Case study on Indoor Air Quality of public offices at RIL, Jamnagar

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Reliance Industries Limited

- Reliance's Jamnagar complex represents the largest industrial project ever implemented by anyone from the Indian corporate sector.
- Situated on the northwest coast of India, the integrated refinery-cum petrochemicals complex of Reliance is located at Motikhavdi, Jamnagar District, in the state of Gujarat India.
- The complex is in proximity to the Gulf of Kutch, a sheltered bay close to the Middle-East crude oil sources.

Introduction

- The entire Jamnagar complex, consisting of manufacturing and allied facilities such as utilities , off-sites, port facilities and a township for the employees, sprawls over more than 7,500 acres.
- The public offices & control rooms are part of the industry. Office buildings are common sites of IAQ problems. Indoor Air Quality(IAQ) is important element of Occupational Health.
- IAQ measurement is to identify the concentration of contaminants which create significant health risk and potentially affect to comfort, concentration and performance of the employees.

Indoor Air Quality (IAQ)

- The quality of air inside building where people work or live.
- The attribute of the respirable atmosphere inside building including gaseous composition, humidity, temperature and contaminants.

Objective

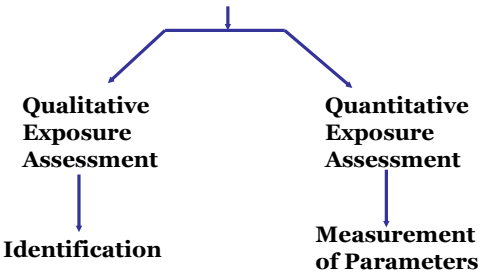
- To Identify the concentration of contaminants.
- To Identify the cause of Indoor Air Quality problem.
- To minimize the health effect due to poor IAQ.
- To work out effective solution to improve the IAQ.

Indoor Environment

- Physical factors - Temperature, Humidity & Illumination
- Chemical contaminants - Volatile Organic Compounds – paint
- Biological contaminants
  - Allergens - Dust mite, Cockroach etc.
  - Fungi - *Cladosporium*
  - Bacteria – *Legionella*

METHODOLOGY

Exposure Assessment



Walk Through Survey

- IAQ Questionnaire
- Visual Inspection / Walkthrough all workplace units
- Measurement of CO/CO_2/VOCs, Bio aerosols
- Review HVAC System design
- Evaluate effectiveness of HVAC system
- Hygienic condition of room

Questioner

1. Identification Building Location
2. Employee Name Job Title
3. Date
4. Background Information: How long have you been working for your employer? _____ Yrs
Where do you spend most of your time at work?
5. During the past three months, have the following changes taken place within 15 feet of your current workstation? Yes / No
New Carpeting Walls painted New furniture New partitions Water damage
6. How often do you use the following at work?
Several times a day About once a day 3-4 times a week < 3 times/week Never
Photocopier Laser Printer Facsimile (FAX) Cleanser, glue, correction fluid, or other strong-smelling chemical
7. Symptoms & Patterns: Check all the symptoms or discomfort you are experiencing:
Headache Blurred Vision Nausea Sinus Congestion Dizziness Difficulty in concentrating Tiredness/fatigue Pain and discomfort of: Irritation of eye, nose, throat Back
Breathing Problems Neck Coughing Hands Sneezing Wrist Wheezing Shoulders Shortness of Breath Others
8. Do you have any other health conditions that may make symptoms worse? E.g.: allergies, immune system disorders, or chronic cardiovascular or respiratory disease
9. Have you seen a doctor for these symptoms? (Do you wish to provide general details?) Yes No
10. Timing: When do you notice these symptoms and how often do they occur? On average, when you notice the symptoms, how long have you been at work?
Less than 1 hour 2-4 hours > 4 hours 1 day After_____ days
Has there been any change to the symptoms or patterns? Yes No If yes, please explain:
When do the symptoms go away? Overnight Rarely/Never After a week away
Can you provide more information? Has the pain or discomfort caused you to take time off work? Yes No
Do you know any other employees experiencing the same symptoms? Yes No If yes, can you provide more details?
11. Suspected or Potential Causes
Check any of the following that are true: Are there any unusual odors? Is the work area too warm? Does the air seem stuffy? Is the work area too cool? Is the air dry? Does the temperature vary from room to room? Is it dusty? Are there drafts where you work?

HVAC Capacity

Sr. No.	Location	Total CFM	Total Employee
1	Account & Budget	16000	90-100
2	Commercial Section	16000	70-80
3	CTS Section	16000	50-75
4	HRD Section	16000	40-50
5	RRTF Control Room	16000	30-40
6	MTF Control Room	16000	30-40
7	Aromatic Control Room (A)	42000	40-50
8	Aromatic Control Room (B)	42000	40-50

ASHRAE Std. 62-1989 (Ventilation for acceptable IAQ) 20 Cfm (Cubic feet per minute) per person

HVAC CAPACITY

Sr. No.	Location	Total CFM	Total Employee
9	CPP Control Room (1st floor)	36000	110-120
10	CPP Control Room (2nd floor)	36000	70-80
11	PP Control Room (Line A/B)	18000	80-90
12	PP Control Room (Line C/D)	18000	80-90
13	RCB control Room	24000	150-160

ASHRAE Std. 62-1989 (Ventilation for acceptable IAQ) 20 Cfm per person

IAQ Measurement

- Measurement of IAQ Parameter was done with the following instruments.

1. IAQ meter measure the CO2, RH & Temperature

2. VOC meter measure the VOC

2. Dust Sampler measure the dust exposure

Standard

	Levels	Source
Carbon Dioxide	<1000 ppm	ASHRAE
Temperature	22.7 o C to 26.1 o C (w) & 20.5 o C to 23.8 o C (s)	ASHRAE
Relative Humidity (RH)	20%-60%	ASHRAE
VOC	< 0.5 PPM	ACGIH
Dust	3 mg/m3	ACGIH
Illumination	300 lux for offices and 500 lux for control room	Indian Standard

ASHRAE – American Society of Heating Refrigerating & Air conditioning Engineers
ACGIH – American Conference of Governmental Industrial Hygienist

IAQ Monitoring Data (Jan 2010)

Sr.	Location	CO_2 level in ppm (AVG)		RH (%) - AVG		Temperature (°C) - AVG	
		High Level	Low Level	High Level	Low Level	High Level	Low Level
1	Account & Budget	811	473	56.1	47.4	23.2	22.8
		791	468	55.8	46.5	23.0	22.6
2	Commercial/CTS	767	495	58.8	46.5	24.3	23.5
		735	490	57.2	44.6	24.2	23.2
3	HRD/RCB	821	466	59.2	51.9	23.3	23.0
		797	443	59.6	52.8	23	22.6
4	Aromatic (A/B)	676	617	40.8	35.4	23.4	22.8
		634	583	45.2	36.8	23.1	22.9
5	CPP (1st floor/ 2nd floor)	672	620	47.7	39.5	24.4	24.1
		602	579	46.9	40.2	24.3	24
6	RRTF/MTF	670	612	44.5	41.3	23.4	22.7
		678	642	45.8	42.8	23.8	22.9
7	PP (Line A/B & C/D)	709	639	54.6	51.3	22.9	22.6
		693	654	59.3	52.2	23.0	22.7

IAQ Monitoring Data (April 2010)

Sr.	Location	Illumination	Dust Concentration	VOC
1	Account & Budget	342 lux & 356 lux	< 0.5 mg/m3	< 0.5 PPM
2	Commercial/ CTS	370 lux & 325 lux	< 0.5 mg/m3	< 0.5 PPM
3	HRD/RCB	302 lux & 535 lux	< 0.5 mg/m3	< 0.5 PPM
4	Aromatic (A/B)	567 lux/514 lux	< 0.5 mg/m3	< 0.5 PPM
5	CPP (1st floor/ 2nd floor)	603 lux/627 lux	< 0.5 mg/m3	< 0.5 PPM
6	RRTF/MTF	589 lux/576 lux	< 0.5 mg/m3	< 0.5 PPM
7	PP (Line A/B & C/D)	546 lux/550 lux	< 0.5 mg/m3	< 0.5 PPM

Results

- All the parameters (Carbon Dioxide, Relative Humidity, Temperature, Volatile Organic Compounds, Suspended Particulate Matter, illumination level) are within normal limits.

Quality Control

- IAQ Standard & Guideline
- Calibration of equipment by NABL accredited calibration laboratory
- Periodic monitoring (yearly schedule)
- Audit (1st party, 2nd party & 3rd party)

Prevention & Control

- A routine maintenance of HVAC systems
- Replace water-stained ceiling tiles and carpets, ceramic or hardwood flooring, proper water proofing.
- Periodical legionella monitoring
- Periodical health check up of employees
- Using pesticides in periods of low or no occupancy
- Curing - Allowing time for building material in new areas to off-gas pollutants before occupancy
- Smoking restrictions

Conclusion

- The most indoor environmental problems can be corrected easily and inexpensively through the awareness program and monitoring of indoor air quality.
- Developing a site-specific sampling and analysis plan, providing knowledge of IAQ to identifying the health symptoms should be a major focus to improve the standard of health of our employees.

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