

# Health Risk Assessment of Air Toxics from Airports: "The State of the Science & Strategies for the Future"

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Presented at the  
Dreams of Flight  
Airport Air Quality Symposium

February 28, 2002

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# Overview

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- Airport Growth & Air Quality Regulations

- Air Toxics and Human Health Risk Assessments

  - ➔ Methods

  - ➔ Limitations

  - ➔ Risk Perception

- Available Studies

  - ➔ SW Chicago Midway

  - ➔ Chicago O'Hare

  - ➔ SEATAC

  - ➔ Southern California

- Risk Drivers

- Mitigation Options

- Recommendations

## The Challenge: Growth Projections for Air Travel

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**"The transition of air transport from an elite to a mass transport mode will be the most important development affecting regulatory practices in the coming years."**

- Airports Council International

## **Air Quality: Where Growth and Regulations Conflict!**

### **Airport Emission Inventories are Going Up - Airports Expanding to Meet Demand**

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- ❑ Aircraft Operations
- ❑ Ground Support Equipment, Auxiliary Power Units
- ❑ Shuttles, Vans, Taxis
- ❑ Passenger Vehicles
- ❑ Cargo Trucks
- ❑ Construction Equipment

## SIP Emission Inventory Budgets Are Going Down to allow States to Predict Timely Attainment of Standards

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- Stationary Sources

- On-Road Mobile

- Off-Road Mobile

- Area Sources

## A Further Complication: Air Toxic Emissions from Airports

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- Replacing/Adding to Noise as a Target for Local Opposition

- Human Health Risk Assessment Science

- ➔ Unregulated

- ➔ Uncertain; Over-conservative

- ➔ Unproven ???

We Need Better Data!!

## Airports Fall Through the Cracks in the Regulation of Air Toxic Emissions

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- Not specifically addressed as “major” or “area” sources in Section 112 of the CAA
- Viewed as “mini-cities” generating numerous pollutants from multiple sources
- Complex mix of mobile and stationary sources
- Governed by many different authorities; housing many tenants

## Nature of the Problem

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- Urban areas struggle with air pollution issues
- Studies raise public concerns about air toxics from airports
- Regulators promulgate permit requirements for sources of air toxic emissions
  - ➔ HHRAs being included as part of air quality impact analyses in California
- Airports lack meaningful thresholds for analyzing impacts of air toxic emissions

## Few Risk-Related Significance Criteria are Available

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- CEQA Checklist is Vague - Significant impact = "Expose sensitive receptors to substantial pollutant concentrations"
- NEPA - also vague - "National policy... to prevent or eliminate damage to the environment...and stimulate the health and welfare of man"

## It's Not Going to Go Away

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- Urban Air Toxics Initiatives on the Rise
- Public Perceptions/Environmental Justice Issues Heating Up
- Availability of Information (Check Out the Oppositions' Web Sites)

This is Not a Problem

That Will Solve Itself

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## Human Health Risk Assessments - Predictions of Cancer, Chronic and Acute Health Effects in Neighboring Communities

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### ■ Emission Inventory (FAA EDMS and ARB Factors)

- ➔ Airport Data (operations/day)
- ➔ Emission Factors (lb/day/operation)
- ➔ Speciation Factors (lb/lb, that is, lb of air toxic per lb of VOC or PM)

### ■ Exposure Assessment and Risk Characterization

- ➔ Emissions Dispersion and Risk Modeling ( $\mu\text{g}/\text{m}^3$  exposure concentrations)
- ➔ Toxicity Factors (excess lifetime cancer risk per  $\mu\text{g}/\text{m}^3$  exposure concentration)

## The Risk Assessment Process: Key Improvements Needed

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- Exposure - Monitoring vs. Modeling of Exposure Concentrations
- Dose Response - Agency Development of Toxicity Factors

### The Big Issues Affecting HHRA

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## HHRA Results are Typically Conservative to an Extreme

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- Estimate maximum "worst-case" emissions
- Estimate concentrations in air based on worst-case meteorological conditions
- Base risk estimates on a hypothetical maximum exposed individual
  - ➔ Assumed to be located at the point where the highest pollutant concentrations will be found, 24 hours/day, 365 days/year, for a 70-year lifetime

## Add Multiple Sources of Uncertainty

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- Emission factors and speciation factors used to estimate toxic emissions from aircraft engines are based on limited emissions tests
  - Toxicity factors derived from animal studies or epidemiological studies of exposed worker populations, extrapolated to low-level exposure, with additional safety factors
  - Uncertainty occurs from the application of hypothetical risk estimates (the maximum exposed individual) to actual populations
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## Compare Overly Conservative Risk Estimates to Stringent Thresholds for Significance

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### ■ State of California - cancer risk thresholds:

➔ 1 in 1,000,000 ILCR at any individual w/o emission controls; 10 in 1,000,000 with TBACT

### ■ Federal - based on benzene NESHAP:

➔ 100 in 1,000,000 at the MEI; 1 in 1,000,000 for an average member of the population

### ■ Hazard index of 1 is the threshold for noncancer health effects:

➔ HI's > 1 indicate "need for further study"

## Available Studies: What Are the Concerns?

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### ■ Southwest Chicago (Midway)

### ■ Chicago O'Hare

### ■ SeaTac

### ■ HHRAs as part of CEQA analyses

➔ LAX

➔ Proposed OCX

➔ SDIA

## Southwest Chicago HHRA (1993)

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■ Study requested by  
US Congressman

■ Average to maximum cancer risks - 200 to 800 in 1,000,000

■ Mobile sources (25% of predicted risks)

■ 1,3-Butadiene most significant contributor to predicted  
cancer risks

## Chicago O'Hare HHRA (1999)

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■ Initiated by communities surrounding airport in response to  
perceived inaction by state and federal agencies

■ Modeled risks from emissions estimates generated by the  
airport

■ Monitored ambient concentrations at the fenceline

## ■Based on modeling:

- ➔ Maximum risk at the fence line - 100 in 1,000,000
- ➔ Risk exceeded 10 in 1,000,000 over an approximate 40 square mile area
- ➔ Risk exceeded 1 in 1,000,000 over an approximate 1,000 square mile area

## ■Air monitoring downwind could detect slightly elevated concentrations of Formaldehyde and Benzene, however:

- ➔ values generally indistinguishable from ambient concentrations typically present in urban air in the U.S.
- ➔ Downwind monitoring stations were located at the fence line, adjacent to a runway

## Chicago O'Hare HHRA - Implications?

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■Would concentrations in air associated with airport operations be distinguishable from "background" levels even a few blocks away?

■What are airport-related risks if concentrations resemble urban background?

## SEATAC

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■Air monitoring study only (in 1993)

- Some VOCs above State ASILs (Acceptable Source Impact Levels)
- Concentrations resemble typical urban background
- Insufficient data for HHRA
- \$4M monitoring study - status???

## HHRAs as Part of CEQA

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- California has an aggressive air toxics program
  - HHRAs part of analysis for LAX, proposed OCX (El Toro), and SDIA
    - ➔ More extensive analysis of mobile sources
    - ➔ Diesel PM and Acrolein have been identified as significant drivers
  - Experience has highlighted limitations with existing HHRA approaches
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## Putting Airport Emissions and Risks into Perspective: MATES

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- SCAQMD Study in 1987; Updated in 1998/1999
- MATES II - HHRA based on Air Toxics in Ambient Urban Air  
- 1,400 In 1,000,000 Cancer Risk, Primary Driver - Diesel PM
- Conclusion - Mobile Source Emissions are Primary Contributors to Estimated Risks

## But What Are the Drivers, Really?

### Acrolein

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- Agency RELs (Reference Exposure Levels) resemble typical ambient concentrations
  - California's Acute REL is based on 40-year old data, includes numerous "safety" factors
    - ➔ Reflects uncertainty, not toxic potency
    - ➔ Result: Acrolein is easily judged to pose significant impacts.
    - ➔ Now proposed by California to be one of five air toxics of particular concern to children and infants (Children's Environmental Health Protection Act).
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# 1,3-Butadiene

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- Recently determined to be a known human carcinogen, but
- Highly reactive in the atmosphere - half life in air of several hours
  - ➔ Wasn't detected in Mostardi Platt samples taken near Chicago O'Hare
  - ➔ Modeled in risk assessments as non-reactive in air; is risk over-stated?

# Diesel PM

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- Risk driver in several risk assessments
  - Judged by EPA as likely to be a human carcinogen, but EPA has not assigned a cancer unit risk factor
  - California has assigned a cancer unit risk factor and implemented an aggressive statewide Diesel PM10 Risk Reduction Plan
  - EPA's Science Advisory Board has expressed concerns about calculating cancer risks from diesel exposure
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## Agree There is a Problem?

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- Is it just a perception?
- Does that matter?

## The Solution?

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- Mitigated Projects
- Cleaner Airports
- Educated, Involved "Public"

## Learn to Accept What You Cannot Change?

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- Accept that you need to find mitigation in nearly every step of regulatory approval process
  - If you don't have a big SIP budget, or toxics are a big issue, the smartest approach may be a mitigated project
  - Get lots of positive PR for your hard work
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## Why Mitigate?

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- Reduce Air Toxics Impacts
- Be Green
- Build Trust in the Community
- Spread the Good News!

## Is Technology Available?

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- CNG Shuttles, Vans
- LPG Trucks
- Electric Vehicles
- Electric Baggage Tugs  
and Belt Loaders
- Terminal/Gate Electrification (400 Hz Power, Pre-Conditioned Air)

## Support Infrastructure

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- CNG Fueling Station
- LPG Fueling Station
- Photo-Voltaic Arrays
- Fast Chargers for GSE
- Vehicle Chargers for Public and Fleet
- Electrical Supply

## Recommendations for Future Study

### It Pays to Plan Ahead

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- Do Air Quality and Environmental Constraints Analysis as You Proceed With Master Planning
- Improve Data and Methods You Have to Work With
  - Conduct Tests to Improve Emission/Speciation Factors
  - Monitor Ambient Air to Verify Modeling Results
  - Lobby for Better Toxicity Factors
  - Develop a Standardized Risk Assessment Approach
- Plan/Budget for Mitigation; Apply for Funding
- Involve the Public