Cabin Air Quality Troubleshooting Advice

ATA:	**21-21**	FIN:		Ref:	**21.21.00011**
A/C Type:	**A300** **A300-600** **A310** **A318** **A319** **A320** **A321** **A330** **A340** **A340-500** **A340-600** **A350** **A380**	A/C Serie:	Topic:	First Issue Date:	**12-NOV-2013**
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Linked Articles:		Linked Documentation:			

Old Wise Ref:
EngOps-16325

Engineering Support

Model:		First Issue Date:	**12-NOV-2013**
Manufacturer:		Last Publication Date:	**10-JUL-2017**

Applicability

ALL

References

THIS ARTICLE REPLACES SIL 21-132

Now EngOps-16326 Dry Ice Transportation

Now EngOps-16316 Environmental Control System Decontamination Procedure

Now EngOps-16317 Aircraft Cabin Air Quality

FAST 19	Cabin Air Quality Article
FCOM 02.02.13	Inclement Weather Operation (A300-600/A310)

FCOM PRO-SUP-91-30 Adverse Weather (A320 and A330/A340 family)

FCOM PROC/SUP PROC/COLD WEATHER PROC Cold Weather Procedures (A380)

Description

Continuing interest in the subject of cabin air quality has prompted this WISE article which aims to consolidate the information and advice already contained in other sources.

This WISE Article highlights best practice available for troubleshooting with an overview of fleet experience and also provides recommendations after a cabin air quality event.

BACKGROUND:

All Airbus aircraft are tested to confirm that airflow rate and contamination levels are good compared to the relevant airworthiness regulations, and in respect of contaminants against internationally accepted safety guidelines, see the following documents ;

Now EngOps-16317 Aircraft Cabin Air Quality

FAST 19 Cabin Air Quality Article

This WISE article provides helpful data based on operator experience, and troubleshooting best practice

Solution

Possible Sources Affecting Cabin Air Quality

There are many potential causes of cabin odours or smoke and it can sometimes prove difficult to isolate the cause of an odour quickly. The following generic list (not ranked)covers the possible causes of odours that should be considered ;

- Engine or APU Ingestion of
  - De-icing fluid into inlet *(See precautions in FCOM 2.02.13 (A300-600/A310) or PRO-SUP-91-30 (A320 and A330/A340 family) or PROC/SUPP PROC/COLDWEATHERPROC (A380)*
  - Exhaust fumes from other aircraft, GPU etc
  - Pollution (eg. smoke from fires)
  - Hydraulic fluid leaks
  - Birds
  - Compressor wash procedure residues
  - Pollens
- Galley Equipment, ovens, coffee makers etc (Ref MPD tasks for galley and toilet air extraction systems)
- Damaged electrical wiring or components
- Inappropriate or excessive use of CO_2 (dry ice) by caterers or excessive quantities being transported (see EngOps-16326)
- Toilet fluid spillage, leakage and also unapproved mixing of different disinfectant fluids within the toilet.
- Leakage of the rain repellent system or rain repellent contamination within the cabin or flightdeck.
- Spillage's within cargo compartments
- Items stowed in overhead overhead bins
- APU oil leaks into the bleed system
- Engine oil leaks into the bleed system
- Contamination of the ECS

First Steps in Troubleshooting a Cabin Odour Report

Usually the source of a cabin odour report is easily determined by considering each of the potential causes above, but sometimes the cause is not obvious. In these cases the questionnaire in Attachment 2 can be used as a way of gathering the data necessary to progress troubleshooting which includes ; Description of Odour, Location of Odour, Flight phase when Odour was reported, Bleed system selections etc.

In order to share fleet experience and optimise troubleshooting, the following tables rank the causes of cabin odour for the fleet based on ;

- Table 1 – Reported Odour Causes Ranked by Highest Number of Reports
- Table 2 – Reported Odour Descriptions Correlated to Most Reported Odour Cause
- Table 3 – Reported Location of Odours Correlated by Most Likely Odour Cause
- Table 4 - Flight Phase When Odour Reported Correlated by Most Reported Odour Cause

These tables are based on available operator feedback and so represent a historical view. Therefore, some of the failure modes causing odour reports listed in the following tables have been rectified by modification action and may not be relevant to all or any existing aircraft standards.

Note : For A320 Family operators, attention is drawn to the TSM task 05-50-00-810-831-A which contains a decision table to identify odour sources, based on operator experiance.

RCSM NOTE : Please use the questionnaire at attachment 2 to record data when appropriate, however even when the questionnaire is not used it is still useful to forward all cabin air quality reports and occurrences to SEEE4.

Table 1 - Reported Odour Causes Ranked by Highest Number of Reports Per Aircraft Type

Most Reported	**A300**	**A300-600**	**A310**		
Primary Cause	Cause Breakdown	Primary Cause	Cause Breakdown	Primary Cause	Cause Breakdown
Electrical Equipment	N2 Indicator Lav Flush Motor ADI BCL	Electrical Equipment	TRU IFE CRT CB Panel	Electrical Equipment	TRU CB Panel ND
Galley Equipment	Oven Coffee Maker Water Heater	APU	Oil Leak	Galley Equipment	Wiring
Engine	Oil Leak	Galley Equipment	Oven	Engine	Hyd fluid ingestion
		Engine	Oil Leak		

Most Reported	**A319**	**A320**	**A321**		
Primary Cause	Cause Breakdown	Primary Cause	Cause Breakdown	Primary Cause	Cause Breakdown
APU	Oil Leak	APU	Oil Leak	APÜ	Oil Leak
Electrical Equipment	FCU VHF1 MCDU Ballast Units Extract Fan	Electrical Equipment	Ballast Unit TRU Reading Light Extract Fan Avionics	Electrical Equipment	Heated Floor Panel RMP MCDU ELAC

			Blower MCDU GPCU	Light Bulb
Engine	Oil Leak	Engine	Oil Leak	
Galley Equipment	Coffee Maker Hot Plate	Galley Equipment	Coffee Maker Oven	

Most Reported Primary Cause	**A330** Cause Breakdown	**A340** Primary Cause	Cause Breakdown
Electrical Equipment	IFE Light FCU DMC2	Electrical Equipment	Lighting Controller ACP Ballast Unit ECAM
Galley Equipment	Coffee Maker Oven Clogged Filters	Galley Equipment	Oven Coffee Maker
APU	Oil Leak	Engine	Prior Engine Wash Oil Leak

Table 2 – Reported Odour Descriptions Correlated to Most Reported Odour Cause

Description	**Primary Cause (Most Reported Listed First)**
Acrid	Electrical Equip / IFE Engine Oil Leak
Burning	Electrical Equipment Galley Equipment Ingestion of Bird
Chemical	Contaminated bleed ducts APU Ingestion **Leakage of rain repellent fluid**
Chlorine	Smoke Hood Blocked Door area drain
Electrical	Electrical Equipment
Dirty Socks	APU or Engine Oil Leaks, possibly contaminated ECS
Foul	Toilet
Fuel	APU FCU/Fuel line APU ingestion of engine exhaust
Oil	Engine or APU Oil Leak
Skydrol	Engine Hydraulic
Sulphur	Wiring Avionics filter water contamination Light Bulb

Table 3 – Reported Location of Odours Correlated by Most Reported Odour Cause

Location Description	Primary Cause (Most Reported Listed First)		
A300/A310/A300-600	**A319/A320/A321**	**A330/A340**	
Cabin	Electrical Equipment	APU Oil Leak Engine Oil Leak Electrical Equip Galley Equipment	Electrical Equipment APU Oil Leak Engine Oil Leak
Cockpit	Electrical Equipment APU Oil Leak Engine Oil Leak **Leakage of rain repellent fluid**	Electrical Equipment Engine Oil Leak APU Oil Leak	Electrical Equipment APU Oil Leak
Cabin & Cockpit	Engine, Hydraulic Fluid Ingest	Engine APU ECS	APU Ingestion
Fwd Galley	Galley Equipment	Galley Equipment	Galley Equipment
Aft Galley	Galley Equipment	Galley Equipment	Galley Equipment

Table 4 – Flight Phase When Odour Reported Correlated by Most Reported Odour Cause

Flight Phase	Primary Cause (Most Reported Listed First)		
A300/A310/A300-600	**A319/A320/A321**	**A330/A340**	
Ground	Electrical Equipment	APU Electrical Equipment	Electrical Equipment
Takeoff	Engine Oil Leak	Engine Oil Leak Ingestion APU Oil Leak **Leakage of rain repellent fluid**	Engine (prior eng wash)
Climb	Electrical Equipment De-icing Fluid Ingestion	Electrical Equipment APU Engine ECS Galley Equipment **Leakage of rain repellent fluid**	Green hydraulic overfill
Cruise	Electrical Equipment	Electrical Equipment Galley Equipment Engine APU	Electrical Equipment Galley Equipment
Descent	APU Oil Leak	APU Engine Electrical Equipment	Electrical Equipment ECS
Approach	APU Oil Leak Galley Equipment	APU	

Identifying the Source of Oil Contamination of the ECS

This section addresses oil contamination of the ECS. The possible sources of oil contamination of the air conditioning system is an oil leak from either the APU or an engine.

The majority of reports associated with oil contamination coincide with or closely follow one of the following crew actions: -

- Initiation of the APU bleed air supply
- Large change in power lever angle (PLA), i.e. top of descent, with engine bleed air already selected ON.

In these cases the air conditioning packs are subjected to changing bleed air inlet flow, pressure and/or temperature conditions. It should also be noted that the temperature of the APU bleed air supply can be higher than the engine air supplies. The generally higher APU air temperatures make it more likely that any existing contamination that is present within the air conditioning system will produce odours. Therefore, a report following initiation of the APU bleed air supply does not necessarily mean that the APU is the cause of the air conditioning contamination from which the smell can originate. Similarly, a smell report following a large change in engine power lever angle when APU AIR is OFF, does not necessarily mean that one or more of the engines is the cause.

In all instances of reported smells both the APU and engine bleed air supplies should be checked for evidence of contamination. Remember that the APU can contaminate both ECS packs, whereas for aircraft with 2 main engines; Engine 1 can only contaminate ECS Pack 1, and Engine 2 can only contaminate ECS Pack 2. For aircraft with 4 main engines Engines 1&2 can only contaminate ECS Pack 1, and Engines 3&4 can only contaminate ECS Pack 2. The process of determining the contamination source can be managed by use of a questionnaire as previously mentioned. Refer to EngOps-16316 for details of the ECS decontamination task which details where to look for oil contamination in the bleed system and ECS packs.

Post Event Maintenance

Diagnosing Continuing Problems

If the odour cause has not been confirmed and fixed, the use of the questionnaire shown in Attachment 1 will facilitate continued reporting if the operator chooses to return the aircraft to service. Attention is drawn to the importance of isolating the source by determining which pack and bleed configuration is involved

One possibility where the source of an oil leak/odour cannot be determined would be to operate the aircraft with each bleed supply OFF (in accordance with the MMEL requirements) in turn to identify a bleed configuration that confirms the odour. If this does not identify a bleed source of the odour, then operate using a single ECS pack to try and identify an ECS pack as a source of the odour. Note that a build-up of oil contamination within an ECS pack can occur over time and eventually cause the ECS pack itself to be the source of an odour. The reporting sheet at attachment 2 can be used to track the different ECS configurations and aid this process.

Aircraft Rectification

Following oil contamination of the aircraft bleed system and ECS, the system should be cleaned following removal of the contamination source, Ref EngOps-16316 and then maintained in a clean condition.

It may be prudent to replace the cabin air recirculation filters following significant in-service events where the filters have either become significantly contaminated, or remain odorous after the event. The recirculation filters may contain particulate residues that may help identify the cause of a cabin air quality incident. Note however, that the filters will not trap gaseous substances, only particulate matter.

Crew Medical Tests

Although it is very rare, an event involving physical symptoms being experienced by the crew requires a fast response in order to capture any available evidence that will confirm or discount any particular contamination source/scenario. Airbus has on occasion been asked to recommend what medical checks of affected crew are appropriate in such circumstances. Airbus does not make any recommendation about when or how crews should have medical checks, but advises that operators should seek medical advice about which medical checks would yield useful information after an event.

Note : In order to reduce the possibility of external variables influencing the results of such examinations, crew movement details between the flight and the medical examination should be recorded.

Record accurate and precise details of clinical symptoms: what symptoms were experienced ? When during the flight did each symptom become apparent ? How long did each symptom last ? Was the symptom relieved by the use of oxygen ? How were the onset of symptoms related to detected smell/odour ? Were the symptoms related to any ECS system switch selections ?

Contacts

Operators requiring more information or further advice should contact ;

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ATTACHMENTS

Attachment 1 – ECS Configurations

Part 1 – Isolating ENGINE/APU/PACK as the contaminant source

Date	Notes	Pack 1	Pack 2	Engine Air	APU Air	Odour
		OFF	ON	ALL OFF	ON	YES/NO
		ON	OFF	ALL OFF	ON	YES/NO
		OFF	ON	ALL ON	OFF	YES/NO
		ON	OFF	ALL ON	OFF	YES/NO
	Take-off config	ON	ON	ALL OFF	ON	YES/NO
	Landing config	ON	ON	ALL OFF	ON	YES/NO
	Landing config	ON	ON	ALL ON	OFF	YES/NO

Part 2 – Isolating Engine(s) as

contamination Source

Date	Notes	Engine Air #1	Engine Air #2	Engine* Air #3	Engine* Air #4	Odour
	APU Air OFF	OFF	ON	ON	ON	YES/NO
	APU Air OFF	ON	OFF	ON	ON	YES/NO
	APU Air OFF	ON	ON	OFF	ON	YES/NO
	APU Air OFF	ON	ON	ON	OFF	YES/NO

- *A330/A340/A380 only*

ATTACHMENT 2 - CABIN AIR CONTAMINATION REPORTING SHEET

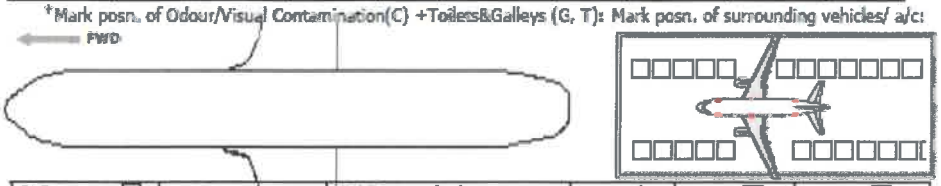
ATTACHMENT 2 - CABIN AIR CONTAMINATION REPORTING SHEET

Contamination is defined here as odours or fumes/smoke present in the cockpit or cabin that are not related to the normal behaviour of the aircraft or disturb the crew and/or passengers. There may or may not be physical discomfort associated with the contamination. Please complete this form with Maintenance, Engineering and Cabin/Flight Crew input as necessary (note that the first section, plus items marked with a (*) are necessary. Attach additional information/comments if applicable or not covered by this form. Data received will be used for trouble shooting assistance and entered into the Cabin Air Contamination Events database to allow analysis.

A/C Reg	A/C Type	From	To	Date	OAT (°C)
Eng Start Method		Time to Start		Eng Start Attempts	
Departure Time	Arrival Time	Evt Time	Flt Lvl	IFTB ☐	Delay mn

Gnd - Ph 1	Gnd - Pax Boarded	Taxi Out	T/O	Climb	Cruise	Descent	Approach	Taxi In
☐	☐	☐	☐	☐	☐	Top ? ☐	☐	☐

*Mark posn. of Odour/Visual Contamination(C) +Toilets&Galleys (G, T): Mark posn. of surrounding vehicles/ a/c:



BLD #1 ON ☐	Pack1 flow:	CKPT Temp (°C):	Wind Direction from...?	Fwd ☐	Port ☐
BLD #2 ON ☐	Pack2 flow:	FWD CAB Temp(°C):		Aft ☐	Starboard ☐
BLD #3 ON ☐	COT1(°C):	MID CAB Temp(°C):	Attach PFR/Report 19/ACMS prints as appropriate		Attach cargo manifest
BLD #4 ON ☐	COT2(°C):	AFT CAB Temp(°C):			
APU BLD ON ☐	CAB FANS ON ☐	Dry Ice on Board ☐			
Bleed Config at Takeoff		Any ECAM Msgs ?			

LAV smoke wrng ☐	CRG smoke wrng ☐	Avncs smoke wrng ☐
Eng Pwr setting	T/Reversers Used ☐	
*Odour/Visible Contamination Description + Additional Information:		

*Maintenance carried out before flight:
1. Scheduled Heavy Maintenance ☐
2. Line Maintenance ☐
3. Unscheduled Maintenance ☐
4. APU Service ☐
5. De-Icing ☐
6. Rain Repellent Service ☐
7. Other ☐

Details:

Physiological Symptoms	Passenger	Cabin Crew	Flight Crew
1. None	☐	☐	☐
2. Headache	☐	☐	☐
3. Dizziness/Fainting	☐	☐	☐
4. Nausea/Vomiting	☐	☐	☐
5. Eye/Nose Irritation	☐	☐	☐
6. Other (see opposite)	☐	☐	☐

If (6), please describe (incl. Seat No or crew station):

*What do YOU consider to be the most likely cause?

Ground Eqpmt	APU	Engine	De-Icing	Galley Eqpmt.	Cargo	Electrical	ECS Packs	Other
☐	☐	Which ? ☐	☐	☐	☐	☐	☐	☐

Return to SEEE4 by Fax: +335 61 934438, e-mail: nigel.dadswell@airbus.com or your local Airbus RCSM

AIRBUS WISE ARTICLE EngOps-16325

Additional Note

THIS ARTICLE REPLACES SIL 21-132

Please also note that

- ***SIL 21-029 is replaced by EngOps16316***
- ***SIL 21-050 is replaced by EngOps16317***
- ***SIL 00-081 is replaced by EngOps16326***