Occupational Health Problems among Flight Attendants

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Newspaper Reports

- William Carley, *Wall Street Journal* 1977:

"Airline crew members and passengers may face a new hazard: ozone sickness, which has apparently struck hundreds of people during recent flights."

Coughs, Headaches, Bloody Noses Experienced

Wash Post 6 May 197

A New Flight Hazard: Ozone Sickness

By William M. Carley

NEW YORK—Airline crew members and passengers may face a new hazard: ozone sickness, which has apparently struck hundreds of people during recent flights.

Ozone gas is in a layer of the earth's atmosphere; normally it has been far too high to cause any problems for airline trips. But now it has apparently been causing illness because airplanes are flying higher to conserve fuel and because the ozone has dipped closer to earth.

Whether low doses of ozones cause any long-term effects isn't known, doctors say. But in the short run, enough ozone in the air can trigger a racking cough that may last for hours, severe shortness of breath, headaches, fatigue, eye irritations and sometimes bloody noses. Describing one recent flight, a Pan American World Airways stewardess says, "Almost everybody in the cabin was coughing and wheezing—the place looked like a turbercu-losis sanitarium."

When the ozone sickness first struck, apparently a few months ago, no one knew what it was. The symptoms, however, are setting off myriad repercussions:

• Squabbles between pilots and stewardesses over what has been happening and what to do about it have been brewing on planes.

• A scientific detective hunt has been under way to track down and confirm the cause.

• A series of hurried tests has been started, mainly by Boeing Co. and Pan American, to try to remedy the problem.

The airlines haven't made public announcements about the ozone sickness, apparently fearing that they might scare passengers away. (Crew

See EXPOSURE, A16, Col. 1

EXPOSURE, From A1

members interviewed generally asked that their names not be used for fear their comments would upset management.) When asked about the problem, company executives emphasize that they are working hard on remedies. "We think we're on the road to a solutitn," says William Waltrip, Pan Am's executive vice president for operations.

The normal oxygen molecule consists of two txygen atoms, while the ozone molecule consists of three. The airline ozone problem isn't restricted to a particular type of aircraft. United Airlines, for example, says scores of people on 35 of its coast-to-coast flights have been hit by the ozone sickness. The flights were in Boeing 747 jumbo jets and McDonnell Douglas DC-8s and DC-10s.

Man recent cases of the illness, however, appear to be on board Pan Am flights from New York, San Francisco and Los Angeles to Tokyo. These flights use the Boeing 747 SP (the initials stand for "special purpose"). The SP flies farther and higher than most other planes. For example, a medium-size jet such as the 727 typically flies for two hours at 35,000 feet on a New York-Chicago run. On a New York-Tokyo nonstop run, a Pan Am SP flies nearly 14 hours at around 45,000 feet. The high altitude, which conserves fuel, and the long distance combine to increase exposure to the ozone high in the earth's atmosphere.

Last year, when Pan Am became the first airline in the world to introduce the SP on its routes, stewardesses were the first to begin complaining. At first, ozone wasn't even suspected as a cause. "It's a long flight to Tokyo, through numerous time zones and your body gets all out of sync so you expect some minor problems," says William Lindner, director of safety at the Transport Workers Union, which represents Pan Am stewardesses. Pan Am's initial reaction to the complaints, Lindner adds, was that "well, some people are hung over." And he says, "I think management also suspected some union tactics may have been involved."

The stewardesses weren't sure what was happening. "The girls don't like the SP anyway because the flight is so long and the air is so dry you become dehydrated," one Pan Am stewardess says. "At first even I thought it must be psychosomatic."

But the number of complaints began rising—and in strange ways. "People seemed to have trouble going out to Tokyo, but not coming back," Waltrip says. "We couldn't figure it out." Pan Am then began monitoring temperature and humidity in the cabin, correlated with latitude and longitude, to seek clues to what was happening. Ozone, not being suspected, wasn't measured.

FLYING: RESPIRATORY HAZARD?

- Studies have suggested that flight attendants may experience increased rates of respiratory symptoms, particularly associated with exposures to long-haul flights.
- This association is plausible because flight attendants are known to experience exposures to respiratory irritants: Ozone, specific chemicals including hydraulic fluids, engine oils, jet fuel and pesticides, cigarette smoke (prior to ban), and viral infectious diseases.

OFFICIAL PRONOUNCEMENTS AT THE TIME

- J. Donald Collier, Director, Environmental Affairs, Air Transport Association: "The record and experience of over 20 years of jet operations is conspicuously quiet on health problems related to air quality".
- FAA: "Standards for air quality are satisfactory".
- John P. Reese, Aerospace Industries Association: "Air quality in aircraft cabins is equal to or better than the air quality in other environments".

DISSENTING VIEWS

- Xenix Corporation: Made ventilation systems for aircraft. Petitioned FAA in 1980's for aircraft cabin air quality standards. They accused the FAA of "a premeditated effort to stonewall and obstruct the efforts to establish meaningful health and safety standards".

FLIGHT ATTENDANT HEALTH STUDIES COMPLETED

- UC Berkeley/CA Department of Public Health Study – IUFA – Reed (1980)
- NIOSH Study – IUFA – Malignant melanoma (1981-82)
- APFA Study #1 – Cone and Cameron (1983)
- APFA Study #2 – Cone and Cameron (1983-4)
- IUFA study – Cone and Earle (1983-4)
- AFA study – Reproductive hazards (1994)
- CA Department of Public Health-AFA Study – Reynolds and Cone – Breast cancer and malignant melanoma (1999)

PHASE 1 STUDY: APFA 1983

- Study initiated by IUFA representing American Airlines flight attendants.
- Symptoms reported particularly on SFO-HNL turnaround flights.

PHASE I STUDY: HYPOTHESES

- Symptoms of respiratory distress, sinus congestion, nasal pain, blocked eustacian tubes and nosebleeds are associated with exposure to airborne contaminants while flying.
- Specific types of aircraft are associated with increased frequency of symptoms.
- Mobil Jet II oil is the cause of the increased symptoms.

PHASE I STUDY METHODS

- Individual flight attendants were examined at the SF General Hospital Occupational Health Clinic
- Questionnaire survey distributed to all flight attendants on the SFO-HNL turnarounds, total of 5 flights each.
- Additional group of flight attendants flying turnarounds from LAX-HNL were surveyed.
- Investigation into the chemicals contained in Mobil II oil

"DIRTY SOCKS" ODOR

- Four flight attendants were examined. All identified "dirty socks odor" associated with symptoms. Symptoms sometimes occurred even without the odor, however.
- Odor and symptoms were most frequently reported on DC-10-10 aircraft. Odor was strongest in over-wing section and galleys. Also in cockpit.
- Odor strongest on taxi, take-off and landing.

“DIRTY SOCKS” ODOR

- Odor more pronounced when Mobil II jet oil was used.
- Odor was reduced when water separator bags were changed.
- American Airlines correspondence indicated that management also suspected Mobil II jet oil to be culprit. They suspected contamination of the Auxiliary Power Unit (APU) door or inlet duct by oil from the #2 engine. Contamination of heat exchangers and insufficient cabin ventilation were also suspected.

POTENTIAL EXPOSURES

- Turbine oils: Mobil Jet II oil is a synthetic oil containing tri-cresyl phosphates: known eye, skin and mucous membrane irritants.
- Hydraulic fluids: Also contained phosphate esters.
- Other potential chemical exposures: NOX, O3, cigarette smoke, formaldehyde, pyrolysis products of engine oils, jet fuel and hydraulic fluid.

MEDICAL EXAMINATION RESULTS

- Clinical evaluation: Symptoms of nasal burning, headache, eye tearing, nasal discharge, sneezing, sore throat, hoarseness, cough and hearing difficulties after beginning to fly SFO-HNL turnarounds.
- Symptoms lasted 1-5 days.

QUESTIONNAIRE RESULTS

- 58 questionnaires received from flight attendants on SFO-HNL turnarounds over 3 day period, 8/15/83-8/17/83. Participation rate 100%
- Age: 34-44, mean = 37 years.
- All were female. 17 were smokers. 42 reported prior allergies.
- Unusual odors noted by 14/20 flight attendants working on one particular aircraft, on taxi and descent.
- Odors described as "dirty socks", musty or "petroleum burning".

SYMPTOMS REPORTED

Symptom	#	%
Eye	38	66
Nose	35	60
Sinus	14	24
Chest	12	21
Ear	11	19
Central Nervous System	10	17

PHASE I STUDY CONCLUSIONS

- Symptoms are caused by one or more air contaminants. At least one of these contaminants is the probable cause of the "Dirty Socks" odor.
- Concentrations very by aircraft type, location within aircraft, and phase of flight.
- Mobil II jet oil implicated as a possible causative agent.

PHASE I STUDY RECOMMENDATIONS

- Identification of all likely cabin air contaminants
- Industrial hygiene sampling of likely contaminants during each phase of flight
- Eliminate causes of exposure, improve maintenance procedures, or engineering changes to aircraft: e.g., more frequent changes of water bags, burn out contaminants from A/C systems, clean APU door/inlet, change to different engine oil, increase fresh air flow.
- Respiratory protection for flight attendants in the meantime.
- Medical / Epidemiologic Surveillance of airline crew for symptoms reported.

PHASE II STUDY

- Meetings with medical department, American Airlines
- Expansion of symptom survey to include other bases and airlines using other equipment.
- Industrial Hygiene Survey onboard flight, SFO-HNL turnaround, on a DC-10 aircraft. Sampling for O3, NOX, SO2, phosphoric acid esters, organic vapors.

RESULTS – PHASE II STUDY

- Sampling results: Nitrous oxide detected on 3 segments of the flight, at concentration of 1 ppm. One segment with nitrous oxide also had "dirty socks" odor noted. No other contaminants detected.
- A total of 683 questionnaires were received out of 720 distributed (95%)
- Age: Mean of 36 years.
- 88% female.
- Allergy history: 36%
- Dates of survey: August 1983-March 1984.
- 68% were non-smokers.
- Aircraft: N (%)
  - 747 170 (26%)
  - DC-10-10 275 (39%)
  - DC-10-30 237 (35%)

PHASE II SURVEY RESULTS

- Symptoms: Statistically significant associations seen with type of aircraft and eye, nose, throat and sinus irritation, eye dryness, watery eyes, redness, burning eyes, nose itching, nasal discharge and dryness, and sinus burning, congestion and pressure/pain.
- Shortness of breath, dizziness and lightheadedness associated with type of aircraft.
- Boeing 747 and DC-10-10 both associated with increased risk of symptoms
- Base: Oakland (World Airways) flight attendants had lower risk of symptoms.
- Dirty Socks Odor: Significantly associated with eye, nose and sinus irritation symptoms.

PHASE II STUDY CONCLUSIONS

- Flight attendants flying DC-10-10 or Boeing 747 aircraft are at significantly higher risk of developing irritant/allergic rhinitis, particularly after exposure to "Dirty Socks" odor.
- Symptoms suggest a powerful mucous membrane and respiratory irritant.
- Nitrous oxide was measured on one flight. It is a known respiratory irritant. Levels were lower than usually associated with such symptoms.
- Prime suspect agents: Vaporization, combustion / pyrolysis products of aircraft fluids, particularly engine oils.

PHASE II STUDY RECOMMENDATIONS

- Flight attendants who have developed symptoms of rhinitis or upper respiratory / eye irritation should be removed immediately from further exposure. Make O2, cartridge respirators available.
- All air packs should be operating at all times.
- Destructive analysis of Mobil II jet oil.
- Further study by FAA or others to determine, cause of the problem, and institution of engineering controls to eliminate the source.

PHASE III STUDY - IUFA

- 1000 members of the Independent Union of Flight Attendants based in SFO and London were surveyed regarding symptoms and exposures, March 1983-April 1984.
- Prospective study of peak expiratory flow rates using a miniature hand-held device to measure lung function before, during and after flights.

PHASE III STUDY RESULTS

- A total of 280 questionnaires were returned. (28%).
- Age: Predominantly 40-49 years of age.
- 90% female.
- Chest pain or tightness reported by 65% of participants. Cough 57%; 38% said they usually had symptoms of shortness of breath or chest tightness while flying.
- Equipment: Boeing 747 SP associated most frequently with symptoms (62%).

PHASE III RESULTS – PEAK EXPIRATORY FLOW

- 8 out of 20 selected to participate in this phase completed testing.
- 2 of 8 had evidence on PEFR of >20% drop over a 24 hour period. Both were associated with long-haul flights. All 8 had small but measurable drop in mean PEFR comparing pre-flight to post-flight measurements. 7/8 had a statistically-significant drop in PEFR.

DISCUSSION

- Results of our studies of flight attendants in the early 1980's demonstrated consistent symptoms and some evidence of decreased pulmonary function associated with certain aircraft / flights.
- Symptoms are similar to those reported in the study performed in 1978 by CA Department of Public Health.
- Contamination of the Auxiliary Power Unit by engine oil was recognized over 35 years ago as a likely cause of symptoms among flight crews.

CURRENT EVENTS

THE NEW YORK TIMES **INTERNATIONAL** WEDNESDAY, AUGUST 7, 2019

British Airways Evacuates Smoky Plane

By ILIANA MAGRA

LONDON — The cabin of a British Airways flight filled with what appeared to be white smoke as it prepared for landing in Spain on Monday afternoon, prompting the airline to evacuate more than 170 passengers, with three taken to the hospital.

In an emailed statement on Tuesday, the airline acknowledged that its flight BA422 from Heathrow Airport near London had experienced a technical issue on its landing approach into Valencia, Spain's third-largest city.

The statement added that three passengers had been taken to a hospital as a precaution and had since been discharged, and that the airline was investigating the details of what had happened.

That came as little comfort to many of those onboard the flight, some of whom posted on social media about their experience.

Most passengers were barely discernible through the white smoke or vapor in a video shared on Twitter by Gayle Fitzpatrick, one of the passengers on the flight.

Neither the crew — some of whom, according to passengers, put on oxygen masks and protective fire gear — nor the airline said anything to the passengers about what happened, Ms. Fitzpatrick, a corporate governance manager at Audit Scotland, said in a message on Tuesday.

"We are still waiting to hear what happened," she said. "It was very scary."

Emergency slides were deployed after landing in Valencia, Spain.

Thomas Budd, a lecturer in airport planning and management at Cranfield University in Britain, said potential causes of smoke in a plane cabin included electrical failures, overheating equipment, galley spillages and hot-air leaks from pneumatic ducts.

In this case, the flight was nearing its finish when the plane started descending rapidly, and "a horrible white acrid smoke" began to fill the cabin, Ms. Fitzpatrick said.

"A detector was going off," she added.

There was a smell of metal and chemicals, Lucy Brown, another passenger, said in a message on Tuesday. "We covered our mouths with our clothes," she said. "We don't know why oxygen masks didn't deploy."

Passengers shouted they couldn't breathe, she added.

Others were crying and hyperventilating, Ms. Fitzpatrick said, but eventually everyone was evacuated — 175 passengers were onboard, along with six cabin crew members and two pilots, British Airways said — by going down chutes after the crew opened the emergency doors.

Ms. Fitzpatrick said on Tuesday that she was still in shock, adding that both she and her husband still had sore chests.

Ms. Brown, who said that she had to wait seven hours after landing to get her luggage, wrote on Twitter on Monday that the experience was terrifying.

"Felt like a horror film," she said. "Hopefully we'll find out what went wrong on the plane soon so it never happens again."

RECENT OCCUPATIONAL HEALTH STUDIES

- 1. Janet Wei, MD, Chrisandra Shufelt, MD, MS, Eveline Oestreicher Stock, MD, Claire Mills, RDMS, RVT, Shivani Dhawan, MS, Riya Jacob, BASc, Tina Torbati, BS, Galen Cook-Wiens, MS, Neal Benowitz, MD, et al. Vascular aging is accelerated in flight attendants with occupational secondhand smoke exposure. JOEM 2019.
- McNeeley E. Estimating the health consequences of flight attendant work: comparing flight attendant health to the general population in a cross-sectional study. BMC Public Health 2018.
- McNeeley E. Symptoms related to new flight attendant uniforms. BMC Public Health 2019