CASIAs Annual Meeting at EASA

8 and 9 May 2017

Fume Events

-Experience of the BFU-

Dipl. Ing. Johann Reuss

German Federal Bureau of Aircraft Accidents (BFU)

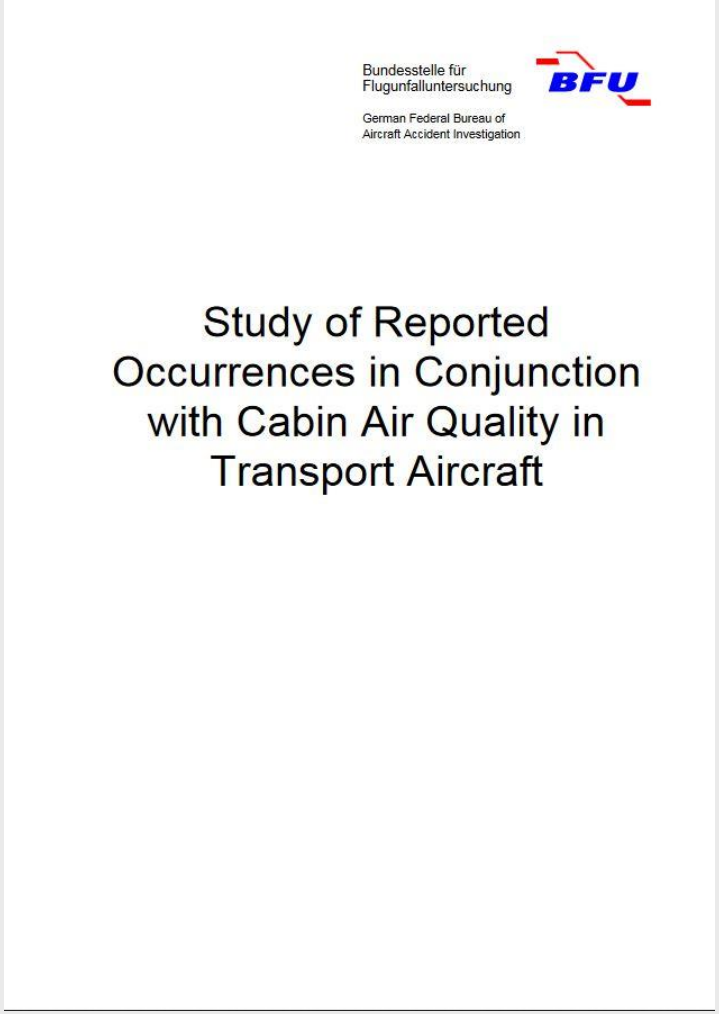
Background

Over the last few years, the BFU has received an increased number of reports of so-called fume events.

In Germany this topic is increasingly discussed among

- flight crews
- occupational unions
- the media and in
- political committees.

Study of Reported Occurrences in Conjunction with Cabin Air Quality in Transport Aircraft


Bundesstelle für Flugunfalluntersuchung

German Federal Bureau of Aircraft Accident Investigation

Study of Reported Occurrences in Conjunction with Cabin Air Quality in Transport Aircraft

This study took occurrences into consideration which were related to:

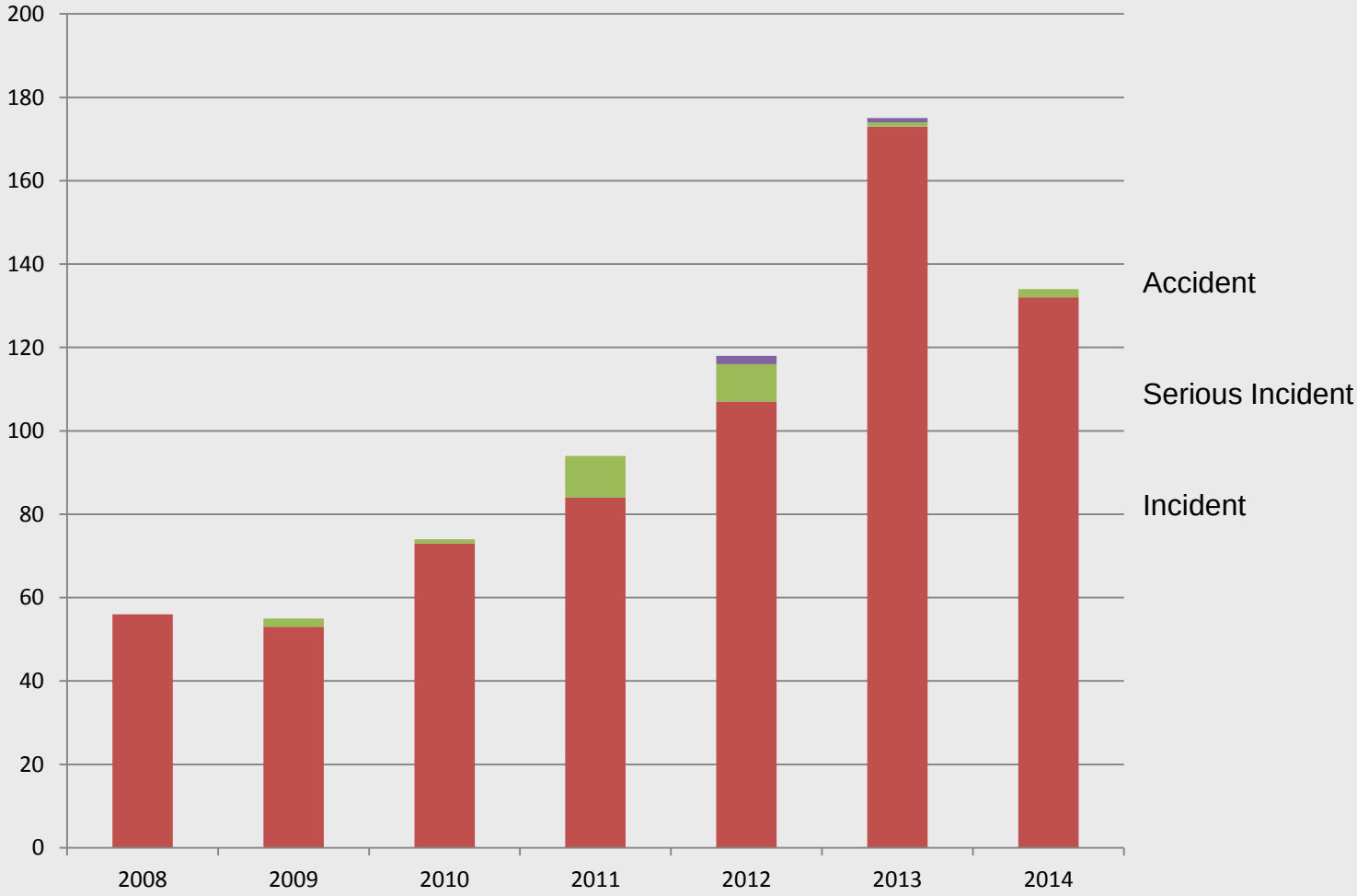
- Smoke
- Smell
- Specific symptoms of aircraft occupants

Published: May 2015

Between 2006 and 2014 BFU received:

- 845 fume occurrences involving transport aircraft
- Four of these occurrences were classified as accidents
- 57 as serious incidents
- 784 non-reportable occurrences were reported
- The BFU has initiated an investigation in 40 of these cases, (Para 3 Subpara 4 FlUUG)

Fume Events 2006-2014



For this study, the BFU has divided the reported occurrences into the following categories:

- Fume events affecting flight safety
- Fume events possibly affecting the occupational safety of crew members
- Fume events affecting the comfort of aircraft occupants
- Fume events and possible long-term effects on aircraft occupants

The results:

- Individual pilots were impaired in their capability to act
- No relevant reduction of flight safety by fume events
- Indications of effects on occupational safety
- Possible connection between long-term health impairments and fume events should be clarified
- BFU recommends that EASA and aircraft industry launch a research project by scientific institutes to examine the possible ingestion of hazardous substances into the aircraft cabin and the effects on human beings

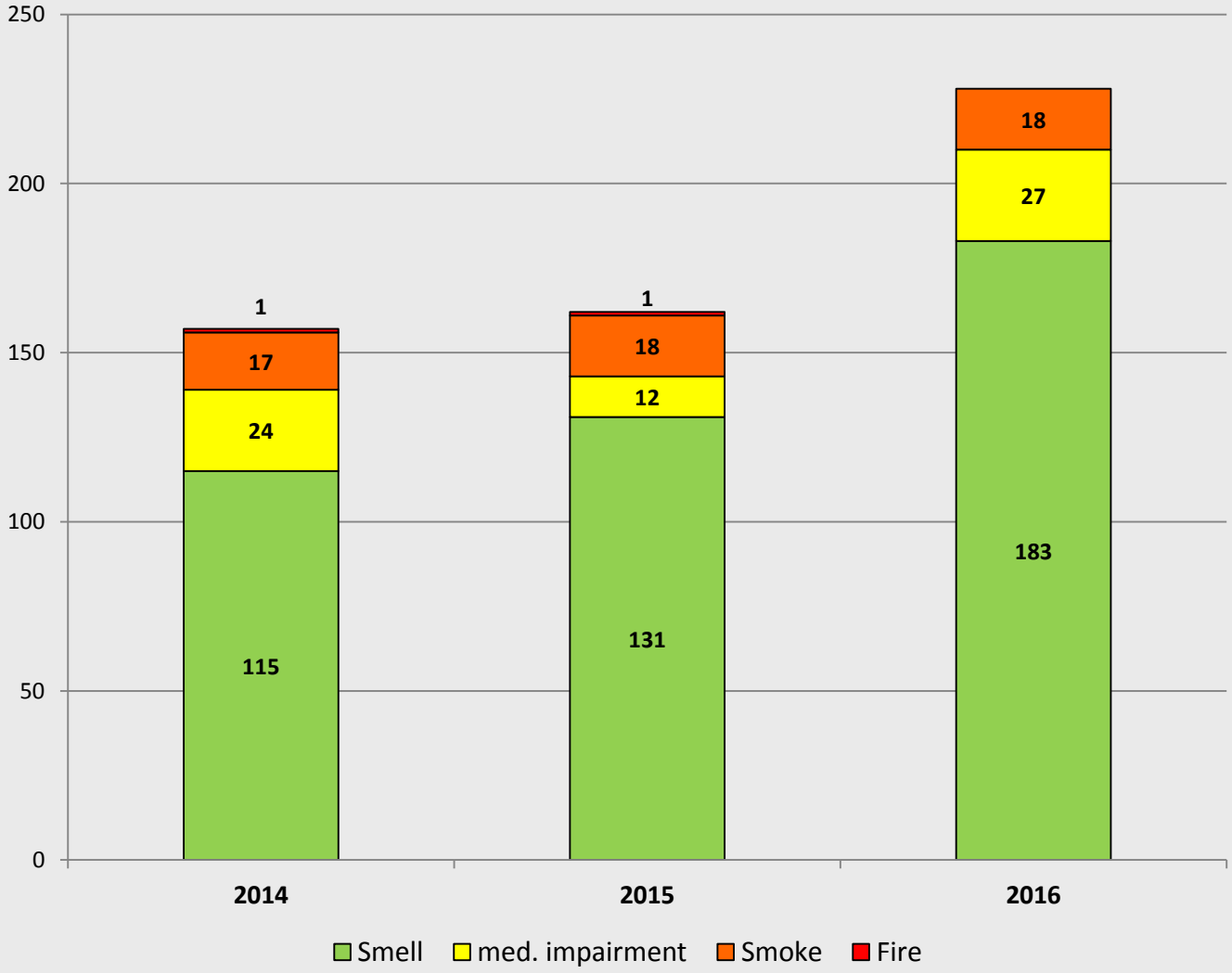
BFU has issued four safety recommendations

- An improved identification and avoidance actions of cabin air contamination possibly hazardous to health
- A standardised reporting procedure
- Improvement of the demonstration of compliance of cabin air quality during the certification process of transport aircraft
- Assessment of a possible conjunction between fume events and long-term health impairments by a qualified institution.

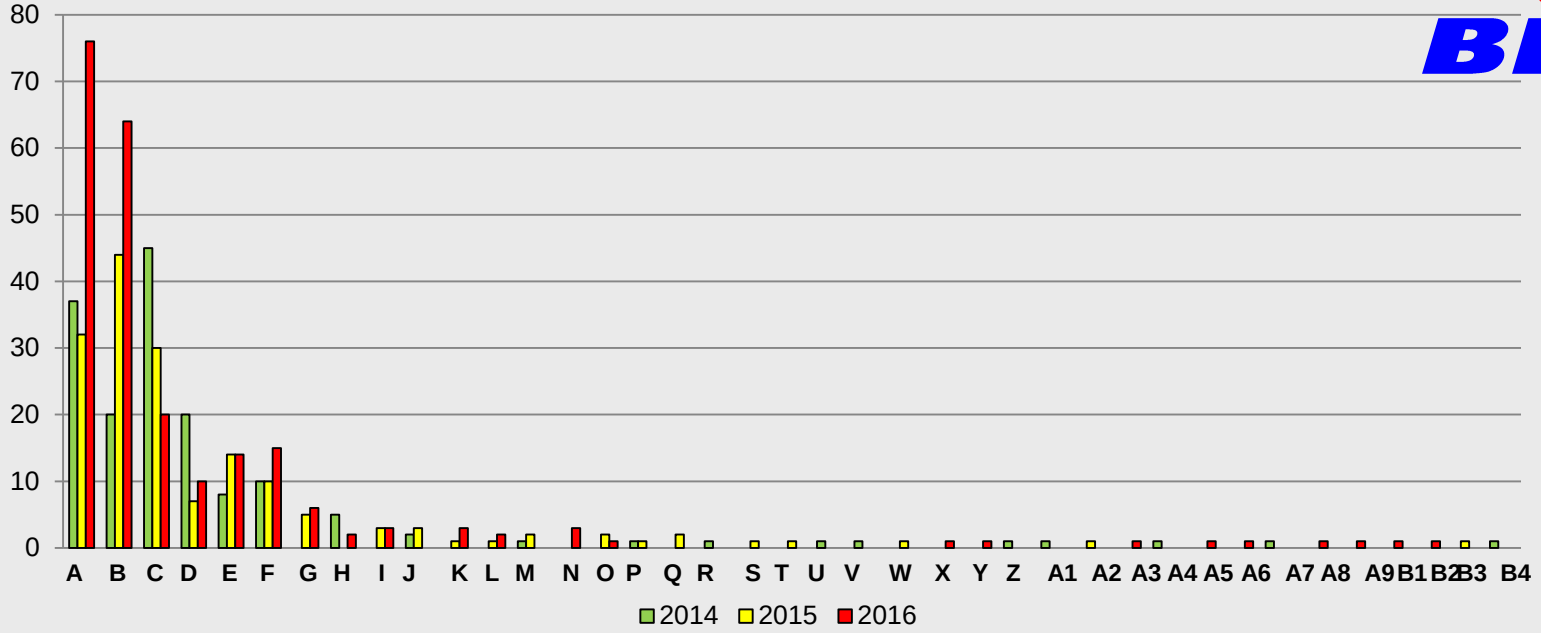
After the Study …

(2014 – 2016)

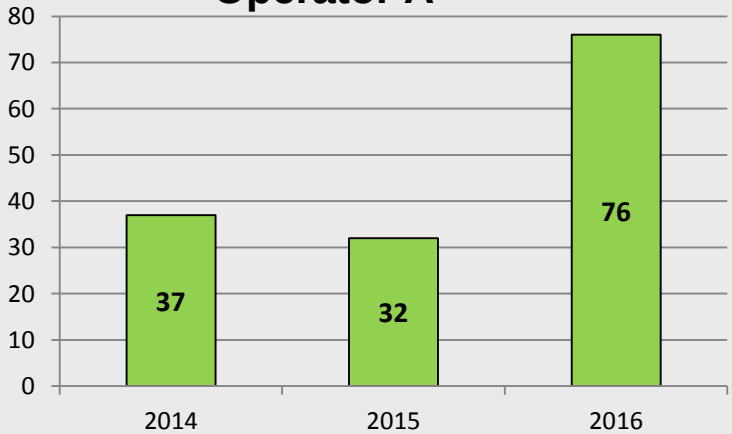
Fire, Smoke, Smell, Medical Impairment



Overall distribution per Operator



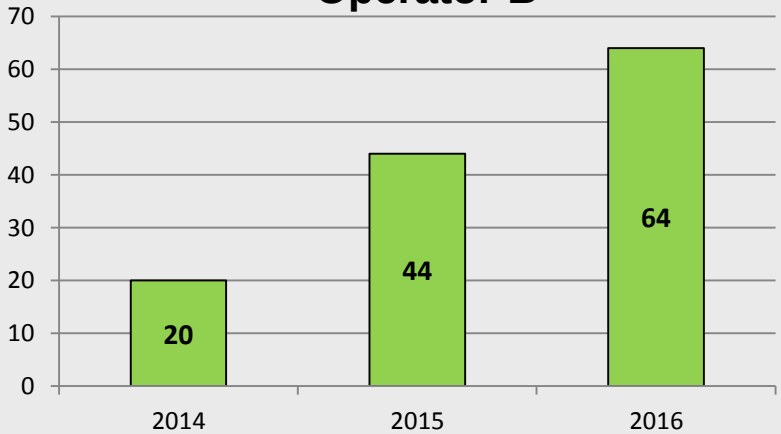
Operator A



- total fleet: approx. 270 A/C
- total events: n = 132
- mean events /yr: n = 44

=> one event per 6 A/C

Operator B



- total fleet. 59 A/C
- total events: n = 119
- mean events /yr: n = 40

=> one event per 1,5 A/C

Investigation

Questionnaire Cabin Air

German Federal Bureau of Aircraft Accident Investigation
Bundesstelle für Flugunfalluntersuchung

Questionnaire Cabin Air (Initial Interview) | BFU Reg.:

Please complete this questionnaire and return it to the BFU within 24 hours.
Fax-No.: +49 531 3548-246 E-Mail: ops@bfu-web.de

Date of Flight:	Departure Aerodrome:	Arrival Aerodrome:
Flight No:	Registration:	Aircraft Type:
Name:	Functions Aboard:	

1. What was observed (smoke and/or smell)?
The word smoke also stands for steam or fog.

☐ Smoke	☐ Smell	☐ Both

Additional Descriptions:

Where there other observations (indication, sounds, malfunctions, etc.)?

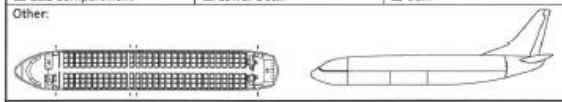
2. Who has made these observations?

☐ Captain	☐ Co-Pilot	☐ Cabin Crew	☐ Pax

3. In which area of the airplane were these observations made?

Flight Deck	Cabin	Cargo Compartment
☐ Cockpit	☐ Upper Deck	☐ FWD
☐ Cockpit Crew Rest	☐ Main Deck	☐ AFT
☐ E&E Compartment	☐ Lower Deck	☐ Bulk

Other:



4. What did you and/or the crew do immediately prior to the first observation?

5. In which flight phase did the observation occur?

☐ Take Off	☐ Climb	☐ Cruise / FL: _____	☐ Descent
☐ Approach	☐ Landing	☐ Taxi	☐ APU Use

Additional Information (Aircraft configuration, Packs, Bleed):

6. Which checklist was applied?

7. How intense and what characteristic did the smell/smoke have? How long did it last?

Minutes:	☐ Increasing	☐ Decreasing

Description of the smell:

Additional description of the smoke:

Opacity:	Colour:	Location (above/below):

Additional Information:

8. Did you experience any impairments? Which and how intense were they?

1) Irritation (e.g. eyes, nose, throat) - but no impairments	☐
2) Feeling unwell (e.g. headache, nausea) - but no impairments	☐
3) Able to perform duties with little difficulty but with reduced efficiency	☐
4) Able to perform duties with some difficulty and/or mistakes	☐
5) Able to perform duties but with great difficulties	☐
6) Unable to perform any duties	☐

Additional Information:

9. How many persons were affected?

Crew:	Passengers:

10. Did you or other crew members don an oxygen mask?

☐ Yes	☐ No

11. Why did your or other crew members don oxygen masks?

☐ Precautionary	☐ Necessary, because: ☐ Procedure (QRH etc.) and/or ☐ Immediate Hazards

If there were "immediate hazards" please describe:

12. Will you have a medical examination done?

☐ Yes	☐ No
When:	Where:

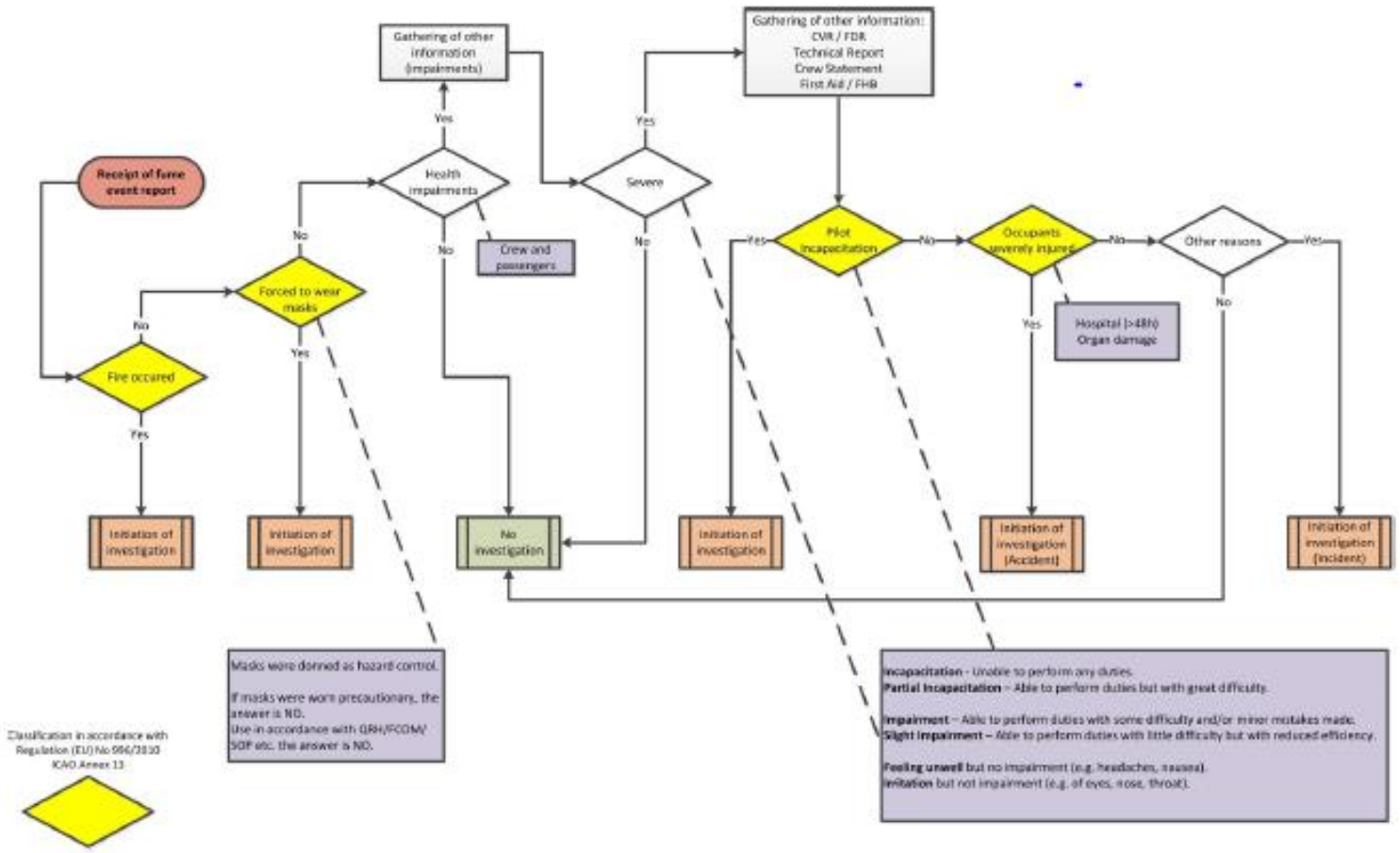
13. Will you pass on the results of the medical examination to the BFU?

☐ Yes	☐ No

14. Cargo (Dangerous Goods List, carry-on luggage, etc.)

City / Date:	Contact Data (E-Mail, Cell Phone, etc.):

Classification Scheme



Necessary chain of causation

- Aircraft: Technical findings
- Cabin Air: Extent and type of contamination
- Human/Medical: Impairment and diagnostic confirmation

Example: Fume event case

Report:

- Strong smell in the cockpit during approach
- Oxygen masks used by flight crew
- Cabin crew member reported a heavy medical impairment

CVR:

- Flight Crew had to use the masks because of the smell
- Cabin crew member reported by interphone: “Here is nothing …”

Investigation:

- Toxicological Statement of the Universitätsmedizin Göttingen:
  - Indication of toxicological impact (Volatile Organic Compounds (VOC))
- Aircraft manufacturer:
  - There are no relevant concentrations in the Cockpit/cabin.

Safety Recommendation
(March 2017)

- The “Deutsche Gesellschaft für Arbeits- und Umweltmedizin” (DGAUM) should establish a scientific guideline for humanbiomonitoring of persons affected by fume events.

  This guideline should be appropriate to ensure a well founded and standarised examination, to verify a physical pollutant load, as well as to define the resulting pathological significance.

  Furthermore, it should implement therapeutical approaches in order to minimize potential negative health effects for persons affected.

  Due to the necessity of contemporary examination and sampling after fume events, and considering the opportunity to install a quality circle procedure, a multicenter network design of examination centres has to be taken into account.

DGAUM statement as reaction to safety recommendation 04/2017

DGAUM

Deutsche Gesellschaft für
Arbeitsmedizin und Umweltmedizin e.V.

15.03.2017

DGAUM 2017: „Fume Events" - Herausforderung für die Wissenschaft

Hamburg, 15.03.2017 - Bereits seit Ende der 1950er Jahre berichten Piloten und Flugbegleiter, aber auch Passagiere nach Geruchsereignissen an Bord von Flugzeugen von Symptomen wie Übelkeit, Schwindel, Herzrasen, Kopfschmerzen und Konzentrationsstörungen. In der wissenschaftlichen Literatur werden diese Geruchsereignisse inzwischen als sog. Fume Events bezeichnet. In den Medien wurden solche Reaktionen u.a. auch als „aerotoxisches Syndrom" oder „Sick-Aeroplane-Syndrom" diskutiert. Bislang konnte trotz wissenschaftlicher Studien dazu keine monokausale Ursache auf stofflich-toxikologischer Grundlage gefunden werden. Deshalb stellen die in Wissenschaft und Medien benutzen Begrifflichkeiten auch keine anerkannten Krankheitsbilder dar.

Dennoch werfen „Fume Evens" bzw. das aerotoxische Syndrom viele Fragen auf und können durchaus auch die Flugsicherheit betreffen. Als mögliche Quelle werden häufig Unregelmäßigkeiten in der Zapfluft-Anlage und damit verbundene Emissionen der Kabinenluft genannt. Bereits 2008 hat die DGAUM als wissenschaftlich-medizinische Fachgesellschaft ein Forschungsvorhaben zur „Exposition und Belastung von Flugpersonal durch Tricresylphosphat" mit Sachmitteln unterstützt, da dieser neurotoxische Stoff als Ursache für die Symptomatik angesehen wurde.

Nach dem gegenwärtigem Stand des Wissens gibt es allerdings keine wissenschaftlich anerkannte Ursache dieses Phänomens. Zur Klärung des Sachverhaltes sind nach Auffassung des Präsidenten der DGAUM, Professor Dr. med. Hans Drexler, weitere Forschungsarbeiten unverzichtbar. Neben der Beschreibung und Einordnung der klinischen Symptomatik muss für Drexler, der ebenfalls Inhaber des Lehrstuhls für Arbeitsmedizin, Sozialmedizin und Umweltmedizin an der Universität Erlangen ist, auch nach toxikologischen, physikalischen und psychologischen Assoziationen gesucht werden, um Hypothesen formulieren zu können, die dann zu verifizieren oder falsifizieren sind.

Kontakt:
Prof. Dr. med. Hans Drexler
IPASUM - Institut und Poliklinik für Arbeits-,Sozial- und Umweltmedizin der Universität Erlangen-Nürnberg
Schillerstraße 25/29
D-91054 Erlangen
Tel.: +49 (0) 9131 / 85 22 31 2
Fax: +49 (0) 9131 / 85 22 31 7
E-Mail: Hans.Drexler@fau.de

- topic known since late 50´s
- until now no proven underlying mechanism
- medical requirements for definition as “syndrome” not given
- more scientific work necessary to clarify the mechanisms and the potential risk
- toxicological, physical and psychological starting points have to be considered

Public news coverage and social media – “alternative facts”

The Aviation Herald

www.avherald.com

Next | Previous | List by: Occurrence | Update | Filter: C A I N R

Incident: Germanwings A319 enroute on Feb 1st 2017, captain dizzy, both flight crew on oxygen

By Simon Hradecky, created Tuesday, Feb 7th 2017 22:06Z, last updated Monday, Apr 24th 2017 20:46Z

A Germanwings Airbus A319-100, registration D-AGWJ performing flight 4U-11 from Berlin Tegel to Cologne (Germany), was enroute when the captain felt dizzy and dopey. Both flight crew donned their oxygen masks and continued the flight to Cologne for a safe landing about 40 minutes after departure from Berlin.

According to information The Aviation Herald received the captain felt he might lose consciousness before the crew donned their oxygen masks. Cabin crew was no longer able to don their smoke hoods.

The occurrence aircraft resumed service 45 hours after landing.

Germany's BFU reported the occurrence has been reported to the BFU, the BFU is currently collecting further information.

On Apr 24th 2017 the BFU followed up reporting, that the occurrence was not rated accident or serious incident and is not going to be investigated.

By Mark Richards on Monday, Apr 24th 2017 20:59Z

"On Apr 24th 2017 the BFU followed up reporting, that the occurrence was not rated accident or serious incident and is not going to be investigated."

Having a potential of both flight crew passing out is "not going to be investigated" is the most bizarre part of this report.

Incapacitating crew with some sort of vapour, from whatever the source, stands as a serious issue!

Lacking any serious investigation, what is the public to think except that the regulators are incapacitated themselves.

Absolutely unbelieveable!
By The Legacy on Tuesday, Apr 25th 2017 06:58Z

That the BFU would not investigate this, and dozens of other breathing-related issues with flights in Germany. Sadly, I think it is only a matter of time before a fatal accident happens. When it does, I'm sure that the BFU will be brought to task, and dozens will be fired and/or charged for their willful lack of care when it comes to their duties.

It is sad that a vast majority of improvements in aviation are spurred from a fatal incident, and not from lessons learned from ordinary incidents.

ICAO Annex 13 Attachment C
By Simon Hradecky on Tuesday, Apr 25th 2017 12:59Z

ICAO Annex 13 Attachment C, which provides a (non-comprehensive) list of occurrences that most likely are serious incidents, lists as one of those occurrences:

Events requiring the emergency use of oxygen by the flight crew.

Public news coverage and social media – “alternative facts” II

BFU initiated preliminary enquiry:

(1) FODA dataset

(2) TLB entries – Workorder printouts –
TEC findings

(3) Cabin Air Questionnaire for the whole crew

(4) Medical data from whole crew

(5) Flight deck crew interrogation

Results:

- None of the pilots feared to pass out or to be unable to perform his duties
- Minor limitations: CPT suffered from headache; FO didn`t show any symptoms
- QDMs precautionary „knowing about the bleed contamination issue“
- Cockpit workflow and decision making normal
- stabilized uneventful approach, normal procedure in cabin
- after landing no decision for expedited controlled deboarding
- no abnormal medical findings in whole crew post-occurrence as far as provided by crew
- Smell generated by residues of de-icing fluid from de-icing process one day before

EASA Study 1

- Study 1: Cabin air quality (CAQ) measurement campaign - study conducted by a consortium of the Fraunhofer Institute for Toxicology and Experimental Medicine and the Hannover Medical School.

Results:

- Cabin/cockpit air quality is similar or better than what is observed in normal indoor environments (offices, schools, kinder gardens or dwellings).
- No occupational exposure limits and guidelines were exceeded.

EASA Study 2

- Study 2: Characterisation of the toxicity of aviation turbine engine oils after pyrolysis - study conducted by a consortium of the Netherlands Organisation for Applied Scientific Research and the Dutch National Institute for Public Health and the Environment.

Results:

- Neuroactive products are present, but their concentration in the presence of an intact lung barrier is too low to be a major concern for neuronal function.

- TCP was present in the analysed oils, however no ortho-isomers could be detected.

- Finally the analysis of the human sensitivity variability factor showed that the complete metabolic pathway and the contribution of inter-individual variability in the metabolic enzymes is still largely unknown for the majority of industrial chemicals, including cabin air contaminants.

Challenge

- To accomplish an appropriate classification (Accident, Serious Incident, Incident)
- To clarify the underlying mechanisms in order to perform an appropriate risk assessment
- To identify the border between flight safety and occupational health
- To differentiate between odorous “smell events” and potential hazardous cabin air contamination
- To distinguish between real reporting developments and “in-operator” dynamics

Conclusion

- Fume events exist, differing mechanisms are likely
- Oxygen masks in the Cockpit are sufficient
- High number of reports
- Flight safety can be marginal effected by aircrews` increased stress levels
- Present risk profile needs to be communicated to crews to provide clarification and coping strategies

Thank you very much!