TECHNICAL NOTE Date: Tue, 04 Jun 2002 [Revised 9/21/02]
Comments on IEPA "Final Report, Chicago O'Hare Airport Air Toxic Monitoring Program"
Ross Ruthenberg

First, it seems that the report is put together more to defend and deny pollution than it is to advance the protection of the environment...the authors being of course the Illinois Environmental Protection Agency. The report concludes overall that, based on measurements, Chicago area toxic and hazardous air pollution concentrations are similar to other major, polluted cities and that O'Hare Airport emissions have an impact on the air quality in adjacent communities, but "that impact did not result in levels higher than those found in a typical urban environment."

Toxics measurements "demonstrated" that:
*Lemont was quite clean, even though it was downwind from major polluters such as refineries, etc.
*Washington school in the south Calumet region was much worse, due to nearby industrialization, than the O'Hare area. [No mention of concern for this bad pollution condition on the children of the area.]
*Northbrook measurements showed it also to be quite clean.
*Difference measurements between Bensenville and Schiller park monitors showed minimal O'Hare impact on days when the former was upwind and the latter was downwind.
*Toxics levels were generally comparable or lower than at other major cities.

More specifically:
The data analysis demonstrated that O'Hare Airport emissions had an impact in the areas adjacent to the airport for several key target compounds, including acetaldehyde, benzene, formaldehyde, polycyclic organics and lead. All these compounds are Urban Air Toxics and have been identified as associated with airport operations. The downwind concentration of acetaldehyde was found to be 45.6% higher than upwind, formaldehyde was 32.8% higher, benzene was 34.1% higher, polycyclics (PAHs) were 65.9% higher and lead was 87.5% higher. An impact from airport operations was not unexpected as airport operations, including aircraft takeoffs, landings, taxiing, refueling and use of support equipment, result in significant emissions of volatile organics and target air toxic compounds. The resulting airport emissions should have had, as the monitoring data shows, some impact in the areas adjacent to the airport. While the downwind concentrations were found to be higher, the results showed that the levels found at O'Hare Airport are still in the "typical urban range" and comparable to or lower than levels found in other large urban areas.

Monitoring Issues
The main monitoring site used by the IEPA to determine O'Hare toxics levels is the Schiller Park location which, in my opinion, is a very poor location choice. Most significantly, it is located too far south to get a good gauge on airport emissions under wind directions of anything except between about WSW to NNW. This means that of the report's 16 total measuring days, distributed every 12 days from June through December of year 2000, only 6 were primarily downwind (in WSW-NNW winds; 1-June, 1-September, 2-November, 2-December). Also poor is the fact that the site is sandwiched between two sources of auto/truck emissions, Mannheim road to the immediate west and the Tri-state tollway to the east, both within a few hundred feet (airport emissions sources are at least 10X this distance). This makes it difficult to separate vehicular emissions from airport emission.

The Schiller Park site is relatively low to the ground (<20 feet) as compared to all other sites (typically at least two stories up), increasing its vehicular emissions exposure and probably decreasing its airport exposure. One would surmise that aircraft emissions, being very hot, would tend to immediately rise up, aided in the summer by rising thermals from the expanses of heated asphalt. Thus, in light winds, the emissions would have an initial "up and over" trajectory of any low placed monitor probe.

[Though this was also true for the Environ study measurements, those measurements were meant to be preliminary in nature (several 8-hour samples) and the study pointed out that there was a need for vertical measurements. Also, the monitoring sites were located west of Mannheim, with measurements limited to "downwind" days, minimizing any vehicular traffic effects.]

The Northbrook site is too far north and acts more like a northern pollution boundary reference monitor. The Bensenville monitor, southwest of the airport, can act as an airport pollutant detector but only under northeast wind conditions, which occurred much less frequently during the June-December period.

What is needed is to have more and better placed monitors, such as an additional one on the north-east airport fence line, relocating the Schiller monitor to the top (west side) of the tall office building just across Lawrence avenue, a monitor in Park Ridge and one in Lincolnwood. This would place 3 monitors in line from the airport fence line to Park Ridge to Lincolnwood (through the high cancer incidence area) and one high up to minimize the vehicular emissions influence.

Indeed, many Illinois pollution emissions sources (e.g. industrial manufacturing) have their own dedicated monitoring systems, as a condition for Illinois to grant the source a permit to operate with such emissions. Considering that O'Hare Airport is a major source of emissions, it should have its own dedicated set of robust, continuous monitors, including "upwind" control monitors. The placement of these monitors should be based on comprehensive pollutant dispersion modeling that considers both ground based and in-flight aircraft emissions sources, as well as the meteorology of the area (especially between the airport and the lake).

Finally, on the monitor siting issue, one would hope that sufficient testing has been done to verify that locating monitors on top of hot, tarred building roofs does not adversely affect the accuracy of measurements. These types of location seemed to be the norm for 4 of the 5 locations (all except Schiller Park and there is a concern that some VOC measurements, for instance, could be desensitized by roof material emissions.

Averaging

"Average" is a word that maybe shouldn't have been invented. Here again in this report, averaging tends to cloud conclusions, in my opinion. For example, even though the 16 (max.) measured days of information for any toxic could have been charted showing both the averages and the min/max ranges, only the average is shown. Though this simplifies media coverage, it purposely minimizes the scientific need to examine and attempt to explain these min/max ranges.

For instance, though winds were monitored and meteorological conditions were noted, there was no apparent attempt to correlate them to specific measurement results, which might show that the substantial variations were a direct function of wind speed, in addition to direction.

The daily measurements are already averages (over 24 hours) in most cases, being based on continuous sample collection through the day. This means that the airport's 10 p.m. to 6 a.m. low-emission period is averaged in to the entire measurement, reducing the net value to around 2/3 of the (average) level of the important 6 a.m. to 10 p.m. period of maximal airport emissions (and also vehicular emissions). Thus, to compare to Environ's 8-hour measurements, the IEPA numbers should probably all be multiplied by a factor of 1.5.

General

The IEPA study made no attempt to model airport emission dispersions, beyond considering wind rose patterns. There was no attempt to identify types and quantities of airport source emissions (especially aircraft) in order to incorporate into an overall dispersion model as well as to attempt to "tag" specific pollutants to the source in order to aid differentiation from other sources at monitoring sites e.g. Schiller Park. Though this was not in the scope of this 6-month toxic monitoring program, it makes it even more difficult to compare results to the original "triggering" Environ study.

There was no attempt in the program to place portable monitoring sites in key communities e.g. Lincolnwood. And there was little post-analysis of results implications other than impact minimization.

The resulting airport emissions should have had, as the monitoring data shows, some impact in the areas adjacent to the airport. While the downwind concentrations were found to be higher, the results showed that the "levels found at O'Hare Airport are still in the "typical urban range" and comparable to or lower than levels found in other large urban areas." This conclusion leaves one quite uncomfortable, considering that most of the "typical" urban pollution concentrations are known to be unacceptable (the raison de' etre for the EPA). Thus, it is of little comfort to know that our atmosphere is just as bad as other major cities. Furthermore, the study does not cite the specific locations used in this comparison, leaving the probability that those sites are also influenced by airport emissions and thus creating a situation of justifying one airport's pollution impact on the basis of being no worse than that from other airports!

Finally, one is left with the distinct feeling that there is less than coincidence to the timing of the release of this "O'Hare emissions are of minimal significance to your health" report, considering (a) it is (a long) 18 months after the last measurement was taken, (b) the IDPH recently also released their "What cancer...we find no out of ordinary incidence rates" and (b) the U.S. Congress is being lobbied very heavily to enact law that removes all Illinois EPA, DPH and legislative authority over such matters.

Overall, the report has value but is an inadequate addressing of the major issues. Part of the inadequacy derives from the short term of the study, which was limited by lack of sufficient funding. It is unfortunate that even that funding ($200K) had to come from Park Ridge rather than the state, in order to get some attention to the issues.

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EPA

Estimation and Evaluation of Cancer Risks Attributed to Air Pollution in Southwest Chicago

Final Summary Report

Submitted To:

U.S. EPA Region 5
Air and Radiation Division

By:

VIGYAN Inc.

April 1993

TABLE 3
ADDITIONAL SOURCES AND ESTIMATED EMISSIONS

Facility Name	Pollutant	Emissions
KOPPERS, INC.		
From State permit	Styrene	0.4 tons/yr
CORN PRODUCTS		
From the final report of Air Toxics Emission Inventories for the Lake Michigan Region	Arsenic	36.0 lbs/yr
	Cadmium	3.8 lbs/yr
	Total Chromium	33.4 lbs/yr
	Formaldehyde	548.8 lbs/yr
	Benzene	4.0 lbs/yr
GE PCB RECLAMATION FACILITY		
From RCRA, EPA ID ILD070015714	Tetrachloroethylene	0.002 lbs/yr
GRACE SPECIALTY CHEMICALS		
From TRI data	Formaldehyde	230 lbs/yr
SUN CHEMICAL		
From RCRA (Proposed incinerator, project has been withdrawn by the company)	Arsenic	0.142 lbs/yr
	Benzene	2.212 lbs/yr
	Beryllium	0.030 lbs/yr
	Cadmium	0.048 lbs/yr
	Chromium	7.048 lbs/yr
ROBBINS INCINERATOR[a]		
From State permit (Proposed)	Arsenic	20.148 lbs/yr
	Cadmium	16.644 lbs/yr
	Total Chromium	289.080 lbs/yr
	Dioxins	2.000 ng/m^3
AIRCRAFT EMISSIONS AT MIDWAY AIRPORT[3]	Benzene	8.99 tons/yr
	1,3-Butadiene	7.60 tons/yr
	Formaldehyde	62.86 tons/yr
	Particulate Matter (Piston Engines)	1.23 tons/yr
	Particulate Matter (Turbojet/Turboprop Engines)	48.87 tons/yr
ROAD VEHICLE EMISSIONS FROM PARKING LOTS AT MIDWAY AIRPORT	Benzene	0.332 tons/yr
	1,3-Butadiene	0.055 tons/yr
	Formaldehyde	0.118 tons/yr
	Particulate Matter (Diesel Vehicles)	0.190 tons/yr
	Particulate Matter (Gasoline Vehicles)	0.068 tons/yr

Cancer cases attributed to the Midway mobile sources were also studied by refined source types and by pollutant. Table B.16 provides a cross reference list of cancer contribution by mobile source origin and by pollutant.

TABLE B.16
CANCER CASES BY POLLUTANT BY SOURCE CATEGORY

Pollutant	Emission Source	Annual Concentrations (ug/m^3)	Individual Cancer Risks	Lifetime Cancer Cases
1,3-Butadiene	All Aircraft	2.87E+00	8.03E-04	1.21
	All Vehicles	1.97E-02	5.51E-06	0.01
Formaldehyde	All Aircraft	2.38E+01	3.09E-04	0.47
	All Vehicles	4.15E-02	5.39E-07	0.001
POM/Particulate Matter	Turbine Aircraft	1.63E+01	2.76E-04	0.39
	Piston Aircraft	4.61E-01	7.37E-06	0.008
	Gasoline Vehicles	2.43E-02	1.24E-06	0.0023
	Diesel Vehicles	6.73E-02	1.14E-06	0.0021
Benzene	All Aircraft	3.40E+00	2.82E-05	0.041
	All Vehicles	1.10E-01	9.15E-07	0.0017

From Table B.16, we found that 1,3-butadiene is the most significant contributor to cancer risk in the area. Approximately one case, or 57% of the total cancer cases attributed to the identified Midway air pollution is caused by 1,3-butadiene. Formaldehyde and particulate emissions each contributes roughly 20% of the total cancer cases (about a half case respectively). Cancer cases due to benzene emissions from Midway, on the other hand, are negligible in comparison to the total cancer cases of 2.

Overall, emissions from aircraft operated at Midway in 1990 contribute up to 99% of the total cancer cases. This was expected since the vehicular emissions estimated at Midway are insignificant compared to the aircraft emissions at Midway. Figures B.5 - B.10 portray the cancer cases at the receptor grid network by pollutant and by emission source.

United States
Environmental Protection
Agency

Air and Radiation

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EPA

Evaluation of Air Pollutant Emissions from Subsonic Commercial Jet Aircraft

Printed on Recycled Paper

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aircraft) between 1992 and 2015. However, CO emissions show a 226 percent increase and NO_x a 190 percent increase over the same period. The estimated increase in NO_x is limited by the assumption that 70 percent of fuel consumption occurs in engines with NO_x certification standards between 20 and 40 percent below the current international standard (ICAO, 1998a). The new international NOx standard to be implemented beginning in 2004 is about 16 percent below the current standard, and thus, at this point it appears that the NASA study may underestimate future global NOx emissions. It is important to note, however, that the FESG effort was based upon international forecasts which included regions of the world that are growing two to three times as fast as the U.S.

The Committee on Aviation Environmental Protection CAEP/2 NOx certification standard represents a technology limit that is demonstrably achievable today. Regarding the next NOx standard agreed to at CAEP/4 in April 1998, the Forecasting and Economic Analysis Support Group (FESG) of the Committee on Aviation Environmental Protection (CAEP) concludes in its Working Paper 4 (WP/4) that the proposed increase in NOx stringency for new engines would have modest impacts on overall aircraft emissions. The CAEP/4 report should be referred to for a discussion of the stringency proposal (ICAO, 1998c). In fact, the majority of modern engine types in production and entering service are known to be compliant with the proposed CAEP/4 NOx standard. Some other engines currently in service can be brought to similar performance standards through modest-cost modifications. The FESG concludes, the benefits of the proposal in terms of reducing the global emissions burden will be marginal. The proposed standard merely insures that future engines will not have NOx emissions that are higher than present technology allows (ICAO, 1998b).

Public Health and Aircraft Emissions

As noted above, the new, more stringent NAAQS for ozone and PM highlight the need for state and local air quality officials to consider new ways to reduce regional emissions and achieve the health-based national air quality standards. In particular, they have significant concerns regarding the effect of NO_x on local and regional environments. Tropospheric NO_x has multiple environmental quality impacts including not only contributing to ground-level O_3 and PM, but also air toxic concentrations, excess nitrogen loads to sensitive water bodies, and acidification of sensitive ecosystems (EPA, 1997a).

Ultimately, EPA's principal concern in evaluating and controlling emissions is the preservation of human health and, secondarily, the protection of public welfare (including protection against damage to crops, vegetation, animals, and buildings). In this regard, some general observations about the entire category of mobile sources can be made. Mobile sources emit VOC and NO_x (O_3 precursors), PM (both PM_{10} and $PM_{2.5}$), SO_2 and CO. Other air pollutant species include polycyclic aromatic hydrocarbons (PAHs) found in the particulate emissions and certain volatile organic compounds (VOCs). The health effects of these pollutants are summarized in Table 1.1[10]; Table 1.2 summarizes the major environmental effects of the same pollutants. As with the health effects, these environmental effects will vary considerably with the amount of pollutant

[10] This information was compiled from official US EPA sources and is only an overview. More complete information is available in the appropriate Criteria Documents. See website www.epa.gov/ncea.

and the duration of its exposure to the environment. Appendix A provides a more detailed summary of the health effects of emissions from air pollution.

Table 1.1. Representative health effects of air pollutants.

Pollutant	***Representative Health Effects***
Ozone	Lung function impairment, effects on exercise performance, increased airway responsiveness, increased susceptibility to respiratory infection, increased hospital admissions and emergency room visits, and pulmonary inflammation, lung structure damage.
Carbon Monoxide	Cardiovascular effects, especially in those persons with heart conditions (e.g., decreased time to onset of exercise-induced angina).
Nitrogen Oxides	Lung irritation and lower resistance to respiratory infections
Particulate Matter	Premature mortality, aggravation of respiratory and cardiovascular disease, changes in lung function and increased respiratory symptoms, changes to lung tissues and structure, and altered respiratory defense mechanisms.
Volatile Organic Compounds	Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment.

Table 1.2. Representative environmental effects of air pollutants.

Pollutant	***Representative Environmental Effects***
Ozone	Crop damage, damage to trees and decreased resistance to disease for both crops and other plants.
Carbon Monoxide	Similar health effects on animals as on humans.
Nitrogen Oxides	Acid rain, visibility degradation, particle formation, contribution towards ozone formation.
Particulate Matter	Visibility degradation and monument and building soiling, safety effects for aircraft from reduced visibility.
Volatile Organic Compounds	Contribution towards ozone formation, odors and some direct effect on buildings and plants.

Report Organization

The remainder of this report is organized as follows:

- Section 2 presents the methodology used to calculate commercial jet aircraft emissions for the selected cities;
- Section 3 presents the analysis results for the 1990 base year and 2010 future year;
- Section 4 discusses the implications for attainment of the NAAQS based upon the analysis results, and presents trends in air travel and aircraft emissions in the coming decades;
- Section 5 presents the conclusions of the initial study;
- Appendix A contains information regarding the health effects of aircraft emissions;

APPENDIX A
HEALTH EFFECTS OF AIR POLLUTION

APPENDIX A
HEALTH AND ENVIRONMENTAL EFFECTS FROM AIR POLLUTION

Health effects due to pollutants may be divided into two major classes: those due to acute exposures and those due to chronic exposure. Acute health effects are experienced immediately or within a few hours of the exposure. Health effects due to chronic exposure may only become apparent after an extended period of time, typically months or years. Cancer is an example of a health effect generally resulting from chronic exposure. Some pollutants can cause both acute and chronic health effects. For a given air pollutant, the chances of an person experiencing a health effect generally increase as the exposure concentration and duration increase. The exposure component of the health effects is discussed below. Determining the source of a pollutant involved in an exposure can be complicated, given the multiplicity of emission sources in most urban areas. Furthermore, the varying individual sensitivity to specific pollutants make the health effects of any individual pollutant exposure difficult to quantify, although for many pollutants the risk to the general population can be characterized. Epidemiological studies and clinical studies to estimate health effects have been performed for a number of pollutants, many of which are associated with aircraft and airport operations.

Environmental effects can also be divided into three broad categories: ecological effects (effects on plants and animals other than humans), damage to materials (soiling, etc.) and visibility (effects on transmission of light through the atmosphere).

A brief highlight of the health effects of chemicals associated with airports follows. A summary of some of the environmental effects for each identified chemical follow each health effects discussion.

SPECIFIC AIR POLLUTANTS ASSOCIATED WITH AIRPORTS

A number of air pollutants are associated with emissions from airports. These include the major criteria pollutants that one would expect from any combustion source: ozone or O_3 (not directly emitted, but formed from other precursor compounds that are emitted), carbon monoxide (CO), nitrogen oxides (NO_X), volatile organic compounds (VOCs), and particulate matter (both PM_{10} and $PM_{2.5}$). Other pollutants include polycyclic aromatic hydrocarbons (PAHs) found in the particulate emissions and certain VOCs. The health and other environmental effects of these chemicals are briefly outlined below. This information was compiled from official US EPA sources and is only an overview. More complete information is available in the appropriate Criteria Documents (e.g., EPA, 1996b).

Ozone (O_3)

Ozone health effects are induced by short-term (1 to 2 hours) exposures to O_3[1], generally while individuals are engaged in moderate or heavy exertion, and by prolonged exposures

[1] Observed at concentrations as low as 0.12 ppm.

(6 to 8 hours) to O_3[2], typically while individuals are engaged in moderate exertion. Individuals experience moderate exertion levels more frequently than heavy exertion levels.

Acute health effects of O_3 are defined as those effects induced by short-term and prolonged exposures to O_3. Examples of these effects are functional, symptomatic, biochemical, and physiologic changes. The acute health effects include transient pulmonary function responses, transient respiratory symptoms, effects on exercise performance, increased airway responsiveness, increased susceptibility to respiratory infection, increased hospital admissions and emergency room visits, and transient pulmonary inflammation.

Acute health effects have been observed following prolonged exposures during moderate exertion at concentrations of O_3 as low as 0.08 ppm. Groups at increased risk of experiencing such effects include active children and outdoor workers who regularly engage in outdoor activities and individuals with preexisting respiratory disease (e.g., asthma or chronic obstructive lung disease). Furthermore, it is recognized that some individuals are unusually responsive to O_3 and may experience much greater functional and symptomatic effects from exposure to O_3 than the average individual.

Chronic health effects of O_3 are defined as those effects induced by repeated, long-term exposures to O_3. Examples of these effects are chronic inflammation and structural damage to lung tissue and accelerated decline in baseline lung function. With regard to chronic health effects, the collective data from studies of laboratory animals and human populations have many ambiguities and provide only suggestive evidence of such effects in humans. It is clear from toxicological data that O_3-induced lung injury is roughly similar across species (including monkeys, rats, and mice) with responses that are concentration dependent. Currently available information provides, at a minimum, a biologically plausible basis for the possibility that the repeated lung inflammation associated with O_3 exposure may, over a lifetime, result in sufficient damage to respiratory tissue to result in a reduced quality of life, although such relationships remain uncertain.

Ground-level ozone interferes with the ability of plants to produce and store food so that growth, reproduction and overall plant health are compromised. By weakening trees and other plants, ozone can make plants more susceptible to disease, insect attacks, and harsh weather. Agricultural yields for many economically important crops (e.g., soybean, kidney bean, wheat, cotton) may be reduced, and the quality of some crops may be damaged, thereby reducing their market value. Ground-level ozone can also kill or damage leaves so that they fall off the plants too soon or become spotted or brown. These effects can significantly decrease the natural beauty of an area, such as in national parks and recreation areas.

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[2] Observed at concentrations as low as 0.08 ppm.

Carbon Monoxide (CO)

Carbon monoxide (CO) is an odorless, colorless gas that is a by-product of the incomplete burning of fuels. CO reduces oxygen carrying capacity of blood and weakens the contractions of the heart, thus reducing the amount of blood pumped to various parts of the body and, therefore, the oxygen available to the muscles and various organs. In a healthy person, this effect can significantly reduce the ability to perform physical exercises. In persons with chronic heart disease, these effects can threaten the overall quality of life, since their systems are unable to compensate for the decrease in oxygen. CO pollution is also likely to cause such individuals to experience angina during exercise. Adverse effects have also been observed in individuals with heart conditions who are exposed to CO pollution in heavy freeway traffic for 1 to 2 hours or more.

Nitrogen Dioxide (NO_2)

Healthy individuals experience respiratory problems when exposed to high levels of NO_2 for short duration (less than three hours). Asthmatics are especially sensitive and changes in airway responsiveness have been observed in some studies of exercising asthmatics exposed to relatively low levels of NO_2. Studies also indicate a relationship between indoor NO_2 exposures and increased respiratory illness rates in young children, but definitive results are still lacking. Many animal studies suggest that NO_2 impairs respiratory defense mechanisms and increases susceptibility to infection.

Several studies also show that chronic exposure to relatively low NO_2 pollution levels may cause structural changes in the lungs of animals. These studies suggest that chronic exposure to NO_2 could lead to adverse health effects in humans, but specific levels and the exposure duration likely to cause such effects have not yet been determined.

NO_2 is an important precursor to both ozone and acidic precipitation, which harms both terrestrial and aquatic ecosystems. Emitted from hydrocarbon combustion at high temperatures, NO and NO_2 (collectively called NO_x) react with gaseous hydrocarbons to form ozone. The mixture of NO_X and ozone in urban air is commonly called "smog".

NO_x also plays a role in the formation of acid rain. Acid rain causes surface water acidification and damages trees at high elevations (for example, red spruce trees over 2,000 feet in elevation). In addition, acid rain accelerates the decay of building materials and paints, including irreplaceable buildings, statues, and sculptures that are part of our nation's cultural heritage.

NO_x contributes to the formation of particles in the atmosphere, with the resulting health and visibility effects discussed in the "PM" section, below. Nationally, about 5 percent of NO_x is transformed into particle nitrate in the atmosphere. Even when it does not form particles, NO_x itself is a brown gas that largely contributes to the visible smog effect evident in the major metropolitan areas of the U.S.

Particulate Matter (PM)

PM is the generic term for a broad class of chemically and physically diverse substances that exist as discrete particles (either liquid droplets or solids) over a wide range of sizes. PM originates from a variety of anthropogenic stationary and mobile sources as well as from natural sources. PM may either be emitted directly or formed in the atmosphere by the transformations of gaseous emissions of compounds including NO_x, VOCs, and sulfur oxides (SO_x). The chemical and physical properties of PM vary greatly with time, region, meteorology, and source category, thus complicating the assessment of health and welfare effects.

PM_{10} refers to particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers. Technical details further specifying the measurement of PM_{10} are contained in 40 CFR part 50, Appendices J and M. PM_{10} is a measure of both fine particles (less than 2.5 microns (μm)) and the coarse particle fraction (particles between 2.5 and 10 μm)[3]. In addition to the evidence found for health effects associated with fine particles, research indicates that exposure to coarse fraction particles is associated with aggravation of asthma and increased respiratory illness, and that there may be chronic health effects associated with long-term exposure to high concentrations of coarse particles (FR, July 18, 1997). A more complete history of the PM NAAQS is presented in section II.B of the OAQPS staff paper, "Review of National Ambient Air Quality Standards for Particulate Matter: Assessment of Scientific and Technical Information."

$PM_{2.5}$ is comprised of particulate matter with a diameter less than or equal to 2.5 μm. The new $PM_{2.5}$ NAAQS were promulgated in July, 1997 and new monitoring requirements for $PM_{2.5}$ are included in Appendix L of 40 CFR Part 50. A discussion of $PM_{2.5}$ health effects is presented in *the Criteria Document for Particulate Matter*, which describes:

- the nature of the effects that have been reported to be associated with ambient PM, including premature mortality, aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days), changes in lung function and increased respiratory symptoms, changes to lung tissues and structure, and altered respiratory defense mechanisms; and

- sensitive sub-populations that appear to be at greater risk to such effects, specifically individuals with respiratory disease and cardiovascular disease and the elderly (premature mortality and hospitalization), children (increased respiratory symptoms and decreased lung function), and asthmatic children and adults (aggravation of symptoms).

The environmental effects of particles center principally on two areas: visibility and soiling. The visibility impacts are immediately apparent to anyone who has seen a major

[3] Coarse particles are larger than 2.5 micrometers, and the PM10 standard does not apply to coarse particles above 10 micrometers.

metropolitan area on a hazy day. Visibility impairment can result from either the direct emission of particles or the formation of particles from the nitrogen oxides and VOCs. The soiling effect of particles is observable on both buildings and vehicles. The soiling can also contribute to the degradation of monuments and artwork. In addition to the "quality of life" effects of visibility reduction there is an additional safety problem for aircraft operating in areas of reduced visibility, in the terms of landing and avoidance of other aircraft.

Volatile Organic Compounds (VOCs)

Organic chemicals emitted into the atmosphere are typically described as VOCs (or "hydrocarbons")[4]. They can arise from evaporation or incomplete fuel combustion. As a class, VOCs react with NO_X in the atmosphere to form ozone, but individual VOCs may have additional health effects. Some VOCs have little or no known direct health effect, while other VOCs, such as benzene, are carcinogens. As with other pollutants, the extent and nature of the health effect will depend on many factors, including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics.

VOCs can cause a variety of environmental effects depending on their chemical nature and the quantity present. At high levels, VOCs can have a damaging effect on plants, crops, buildings and materials. Of course, the principal environmental effect of VOCs is their contribution to the formation of ozone with its concomitant environmental effects. Likewise VOCs can contribute to the formation of particles (either directly through cooling down of hot engine exhaust or indirectly through chemical conversion and condensation) which have the environmental effects listed above. VOCs that contain chlorine can also contribute to stratospheric ozone depletion.

[4] See Code of Federal Regulations, Title 40 part 5/Section 100 for complete definition.

AReCO

ALLIANCE OF RESIDENTS CONCERNING O'HARE, Inc. "a grass roots organization"

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November 13, 2003

Testimony from the Alliance of Residents Concerning O'Hare regarding the proposed rulemaking on Control of Air Pollution From Aircraft and Aircraft Engines; Emission Standards and Test Procedures – Docket #OAR 2002-0030

by Jack Saporito:

Thank you for inviting us to comment. I am Jack Saporito, executive director of the Alliance of Residents Concerning O'Hare.

AReCO is a respected Chicago area organization known globally and with many years experience, that has been at the vanguard of airport and aircraft related public health, safety and environmental issues since the mid-nineties. AReCO represents over 40 area communities with municipal, family and professional membership from across the country.

AReCO is not your typical environmental organization since most of the Board members are successful business people and, while AReCO is concerned about the economic costs of the public health and other quality of life problems, especially since that is one of the major reasons businesses locate where they do, AReCO is also very concerned about the health and environmental problems that harm airport neighbors living 20 miles or more away from airports.

Today, I am representing many of the well over 700 groups and hundreds of cities and towns that are concerned about airport and aircraft related issues, many of whom, along with several scientists, provided support for me to attend today.

Many of my colleagues and members that I represented for the national organization are employed in the aerospace industry: pilots, air-traffic controllers, employees of NASA and Boeing, Williams Aviation Consultants and many others, such as the well-respected Baylor University's School of Aviation and Air Sciences. As a result, we have a strong working knowledge of the issues, bringing strong factual evidence to the table.

We have a vital interest in assuring that the environmental protection process fully complies with full disclosure, all environmental laws and regulations and all other aspects that will protect citizens' health, safety, our environment and other quality of life issues.

As you know, airport operations emit extraordinary amounts and types of serious and deadly air, noise, ground, and water pollution, which is mostly unregulated and grossly underreported.

Airports and their aircraft are among the worst polluters in the world, causing significant damage not only with their extraordinary contribution to climate change, but, also pandemic public health problems caused by their toxic pollution.

It is important to remember that airports and their aircraft operations are major local point or area emission sources, since over 90% of aircraft emissions are emitted at or relatively near the airport during the landing and take-off cycles. Airports are basically functioning major cities with mega aircraft operations with all the supporting operations that a city would need including an onsite incinerator and about 175,000 cars, trucks, taxis, etc. that go into O'Hare each day. For example, Chicago's O'Hare airport is located on only about four (4) square miles of land within a densely populated area. Accordingly, a new O'Hare/Peotone study shows that **8.3 million people's health is affected by O'Hare operations, 5.5 million significantly so.**

It is unclear to me why the EPA is motivated in this proceeding to set new NOx emissions limits: is it for climate change problems or for health reasons – or is it for both?

As you may know, the U.S. General Accounting Office looked at the issue regarding climate change and found that in the United States, aviation emissions accounted for about three percent of the greenhouse gases and other emissions that contribute to the global warming phenomenon. While this percentage is small in relative terms, (but when you think that all this damage is coming from about 8,600 aircraft), aviation emissions are also significant for a number of reasons:

(Quote source: Congressman Oberstar's press release on GAO study)

"Jet aircraft emissions are deposited directly into the upper atmosphere and some of them have a greater warming effect than gases emitted closer to the surface, such as automobile exhaust.

1. The primary gas emitted by jet aircraft engines is carbon dioxide, which can survive in the atmosphere up to 100 years." While the release of NOx from aircraft in the upper atmosphere is relatively small but because it is released directly in the upper atmosphere it last 25 times longer than ground-based emissions. Thus, that equates to commercial jet aircraft emit more than half of the man-made NOx burden.
2. "Carbon dioxide, combined with other exhaust gases and particulates emitted from jet engines could have two to four times as great an impact on the atmosphere as carbon dioxide emissions alone.
3. The growing demand for jet air service is likely to generate more emissions that cannot be offset by reductions achieved through technological improvements alone."

The GAO report[1] recommended further research into the impact of jet exhaust on the global atmosphere to help guide the development of new aircraft engine technology. It also called upon governments to reduce emissions through improved air traffic control and regulatory and economic incentives.[2] (Thus, reducing the number of flights.)

Now, many new studies point to commercial jet aircraft as a major, if not <u>the</u> major cause of man-made climate change. As in the GAO report, look for the European nations and others to also demand rationing of flights.

Regarding the proposed NOx standards and public health: The EPA proposes to adopt into U.S. regulations already existing International Civil Aviation Organization (ICAO) aircraft engine NOx standards.

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[1] Aviation and the Environment: Aviation's Effects on the Global Atmosphere Are Potentially Significant and Expected to Grow. GAO/RCED-00-57, Feb. 2000.

[2] Source: "Oberstar: GAO Study Links Aircraft Emissions to Global Warming," Feb. 22, 2000.

Note that engine design is driven by air transportation industry customers, who are primarily interested in reduced fuel costs per passenger flight mile (or "mileage" costs). The next priority is noise level. Everything else, including NOx emissions, is tertiary. It will be argued by the industry that reducing fuel consumption will reduce emissions but that is not systemically true, since flights are projected to massively increase, perhaps tripling in a relatively short period of time, as the Federal Aviation Administration (FAA) testified to Congress this July. Also, we have internal FAA and NASA documents, dated prior to September 11, 2001, that state that flights will double before 2010 and every 8-10 thereafter until 2050.

In fact, the EPA's proposed actions will not significantly change local NOx and ozone contaminant concentrations from airports, with attendant serious negative health impacts on millions of people, nor will it materially improve acid rain conditions, particulates, water acidification, weather changes, etc. This is **too little, too late and that's too bad.**

The proposed NOx standards for engine certification are already nine (9) years old, and will apply only to newly certificated engines after January 2004. It will NOT apply to any aircraft in the existing fleet, nor will it apply to any newly manufactured aircraft using already certified engines. Almost all (94%) of existing aircraft fleet engines would already meet these new standards!

Newer aircraft engines often spew out more NOx than the older engines they replace and the trend is not improving, primarily because the air transportation industry has little or no interest in the issue...fuel economy (bottom-line profit) is the #1 motivator, not reducing toxic emissions into our environment.

The USEPA "participates" in ICAO standard setting committees, but the reality is that commercial air interests and money provide an overpowering basis for the standards. Also, many of the members are third world countries and cannot afford the needed standards, especially since they buy our used aircraft when they are 20-30 years old.

We are also concerned about the United States' research pursuit directed at reduced NOx and emission levels since, for instance, engine NOx reduction research by the National Aeronautic and Space Agency (NASA) has, for all practical purposes, ceased[3] because of minimization of funding.

The "new" NOx standards, even though they are directed at engine manufactures for, say, the next decade, mean that no substantial overall fleet impact will be seen until perhaps two or more decades from now, partly because they do not at all push the technology level bar upward. To give you a sense of the timeline: even if we had the technology today, it would take two to three decades before an adequate portion of the fleet met these new requirements in the U.S.!

We need also to be concerned about...in reducing NOx emissions and unacceptable noise levels, with current engine technology and petroleum fuels that commercial jet aircraft are addicted to for the 4-5 decades, increased hazardous and toxic emissions; therefore, compounding airport-poisoning health problems that are already pandemic in nature.

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[3] Aviation and the Environment: Strategic Framework Needed to Address Challenges Posed by Aircraft Emissions. [GAO-03-252], Feb. 28, 2003.

Data from both the state of Illinois and U.S. Environmental Protection Agencies show that O'Hare's aircraft alone, already emit more Volatile Organic Compounds than those from all Illinois electric power plants combined, with Carbon Monoxide emissions as much as 60% of that total! Adding the associated ground, mobile and stationary emissions would double that! Based on data AReCO has, it appears that the other Clean Air Act criteria emissions are also "off-the-charts".

And it is not only the amount of emissions but also other trigger effects such as the synergistic effects of over 200 hazardous and toxic airport-aircraft emissions that we have discovered being emitted.

Engine particulate matter standards, beyond NOx derived secondaries, continue to be non-existent, with the air industry dominated ICAO totally unwilling to advance beyond their now ancient "smoke number" standard. The ICAO developed this in order to "hide" the pollution from the naked eye.

In order to protect the American public, the USEPA MUST officially adopt a position and action plan in this proceeding to rectify this egregious situation.

Aviation-related emissions are different than any other type of polluter and it doesn't take much. A Los Angeles School District study's data found that small flight volumes of approximately fifteen jets per day are associated with a significant increase in cancer risk among residents living under the flight paths.

A recent prestigious eight-state EPA study found that, collectively, the aircraft alone at Boston's Logan, Bradley, and Manchester airports emitted 3,538 tons of NOx, 4,461 tons of CO, and 700 tons of HC in 1999. The combined aircraft-related benzene emissions were 20 tons at the three airports in 1999. *By startling comparison, aggregate benzene emissions from the largest stationary sources in Massachusetts, Connecticut, and New Hampshire combined totaled only six tons in 1996.*[4] Note that: O'Hare, Dallas, Atlanta each alone has more airport operations and generally larger aircraft than all three New England airports collectively.

In fact, extrapolating the study's findings to Chicago's O'Hare Airport and all its related aircraft operations demonstrates that it is not only one of the worst polluters in the state of Illinois, but among the worst, if not *the* worst man-made polluter in the whole United States! Government and independent studies show strong correlations that O'Hare Airport and its aircraft operations is a major contributor in full or in part toward the deaths of hundreds of people a year, from cancer alone.

Besides the significant impacts that aircraft have on our upper atmosphere, locally, the emissions from airports and aircraft operations pose a significant health threat and have been linked to conditions including cancer, asthma, brain tumors, emphysema, heart disease, leukemia, Hodgkin's disease, kidney damage and scores of others[5]. Evidence shows emissions from airports and aircraft

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[4] Northeast States for Coordinated Air Use Management and Center for Clean Air Policy. "Controlling Airport-Related Air Pollution," June 2003.

[5] Health Citations:

a- McCulley, Frick and Gilman Inc. Air Quality Survey Final Result January 1995, pp.26,27,36

b- EPA Toxics Emissions from Aircraft Engines Air RISC Information Support Center July 22, 1993, p.13

c- McCartney, M. Airplane Emissions Department of Environmental Health Sciences 21 April 1986, p.99

d- VIGYAN Inc. USEPA Estimation and Evaluation of Cancer Risks Attributed to Air Pollution in Southwest Chicago Final Summary Report Region 5 Air and Radiation Division April 1993

e- Lewis, R.A. Hazardous Chemical Desk Reference 2nd Edition 1991 Van Nostrand Reinhold operations expose an extremely large number of people living and working at distances greater than 20 miles from a facility. A study commissioned by four local communities found that O'Hare emitted over 200 air toxins and showed that O'Hare presented unacceptable cancer risks for a 32-mile radius around the airport. Over 70% of our nation's population lives within 20 miles of a major airport...this bears repeating, over 70% of our nation's population lives within 20 miles of a major airport!

We firmly believe that O'Hare is a major reason that the Chicago area has some of the highest cancers and other airport-poisoning disease rates in America. There are three other major airports located within 20-25 miles of O'Hare. That situation is no different than most major cities.

**What is needed are comprehensive and aggressive solutions:

1. The EPA should establish the NOx regulations at a much tougher level, one that might be acceptable, if 90% of existing fleet engines could not meet it. This same standard should additionally be applied retroactively to all existing aircraft, with a phase-in period of linearly increasing stringency for the next 20 years.
2. The air industry should be forced to contribute (e.g., through Passenger Facility Charges) at least $10 million/year to the EPA and NASA for engine research directed at emissions reductions.
3. The USEPA should immediately change regulations to cause all airports to be considered consolidated sources of NOx and other "criteria" and toxic pollutant emissions. This aggregation should include all fixed, mobile and area sources of airport and aircraft related sources, both on and off airport property as well as all aircraft operations below generally 3000 meters altitude.
4. EPA and FAA should petition and demand that ICAO include significant voting representation of environmental interests within their Committee on Aviation Environmental Protection (CAEP) committees; otherwise, U.S. funding will be appropriately reduced.
5. This proceeding should require all new aircraft engine certifications to include measurements and characterization for PM10 and PM2.5 particulate matter emissions in each of the 5 major operating modes, starting in year 2004.
6. Further, this proceeding should require all existing engines to be similarly measured and characterized for particulate matter over the next 3 years.
7. All airport expansion projects from here forward, involving an operational increase, shall have environmental evaluations and effective mitigation of the consolidated airport operations producing particulate matter (at least PM2.5) air quality degradations, estimated using, amongst other metrics, either aircraft engine measurements or default "maximum expected" values established by the EPA, and using dispersion analysis models and techniques appropriate to the geographical and meteorological airport conditions rather than just the FAA "mandated" model.
8. In a next proceeding, the EPA, FAA along with Congress should establish airport based incentive landing fees proportional to the amount of pollutants an aircraft emits at that facility (in the total 5 operating modes), where such fees are of an amount guaranteed to materially prompt both airlines and airports to reduce pollutant emissions. These incentive fees should be placed in a trust fund directed strictly at environmental improvements and administered by the EPA, with an independent fund dispersal over-sight board, which includes significant environmental interest representation.

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f- Puget Sound Air Pollution Control Agency 1993 Air Ouality Data Summary, p.62

I would like to finish with what we believe is one of the top stumbling blocks to protecting the majority of Americans who are harmed by airport and aircraft operations: one of the many purposefully oft-repeated air industry distortions is that airports, in general, and Chicago's O'Hare airport, specifically, are the primary "economic engines" of cities' future growth; however, as pointed out in "A Vicious Cycle"[6], the primary indicating numbers do not bear that out.

Furthermore, the ill-advised plans that are going forward to massively expand existing airports will basically provide only temporary construction jobs, while eliminating perhaps millions of potential new jobs and businesses that would be created by building a national world-class high-speed rail system with sophisticated intermodal operations.

We stand with the GAO[7] in opposing such massive expansion of existing facilities and with them on their major solutions to long-term capacity needs which are: 1) Take the issue away from the FAA and make this a transportation issue not just an aviation issue; 2) Put back the airport operational and management controls, the removal of which started the massive airport delays we saw in 2000; 3) Build a national Wayport system, and: 4) build a world-class national high-speed rail system.

Finally, airports and major urban populated areas are indeed incompatible, not necessarily because of some inherent incompatibility, but rather BECAUSE both the regulators (FAA, EPA, etc) have not yet properly set the necessary protective rules in place AND the airports/airlines have not properly characterized their emissions or the technology needed.

There are also other solutions such as building new, environmentally friendly airport designs, developing new fuel sources, etc.

This is America and we need to set the protection bar higher, not adapt one that is set for developing nation's pocketbooks or just airline profit maximization.

We need to protect the American public.

Thank you.

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[6] Peter Martin and Alan Martin. "A Vicious Cycle: How Can The Government Justify Expanding Airport Capacity To Solve An Overcapacity Problem?," Oct. 2003.

[7] U.S. Government Accounting Office. "Long-Term Capacity Needed Despite Recent Reduction in Flight Delays," [GAO-02-185] Dec. 2001.