



Indoor Air Technologies Inc.
www.indoorair.ca

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(613) 731-2559; (800) 558-5892 Canada and USA

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 and ventilation system research and development.
- ❖ Indoor air quality, soil gas and HVAC system investigations.
- ❖ 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).

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 400 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, ventilation and moisture problems. Douglas Walkinshaw of IAT has been awarded ten IAQ related patents in Canada, the USA and Europe, and has several other patents pending.

IAT organized the 5th 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 a member of the ASHRAE committee that developed the 1989 ventilation standard that remains a basis for current ASHRAE building ventilation standards. He is currently a member of ASHRAE 161P, air quality in commercial aircraft.

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, click on “Investigations” and then click on “Indoor Air Quality Investigations”.

Table I: Example Indoor Investigations

Client	Project
Association of Flight Attendants..... Washington Canadian Union of Public Employees... Toronto	Investigated and compared VOCs in high vs low occupancy density environments from offices to aircraft.
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.....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 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...Toronto	Measured environmental tobacco smoke (ETS) exposure vs. system operation in Hamilton, Sault Ste. Marie & Whitby jails.
Ontario Realty Corporation and Manage BoardToronto	Measured VOCs, SVOCs, ventilation, microbials, soil gases and entry pressures. Identified sewer gas, carpet microbial dust, carpet offgasing 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 ₂ , SO ₂ ingestion from trucks offloading at loading dock.
Public Works & Govt. Services Canada.....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.
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 and go to for example “ECHO Basement” and “ECHO Air”.

Problem

Technology

- a. Basement mold; soil gas, humidity and water entry through foundations.
- b. Winter time condensation in wall cavities in humidified buildings.
- 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.

- d. Fuselage condensation in aircraft.
- e. Electrical fires in aircraft.
- f. Thermal discomfort in aircraft.

2. Alternately pressurized and depressurised continuous air barriers preventing stack-pressure-driven air transfer across aircraft cabin liners.

- 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.

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, 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 \$2,500,000 and remedial measures totaling some \$6,000,000 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
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
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

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

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

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.

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), 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 pending for aspects solving moisture, fire, air quality and thermal comfort problems. European and Canadian patents pending for aspects solving moisture and other problems.
- 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 5th 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), two separate flight attendant flight refusals with respect to air quality in an aircraft (Montreal, Toronto), a Legionnaire's disease case (Ann Arbor, MI).

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- 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.