AIRLINER CABIN AIR QUALITY

STATEMENT OF THE
INDEPENDENT FEDERATION OF FLIGHT ATTENDANTS

AND THE
INTERNATIONAL BROTHERHOOD OF TEAMSTERS, AIRLINE DIVISION

TO THE
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION
SUBCOMMITTEE ON AVIATION

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Mr. Chairman and Members of the Subcommittee;

Thank you for the opportunity to speak with you today concerning airliner cabin air quality. My name is Mary Ellen Miller, Director of Safety and Health for the Independent Federation of Flight Attendants, representing the flight attendants of Trans World Airline. With me today is Nancy Garcia, Health and Safety Representative for the Teamsters Airline Division (IBT). IBT represents the flight attendants at Northwest airline and World Airways.

Although we do appreciate the opportunity to appear before this committee to discuss flight attendant concerns about cabin air quality, we are aware that this is not the first time we have had to bring this and other concerns before Congress. To prepare this testimony we were reminded that this is just one of many issues which have been brought before you because of flight attendant concerns that have not been adequately addressed by the Federal Aviation Administration (FAA).

During 1983 and again in 1984, flight attendant unions testified before Congress on the very issue under review today. As a result of those hearings, Congress, in Public Law 98-466 mandated that the National Academy of Sciences conduct a study to determine whether air quality and standards aboard commercial aircraft are adequate for health and safety of all who fly. The Academy was asked to determine whether such aspects of cabin air as the quantity of outside air, the quality of on board air, the extent of pressurization, the characteristics of humidification, the presence of cosmic radiation, contaminants (such as bacteria, fungi, and other microorganisms), and pollutants (such as environmental tobacco smoke, carbon monoxide, carbon dioxide, and ozone) could be responsible for health problems in the long or short run; to recommend remedies for problems discovered; and to outline the safety precautions necessary to protect passengers in the event of in-flight fires, which produce smoke and fumes.

The Academy published it's findings in 1986. In their report 'The Airliner Cabin Environment' they made eight recommendations to improve cabin air. The FAA has not acted on one of them. Only one recommendation has been implemented — the domestic smoking ban — and that was by congressional legislative action.

In 1989, three years after the NAS report, the FAA issued a proposed rule that would set limited air flow standards for newly certificated aircraft. The proposed rule is still that — a proposal. Recently, the FAA has responded to another 1986 NAS recommendation and has announced that it is preparing to lower the Federal Air Regulation (FAR) 25.831 limit on Carbon Dioxide (CO 2) from 3% to .5%. The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommended limit is .1%. While this is a significant reduction from the current outdated

standard, .5% is still five times the ASHRAE recommended limit of .1%. Again, this is , as yet, a proposed action and not an accomplished deed.

So where are we today? What progress has been made eleven years after the first congressional hearing on cabin air quality and eight years after the NAS report? Let us do a quick review. The NAS report stated:

> "Empirical evidence is lacking in quality and quantity for a scientific evaluation of the quality of airliner cabin air or of the probable health effects of short or long exposure to it. Standards directly applicable to commercial aircraft have not been established for cabin ventilation rates, environmental conditions, and air contaminants, and adequate data on these factors are not available. The Committee therefore recommends that FAA establish a program for the systematic measurement, by unbiased independent groups, of the concentrations of carbon monoxide, respirable suspended particles, microbial aerosols, and ozone and the measurement of actual ventilation rates, cabin pressures, and cosmic radiation on a representative sample of routine commercial flights. These findings should be subjected to peer review. This would provide a basis for establishing appropriate standards if justified and or requiring regular monitoring if necessary.
>
> The committee recognized the extreme difficulty of interpreting data on the health effects of air travel, but believes that several kinds of data can be collected. The Committee recommends that FAA establish a program to monitor selected health effects on airliner crews."

Further, the NAS study could see the handwriting on the wall. They said:

> "It is highly probable that eye, nose, and throat irritation will increase among airline passengers as outside-air ventilation rates are decreased and recirculation is increased to improve fuel efficiency."

Neither of the NAS recommended programs was ever implemented in spite of the fact that new generation aircraft utilizing recirculation systems were already taking to the skies in the early and mid eighties.

Even before the new generation aircraft ventilation systems flight attendants were reporting respiratory illnesses related to cabin air quality. In fact, California Department of Industrial Relations workers compensation data concerning work injuries and illnesses reported by flight attendants during 1979 showed flight attendants had twenty times the expected frequency of respiratory illnesses compared with other workers.

Despite the NAS report, flight attendants and passengers complaints and documented flight attendants illnesses, the FAA continues to ignore the cabin air quality issue. Industry has not done much better. Just a few weeks ago the Air Transport Association (ATA) made public the result of their cabin air quality "study" which concluded that cabin air quality is just fine. But a limited survey of a few short range non-smoking flight segments is not what NAS had in mind, nor do we believe it is appropriate to draw

conclusions about cabin air quality from such limited data. In short, flight attendants continue to be concerned about cabin air quality and, if anything, our concerns have increased.

The Move to Less Ventilation

According to a report by Paul Halfpenny, formerly with Lockheed aircraft, when fuel costs shot up drastically in 1979 and 1980, the airlines began looking for ways to cut direct operating costs. A number of studies were made by McDonnell-Douglas in conjunction with NASA and one major airline to see if acceptable cabin conditions could be maintained with reduced bleed air and filtered recirculated air. The tests concluded that bleed air on the DC-10 aircraft could be reduced by about 50%, and replaced with recirculated air treated through filters. Now all new aircraft have incorporated recirculation systems.

Air for recirculation may be taken from below the floor as in the MD-80 series, from overhead as in the A-300 and DC-10, or from both sources as in the B-747. Air may be recirculated throughout the cabin providing total mixing of all air as in the MD-80, B-737, B-757 or B-767 or it may be recirculated only back into its own source zone, as in the DC-10 and A-300. The B-747 has systems that take recirculation air into a general mixing manifold for distribution throughout the cabin, and supplement it with air taken from each zone and returned to that zone.

All aircraft use filters in their recirculation systems. These filters are capable of removing particulates down to 0.3 micrometers with efficiency greater than 95%. These filters do not remove any gaseous contaminants such as CO2, CO, body odors or the gaseous products of cigarette smoke. Charcoal filters can be used to remove many gaseous contaminants, however they are not effective for CO2 or CO.

It is important that the recirculated air and the fresh air be properly mixed before it is distributed to the cabin. If this does not happen due to poor design or mechanical failure, too much recirculated air and not enough fresh air will be supplied to certain areas. These areas will feel "stuffy" or "stale" as CO2 builds up.

Reduced ventilation can also occur through flight crew selection of a reduced pack operation. Reducing packs is not a violation of any FAA standard. In fact, the MEL's (Minimum Equipment Lists) allow for an aircraft to fly with one pack inoperative as well as with all fans inoperative. The shutting down of packs is not unique to one airline in the industry, in fact it is a wide-spread practice due to the fuel savings generated by the reduction.

For example, you can see from the bulletin issued by one of the major airlines shutting down packs that when flying a 747, turning off one pack is standard operating procedure after the aircraft reaches cruise altitude. Further, the bulletin states that pilots are directed to "use gasper and cabin recirculation fans as necessary for passenger comfort." This suggests that gaspers and fans are routinely shut down. When you

operate with a pack shut down and you shut off cabin recirculation fans, you have compounded the air quality problem. In fact, Boeing acknowledged this problem in a 1993 article for Airliner Magazine. The article by Daniel Space, Boeing Senior Engineer of Environmental Control Systems 747/767 Division states that:

> "Whether on the ground or in flight, Boeing does not recommend shutting off the airplane ventilation system when passengers are on board: an exception to this is for no Pack takeoffs in which the air distribution Packs are shutoff for a short duration on takeoff only, but not the recirculation fans." (***emphasis added***)

Boeing has also issued a Service Letter in August 1993 to all Boeing customers, the ATA, and IATA. In the Service Letter they state the purpose is to advise operators of Boeing's design requirements, objectives and criteria for cabin air quality. They further state that the information should be made available to flight and cabin crews as well as engineering personnel. The five page document, which to our knowledge was not distributed to cabin crew, emphasized the need to keep all fans operating including available overhead and underfloor, supplemental and recirculating fans. They also asked airlines to operate the air conditioning and pressurization systems in accordance with published procedures, to operate air conditioning packs (or supply equivalent conditioned air) any time passengers are on board, and to maintain recirculation filters according to established maintenance intervals.

Boeing also concluded that the well-known event reported in 1977 where several airplane passengers became ill after a flight in which they had remained on board the airplane while the ventilation system was not operating, would probably not have happened had the system been operating.

The Boeing Service Letter also touches upon another interesting component in the cabin air quality controversy. In this document Boeing states that ventilation systems on Boeing airplanes currently in production provide approximately 50% fresh air and 50% recirculated air to the passenger cabin. This results in twenty to thirty total air changes per hour for the passenger cabin and as many as eighty total air changes per hour for the flight deck. The flight deck is provided a larger quantity of air per person for equipment cooling purposes and to minimize temperature gradients which result from solar heat loads and heat loss through the airplane skin and windows.

This difference between flight deck and cabin environments often creates another problem. If you will refer back to the airline bulletin on pack operating procedures, you will see that it directs flight deck crews to "be alert and responsive to advisories from the cabin. On limited occasions (***emphasis added***), short intervals of 3-pack operation may be required to increase circulation." This procedure sets up a potential conflict between the flight deck and the cabin. It makes cabin air quality on any given flight dependent upon subjective criteria.

Many years ago coal miners carried canaries down into the mines to test air quality. The flight attendant should not have to be the "canary" that detects an air quality problem aboard a modern airliner. A flight attendant should not have to assess air quality

and make a case to the flight deck to correct a problem. It is unfair to place the flight attendants in that position and, frankly, it is also unfair to the captain. Determining air quality standards, monitoring the cabin environment and setting policy and procedures are more properly jobs for the FAA.

Now, what about the fuel savings? The $2 million in the bulletin is based on an expected fuel savings of 1.5%, figure which may be optimistic considering data including some by McDonnell Douglas puts the savings closer to 0.8%. According to Healthy Buildings International, an air quality research firm, a closer examination shows the savings from reduced ventilation to be shortsighted. For example, consider the following scenario aboard a 747 aircraft, which typically recycles air: Increasing ventilation from say, 10 cubic feet per minute (cfm) to a minimum recommended rate of 20 cfm per passenger on a five-hour flight aboard a full 747 would result in a total cost increase of $240, or approximately 60 cents per passenger. (HBI calculated these figures when fuel prices were higher than today).

The aircraft cabin, in-flight, constitutes a total life-support system and cannot be, as reasonably compared to a bus, train, or to a restaurant or theater full of patrons. If oxygen-insufficiency should develop in any of these on-ground structures, the normal opening and closing of doors and the normal leakage of air through the structure itself will help to make up the deficiency. Air is known to even leak through brick, as a building "breathes".

At altitude, the positive-pressure status of the cabin, relative to the outside atmosphere, precludes the possibility for any leakage of air <u>into</u> the cabin. Rather, the air leaks which occur, all occur outward, <u>necessitating an even greater uptake of air through the existing ventilation systems.</u> Shutting down one third of the cabin ventilation system, may effect a net savings, annually, of some appreciable amount. But, at what cost to passengers and flight attendants?

The Cabin Environment

Just as in "sick buildings", the lack of adequate ventilation in aircraft reduces indoor air quality by permitting pollutants to accumulate. Some of these pollutants and some of their sources include carbon dioxide, produced by human breathing and dry ice in airplane galleys; atmospheric ozone, fibers and dust; nitrogen oxides; volatile organic compounds from fuel, cleaning fluids and other sources, nicotine from tobacco smoke; and bacteria, fungi and viruses.

Carbon Dioxide

NAS found carbon dioxide levels on aircraft in excess of limits recommended by ASHRAE and NIOSH; studies on Lufthansa showed levels more than twice the standard when operating air packs at 50% capacity.

The GEOMET study also found flights frequently were above the 1000 ppm level recommended by ASHRAE and GEOMET suggested that additional measurements of CO2 be done on different types of aircraft and with different levels of passenger occupancy. They also noted as a disadvantage the fact that their testing did not consider the different breathing height level of flight attendants, and the time flight attendants spend in the galleys of the aircraft.

As previously mentioned, the FAA is preparing to lower the current FAA regulatory limit of 3% for CO2 exposure to the OSHA limit of .5%, rather than the ASHRAE recommendation of .1%. The OSHA limit is a worker limit. The ASHRAE number is for public exposure. In the cabin of an aircraft, it is impossible to separate the workplace from the public place, consequently, passengers and flight attendants alike will be subject to a workplace limit. We believe that the more stringent standard is more appropriate.

Ozone

Eleven percent of the flights in the NAS report violated FAA standards for ozone levels, with some levels more than eight times higher than recommended. This is cause for concern, especially when you consider that exposure to ozone, even at levels below the maximum limits, can cause eye, nose and throat irritation, as well as asthmatic symptoms. Cabin ozone limits are set by FAR 121.578 and FAR 25.832. The use of catalytic ozone converters is generally required on airplanes flying where the cabin ozone levels can be predicted to exceed these FAR limits. The actual cabin ozone concentration depends on the design of the air distribution system and how it is operated and maintained and whether or not catalytic ozone converters are installed.

Flight Attendants are more exposed than passengers to the effects of ozone because they are more active and therefore have a higher respiratory rate. In addition, they breathe less humid air than seated passengers and this may increase the effects of ozone.

NAS could find no documentation of the effectiveness of the various methods being used by the airlines to control ozone. Therefore, the Committee suggested that FAA carry out a carefully designed program to ensure that cabin ozone concentrations comply with Department of Transportation regulations. The FAA has not instituted any program to monitor actual in-flight ozone exposures and the efficiency of current control measures.

Toxic Exposure

There are occasionally examples of what appears to be an atypical kind of extreme exposure. I would like to tell you about one such case. This incident occurred on June 12, 1990 at one of the major carriers and involved a 727 aircraft traveling from Columbus, Ohio to New York's LaGuardia airport. It had a flight attendant crew of four, and a total of twenty-two passengers. Many began experiencing health problems shortly after departing Columbus. By the time the flight arrived in New York, it was necessary that

paramedics and five ambulances meet the flight, as one-fourth of the passengers and one flight attendant were sick, and two other flight attendants were unconscious. Little is still known about the possible exposures that may have caused this reaction as the FAA admitted that it was not equipped to do on-board testing and was unsure if the airline or anyone else had done so. The FAA apparently made no request of any agency such as OSHA, which is equipped to do on-board testing, to provide assistance.

Humidity and Ventilation

Although it is a widely held belief now that increased ventilation to the cockpit was solely for the reason of meeting avionic and electronic equipment cooling loads, rather than ventilation, there is some evidence that there were other concerns. In a 1952 survey conducted by the A-9 committee of SAE, flight crews complained about the discomfort of the dry cabin air, the increased incidence of colds, and debilitating effects of smoke and odors resulting from recirculation of cabin air into the flight station. As a result of these objections and other developments, regulations have been established that require that the flight stations be supplied with 100% fresh air through an independent temperature control system.

Ventilation rate is expressed in volume of air per passenger. This value will vary greatly with a load factor. Within the average rate calculated for an aircraft, there will also be variations in different sections if multi-class seating density, is in operation. Aircraft are often altered by the addition of more seating, although no changes are made to the ventilation systems to accommodate additional passengers. The density of passengers aboard a tightly sealed airliner, combined with inadequate ventilation can make an airplane almost ideal for the spread of fungi, bacteria and viruses. Although most bacteria should be captured by a good filter, viruses are not captured as easily - furthermore, viruses prefer dry environments, like an aircraft.

The NAS study recommended that maximal airflow be used with full passenger complements to decrease the potential for microbial exposure and that recirculated air be filtered (to remove particles larger than 2-3cm) to reduce microbial aerosol concentrations.

Environmental Tobacco Smoke

ETS is now widely accepted as a health hazard to non-smokers. NAS found that it was apparent aircraft ventilation would not meet accepted criteria for acceptability.

The committee also felt that this potential threat to the health of nonsmoking passengers and flight attendants should not be ignored, especially because flight attendants on some airlines can fly up to the twenty-eighth week of pregnancy.

Recently, Alan Hinman, Director of CDC's National Center for Prevention Services told Indoor Air Review that ETS is a serious indoor air quality problem in planes. The ETS problem on all flights needs to be addressed.

Pesticides

The use of pesticide into passenger cabins and cargo holds on international flights coming into the United States was discontinued in 1979 after it was determined that the dangers to health out-weighed any benefits. However, for the past 15 years, the practice of releasing pesticides on international flights into 27 countries continues. International flights, on descent into, or on arrival at Antigua, Argentina, Australia, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Grenada, Guam, Guatemala, Honduras, Jamaica, Mexico, New Zealand, Nicaragua, Northern Marianas Islands, Panama, Peru, St. Lucia, Saint Maarten, Trinidad, and Venezuela, have their passenger cabins and cargo holds sprayed with pesticide by flight attendants as required by regulations of the local governments. Airline reservation agents are usually unaware of pesticide spray and rarely have information about the affected flights.

The spray often is Airosol Aircraft Insecticide, which has d-phenothrin as its active ingredient. D-Phenothrin is one of a class of pesticides called pyrethrins, which is non-persistent in the environment while being acutely toxic to insects. The spray is registered with the Environmental Protection Agency and sold under the trade name Black Knight Roach Killer. The release of pesticide into passenger cabins and cargo holds is approved by the World Health Organization.

Although governments are trying to prevent insects from being transported into their countries, pesticide release into passenger cabins and cargo areas on international flights may get an occasional unwanted pest, but it is highly unlikely that it possesses the vapor pressure that can penetrate luggage or cargo containers. Until foreign governments revise their pesticide spraying regulations on international flights, air travelers will continue to be exposed to pesticides on their travels into these countries.

Flight attendants have expressed their concern for many years about the pesticide spraying, and passengers have complained to the EPA that the spraying has caused headaches, nausea, fatigue, seizures, and in some extreme cases, memory loss or a depressed immune system. In fact, approximately ten years ago a passenger from Great Britain who suffered from emphysema, was on a flight from Canada that was landing in Sydney. His wife requested that he be allowed to leave the plane before spraying, but her plea was denied. D-phenothrin was sprayed, and the passenger died 18 hours later of "acute exacerbation of chronic air-ways obstruction."

Flight attendants have also complained that their health has suffered from pesticide exposure. Marilyn Genz, a retired flight attendant, filed suit against the Department of Health and Human Services maintaining that her health problems, which include liver damage and abnormal clotting of her blood, were caused by nearly 25 years of required pesticide spraying prior to landing.

We are grateful that the Clinton Administration through DOT Secretary Pena has requested that the 27 various governments cease insecticide spraying requirements of arriving aircraft. We also feel strongly that passengers must be notified about the

spraying in advance of their flight. Further, flight attendants should be provided information and training on pesticide spraying and should be provided with protective gloves at and other protective equipment.

Conclusion and Recommendations

I do come today to bring what we consider a new and positive development.

As you know, flight attendants have asked for environmental studies that involved their real world situation for a very long time. Without a systematic data collection program, as recommended by NAS, that measures air flow and contamination in airplane cabins, we are left with the generic sort of studies that do not satisfy flight attendant concerns. The problem seems simple:

> If we have an air quality problem on certain flights, then we need to identify what its source is and attempt to solve the problem. Certainly, it is not in our best interest to have passengers complaining about air quality, nor is it a good working environment for the flight attendants.

The basic prerequisite to ensure the health and comfort of passengers, flight attendants and flight operations personnel is to provide the highest quality aircraft cabin air possible to attain. But also, as employee-owners of TWA, we have a new and vested interest in providing the highest quality aircraft cabin air — and that is the bottom line. We believe there is a financial return to having employees and passengers, healthy and happy. Consequently, TWA jointly with IFFA will conduct a study of selected TWA flights. The selection is being made from flights where flight attendants have expressed concern or experienced problems. Also, we believe this is the first actual flight attendant driven study in the industry. The scope of the study will include carbon dioxide, carbon monoxide, volatile organic compounds, aldehydes, nicotine, airborne particulates, ozone, bioaerosols, temperature, and relative humidity, among other possible areas of concern identified by flight attendants.

The lack of flight attendant input into the ATA survey of 35 flights was one of its major flaws. They did not ask flight attendants to identify those flights that may need to be evaluated. Furthermore, they looked at very little that would be helpful in identifying problems. They went looking for no problems and they found no problems. They did not investigate wide-bodied, international, smoking flights, and their report includes only the averages of the few flights they surveyed.

We believe the cooperative step that TWA has taken jointly with IFFA is the right one.

In conclusion, IFFA and the Teamsters recommend that the FAA:

- Implement the National Academy of Sciences' recommendations including establishing an acceptable program for systematic measurement of air

borne particles and ventilation rates, CO2 and CO exposure, as well as ozone.

- If design limitations require recycling of cabin air, enforce effective filtration, and strict filter replacement schedules
- Collect data on health effects on crew members
- Assign responsibility for health of crew to an agency such as OSHA
- Establish cabin air quality information training program

The aircraft cabin environment is totally unique. It also, we are told, is one of the most crowded human environments, particularly in some aircraft which exceed 200 persons per thousand square feet of floor area.

The eight years since the NAS report has not resulted in improved air quality, in fact the trend is for more recirculation. Additionally, only one NAS recommendation was acted upon and that was by Congress. It is time to act on those recommendations made eight years ago.