

# Indoor Air Quality Measurement in Government Buildings



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## Outline of Presentation...

- Introduction
- History of IAQ Measurement Services in EMSD
- The IAQ Measurement Trial Scheme
- Measurement Results of the Trial Scheme
- Certification of Government Premises under the IAQ Certification Scheme
- Measures to ensure Good IAQ



## Introduction ...

- On average we spend more than 70% of our time at homes, in offices and other indoor environment
- The quality of indoor air is therefore crucial to our health and well-being
- Good IAQ could safeguard our health, contribute to our comfort and well-being and improve the productivity of the office



## Factors Affecting IAQ ...

- Emission from building materials
- Permeability of the wall structures
- Ventilation practices and ventilation rates
- Building maintenance and cleaning habits
- Emissions from equipment
- Body effluents
- Ambient air quality



## Common Indoor Air Pollutants ...

Common Indoor Air Pollutants	Sources
Carbon Dioxide	People
Formaldehyde	Pressed wood furniture, partition, carpet, etc.
Volatile Organic Compounds	Consumer products, such as cosmetics, pesticide, cleaning agent, paints, etc.
Environmental Tobacco Smoke	Smoking
Radon	Building materials



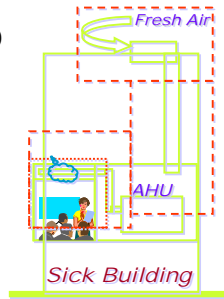
## Common Indoor Air Pollutants ...

Common Indoor Air Pollutants	Sources
Biological Contaminants	Mould growth on damp surface
Carbon Monoxide and Oxides of Nitrogen	Combustion Products
Dust and Particles	Construction site, highways, roads
Ozone	UV sources, printers, photocopiers
Asbestos	Fibrous materials



## Sick Building Syndrome ...

- Sensory (eyes, nose, throat) irritation
- Flu-like symptoms
- Chest tightness
- Itchy skin occasionally with the development of rash
- Headaches
- Lethargy
- Poor concentration
- irritability



## Building Related Illness ...

### Legionnaires Disease

- Outbreak in July 1976
- Symptoms of malaise, muscle pains, cough, breathlessness, headache and fever



## Purpose of Conducting IAQ Measurement ...

- To minimize the health effect due to poor IAQ;
- To identify the cause of IAQ problem;
- To work out effective solutions to improve the IAQ.



## History of IAQ Measurement Services in EMSD ...

- In view of growing concerns in this area, EMSD set up a dedicated team, to conduct tests on indoor air quality in 1994
- 3 chemical parameters
  - carbon dioxide (CO<sub>2</sub>);
  - respirable suspended particulates; and
  - Radon (Rn)
- 1 biological parameter
  - airborne bacteria

## Carbon Dioxide (CO<sub>2</sub>)...

- human respiratory product
- surrogate in measuring air freshness
- do not present a health risk
- mitigate by dilution
- objective : < 1,000 ppm



## Airborne Dust Particulates...

- nominal aerodynamic diameter < 10 μm
- microbial, mineral and combustion particulates
- cause nasal, eye and skin irritation
- tobacco smoke is a source
- objective : < 0.180 mg/m<sup>3</sup>



## Total Viable (Bacterial) Count...

- carried by people, soil and plant debris
- naturally higher in crowded places
- does not necessarily imply human infections
- trigger allergic reactions
- objective : < 1,000 cfu/m<sup>3</sup>



## Radon (Rn)...

- radioactive gas
- radium disintegrates radioactively in rocks
- decay to tiny radioactive particles
- mitigate by dilution
- objective : < 200 Bq/m<sup>3</sup>



## History of IAQ Measurement Services in EMSD ...



## History of IAQ Measurement Services in EMSD ...

- Together with 2 physical parameters
  - room temperature; and
  - relative humidity
- Measurement is made on a 15-minute basis with 1 sampling point per 100 - 200 m<sup>2</sup> as part of the MVAC maintenance service
- Outdoor air measurement is also carried out to provide additional information on IAQ

## History of IAQ Measurement Services in EMSD ...

- The recommended level is similar to the Good Class IAQ Objective under the IAQ Certification Scheme
- Apart from IAQ measurement, we also give recommendations for improvement when necessary in government buildings
- Prepared the necessary groundwork for the government's IAQ management programme and subsequent Certification Scheme

## IAQ Measurement Trial Scheme ...

- The Government has set up an inter-department IAQ Management Group (IAQMG) to coordinate the development on the control of IAQ in Hong Kong
- Draft Guidance Notes (GN), based on international references on IAQ, was developed by the IAQMG in November 1999
- The Indoor Air Quality (IAQ) Guidance Notes stipulate the technical requirements and the measurement criteria of 12 IAQ parameters

## IAQ Measurement Trial Scheme ...

- The Government took a lead and launched a Trial Scheme in measuring the IAQ of government buildings based on the GN's requirements
- EMSD took up this Trial Scheme in 2000
- Around 850 sampling points were examined for 72 buildings
- The number of sampling points was determined according to the type and configuration of individual building

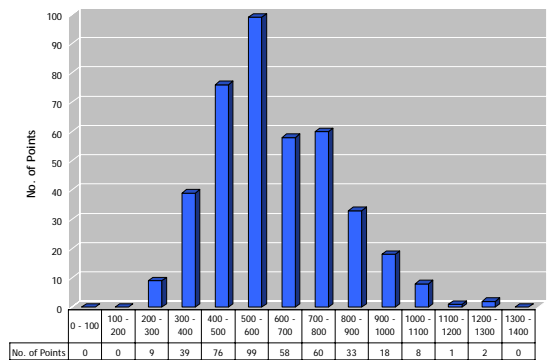
## IAQ Measurement Trial Scheme ...

- 72 government premises of various types (including both government owned and leased offices) were included in the Trial Scheme
  - Government Offices
  - Community Halls
  - Libraries
  - Games Halls
  - Hospitals and Clinics
  - Others ...

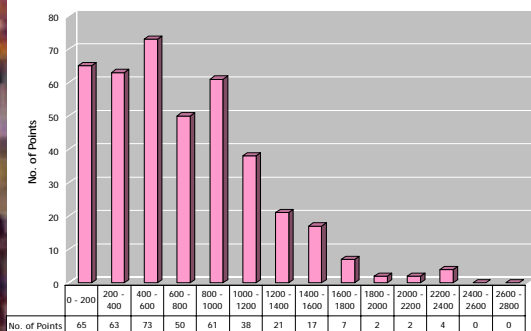
## Measurement Results of the Trial Scheme ...

- All the sample points of each of the physical parameters (viz. room temperature, relative humidity and air movement) comply with the Good Class IAQ Objectives
- For chemical and biological parameters, over 90% of the sample points comply with the Good Class IAQ Objectives
- Distribution of chemical and biological parameters for 38 nos. of government buildings

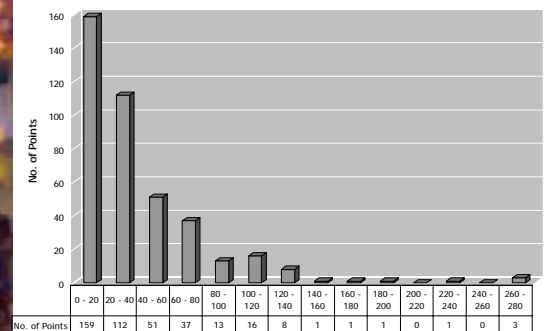
Carbon Dioxide in Government Buildings  
(measured in ppmv; GN limits: <1000 Good; <800 Excellent)

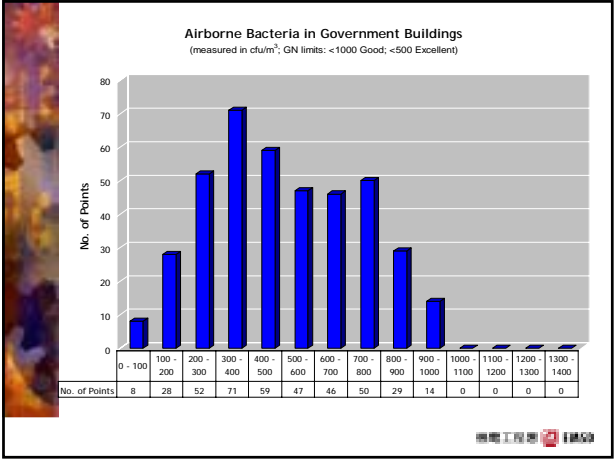
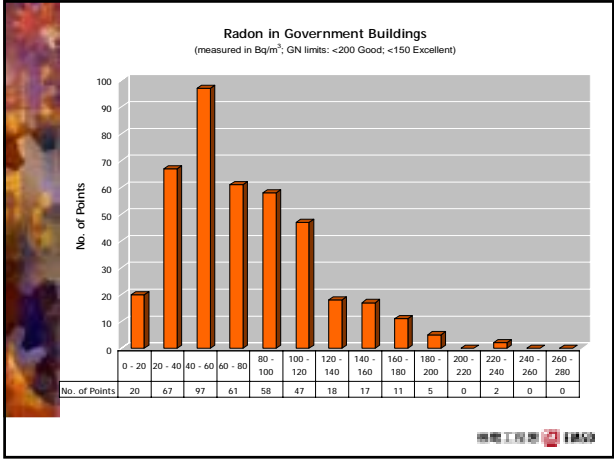
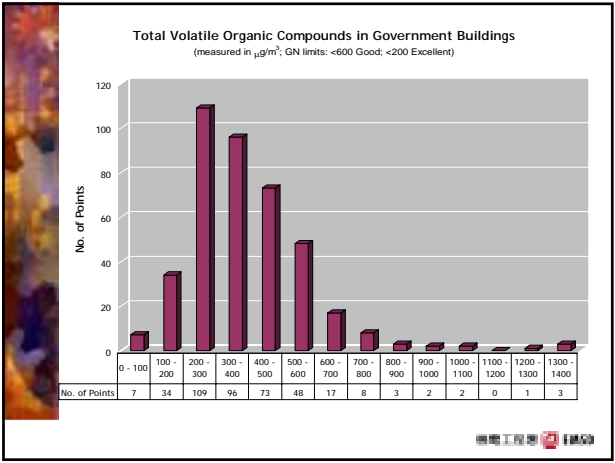
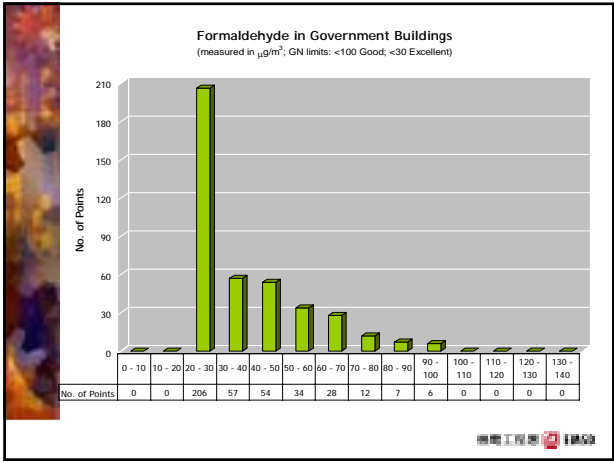
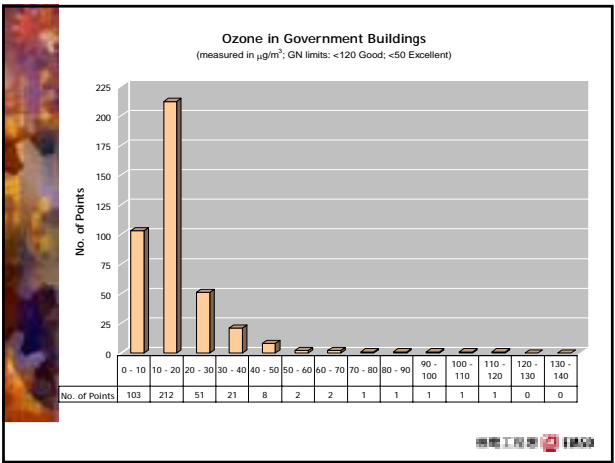
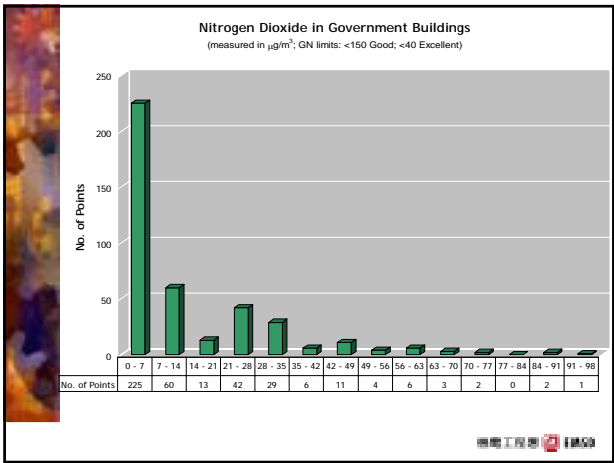


Carbon Monoxide in Government Buildings  
(measured in  $\mu\text{g}/\text{m}^3$ ; GN limits: <10000 Good; <2000 Excellent)



Respirable Suspended Particulates in Government Buildings  
(measured in  $\mu\text{g}/\text{m}^3$ ; GN limits: <180 Good; <20 Excellent)





## Certification of Government Premises under the IAQ Certification Scheme ...

- The IAQ Certification Scheme was launched in mid-September 2003
- 72 venues were measured under the Trial Scheme
  - 64 venues met the Good Class IAQ Objectives;
  - 5 venues (hospital and clinics) were not covered by the Scheme;
  - 2 venues were renovated after the measurement; and
  - 1 venue was moved

## IAQ Certification Scheme ...

- a 2-level IAQ objectives (Excellent Class and Good Class);
- a voluntary and self-regulatory approach;
- participation is free;
- the certificate is valid for 12 months;
- certification is generally made on the basis of a building as a unit.



## Indoor Air Quality Objectives for Office Buildings and Public Places ...

Parameter	Unit	8-hr average (at 25°C and 101.325 kPa)	
		Excellent	Good
Carbon Dioxide (CO <sub>2</sub> )	ppm	< 800	< 1,000
Carbon Monoxide (CO)	µg/m <sup>3</sup>	< 2,000	< 10,000
Respirable Suspended Particulates (RSP)	µg/m <sup>3</sup>	< 20	< 180
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	< 40	< 150
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	< 50	< 120
Formaldehyde (HCHO)	µg/m <sup>3</sup>	< 30	< 100
Total Volatile Organic Compounds (TVOC)	µg/m <sup>3</sup>	< 200	< 600
Radon (Rn)	Bq/m <sup>3</sup>	< 150	< 200
Airborne Bacteria	cfu/m <sup>3</sup>	< 500	< 1,000
Room Temperature	°C	20 - 25.5	< 25.5
Relative Humidity	%	40 - 70	< 70
Air movement	m/s	< 0.2	< 0.3

## IAQ Certificate ...



## Good Class Venues ...

- |  |   |  |
|--|---|--|
| <ul style="list-style-type: none"> <li>▪ 民安安全服務處總部<br/>Civil Aid Service Headquarters</li> <li>▪ 土木工程署大樓<br/>Civil Engineering Building</li> <li>▪ 機電工程署總部<br/>EMSD Headquarters 98</li> <li>▪ 機電工程署九龍工場<br/>EMSD Kowloon Workshop</li> <li>▪ 何文田政府合署<br/>Homantin Government Offices</li> <li>▪ 入境事務大樓<br/>Immigration Tower</li> <li>▪ 觀塘政府合署<br/>Kwun Tong Government Offices</li> <li>▪ 觀塘陸夫人訓練中心<br/>Lady Trench Training Centre</li> </ul> | <ul style="list-style-type: none"> <li>▪ 旺角政府合署<br/>Mongkok Government Offices</li> <li>▪ 茶具文物館<br/>Museum of Tea Ware</li> <li>▪ 工務中央試驗所大樓<br/>Public Works Central Laboratory Building</li> <li>▪ 全權政府合署<br/>Queensway Government Offices</li> <li>▪ 稅務大樓<br/>Revenue Tower</li> <li>▪ 修頓中心<br/>Southern Centre</li> <li>▪ 土瓜灣政府合署<br/>Tokwawan Government Offices</li> </ul> | <ul style="list-style-type: none"> <li>▪ 荃灣多層停車場大廈<br/>Tsuen Wan Multi-story Carpark Building</li> <li>▪ 荃灣政府合署<br/>Tsuen Wan Government Offices</li> <li>▪ 灣仔環境資源中心<br/>Wan Chai Environmental Resource Centre</li> <li>▪ 灣仔政府大樓<br/>Wanchai Tower</li> <li>▪ 水務署運作及服務中心<br/>WSD Operation and Service Centre</li> <li>▪ 油蔴地停車場大廈<br/>Yaumatei Carpark Building</li> <li>▪ 元朗政府合署<br/>Yuen Long Government Offices</li> </ul> |
|--|---|--|

## Measures to ensure Good IAQ ...

- carry out routine maintenance of MVAC systems
- clean air filters regularly
- strictly enforce non-smoking policy
- clean up water spill and report water leaks
- do not block air grilles and diffusers
- locate copiers and printers away from occupants
- develop proper house-keeping procedure

## Total IAQ Solutions by EMSD ...

Total IAQ solutions package offers customised and convenient "one-stop" IAQ services for customers to improve indoor air quality, ensuring better health, less sickness, improved efficiency and higher productivity among staff. With a total service package ranging from consultancy and advice to determine individual requirements, measuring and testing existing air quality, proposing and implementing necessary improvements to meet the IAQ objectives in Hong Kong, followed by the necessary support services, our package ensures quality environments with a minimum of fuss and hassle.



## Comprehensive IAQ Measurement Service ...

- Background information
  - Floor plan
  - Occupancy level
  - Housekeeping practices
  - HVAC system design & maintenance
- Walk-through survey
  - On-site inspection
  - Identify abnormality, e.g. any particular odours, any renovation works



## Comprehensive IAQ Measurement Service ...

- HVAC system inspection
  - Maintenance records
  - Cleanliness of plant rooms
  - Condition of air filters
- Environmental measurement
  - Air flow
  - Temperature
  - Relative Humidity
  - CO & CO<sub>2</sub>, etc.



## Comprehensive IAQ Measurement Service ...

- Finding & Conclusion
  - Gathering and analysis of all the background information, survey information and environmental measurement results
- Mitigation
  - Source control
  - Ventilation
  - Air cleaning
  - Administration measures
- Verification
  - Verify the success of the mitigation measures



## Your Partner ...

EMSTF provides the following professional IAQ services:

- Develop proper housekeeping procedures
- Conduct regular IAQ survey to minimize potential problems
- Conduct special IAQ survey to identify suspected problems



## Your Partner ...

- Provide expert advise on the impact of IAQ to your office
- Develop engineering solutions for HVAC systems to rectify IAQ problems
- Design, install and commission IAQ or air-conditioning systems for better IAQ



**More Information ...**

<http://www.emsd.gov.hk>

<http://www.iaq.gov.hk>

**thank you**