cabin and/or flight deck can also be sources of fumes. Personnel should understand the importance of distinguishing, where possible, between these two sources (i.e. ventilation supply air versus items in cabin or flight deck). Crew members should be provided with information that will enable them to quickly assess and attempt to distinguish between these two sources of contaminants and respond accordingly. Table 1 presents examples of potential types of fumes from each of these two sources.

**Table 1. Examples of potential types of fumes**

Potential contaminants in the ventilation supply air	De-icing and/or anti-icing fluid Electrical faults Engine compressor wash Engine oil Exhaust (aircraft or ground vehicles) Fuel Hydraulic fluid Recirculation fan failure
Items in the cabin and/or flight deck that can be sources of fumes	Carry-on baggage Cleaning products Disinfectants Disinsectants Food items Galley equipment Lavatories

2.3.3 Below is an overview of potential contaminants in the ventilation supply air:

- a) *De-icing and/or anti-icing fluid fumes* — De-icing and/or anti-icing fluid is applied to the exterior surfaces of the aircraft in large volumes and under high pressure. If procedures are not properly applied, then fumes may enter the cabin and flight deck. For example, if the de-icing and/or anti-icing applicators spray the engines or APU intake, then the fluid can be heated to high temperatures in the engines or APU, and fumes can contaminate the aircraft air supply. It is usually apparent if fumes in the cabin are sourced to de-icing and/or anti-icing fluid because these operations are highly visible and the odour of the fumes is distinctive.
- b) *Electrical fumes* — Fumes from either failed or faulty electrical systems can contaminate the aircraft air supply to the cabin and flight deck. Electrical fumes can also be sourced to in-cabin electrical faults.
- c) *Engine compressor wash fumes* — After washing the engine compressor using detergent, fumes from residual detergent may enter the cabin and flight deck air supply systems.

- d) *Engine oil fumes* — Engine seals, starter generator, accessory gear box, and oil-lubricated bearings are engine and APU components that can leak oil into the cabin and flight deck ventilation supply air. In addition, the oil reservoir for an engine or APU can be over-filled, resulting in spillage and ingestion into the aircraft air supply system.
- e) *Exhaust fumes* — Fumes from diesel-powered ground service vehicles and other aircraft can be ingested into the air supply, especially if the air intake is located near the vehicles.
- f) *Fuel fumes* — Fuelling operations at an aerodrome, aircraft tank venting during filling, and failed engine relights are sources of fuel fumes that may enter the cabin and flight deck air supply systems.
- g) *Hydraulic fluid fumes* — Hydraulic fluid leaks and spills on the surface of the fuselage can be drawn into the APU, along with the outside air intended for ventilation. In such instances, the hydraulic fluid and outside air are heated in the compressor and, ultimately, supplied to the cabin and flight deck.
- h) *Recirculation fan fumes* — Recirculation fans can fail and produce fumes caused by electrical or bearing failure.

*Note.— Industrial pollution, ozone, bird strikes and volcanic ash are not addressed in this circular.*

2.3.4 Contaminants in the cabin and/or flight deck, whether sourced to the ventilation air, or an item in the cabin or flight deck, are typically odorous but are not usually accompanied by visible smoke or haze. Crew members should not assume that visible signs of contaminants (e.g. smoke or haze) must be present in order to note, assess and report them.

2.3.5 Oil fumes from the engines, APU or the environmental control system may contaminate the aircraft air supply system. In such instances, the oil fumes may contaminate the downstream ventilation ducting and the air carried through those ducts to the cabin, flight deck or both. The primary source of hydraulic fluid fumes in the cabin and flight deck ventilation air is hydraulic fluid ingested into the APU intake.

## 2.4 ODOUR DESCRIPTORS

2.4.1 Crew members use a wide variety of terms to describe oil and hydraulic fluid fumes. Often, oil fumes do not smell like oil. Instead, they are typically described as smelling like dirty socks/smelly feet, foul, or musty. Hydraulic fluid often has a distinctive and recognizable odour that is often described as acrid.

2.4.2 Odour is subjective, such that different people can experience and describe the same fumes differently. Also, olfactory fatigue reduces a person's ability to detect odours over time.

2.4.3 Educational material and standardized smoke and fumes reporting forms (refer to the Appendix to Chapter 4) should include the odour descriptors typically used for air supply system-sourced oil and hydraulic fluid fumes. Crew members should know these descriptors in order to effectively communicate and report the presence of fumes.

## 2.5 POTENTIAL FOR IMPAIRMENT

2.5.1 Educational material should list potential acute symptoms that may be experienced as a result of exposure to oil or hydraulic fluid fumes. When flight and/or cabin crew members are impaired by acute symptoms, flight safety may be compromised.

2.5.2 Potential acute symptoms from exposure to oil or hydraulic fluid fumes include: irritated eyes, sinus congestion, respiratory symptoms, gastrointestinal upset and neurological symptoms.

2.5.3 Educational material should inform personnel that the neurological symptoms may downgrade crew member performance during flight operations in areas such as: alertness, attention span, information processing, working memory and response time. Symptoms may develop slowly, and degraded performance may not be initially obvious. Given the potential flight safety implications, flight and cabin crew members should be trained to recognize and respond promptly to the presence of fumes, particularly air supply system-sourced fumes (refer to Chapter 3).

## **2.6 PROCEDURES TO APPLY IN FUME EVENTS**

Given the potential flight safety implications of exposure to oil or hydraulic fluid fumes, crew members should be trained to protect themselves from exposure to air supply system-sourced fumes, whenever possible (refer to Chapter 3). Operator procedures should address means of minimizing the effects of fume events on aircraft occupants.

## **2.7 REPORTING OF FUME EVENTS**

Crew members should know how to report all fume events, particularly fumes sourced to the ventilation air supply along with other relevant details, as per their operator procedures, for the purposes of documenting occurrences. Reports assist AMT in troubleshooting the root cause of the fumes and enable the operator to monitor any trends. Detailed guidance on reporting of fume events is presented in Chapter 4.

---

## Chapter 3

# TRAINING

### 3.1 GENERAL

3.1.1 This chapter presents guidance on training to recognize and respond to fume events, commensurate to the following groups of aviation professionals' duties and responsibilities: flight crew, cabin crew, AMT and, as applicable, relevant management personnel. Group-specific training should be provided in addition to basic education. Guidance on basic education of fume events, suitable for all groups listed above, is presented in Chapter 2. The operator may conduct a gap analysis based on the content of this chapter and determine which additional elements should be included to enhance training related to fume events.

3.1.2 The operator should select appropriate training delivery method(s) (e.g. classroom, computer-based training, hands-on exercises or simulated exercises in representative training devices) as appropriate to the subject matter.

3.1.3 The operator should address the following, specific to the group of aviation professionals:

- a) procedures to recognize and respond to fume events; and
- b) reporting of fume events.

### 3.2 FLIGHT CREW

3.2.1 Flight crew members should recognize and respond to fume events. Training should include:

- a) *Use of oxygen* — Flight crew members should don oxygen masks if there is a suspected fume event, including events without any visible signs of contaminants such as smoke or haze.
- b) *Application of operator procedures* — Flight crew members should follow any of: the operations manual, the flight crew operations manual and appropriate checklists. They should also be familiar with any fumes procedures that cabin crew members are trained to apply.
- c) *Communication* — Flight crew members should establish communication with cabin crew members (refer to section 3.3 b)).
- d) *Post-event procedures* — Flight crew members should apply post-event procedures. These may include, but are not limited to, requiring any crew member who felt/feels unfit to report it and seek assessment by a medical practitioner, as necessary.
- e) *Applicable documentation* — Flight crew members should report the event and complete required documentation, which may include:
  - 1) mandatory reports, as required by the State of the Operator — Flight crew members should discuss the event with the cabin crew members to reflect their views in the report;

- 2) aircraft technical log — Flight crew members should report fume event-related information in the associated aircraft technical log entry; and
- 3) smoke and fumes reporting form — Flight crew members should complete the appropriate form, in coordination with the cabin crew in order to obtain the most complete information possible (refer to the Appendix to Chapter 4).

3.2.2 In addition, flight crew members should be trained to implement any operator-approved modifications to engine or APU start-up sequences intended to reduce the risk of bleed air contaminants entering the air supply system.

### 3.3 CABIN CREW

Cabin crew members should recognize and respond to fume events. Training should include:

- a) *Location/source, type and intensity of fumes* — Cabin crew members should attempt to identify and locate the source of the fumes (i.e. air supply system or cabin equipment/item) and attempt to identify the type (e.g. dirty socks, musty/mouldy, acrid) and intensity (e.g. mild, moderate or strong) of the fumes.
- b) *Communication* — During a fume event, cabin crew members should communicate with each other. Communication should also be established between the in-charge cabin crew member and the flight crew. Training should outline the specific pieces of information to be communicated, including, but not limited to:
  - 1) nature of the fumes;
  - 2) intensity of the fumes;
  - 3) any visible signs (e.g. haze or mist);
  - 4) apparent source and, for suspected air supply system fumes, confirmation that cabin sources have been ruled out, to the extent possible;
  - 5) location within the cabin;
  - 6) phase of flight when the odour was first noticed, as well as subsequent times when it was noticed;
  - 7) action(s) already taken (if any) and coordination with flight crew members on actions to be taken; and
  - 8) presence of any affected passengers and/or crew members, including the type of symptoms and the administration of first aid, if applicable.
- c) *Passenger and cabin management* — Cabin crew members should manage the passengers and the cabin. This may include, but is not limited to:
  - 1) relocating passengers, if required;
  - 2) informing passengers and reassuring them; and
  - 3) administering first aid to passengers and/or crew members.



- d) *Post-event procedures* — Cabin crew members should apply post-event procedures for the remainder of the flight. These may include, but are not limited to:
- 1) monitoring the area;
  - 2) continued communication with the flight crew and other cabin crew members; and
  - 3) applying crew member incapacitation procedures, if applicable.
- e) *Applicable documentation* — Cabin crew members should complete the applicable documentation, such as the smoke and fumes reporting form, in coordination with the flight crew in order to obtain the most complete information possible (refer to the Appendix to Chapter 4).

*Note.*— Detailed guidance on cabin crew training, including training specific to crew member incapacitation and first aid, is contained in the Cabin Crew Safety Training Manual (Doc 10002).

### 3.4 AIRCRAFT MAINTENANCE TECHNICIANS

AMT should be trained on methods used for troubleshooting potential air supply system-sourced fumes. Training should include:

- a) *Use of crew reporting* — AMT should review the flight and cabin crew reports to assist their efforts in establishing the source of the fume event. This includes information provided by the crew on: apparent source of fumes; air supply system source during the event; odour descriptors; phase(s) of flight; location(s) within the aircraft (i.e. cabin, flight deck, or both); and whether any flight crew, cabin crew and/or passengers reported symptoms.
- b) *Methods used for troubleshooting* — Once sufficient information has been gathered from the crew reports, AMT should search for the cause of the problem. Methods for troubleshooting include performing visual inspections, conducting a close walk-around of the aircraft, and investigating fluid accumulation (e.g. engine oil, hydraulic fluid) or internal leakage.

*Note.*— In addition to troubleshooting, the operator should implement preventive maintenance measures. AMT should be trained to apply these measures on a regular basis. Preventive maintenance measures may include: replacing high-time components before they fail, implementing measures to prevent over-servicing the oil and hydraulic fluid reservoirs, and preventing improper shutdown of the APU.

### 3.5 MANAGEMENT PERSONNEL

3.5.1 Relevant management personnel should receive basic education and be able to understand the causes of fume events and the potential impacts on flight safety. The level of detail included may vary based on the role of the management personnel.

3.5.2 Manager and supervisor training should address the following:

- a) *Background* — A description of the potential causes of fume events and the potential impacts on flight safety.

- b) *Responsibilities specific to the position* — A description of the responsibilities specific to the role (e.g. cabin crew manager), including promoting event reporting by operational personnel, as part of the operator's safety culture.
- c) *Cooperation* — An emphasis on the need for cooperation amongst the various stakeholders as this is a cross-functional issue which requires effective inter-departmental interactions (e.g. flight operations, maintenance, and training departments).
- d) *A safety management approach* — The importance of monitoring the issue through the operator's safety management system (SMS) and its existing processes (e.g. for reporting events).

3.5.3 Basic education for senior management may be accomplished through a briefing. In addition to a high-level review of the topics presented in 3.5.2, the briefing should cover specific responsibilities of senior managers (e.g. Director of Maintenance). These responsibilities include compliance with national regulatory requirements, where applicable.

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## Chapter 4

# STANDARDIZED REPORTING

### 4.1 USE OF STANDARDIZED REPORTING PROCESSES

4.1.1 Accurate and timely reporting of hazards, incidents and accidents is fundamental to determining the cause of an event, responding appropriately, and preventing reoccurrence. One of the best sources of data is direct reporting by front-line personnel, such as flight and cabin crew members, and AMT. A workplace in which personnel are trained and encouraged to report potential or actual hazards and events is a prerequisite for effective reporting. Established reporting systems (e.g. log book entries, crew reports) provide sources of data that the operator can use to support its SMS and enhance safety.

4.1.2 ICAO addresses data collection, analysis and any actions required for the enhancement of safety in its SMS requirements, which are found in Annex 19 — *Safety Management*. As per these requirements, operators must establish reporting procedures, as well as safety risk management processes, with a combination of reactive, proactive and predictive methods of data collection, and safety assurance processes, which include safety performance monitoring and measurement.

4.1.3 Operators that have not yet fully implemented an SMS may still put in place standardized reporting processes to collect data. In both cases, the established processes may be used for reporting, data gathering and analysis of the types of fume events covered in this circular.

*Note.— Guidance on SMS and reporting is contained in the Safety Management Manual (SMM) (Doc 9859).*

### 4.2 GOAL OF EVENT REPORTING

4.2.1 The operator should encourage flight and cabin crew members to report fume events. Reporting enables the operator to document these events. The operator should have a process to ensure that the data from crew reports is captured and utilized.

4.2.2 Crew reporting is essential to assist AMT in identifying the root cause of an event and taking corrective action to prevent reoccurrence. Therefore, it is important that flight and cabin crew members provide detailed and accurate information following an event. Detailed guidance on standardized reporting is presented in section 4.4.

### 4.3 TYPES OF REPORTING SYSTEMS

The operator's reporting systems may include mandatory reporting systems and voluntary reporting systems. Mandatory event reports are defined by the State of the Operator. An event, such as the evacuation of crew and/or passengers, needs to be reported to the State, as part of mandatory reporting. Voluntary reporting systems should be non-punitive. The operator should promote a safety culture that encourages proactive reporting of fume events through all reporting systems.

#### 4.4 STANDARDIZED REPORTING

4.4.1 Standardized reporting assists the operator in systematically gathering all the desired information pertaining to a specific type of event and interpreting results in a consistent manner. This information enables the operator to monitor data trends over certain periods, monitor the operational impact of events, determine potential causes, and log both increases and decreases in the frequency and severity of events.

4.4.2 Standardizing reporting at the international, regional and national levels, allows information to be shared, better enabling the identification of trends and causes of events, and the determination of actions required for the enhancement of safety, if necessary.

4.4.3 In order to obtain standardized reporting, the operator should clearly define sections to be included in a report form. This allows personnel to input concise information, in a systematic manner, using common terminology. The standardized smoke and fumes reporting form includes the following sections:

- a) flight and reporter details;
- b) smoke or fire information, if relevant (including the nature and apparent source of smoke or fire);
- c) fume information (including the nature and apparent source of fumes);
- d) other observations (all events);
- e) symptoms/reactions (all events); and
- f) maintenance follow-up and information (all events).

4.4.4 The smoke and fumes reporting form should be submitted in conjunction with an aircraft technical log entry. The operator should develop a procedure to collect and process smoke and fumes reports, including maintenance actions.

4.4.5 The standardized smoke and fumes reporting form is presented in the Appendix to Chapter 4. Operators are encouraged to adopt this standardized form for the reporting of fume events. The use of the form enables the collection of uniform data, allowing stakeholders to conduct analyses and monitor trends. It also allows multiple States and operators to share and/or pool information and compare results.

-----

## Appendix to Chapter 4

### STANDARDIZED SMOKE AND FUMES REPORTING FORM

SECTION 1: FLIGHT AND REPORTER DETAILS			
<i>Note: For each question, check all that apply. If one answer is dominant for a given question, write a ☆ next to that item.</i>			
AC number: _____	Flight date (DD/MM/YYYY): _____	Form completed by:	
AC type: _____	Reporter name: _____	<input type="checkbox"/> Flight crew <input type="checkbox"/> Cabin crew <input type="checkbox"/> Maintenance <input type="checkbox"/> Other	
Tech log # (if known): _____	Employee no.: _____	PIC signature: _____	
Departure stn.: _____	Email: _____	(operator discretion)	
Arrival stn.: _____	Phone: _____		
<b>Phase(s) of flight:</b>	<input type="checkbox"/> Climb <input type="checkbox"/> Cruise <input type="checkbox"/> Descent <input type="checkbox"/> Approach <input type="checkbox"/> Landing <input type="checkbox"/> Taxi-in <input type="checkbox"/> Parked (post-flight)	<b>Estimated duration of incident:</b> _____ (hrs.) _____ (min.)  <b>Engine power level changes:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown  <b>Known history of similar conditions on same aircraft?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	<b>Recent aircraft service history:</b> <input type="checkbox"/> None <input type="checkbox"/> De-icing or anti-icing <input type="checkbox"/> Engine/APU oil serviced <input type="checkbox"/> Hydraulic fluid serviced <input type="checkbox"/> Pesticide application <input type="checkbox"/> Other: _____ <input type="checkbox"/> Unknown
SECTION 2: SMOKE OR FIRE INFORMATION			
<i>Note: For each question, check all that apply. If one answer is dominant for a given question, write a ☆ next to that item.</i>			
<b>Evidence of smoke or fire?</b> <input type="checkbox"/> Smoke <input type="checkbox"/> Fire <input type="checkbox"/> Neither smoke nor fire  <b>Type of smoke or fire?</b> <input type="checkbox"/> Localized smoke <input type="checkbox"/> Generalized smoke <input type="checkbox"/> Open flame	<b>Location of smoke or fire:</b> <input type="checkbox"/> Cabin; if cabin <input type="checkbox"/> Flight deck <input type="checkbox"/> Flight crew rest area <input type="checkbox"/> Cabin crew rest area <input type="checkbox"/> Lavatory _____ <input type="checkbox"/> Galley _____ <input type="checkbox"/> Cargo	<input type="checkbox"/> Forward cabin <input type="checkbox"/> Mid cabin <input type="checkbox"/> Aft cabin <input type="checkbox"/> Upper deck cabin  <p style="text-align: center;"><b>Skip to SECTION 4.</b></p>	

SECTION 3: FUME INFORMATION																																																					
<i>Note: For each question, check all that apply. If one answer is dominant for a given question, write a ☆ next to that item.</i>																																																					
<b>If fumes, describe type:</b>	<b>If fumes in cabin:</b>	<b>If fumes in flight deck:</b>	<b>If fumes in cargo:</b>																																																		
<input type="checkbox"/> Acrid <input type="checkbox"/> Chemical <input type="checkbox"/> De-icing <input type="checkbox"/> Dirty socks <input type="checkbox"/> Exhaust <input type="checkbox"/> Electrical <input type="checkbox"/> Fuel <input type="checkbox"/> Musty or mouldy <input type="checkbox"/> Oily/burning oil <input type="checkbox"/> Vomit <input type="checkbox"/> Other: _____  <b>Intensity of fumes</b> <input type="checkbox"/> Mild <input type="checkbox"/> Moderate <input type="checkbox"/> Strong <input type="checkbox"/> Nauseating	<input type="checkbox"/> Forward cabin <input type="checkbox"/> Mid cabin <input type="checkbox"/> Aft cabin <input type="checkbox"/> Upper deck <input type="checkbox"/> Cabin crew rest area <input type="checkbox"/> Galley <input type="checkbox"/> Lavatory  <b>Apparent location of fumes in cabin/flight deck:</b> <input type="checkbox"/> Air supply system vents <input type="checkbox"/> Cabin item <input type="checkbox"/> Flight deck equipment <input type="checkbox"/> Galley equipment <input type="checkbox"/> Other: _____ <input type="checkbox"/> Unknown	<input type="checkbox"/> General flight deck area <input type="checkbox"/> Flight crew rest area          <b>Potential source of fumes coming from outside the aircraft:</b> <input type="checkbox"/> De-icing or anti-icing underway <input type="checkbox"/> Fueling underway <input type="checkbox"/> Proximity to ground service vehicle exhaust <input type="checkbox"/> Proximity to other aircraft (exhaust) <input type="checkbox"/> Other: _____	<input type="checkbox"/> Known source <input type="checkbox"/> Unknown source  If known, identify: _____ _____																																																		
SECTION 4: OTHER OBSERVATIONS — ALL EVENTS																																																					
<i>Note: For each question, check all that apply.</i>																																																					
<input type="checkbox"/> Blocked drain <input type="checkbox"/> Cabin item: _____ <input type="checkbox"/> Galley equipment malfunction	<input type="checkbox"/> In-flight entertainment system malfunction <input type="checkbox"/> Irregular equipment noise	<input type="checkbox"/> Leak or spill <input type="checkbox"/> Lights flickering or malfunction <input type="checkbox"/> Other: _____	<b>Air supply source:</b> <input type="checkbox"/> APU <input type="checkbox"/> Engines <input type="checkbox"/> Ground conditioned air unit <input type="checkbox"/> Ground air starter <input type="checkbox"/> Other: _____																																																		
SECTION 5: SYMPTOMS AND REACTIONS — ALL EVENTS																																																					
<i>Note: For each question, check all that apply.</i>																																																					
<b>Symptoms reported?</b> <input type="checkbox"/> Yes (if yes) <span style="color: blue; font-size: 1.2em;">➔</span> <input type="checkbox"/> No <input type="checkbox"/> Unknown  <b>If yes, symptoms reported by:</b> <input type="checkbox"/> Flight crew <input type="checkbox"/> Cabin crew <input type="checkbox"/> Maintenance <input type="checkbox"/> Passenger(s): Seat # ___ ___	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%; padding: 2px;">Symptoms/reported by</th> <th style="width: 15%; padding: 2px;">Flight crew</th> <th style="width: 15%; padding: 2px;">Cabin crew</th> <th style="width: 15%; padding: 2px;">Maintenance</th> <th style="width: 25%; padding: 2px;">Passenger(s)</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">Abnormal taste</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Dizziness</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Fatigue or weakness</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Headache</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Irritated eyes, nose, throat</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Slowed thinking</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Tingling</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Trouble breathing</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Other</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Symptoms/reported by	Flight crew	Cabin crew	Maintenance	Passenger(s)	Abnormal taste					Dizziness					Fatigue or weakness					Headache					Irritated eyes, nose, throat					Slowed thinking					Tingling					Trouble breathing					Other						
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<b>Emergency equipment used?</b> <input type="checkbox"/> Yes; if yes, complete table <input type="checkbox"/> No	Equipment/used by	Flight crew	Cabin crew	Maintenance	Passenger(s)
	Oxygen mask				
	Smoke goggles				
	Portable breathing equipment				
	Portable oxygen bottle				
	Fire extinguisher				
	Drop down masks				

<b>Medical assistance required?</b> <input type="checkbox"/> None <input type="checkbox"/> Flight crew <input type="checkbox"/> Cabin crew <input type="checkbox"/> Passenger: Seat(s) ___ ___ <input type="checkbox"/> Maintenance	<b>Type of medical assistance (if applicable)</b> <input type="checkbox"/> On-board only <input type="checkbox"/> Medical advisory service <input type="checkbox"/> Emergency medical services met aircraft <input type="checkbox"/> Emergency room or clinic <input type="checkbox"/> Other: _____	<b>Additional details:</b> _____ _____ _____ _____
		_____ _____

**SECTION 6: MAINTENANCE FOLLOW-UP AND INFORMATION — ALL EVENTS**

*Note: For each question, check all that apply.*

<b>Maintenance fault or source identified?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No	<b>Impact on operation</b> <input type="checkbox"/> None <input type="checkbox"/> Diversion <input type="checkbox"/> Return to base <input type="checkbox"/> Aircraft change <input type="checkbox"/> Flight cancelled <input type="checkbox"/> Gate delay <input type="checkbox"/> Other: _____	<b>Maintenance action(s), if known:</b> _____ _____ _____ _____ _____
		_____ _____

**IF NEEDED, PROVIDE ADDITIONAL COMMENTS ON SEPARATE PAPER**

## Chapter 5

# METHODS TO TROUBLESHOOT POTENTIAL AIR SUPPLY SYSTEM-SOURCED FUMES

### 5.1 GENERAL

There are many sources of fumes in an aircraft cabin. Detailed, comprehensive information provided by flight and cabin crew members regarding a fume event enables the AMT to obtain the best results when trying to resolve an issue on the first attempt. Operator procedures should provide instructions to the flight and cabin crew regarding the required content of an event report. This information is useful to the AMT when troubleshooting a fume event.

*Note.— AMT should apply the established maintenance procedures. Guidance on troubleshooting provided in this guidance does not supersede or circumvent such procedures.*

### 5.2 USE OF THE SMOKE AND FUMES REPORTING FORM

5.2.1 The information contained in the smoke and fumes reporting form helps maintenance narrow down the source of the problem, including when the odour first appeared; which air supply system source was in use when the fumes were reported; and whether the fumes were detected in the cabin, flight deck or both.

5.2.2 In addition, maintenance should obtain information from the smoke and fumes reporting form on the odour itself (e.g. what did it smell like?). For example, engine oil may be described as smelling like dirty socks/smelly feet or as a musty/mouldy smell. Hydraulic fluid has a very distinct smell, usually described as acrid. Odour descriptors are subjective but may provide useful insight (refer to section 2.4 of Chapter 2). Maintenance should also review information from the smoke and fumes reporting form about any symptoms experienced by aircraft occupants (refer to the Appendix to Chapter 4).

### 5.3 TROUBLESHOOTING

5.3.1 Once information from the smoke and fumes reporting form has been collected, the AMT should focus on identifying the root cause, without limiting the search to downstream components. If indications are of engine oil, the AMT should begin troubleshooting with a good visual inspection of the engines and APU area. This involves looking closely at the engine fan blade root area, spinner area, and inlet guide vanes for any evidence of oil which would suggest a failed oil seal at the front stage of the compressor section.

5.3.2 The AMT should open the engine cowling and verify if there are any signs of oil accumulation. If so, the source of the oil should be investigated. Oil in the scupper area could indicate an over-serviced engine or spillage associated with improper servicing. Both of these scenarios could cause oil to be ingested into the compressor section and oil fumes to enter the engine bleed air system.



5.3.3 When troubleshooting, the AMT should look for oil accumulation in the cowling, as a first step, and investigate any accumulation, which could cause contamination to bleed systems, depending on how the packs were configured during the event.

5.3.4 If no external oil accumulation is noted, the next step is to investigate a possible internal oil leakage. Reported oil fumes just after engine start, or during other changes in engine power settings, may be due to a pressure differential across the engine oil seals. The AMT should determine if there has been an increase in oil consumption on any of the engines on the incident aircraft. If so, the AMT should narrow the investigation to that engine. The AMT should then disconnect the ducting at the low and high pressure bleed ports on the engine and determine if there is evidence of burnt oil (coking) in either duct. If so, the engine should be considered the source of the contamination.

5.3.5 If, due to time constraints, it is not possible to remove the ducting at the engine, then the AMT should check the ducting as close to the engine as possible. If the aircraft is equipped with a water separator in the air conditioning system, the AMT should check for oil contamination there. If contamination is found, this would indicate oil leakage. However, it would not be possible at that point to determine if the source of the contamination was the engine or APU. Further investigation would be required to trace the ducting back to each bleed source.

5.3.6 If the aircraft is equipped with oil lubricated bearings in the air cycle machine (ACM), the AMT should assess if the oil level is low, or if the ACM has been consuming oil. If so, the AMT should examine the inside of the outlet ducting for signs of contamination.

5.3.7 If indications point to hydraulic fluid as the source of fumes, the AMT should perform a close walk-around of the aircraft. The AMT should look closely for evidence of fluid streaking down the fuselage and ending near an air inlet. Actuators, including in the landing gear, should be examined for signs of hydraulic fluid leakage. The AMT should also examine the area around the hydraulic servicing area, because over-servicing or spillage during servicing can cause hydraulic fluid to leak out of the servicing area and streak into an air inlet.

5.3.8 If the odours are not oil or hydraulic fluid related, then environmental issues should be considered. The AMT should verify if the aircraft was de-iced earlier on the day of the event, as this could be a possible source. If the odours were noticed on the ground but dissipated after take-off, the AMT should explore the possibility that ground equipment may have been left running in close proximity to the aircraft. Alternatively, the aircraft may have been in a long line waiting for take-off such that jet exhaust from another aircraft in front of the incident aircraft may have been ingested into the bleed air system. If the odour began just after engine start, the AMT should consider the possibility that there was a strong tailwind during engine start. This could have caused exhaust fumes to enter the bleed air system. If odours appeared and disappeared while the aircraft was in flight, other sources may be considered (e.g. did the flight path go over a forest fire or other source of contaminants?).

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## Chapter 6

### EVENT INVESTIGATION

#### 6.1 GENERAL

6.1.1 An event investigation should focus on:

- a) gathering factual and standardized information from flight crew members, cabin crew members and AMT;
- b) gathering technical findings on any replaced components;
- c) identifying the cause of the event, if possible; and
- d) developing recommendations to prevent reoccurrence.

6.1.2 Event investigations should be conducted by qualified, trained personnel.

#### 6.2 CONTENT OF THE INVESTIGATION

6.2.1 The following points should be addressed in the investigation of a fume event:

- a) general information on the event flight (i.e. data from the smoke and fumes reporting form);
- b) relevant documentation (e.g. maintenance logs, including maintenance history and servicing records, release forms, injury reporting forms);
- c) aircraft information (e.g. condition of aircraft systems; types and results of troubleshooting procedures);
- d) human performance (i.e. crew member and AMT actions);
- e) additional information (e.g. medical reports, first responder reports); and
- f) interviews, if applicable, including perspectives of one or more flight crew members, cabin crew members and AMT.

*Note.— In some instances, crew members undergo a medical follow-up after an event. However, this subject is beyond the scope of this circular.*

6.2.2 Detailed guidance on conducting an investigation is presented in the *Manual of Aircraft Accident and Incident Investigation* (Doc 9756), Part III — *Investigation*.

— END —



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