airlines

SMOKESCREEN OVER CABIN AIR QUALITY

Banning or reducing smoking on board aircraft may disguise poor ventilation, reports Günter Endres, leaving passengers vulnerable to discomfort and disease

The airline industry's fad to ban smoking in their aircraft is cleaning up passenger cabins. Right? Wrong. While airlines rid cabins of environmental tobacco smoke (ETS), laudable though this is, some are reducing the fresh air supply as you fly.

So is cutting out, or at least reducing, this smelly and visible contaminant from the cabin really such a grand gesture? Or is it hiding a laissez-faire attitude to, and at worst, a dangerous disregard for their passengers' health?

Scientists are divided over how harmful ETS really is, but evidence suggests that smoking, although the only visible form of pollution, is far from the most serious health risk in the passenger cabin. Yet the disputed findings of the US Environmental Protection Agency (EPA) resulted in smoking being banned temporarily on all US domestic flights from April 1988; this has since been made permanent.

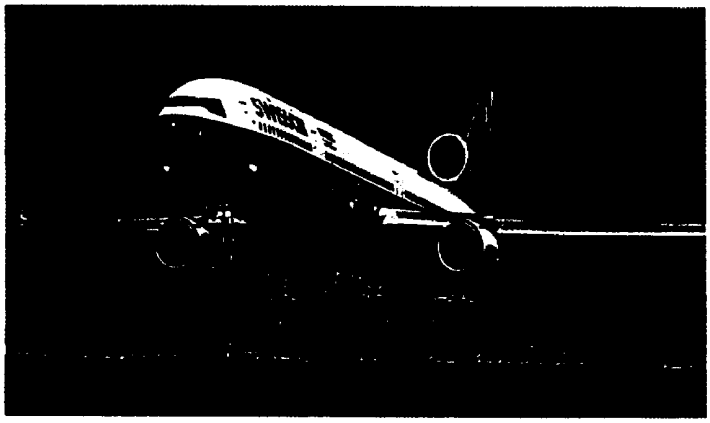
The EPA, suggests Dr Borelli, manager of Scientific Issues at tobacco giant Philip Morris, perhaps not surprisingly, ignored its own guidelines and scientific data to reach a predetermined conclusion on ETS. "Science is meant to find the truth," he says, "but not with ETS." The EPA, he alleges, is guilty of using weak science to justify socio-political goals.

Fatigue, dizziness, drowsiness, nausea, headaches, eye and nose irritation and respiratory problems are typical symptoms experienced by passengers during and after a long flight, whether travelling in the smoking or non-smoking section. The reason: well below minimum amounts of fresh air, compared to acceptable levels in other enclosed environments such as office buildings, are circulated in the passenger cabin. This leaves smoke and more harmful contaminants hanging in the air.

The American Society of Heating, Refrigerating and Airconditioning Engineers (ASHRAE) recommends fresh air changes of 20 cubic feet per minute (cfm) in enclosed spaces, though not with specific reference to aircraft. Yet less than 7 cfm have been measured in the high-density economy section of a full Boeing 747 by the Washington DC-based National Academy of Sciences' National Research Council. During the same flights, business and first-class passengers fared considerably better – 30 to 50 cfm – with the cockpit crew breathing up to 150 cfm of fresh air.

According to Deutsche Airbus, designing air-conditioning zone divisions which roughly correspond to the different class layouts "is not a matter of ensuring first-class air for first-class passengers, while providing third-class air to the economy class, but is rather due to the fact that seat density varies".

The US Federal Aviation Administration insists on fresh air for pilots in the cockpit, but has no such regulations for crew compartments and passenger cabins. In Europe, the Joint Aviation Authority in its regulation JAR 25 states: "Each passenger and crew compartment must be ventilated," but then it specifies only: "Each crew compartment must have enough fresh air (but not less than 10 cfm per crew member) to enable crew members to perform



A comparison of cabin airflow

	Cabin volume (m^3)	Air exchange rate (per hour)	Air recirculated (%)	Fresh air rate (cfm per passenger)*
Narrowbody				
Boeing 727-100	151	22.9	0	18.9
Boeing 727-200	165	26.4	0	16.8
Boeing 737-100	120	26.1	0	16.8
Boeing 737-200	131	23.9	0	15.1
Boeing 737-300	149	14.2	42	9.6
Boeing 757	184	15.6	48	9.0
McDonnell Douglas				
DC9-30	124	27.3	0	18.1
DC9-50	148	22.9	0	16.4
DC9-80/MD-80	173	19.7	22	14.1
Widebody				
Boeing 747	790	14.7	26	17.1
Boeing 767	319	10.4	52	9.1
McDonnell Douglas				
DC10-10	419	22.8	0	19.4
DC10-40	419	14.9	35	12.9
Lockheed L1011-1/100	537	17.8	0	18.6
Lockheed L1011-50	494	19.3	0	20.6
Airbus A310	334	9.7	53	10.1

*At full capacity. cfm = cubic feet per minute

Source: ASHRAE Journal

their duties without undue discomfort or fatigue." The passenger, it seems, must swallow whatever is provided.

The authorities argue that cockpit and cabin crew are more at risk because of the long term and frequency of exposure, while passengers only travel occasionally. Crews typically spend a minimum of 900 hours per year in the air, but even a 'frequent flyer', says Dr Harriet Burge, an air quality expert at the University of Michigan, spends a relatively short time in the air compared with flight attendants. High levels of cooling are also necessary for the efficient functioning of flight instruments.

This is one reason why temperature and ventilation are directly controlled by the flight crew. The other, less compelling reason, is to enable captains to obey their employers' instructions when operating environmental control units (air packs) at reduced flow on certain aircraft, or with at least one of three air packs shut down to save fuel.

Some airlines pay pilots bonuses for saving fuel and some shut down one air pack if the cabin is only half full – the fewer the passengers, the less air is required.

"It is unfortunate," says Gray Robertson, president and co-founder of Healthy Buildings International, "that, while the emergence of the 'sick building syndrome' is leading building owners and operators to improve ventilation, the airlines are heading in the opposite direction."

Removing odours

Swissair is one airline that has been searching for a means to improve the recirculated air. It has two MD-11s flying with special filters which use chemical absorption to clean the air, and will shortly commence testing with an ionisation system to remove odours. According to project engineer Fritz Wittwer, the absolute minimum amount of fresh air supplied to the cabins is 10 cfm per passenger.

Its MD-11s are also fitted with individual, passenger-controlled air outlets – an optional feature which may indicate whether an airline wants to have full control over the air supply.

One study sponsored by the US Department of Transportation (DoT), shortly after the smoking ban came into force, quantified pollutant levels in airliner cabins and assessed the associated health risks for crew members and passengers. The study undertaken by GEOMET Technologies of Germantown, Maryland, also for the DoT, focused on ETS and measured ozone, microbiological aerosols, carbon dioxide, temperature and humidity, taking smoking and non-smoking flights at random.

Of these contaminants and environmental parameters, Niren Nagda, director of GEOMET's indoor environment division, and his team found worryingly high

Smoking has been banned on all US domestic flights on the strength of findings by the Environmental Protection Agency.

levels of carbon dioxide (CO_2) on 87 of the 92 flights studied. These exceeded the maximum CO_2 levels – 1,000 parts per million (ppm) – set by ASHRAE, which considers CO_2 concentration an indicator of indoor air quality.

A fresh air ventilation rate of 15 cfm per person is thought adequate to keep within guidelines, but Poitrast and Carpenter, in their Proposed Indoor Air Quality Standard prepared for the Air Force Occupational and Environmental Health Laboratory at Brooks Air Force Base, Texas, argue that CO_2 levels may need to be kept even lower (below 600 ppm) to minimise sleepiness, fatigue, poor concentration and stuffiness. Jet lag is believed to result from too much carbon dioxide.

The case believing ETS may be a cancer-causing agent remains weak, and excessive CO_2 concentrations may have little more effect than lowering the passengers' comfort levels. But what of cosmic radiation, microbiological aerosols and viruses?

Dr Burge says: "There are many episodes of infectious disease that could, if you took the trouble, be directly traced to travel on aircraft. It is also possible that if someone on the flight has an active case of an infectious disease like influenza, then other people on board will also have that disease by the end of the flight."

New filtration systems claim to remove up to 99.99% of airborne contaminants 0.5 microns and larger, but potentially harmful bacteria and especially viruses from the cabin environment can still slip through the net. Indeed, the most common pathogenic airborne viruses responsible for colds, flues, croup and pneumonia are all considerably smaller. But although the techniques are available, the practical difficulties and prohibitive costs of measuring viruses on board aircraft inhibit progress.

Dr Scott Baker of Risk Focus/Versar assessed the DoT study and stated that the risks from exposure to ETS are not very significant, while the findings on carbon dioxide and cosmic radiation levels offer "pretty substantial risks". But these have been ignored. No regulatory actions have been taken on either issue; attention has been somewhat diffused by the pre-emptive smoking ban on aircraft. Therefore, are agencies and airlines using a smokescreen to cover up more serious health issues in order to save money? Not surprisingly, both groups deny this. Gray Robertson is convinced that until it becomes a legislative issue, no action will be taken.

Deutsche Airbus's statement that, "whatever the passenger wants, he gets – sooner or later," offers no real encouragement. Nor does its insistence that "stale air, at least, has offered no cause for passenger complaint for a long time."

Because of increased costs, airlines are unlikely to take the lead. Later, if at all, is the most probable scenario. The cost saving for the airlines is very real, but there may be a price to be paid in passengers' health. ■

The mounting cost of fresh air

Until the late 1970s, all airlines provided passengers with 100% fresh air in aircraft cabins. But the fuel crisis, during which costs rose from 11 cents a gallon to over US$1, changed all that.

In 1980, in a direct response to the crisis, McDonnell Douglas issued a report to major airlines – American, Braniff, Continental, Delta, Northwest, Pan Am, Trans World and United among them – which suggested that halving the fresh air intake in its DC-10s would make a 0.8% fuel saving.

This is because fresh air for the ventilation system is bled from the engine and extra power is required to provide it, using more fuel. For example, 350 cubic feet of bleed air costs 50 cents on the DC-10.

Current engine development and the growing need to reduce fuel burn will place even more pressure on fresh airflows. As pressure and bypass ratios increase, the extraction of bleed air from the engine core will have a greater effect on the thrust level.

Based on typical use, Douglas contended that some 62,000 gallons of fuel could be saved annually on each DC-10 by using recirculated air.

Other aircraft manufacturers also implemented the energy saving option; all modern aircraft are now equipped with systems that use up to 53% recirculated air. There is also a lot of pressure on cockpit crews to save more fuel by cutting back the fresh air supply further, placing even greater emphasis on recirculation.

The only benefit to the passenger and crew of mixing reprocessed air with cold fresh air is that it gives partial relief to the low humidity problem. The mixture of air blown into the cabin has a humidity between 10% and 20%, which is still well below the normal 40% to 70% 'comfort' range and leaves passengers feeling dry and thirsty.