Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Aviation Occurrence Investigation – AO-2007-063

Final

Fumes event

19 km E Melbourne Airport, Vic.

23 November 2007

VH-OGG

Boeing Company 767-338

Australian Government

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Figure 1 adapted from the aircraft operator's publication.

Abstract

On 23 November 2007, a Boeing Company 767-338, registered VH-OGG, was being operated on a scheduled passenger service between Sydney, NSW and Melbourne, Vic. On board were two flight crew, seven cabin crew and 255 passengers. The aircraft departed Sydney at 1426 Eastern Daylight-saving Time (EDT).

At about 1455, a passenger reported to a flight attendant that he could smell fumes coming from the gasper air vent above his seat. The passenger later reported that the fumes smelled like jet exhaust. The passenger became unconscious, and was administered oxygen. He regained consciousness within a few seconds of being administered oxygen. A second passenger, seated in the area, also reported feeling nauseous at the time.

The flight crew declared a state of urgency to air traffic control and began performing the 'Smoke or Fumes – Air Conditioning' checklist. The aircraft landed at Melbourne Airport at 1529.

There were no other reports of adverse effects from any of the other passengers or crew on board the flight. The two affected passengers had travelled extensively by air with no previous adverse reactions. The investigation could not determine whether the passengers' symptoms were as a result of fumes in the aircraft cabin, or whether there were other unidentified medical conditions that may have contributed to the symptoms exhibited by the two passengers.

The investigation identified a non-contributory safety issue related to adherence to curing times following application of corrosion inhibiting compounds in the aircraft's cargo bays. The report details safety action taken by the operator to address this safety issue.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government. ATSB investigations are independent of regulatory, operator or other external organisations.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

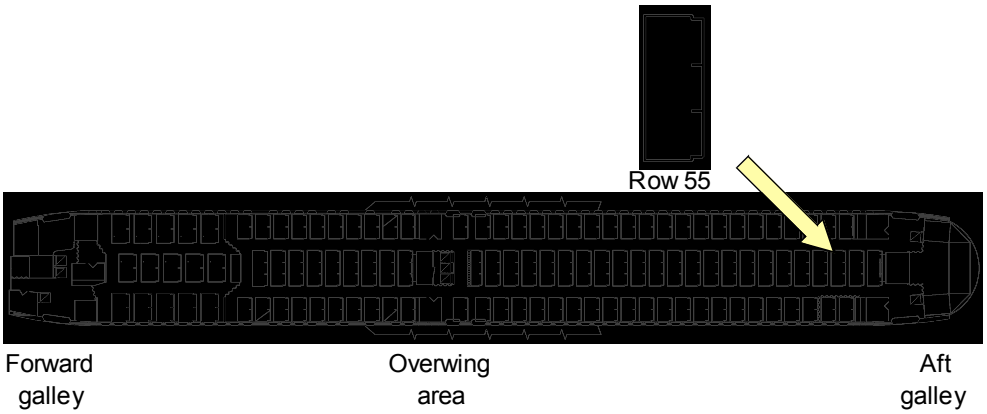
FACTUAL INFORMATION

History of the flight

On 23 November 2007, a Boeing Company 767-338, registered VH-OGG, was being operated on a scheduled passenger service between Sydney, NSW and Melbourne, Vic. On board were two flight crew, seven cabin crew and 255 passengers. The aircraft departed Sydney at 1426 Eastern Daylight-saving Time[1].

At about 1455, a male passenger in seat 55E (Figure 1) reported to a flight attendant that he could smell fumes coming from the gasper air vent above his seat and that these fumes were making him 'feel sick'. The passenger later reported that the fumes smelled like jet exhaust. The flight attendant put her nose near the vent but could not detect any odour. She then shut off the gasper air vents above that seat, and notified the customer service manager (CSM). The CSM then notified the flight crew about the ill passenger.

Figure 1: VH-OGG cabin layout



About 5 minutes later, the flight attendant checked on the passenger, who reported that he felt worse. He later described his condition during the incident as 'sick and fuzzy headed', that he could not 'think with clarity', but that he was 'not sick in the stomach'. He reported that his eyes may have been slightly sore but not watery. The CSM reported that the passenger appeared 'ashen'.

The CSM put his nose near the vent but could not detect any odour. The CSM offered the use of oxygen to the passenger, who agreed to use the oxygen. The CSM obtained a portable oxygen kit from the rear of the aircraft and returned to the passenger. When he returned, the passenger was no longer fully conscious. The cabin crew reported that the passenger provided a slight response to aural stimuli.

The cabin crew moved the passengers from the seats each side of 55E. The wife of the passenger in seat 55E, who was sitting in seat 55F, stood in the aisle on the right

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time (EDT), as particular events occurred. At the time of the event Eastern Daylight Saving Time was Coordinated Universal Time (UTC) + 11 hours.

side of the aircraft at row 55. A passenger in seat 55D moved to a previously unoccupied seat and remained there for the rest of the flight.

The cabin crew laid the ill passenger across the three seats and elevated his legs. The CSM supplied the passenger with oxygen from the portable oxygen kit. He later reported that the bag on the oxygen mask was inflating and deflating, indicating that the passenger was breathing. Within a few seconds, the passenger became fully conscious and was able to talk with the cabin crew. After several minutes the passenger sat up in his seat, and said he was feeling 'much better'.

The passenger's wife, who was now standing, then began feeling ill. She later described her condition during the incident as 'nauseous' and 'cloudy headed'. She sat back in seat 55F and was offered oxygen. She reported that taking oxygen did not make her feel better.

The aircraft began descent at 1507. At about that time, the flight attendant who had first attended to the passenger noticed a 'burning oil smell' around the overwing area. She notified the flight crew of this odour.

The flight crew declared a PAN-PAN[2] to air traffic control and began to perform the 'Smoke or Fumes – Air Conditioning' checklist, which included:

- Oxygen masks and smoke goggles – ON
- Crew communications – ESTABLISH
- Recirculation fan switches (both) – OFF
- Gasper fan switch – OFF
- Humidification switch – OFF
- Auxiliary power unit bleed air switch – OFF

The checklist also contained additional steps for isolating the air conditioning packs in the event that smoke or fumes continued. The crew reported that they did not have enough time prior to landing to assess whether the fumes had dissipated, so those steps were not performed.

The cabin crew prepared for landing and left the portable oxygen kit for the male passenger's use, having secured the bottle under seat 55D. The cabin crew returned to their normal stations for landing.

The aircraft landed at Melbourne Airport at 1529 and all passengers disembarked.

The two passengers who had been in seats 55E and 55F accepted an offer by the operator's staff to seek medical examination by paramedics. However, the passengers reported that they were subsequently advised by the operator that the ambulance was unable to attend in the near future and that it would assist them in arranging transport to their accommodation. The passengers reported that they did not later seek a medical examination in relation to the event.

2 PAN-PAN: a state of urgency requiring assistance, without immediate danger of life or aircraft.

Previous fumes incident on VH-OGG

During the previous sector flown by VH-OGG, cabin crew reported an electrical burning smell around the forward galley area after takeoff. Electrical power to the galley was switched off and the smell abated. Galley electrical power was switched on after about 10 minutes, and a similar smell was reported a further 10 minutes later in the same area. Galley and laptop electrical power for the area was switched off and the smell abated. A similar smell was reported about 90 minutes later in the same area, with a slight smell remaining until landing.

Immediately after this flight, maintenance personnel examined electrical equipment in and around the forward galley area, but did not report any indications of burning.

The flight crew and cabin crew of the incident flight were informed of this event prior to takeoff. The flight crew later reported that they reviewed the operational checklists relating to smoke and fumes as a precaution prior to takeoff.

Cabin crew and passenger interviews

During the investigation the two flight crew, six cabin crew members and the passengers in seats 55D, 55E and 55F were interviewed.

The passenger in seat 55D and five of the cabin crew members reported that they did not notice any fuel or exhaust odours during the flight.

The first officer noticed a fuel odour during taxi after the flight, but the captain did not detect it. The first officer reported that the odour was 'very weak, if anything – hardly noticeable' and lasted less than 10 to 15 seconds. He also reported that this odour would sometimes occur on the ground or with a tailwind. The captain and first officer reported that they did not notice any fuel or exhaust odours at other times during the flight.

The passengers in seats 55E and 55F both reported a smell at about the time the aircraft was pushed back from the terminal prior to takeoff. The male passenger described it as a 'normal aviation fuel' smell. The female passenger described it as an 'unburned fuel' smell.

The passenger in seat 55E was aged 57 and later reported that he had been in good health. He was not aware of any existing medical condition that may have contributed to the symptoms he exhibited during or after the flight, and that he had no history of collapse prior to the flight. He reported that he felt 'fuzzy' immediately after the flight but did not notice any other effects following the incident. The passenger reported that he had travelled extensively by air domestically and internationally, and had 'never had a reaction of this nature on any type of transportation' including on a return flight on 25 November 2007.

The passenger in seat 55F was aged 50 and later reported that she had been in good health. She was not aware of any existing medical condition that may have contributed to the symptoms she exhibited during or after the flight. She reported that she experienced nausea and 'light-headedness' for the next 2 or 3 days, and experienced headaches for 2 days. She reported that she felt anxious during the incident as a result of concern for her husband.

None of the interviewed crew members, or the other interviewed passenger, reported any physiological effects after the flight. No other passengers notified the

operator or the Australian Transport Safety Bureau (ATSB) of any adverse effects after the event.

Post-flight inspections

Immediately after landing, fire service personnel visually inspected the aircraft exterior and did not detect any smoke or fire. Fire service personnel also used heat sensing equipment to examine the vents above seats 55D, 55E, and 55F, and did not detect any excessive heat that could have indicated a fire.

Maintenance personnel inspected and tested the aircraft air conditioning system, cargo areas and galleys, and reported no odours or faults. An assessment flight of the aircraft on 23 November tested the air conditioning system, pneumatic system, auxiliary power unit and galleys. No odours or faults were reported.

Previous maintenance activity

On 22 November, corrosion inhibiting compound was applied in the aircraft's rear cargo area. Several types of compound were approved and available for the maintenance organisation for corrosion inhibiting use and the particular compound used was not recorded. The maintenance procedures included 'tack-dry'[3] curing times for three of the four approved classes of compounds and the maintenance records did not show how much curing time was required or applied after application. As such, the investigation could not determine whether sufficient time had been allowed for the curing of the compound to prevent fume accumulation.

The operator reported that maintenance personnel were required to record the part number of any material such as corrosion inhibiting compounds that were applied to aircraft, and record any requirement for curing time in one of several available logs and work cards depending on the circumstances of the activity. The incident flight was the second sector flown by the aircraft since the corrosion inhibiting compound was applied.

Aircraft environmental control system (ECS)

The aircraft's ECS included two air conditioning packs, and a recirculation system to improve efficiency. Two recirculation fans drew filtered air from behind the forward cargo bay for recirculation into the cabin. When both recirculation fans were operating, about half of the air delivered by the ECS was recirculated, with the remaining half consisting of conditioned outside air. Both recirculation fans were normally switched on when the aircraft was in flight.

The ECS system was designed to maintain a generally rearwards airflow with a single outflow (cabin pressure control) valve at the rear of the aircraft. The airflow makes it unlikely that air in the rear cargo compartment can enter the air conditioning system. When both air conditioning packs were operating the ECS system exchanged all cabin air about every 150 seconds.

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3 Tack-dry: descriptive of the stage in the drying of a substance at which it is sticky and no longer wet to the touch.

Recorded data

Recordings from the aircraft's flight data recorder (FDR) and quick access recorder (QAR) were obtained by the investigation. The recordings contained data on:

- environmental control system (ECS) packs (on/off)
- ECS pack flow (low/high)
- recirculation fans (on/off)
- auxiliary power unit bleed valves (open/closed)
- bleed isolation valves (open/closed).

The recordings did not contain data on intercom system keying, humidification switch position or gasper fan switch position.

The recordings indicated that:

- the ECS packs were on for the duration of the flight;
- the left recirculation fan was off for the duration of the flight; and
- the right recirculation fan was on during takeoff and climb, and was turned off at 1520.

ANALYSIS

Types of fumes

From interviews with crew and passengers, the investigation identified the following instances when fumes were noted during the flight:

- During the previous sector flown by the Boeing Company 767-338, cabin crew smelled 'electrical burning' around the forward galley area after takeoff. A similar smell was noticed about 20 minutes after that, with a slight smell remaining for the duration of the flight.
- At about the time the aircraft was pushed back from the terminal prior to takeoff, the passengers in seats 55E and 55F noticed an 'unburnt fuel' or 'aviation fuel' smell.
- During the cruise phase of flight, for a 5 to 10 minute period, the passenger in seat 55E noticed an 'exhaust fumes' smell.
- During descent, one of the cabin crew noticed a 'burning oil' smell.
- During taxi after the flight, the first officer reported smelling 'exhaust fumes'.

The descriptions, locations, and times reported for each of these fumes differ substantially. Although individuals may describe a smell differently, it is unlikely that an 'electrical burning' smell would be confused with an 'aviation fuel', 'exhaust', or 'burning oil' smell.

The 'exhaust fumes' and 'burning oil' smells noticed during the cruise and descent phases may be related. However, this is unlikely considering that the cabin crew member who reported the 'burning oil' smell during descent did not notice the 'exhaust fumes' during cruise, even though she was in the area and attempting to smell the reported fumes at the time.

The investigation concluded that each of the reported instances of fumes were probably unrelated.

Source of fumes

The investigation did not determine the source of the 'electrical burning' smell around the forward galley area during the previous sector flown by the aircraft.

The first officer reported that aviation fuel fumes would sometimes enter the cabin during taxi. The investigation considered that the smells that were noted during taxi in Sydney and later in Melbourne were most likely due to fumes external to the aircraft entering the aircraft's air conditioning system.

Of the six cabin crew and three passengers interviewed by the investigation, only the passenger in seat 55E reported any fumes occurring around the time that he lost consciousness. Additionally, none of the interviewed cabin crew reported any other passengers advising them of fumes or reporting adverse effects. This suggests that the fumes reported by the passenger were either localised, or insufficiently strong to be noted by the two other passengers and six crew members who were interviewed.

Although corrosion inhibiting compound had recently been applied in the aircraft's rear cargo bay, it is unlikely that fumes from that compound had entered the aircraft's cabin in a sufficient quantity to induce adverse effects on passengers. The aircraft's internal airflow would have resisted forward movement of any fumes, which would have been required for entry into the aircraft's recirculation system via the inlets near the forward cargo bay. The amount of recirculated air would probably have been considerably less than half because the left recirculation fan was off for the duration of the flight. In addition, the high air exchange rate would have rapidly diluted any fumes.

Due to the high airflow in the cabin, any fumes would have been distributed around the entire cabin and cockpit, and not concentrated in one area. The investigation could not identify any potential source of fumes that would affect the area around seat 55E only.

The investigation found no other evidence regarding the source of the 'burning oil' smell noticed by the cabin crew member during descent.

Effect of fumes

As the source of the fumes was not identified, and no medical examination was subsequently conducted on either of the affected passengers, the investigation could not determine whether the passengers' illnesses were related to the fumes. The female passenger reported that she felt anxious after her husband had become unconscious. The investigation could not determine whether this anxiety contributed to her physiological symptoms.

None of the six crew members, or the other interviewed passenger, reported experiencing any adverse effects during or after the flight. Furthermore, there were no other reports of adverse effects from any of the other passengers or crew on board the flight. It is difficult to reconcile the localised nature of the fumes event, with nobody other than the passengers in seats 55E and 55F noticing the fumes and seemingly being affected. While it is possible that the passenger in seat 55E may have been particularly susceptible to fumes, or a particular type of fume, he was not aware of any such susceptibility and had previous extensive travel experience.

Corrosion inhibiting compound curing time

The operator's procedures for the application of corrosion inhibiting compound did not completely and unambiguously specify how much curing time was required to prevent accumulation of fumes. In addition, the maintenance records for the application of corrosion inhibiting compound on 22 November did not show any requirement for a curing time to be met. As a result, there was no assurance that sufficient curing time would be allowed.

In this occurrence the location of the corrosion inhibiting compound meant that any possible fumes were unlikely to enter the cabin. However, had the corrosion inhibiting compound been applied in the forward cargo bay with insufficient curing time, fumes from the compound could have entered the aircraft's cabin through the recirculation inlets at the rear of the forward cargo bay and may have affected the health of crew and passengers.

In addition to the risk of harmful fumes, non-adherence to curing times for other types of compound, such as adhesives and sealants, could render the compounds ineffective for their intended purpose.

Flight crew checklist

The third item for the 'Smoke or Fumes – Air Conditioning' checklist was to turn off both recirculation fan switches. The flight data recorder (FDR) data indicated that the aircraft's left recirculation fan remained off for the entire flight, while the right recirculation fan was turned off during descent. The right recirculation fan was probably turned off by the flight crew as part of the checklist.

The investigation could not determine why the left recirculation fan was not switched on prior to the flight. However, that would have reduced the amount of recirculated air provided by the aircraft's environmental control system and reduced the amount of any recirculated fumes.

FINDINGS

From the evidence available, the following findings are made with respect to the fumes incident involving the Boeing Company 767-338 and should not be read as apportioning blame or liability to any particular organisation or individual.

Other safety factors

- The operator's maintenance procedures did not completely and unambiguously specify curing times following application of corrosion inhibiting compounds *[Safety Issue]*.
- The required curing time was not recorded in the aircraft's maintenance documentation during the maintenance activity.

Other key findings

- The investigation could not determine whether the passengers' symptoms were as a result of fumes in the aircraft cabin, or whether there were other unidentified medical conditions that may have contributed to the symptoms exhibited by the two passengers.
- Any fumes present in the rear cargo compartment due to prior application of corrosion inhibiting compounds were unlikely to enter the aircraft's cabin and probably did not contribute to the passenger's symptoms.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Aircraft operator

Maintenance procedures for the application of corrosion inhibiting compounds

Safety issue

The operator's maintenance procedures did not completely and unambiguously specify curing times following application of corrosion inhibiting compounds.

Action taken by the operator

The operator reported that it will revise its Process Specification Manual and Material Specification Manual sections covering the application of corrosion inhibiting compounds to clarify the corrosion inhibiting compounds curing times.

It will revise its Process Specification Manual section covering the application of corrosion inhibiting compounds to:

- clarify when insulation blankets can be installed after the application of corrosion inhibiting compounds
- highlight the notes concerning the avoidance of corrosion inhibiting compounds on ducting or hot surfaces
- reference the Aircraft Maintenance Manual procedures for the application of corrosion inhibiting compounds
- add applicable Service Bulletin and Service Letter references concerning flammability of insulation blankets with excessive corrosion inhibiting compounds.

The operator reported that it will revise its Engineering Procedures Manual to remove the word 'chemical' from the title, and add references to the aircraft maintenance manual procedures for the application of corrosion inhibiting compounds.

APPENDIX A: SOURCES AND SUBMISSIONS

Sources of information

Flight crew and some cabin crew of VH-OGG

Three passengers from VH-OGG

VH-OGG owner and operator

Aircraft manufacturer.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the Executive Director about the draft report.

A draft of this report was provided to the flight crew, six cabin crew, the aircraft owner/operator, the Civil Aviation Safety Authority and the two passengers that were involved in the event.

Submissions were received from the aircraft owner/operator and the two passengers. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.