



## Indoor Air Technologies Inc. [www.indoorair.ca](http://www.indoorair.ca)

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### **Phone Numbers:**

North America 613-731-2559  
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### **Expertise:**

Indoor air quality, ventilation, moisture, building science, air flow control strategy design and commissioning.

### **Geographical areas served:**

Canada, USA and Europe

### **Services:**

- ❖ Indoor air quality, soil gas and HVAC system problem investigation.
- ❖ Indoor air quality and HVAC system problem solving.
- ❖ Indoor air quality and ventilation standards development.
- ❖ ECHO System® ventilated and depressurized walls and basement subfloor design and construction management (Canada Patent 1,230,461, USA Patent 4,843,786, and Ontario Building Code Authorization BMEC 97-05-214).
- ❖ Aircraft ECHO Air jet aircraft environmental control system design and commissioning (USA Patent US6,491,254, Europe Patent EP1140625, Canada patent pending).

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## INDOOR AIR TECHNOLOGIES INC. (IAT)

Indoor Air Technologies Inc. (IAT) is a consulting engineering firm specializing in indoor air quality, ventilation, and moisture investigations and solutions. IAT was incorporated in Canada in 1988 and in the United States in 1989.

IAT is a pioneer in indoor air quality investigations and problem solving since 1988, with its principal investigator in this field since 1982. IAT has conducted over 300 indoor air and HVAC systems investigations in a variety of environments including office buildings, schools, residences and aircraft.

IAT has developed technologies to address a number of indoor air quality and moisture problems. Two of these have been awarded national as well as international patents.

IAT organized the 5<sup>th</sup> International Conference on Indoor Air Quality and Climate in Toronto Canada in 1990. This was the largest to date technical conference on this subject in Canada. Douglas Walkinshaw, Ph.D., P.Eng. of IAT was the conference president and technical paper editor in chief, with a five volume technical paper proceedings and over 500 reviewed papers. Douglas Walkinshaw was member of the ASHRAE committee that developed the 1989 ventilation standard that remains a basis for current ASHRAE building ventilation standards.

Lists of example investigations, technology development projects, science projects and sites investigated follow.

## INVESTIGATIONS

Following is a listing of some typical IAQ investigations and problem-solving projects. For more in-depth information, visit our web site at [www.indoorair.ca](http://www.indoorair.ca), click on "Investigations" and then click on "Indoor Air Quality Investigations".

**Table I: Example Indoor Investigations**

| Client                                                                                            | Project                                                                                                |
|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Association of Flight Attendants..... Washington<br>Canadian Union of Public Employees... Toronto | Investigated and compared VOCs in high vs low occupancy density environments from offices to aircraft. |

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|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Canada Mortgage and Housing.....Ottawa                                 | Demonstrated the ECHO System depressurised drained and insulated basement envelope construction to prevent mold, soil gas, and water leakage problems.                                                                                                              |
| Camp Hill Hospital.....Halifax                                         | Identified dishwasher exhaust re-ingestion by AHU as cause of skin, respiratory, eye irritation, headaches and dyspnea.                                                                                                                                             |
| Clemann Large Patterson.....Ottawa                                     | Developed ventilation and envelope leakage parameters for control of dust entry and measured system performance in the Canadian National Space Centre.                                                                                                              |
| Conlin, McKenney, Philbrook.....<br>.....Ann Arbor, Michigan           | Measured water droplet aerosolization from hot water tank leakage into furnace re a Legionnaire's Disease incident.                                                                                                                                                 |
| Cunningham, Lindsey Canada..... St. Albert                             | Identified sump mold source in block basement following flooding and stripping, and subsequent mold regrowth in drywall in refinished basement without flooding.                                                                                                    |
| Enbridge..... Toronto<br>NRG..... Halifax                              | Compared IAQ health impacts of residential use of natural gas vs. other energy sources.                                                                                                                                                                             |
| State Farm Fire & Casualty..... Kingston                               | Assessed effectiveness of a fuel oil spill clean up in eliminating oil VOCs.                                                                                                                                                                                        |
| Homeowner..... Cleveland                                               | Identified contaminated soil gas entering a new house via block wall cavities in foundation preventing house occupation.                                                                                                                                            |
| Homeowner..... Cornwall                                                | Identified soil VOC and microbial basement entry preventing house occupation.                                                                                                                                                                                       |
| Minto Commercial.....Ottawa                                            | Assessed office buildings for IAQ sources of occupant complaints including HVAC system filtration and microbials, office circulation and bioeffluent accumulation, volatile organic compounds and cleaners, carbon monoxide and vehicular exhaust.                  |
| Ontario Hydro.....Toronto                                              | Studied IAQ impacts of energy conservation measures.                                                                                                                                                                                                                |
| Ontario Public Service Employee's Union...<br>.....Toronto             | Measured environmental tobacco smoke (ETS) exposure vs. system operation in Hamilton, Sault Ste. Marie & Whitby jails.                                                                                                                                              |
| Ontario Realty Corporation and Manage Board<br>Secretariat.....Toronto | Measured VOCs, SVOCs, ventilation, microbials, soil gases and entry pressures. Identified sewer gas, carpet microbial dust, carpet offgassing during stream cleaning, product VOC and ventilation deficiencies in a 200,000 SF Kingston government office building. |
| Perley Rideau Veterans' Health Center, Ottawa                          | Measured vehicular exhaust RSP, CO, NO <sub>2</sub> , SO <sub>2</sub> ingestion from trucks offloading at loading dock.                                                                                                                                             |
| Public Works & Govt. Services Canada.....<br>.....Ottawa               | Monitored new building VOCs during initial occupation. Identified hidden mold problem in a group of portables. Developed heritage building depressurisation solution allowing humidification in winter weather without architectural changes.                       |

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|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temiskaming Health Clinic.....New Liskeard | Identified vehicular exhaust contaminant infiltration from a warehouse through a common wall. Solved through construction of an ECHO depressurised common wall. |
| University of Ottawa.....Ottawa            | Identified laboratory fume-hood VOC exhaust re-ingestion caused by building pressure imbalance intended to save energy.                                         |

## TECHNOLOGY DEVELOPMENT

Indoor Air Technologies has developed world-leading technologies to address a number of air quality and moisture problems. For more in-depth information, visit our web site at [www.indoorair.ca](http://www.indoorair.ca) and go to for example “ECHO Basement” and “ECHO Air”.

| Problem                                                                                                                                                                                          | Technology                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a. Basement mold; soil gas, humidity and water entry through foundations.<br>b. Winter time condensation in wall cavities in humidified buildings.<br>c. Air contaminant transfer through walls. | 1. Drained and depressurised wall and sub floor continuous air barriers preventing stack-pressure-driven air transfer across building interior vapor and air barriers. <sup>1</sup>                       |
| d. Fuselage condensation in aircraft.<br>e. Electrical fires in aircraft.<br>f. Thermal discomfort in aircraft.                                                                                  | 2. Alternately pressurized and depressurised continuous air barriers preventing stack-pressure-driven air transfer across aircraft cabin liners. <sup>2</sup>                                             |
| g. Tobacco smoke circulation to non-smoking areas from smoking areas.                                                                                                                            | 3. Air cleaner circulation that creates room depressurisation and transfer air with tobacco smoke particulate and gases removed and suitable for building HVAC recirculation to the rest of the building. |

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<sup>1</sup> USA Patent 4,843,786, Canada Patent 1,230,461. Ontario Building Code BMEC 97-05-214.

<sup>2</sup> European Patent 1140625. USA Patent US 6,491,254 B1. Canada Patent Pending.

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## SCIENCE PROJECTS

Indoor Air Technologies has organized and contributed to the organization of many indoor air quality and climate related scientific conferences and seminars, edited proceedings, and contributed to related standards development, nationally and internationally.

Some examples follow.

| Client                                                                            | Project                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Air and Waste Management Association                                              | Managed the "Indoor Air Quality in Cold Climates" Conference, Ottawa, 1985. In 1988 assisted in setting society priorities in transformation from APCA to AWMA.                                                                                                             |
| American Society of Heating, Refrigerating & Air-Conditioning Engineers (ASHRAE). | Contributed to the ventilation standard for buildings, 62-1989. Contributing to the proposed aircraft ventilation and air quality standard SPC 161P. Assisted with the organization of ASHRAE Conferences technical programs: IAQ86, IAQ87, IAQ88, IAQ89, IAQ91, and IAQ92. |
| Canadian General Standards Board                                                  | Contributed to combustion venting safety standard, CAN/CGSB-51.71-95, 1995.                                                                                                                                                                                                 |
| Health Canada                                                                     | Contributed to this agency's' "Exposure Guidelines for Residential Indoor Air Quality", 1987.                                                                                                                                                                               |
| International Academy of Indoor Air Sciences (IAIAS)                              | Managed the 5th International Conference of Indoor Quality and Climate: Indoor Air '90, Toronto, 1990.                                                                                                                                                                      |
| International Society of Indoor Air Quality (ISIAQ)                               | Founded the society and managed the development of "Control of Moisture Problems Affecting Biological Indoor Air Quality", 1996.                                                                                                                                            |

Ontario Home Builders' Association

Seminars:

1) Fungal investigations – What is that Black stuff? 2) Soil gases – Hazards and solutions

For a look at these seminars, please visit our web site at [www.indoorair.ca](http://www.indoorair.ca), click on "Investigations". Then click on the seminar title.

World Health Organization (WHO)

Contributed to WHO Guidelines for Sick Building Syndrome, Copenhagen, 1988.

## **INDOOR ENVIRONMENTS INVESTIGATED**

Indoor Air Technologies has managed indoor air quality and climate related investigations totaling some \$3,000,000 and remedial measures totaling some \$10,000,000 in Canada and the USA.

Indoor environments and their locations investigated include:

### **Aircraft**

B-737-200

### **Churches**

Emmanuel Church, Portland, ON

Our Lady of Grace Church, Ingleside, ON

St. Thomas Church, Ottawa, ON

### **Commercial offices, retail, hotel**

130 Slater Street, Ottawa, ON

1300 St. Joseph's Blvd, Orleans, ON

1355 Bank St, Ottawa, ON

1780 Kerr Ave, Ottawa, ON

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222 Queen Street, Ottawa, ON  
320 McLeod Street, Ottawa, ON  
36-42 King Street West, Brockville, ON  
441 MacLaren St, Ottawa, ON  
488 Gladstone Ave, Ottawa, ON  
53 Auriga Drive, Nepean, ON  
60 Queen St, Ottawa, ON  
880 Wellington City Center, Ottawa, ON  
945 Wellington St, Ottawa, ON  
Baskin-Robbins, Prince of Wales & Meadowlands, Ottawa, ON  
Bradson Building, Ottawa, ON  
Canada Place, Ottawa ON  
Carlington Community Centre, Nepean, ON  
Chateau Laurier, Ottawa, ON  
Commercial Plaza, Ann Arbor, Michigan  
Dows Lake Court, Ottawa, ON  
Edmonton Mall, Edmonton, AB  
Emerald Plaza, Ottawa, ON  
Enbridge, Toronto, ON  
Enterprise Building, Ottawa, ON  
Jean Coutu, Gatineau, PQ  
L' Hotel, Toronto, On  
Macdonald Cartier Building, Kingston, ON  
Maritimes NRG, Halifax, NS,  
Mill Restaurant, Ottawa, On  
Minto Chappel Hill Sales Office, Orleans, ON  
Minto Place, Ottawa, ON  
Nuden, Ottawa, ON  
Ottawa Congress Centre, Ottawa, ON  
Pancake House, Cornwall, ON  
Pharmasave, Almonte, ON  
Place du Canada, Montreal, PQ  
Trattoria Restaurant, Ottawa, ON  
Varette Building, Ottawa, ON  
World Exchange Plaza, Ottawa, ON  
Zumas Restaurant, Ottawa, ON

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**Government offices, laboratories**

1941 Ogilvy Road (CSIS)  
240 Sparks Street, Ottawa, ON  
Booth Building, Ottawa, ON  
Brooke Claxton Building, Tunney's Pasture, Ottawa, ON  
Canada Employment Centre, Becancour, PQ  
Canadian Space Centre, Nepean, ON  
City of Kanata, Kanata, ON  
City of Toronto ETS Bylaw  
De la Salle Building, Ottawa, ON  
East Memorial Building, Ottawa, ON  
Four Corners, Marshall Building, Ottawa, ON  
Health Protection Branch Finance Building, Tunney's Pasture, Ottawa  
Jeanne Mance Building, Tunney's Pasture, Ottawa, On  
Judy Lamarsh Building, Chatham, Ontario  
Justice Building, Ottawa, ON  
Kanata Hydro, Kanata, ON  
Macdonald-Cartier Building, Kingston, ON  
NRCan Portables, Bells Corners, ON  
Place Vanier, Vanier, ON  
Prescott Russell Municipal Offices, South Dundas, ON  
Rideau Museum, Ottawa  
Taxation Centre, Winnipeg, MA  
West Memorial Building, Ottawa, On

**Hospitals/Clinics/Nursing Homes**

Camp Hill Hospital, Halifax, NS  
Children's Hospital of Eastern Ontario, Ottawa, ON  
Civic Hospital, Ottawa, ON  
Cornwall Regional Hospital Linen Service, Cornwall, ON  
Deep River and District Hospital, deep river, ON  
Health Clinic, New Liskeard, ON  
Perley Rideau Veteran's Centre, Ottawa, ON  
Queen Elizabeth Hospital, PEI  
Winnipeg Hospital, MA

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## **Industrial**

Airbus 310  
Boeing 737  
Bombardier RJ  
Canadian Gas Association, Toronto, ON  
Canadian Electrical Association, Montreal, PQ  
Canadian Tobacco Manufacturer's Council  
De Havilland Global Express  
Hertz Car Rental, Ottawa Airport, Ottawa, ON  
City of Ottawa Articulated Buses, Ottawa, ON  
Red Pine Outdoor Equipment, Ottawa, ON  
Shell Station, CFB Uplands, Ottawa, ON

## **Institutional**

Hamilton Wentworth Jail  
Sault Ste. Marie Jail  
Whitby Jail

## **Residences**

Some 250 residences in British Columbia, New York, Ohio, Ontario, PEI, and Quebec.

## **Schools**

CEGEP, Heritage Campus, Hull, PQ  
Charles Hulse School, Ottawa, ON,  
Dufferin Peel Roman Catholic Separate School Board, Mississauga, ON  
Glebe Collegiate, Ottawa, ON  
Glengarry House, Carleton University, Ottawa, ON  
Hawthorne Meadows, Ottawa, ON  
Heritage Private School, Ottawa, ON  
Ottawa Montessori School, Ottawa, ON

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**Douglas S. Walkinshaw, President, Indoor Air Technologies Inc., Canada and USA****DEGREES**

|                                |                                        |
|--------------------------------|----------------------------------------|
| Ph.D. (Mechanical Engineering) | University of Alberta, Edmonton, 1970. |
| M.Eng. (Applied Mechanics)     | McMaster University, Hamilton, 1966.   |
| B.Eng. (Civil Engineering)     | McMaster University, Hamilton, 1964.   |

**CAREER POSITIONS**

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1988 – present | President, Indoor Air Technologies Inc., Canada and USA.                                                                       |
| 1986 - 1988    | Coordinator, Indoor Air Quality, Health Canada, Environmental Health Directorate.                                              |
| 1982 - 1986    | Coordinator, Indoor Air Quality, National Research Council Canada, Division of Building Research.                              |
| 1972 - 1982    | Director, Science & Technology; Chief, Engineering Construction Research. Public Works Canada, Design and Construction Branch. |
| 1965 - 1972    | Defence Research Board Scientist, Department of National Defence, Shock and Blast Physics.                                     |

**PROFESSIONAL ASSOCIATIONS**

|                 |                                                                                   |
|-----------------|-----------------------------------------------------------------------------------|
| Founder         | International Society of Indoor Air Quality and Climate (ISIAQ).                  |
| Founding Member | International Academy for the Indoor Air Sciences (IAIAS).                        |
| Member          | American Society of Heating, Refrigerating & Air-Conditioning Engineers (ASHRAE). |
| Member          | Ontario Home Builders Association (OHBA), Technical Committee.                    |

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|-----------------|--------------------------------------------------------------------------------------------|
| Member          | Association of Professional Engineers of Ontario (APEO).                                   |
| Honorary Member | Russian Association of Heating, Ventilation and Air-Conditioning Engineers (ABOK), Moscow. |

## **SOME PROFESSIONAL CAREER HIGHLIGHTS**

### **❖ President, Indoor Air Technologies Inc, Canada and USA, 1988 to present**

- Managed over 300 indoor air quality investigations using state of the art ventilation, microbial, organic compound (VOC and SVOC), respirable particulate, and radiation data collection and analyses.
- Invented ECHO System ventilated and depressurised building envelopes. USA and Canada patents given for aspects solving moisture and soil gas problems.
- Design and commissioned ~\$3 million in building IAQ-related renovations/new construction.
- Co-invented ECHO Air ventilated, alternately pressurized and depressurised aircraft envelopes. USA patent 6,491,254, for aspects solving moisture, fire, air quality and thermal comfort problems. European and Canadian patents pending for aspects solving moisture and other problems.
- Identified environmental tobacco smoke movement from cell areas with smoking to prison guard non-smoking areas in Ontario prisons.
- Designed an air sealing/cleaning/ventilation system enabling acceptable air recirculation from rooms with tobacco smoking to rooms where smoking is not allowed.
- Managed the 5<sup>th</sup> International Conference on Indoor Air Quality & Climate, Toronto, 1990. 1300 attendees, 100 commercial exhibits and a 500 technical papers published in 5 volume series.
- Led the foundation of the International Society of Indoor Air Quality and Climate.
- Key note speaker on indoor air quality at meetings in Canada, the United States, Denmark, Germany, Belgium, UK, Sweden, Finland, Italy, Russia, Japan and China.
- Expert witness in a number of cases including: a sick building case (Ottawa, ON), ETS exposure of guards in three Ontario prisons (Toronto, Hamilton, Sault Ste. Marie), a

flight attendant's case with respect to air quality in an aircraft (Montreal), a Legionnaire's disease case (Ann Arbor, MI).

- Member of the ASHRAE committee (SPC161) developing a ventilation and indoor air quality standard for commercial passenger aircraft.

❖ **Coordinator, Indoor Air Quality, Health Canada, 1986-88**

- Issued first IAQ guidelines for residences and began guideline development for office buildings.
- Member of the ASHRAE committee that developed ventilation standard 62-1989. This standard was been used throughout the United States and Canada for over a decade.
- Managed Canada's first international conference on indoor air quality, Indoor Air Quality in Cold Climates, 1985, 300 attendees, 55-paper APCA publication.

❖ **Coordinator, Indoor Air Quality, National Research Council Canada, 1982-86**

- Started National Research Council's first indoor air quality research program, including first use of GC/MS, tandem MS, three part sorption tubes and thermal desorption for indoor air VOC analyses.
- Coordinated three NRC divisions in an indoor air quality investigation of urea formaldehyde foam insulation (UFFI).

❖ **Director, Science and Technology, Public Works Canada, 1972-1982**

- Managed development of experiments and computerized design and analysis tools for buildings, bridges, and marine structures.
- Oversaw federal building energy conservation research budget (\$7million/year).

❖ **Scientist, Defence Research Board, 1965-72**

- Conducted field trials and analysed DHH 280 superstructure under nuclear blast effects.
- Analysed Gentilly, Quebec, nuclear reactor design under a nuclear excursion.