

IMPROVEMENT IN INDOOR AIR QUALITY AND METHODS: AN ANALYTICAL STUDY

NIKHIL BHATIA^{1*}, PBL CHAURASIA², PN MATHUR¹

¹Research Scholar, Department of Civil Engineering, Suresh Gyan Vihar University, Jaipur.

²Professor, Centre of Excellence, Solar Energy Research and Utilisation, Suresh Gyan Vihar University, Jaipur.

³Associate Professor, Department of Civil, Suresh Gyan Vihar University, Jaipur.

*Corresponding Author, Email : bhatia.nikhil1991@gmail.com

Abstract : People spend their most of the time indoor either at office or at home and if the indoor environment is so polluted then there are so much health related issues such as sneezing, headache, nausea, and respiratory diseases as asthma. Green buildings have been designed, constructed and operated in such a way that there should be minimum impact on the environment. These discussions of IEQ have not included many specific recommendations for building design, construction, or operation. Almost all the projects of green buildings make reference to indoor air quality. As we talk about the rating systems the greenness of a building are based on the designs that we have made. These building features are discussed in terms of their completeness, on building design, construction for good indoor air quality. This paper has a description of all the indoor air quality features of the building which involves the ventilation and contaminant concentration measurements. For indoor environment we must provide good ventilation systems and proper design to maintain high degree of hygienic level. It also viewed the results of a large IEQ survey in buildings, comparing green with non- green buildings.

Keywords - Indoor Air Pollution, Air Fresheners, Chemical Pollutants.

INTRODUCTION

Green buildings have been described as being designed, constructed, operated, and maintained to have a minimal negative impact on the environment of the building. In terms of the global environment, this can be achieved by employing some form of environmental life-cycle assessment of all components and resources involved with constructing, operating and maintaining a building. In terms of indoor environment, this means employing building materials, maintenance products and practices, and operating strategies that provide acceptable indoor air quality (IAQ) to building occupants^[1]. The idea of providing good indoor air quality in buildings does not pertain exclusively to green buildings. 90% of our time is spent in the indoors either at homes or at offices, Therefore, it is necessary to maintain higher level of health and safety inside all types of buildings^[9]. In the last several years, it has been presumed that the air inside the buildings is more polluted than the air outside in most of the industrialized

cities^[2]. As we talk about the new buildings many new practices and techniques are used to maintain good indoor environment. But still due to poor micro climate and dusty environment the occupants do not open the windows regularly, and also the A.C. spaces are not well maintained and all these problems we have to improve it^[2,3]. As we talk about the indoor air pollution it is very necessary to identify causative agents and all the sources which generates through them. All these pollutants are caused due to combustion products used in buildings, equipment used in buildings, vehicle emissions, chemicals used in maintenance, environmental tobacco smoke and polluted outdoor air. A comprehensive study is going on considering above factors on indoor air quality and their effect on sick building syndrome.

PRESENT SCENARIO

As we talk about the present scenario of indoor air, most of the time we spent indoor either sleeping, at school or at

offices then there are many indoor air pollutants that occur inside. These pollutants come from the materials, products that we use every day. All these causes problem to breathe in the air indoors due to the pollutants.

IMPROVEMENT OF INDOOR AIR QUALITY IN HOME

There is a need to allow more air inside and humidity should be controlled for sufficient ventilation which will prevent moisture on walls and windows. One can measure humidity by using a hygrometer, if dehumidifier is required. The relative humidity which is measured in home in which we live should be below 50% in summer and 30% in winter. We need to repair faulty roofs, walls, and basements and clean watery surfaces with a detergent. Home should be regularly clean and it should be dust free.

IMPROVEMENT OF INDOOR AIR QUALITY IN OFFICE

All the air vents or grills should not be blocked in the offices and building smoking policy should be obeyed. We need to maintained water and office plants properly. All the garbage should be properly and quickly absorbed so that it is easy in throwing. All the products that could spread harmful effects into the building should be avoided. Building or facility member should be notified immediately if any indoor air quality problem is found.

CASE STUDY STATISTICS

Corporate office of Eicher Goodearth Pvt. Ltd.

The project is corporate headquarters of Eicher located in Gurgaon, Haryana. This project is contending for LEED (Leadership in Energy & Environmental Design) NC Platinum rating^[4]. It consists of 2 basements which occupied for parking area and 6 storey's at above the ground floor which is

occupied for offices. Eicher Headquarters is located in urban area of Sector 34, Gurgaon where all kind facilities are amenities are available^[4].

Points related to site : A busy bus stop is along the boundary wall of the project site, from where one can find the entire major routed to the city.

To promote habitat and natural rain water percolation, project team has dedicated 14746.5 sqft of green area within the site. All the plants used for the landscape are native to North India climate & only require first 6-8 months of watering. All open terraces and roof surfaces are covered with reflective tiles. More than 95% construction waste was diverted from landfill sites. More than 30% material (by cost) has been brought locally. More than 10% of materials have recycled content As we talk about indoor air quality in the building, special care is taken in this corporate headquarters. The whole campus has been declared as no smoking Zone as per Govt. Of India regulations. 30% extra fresh air provision has been kept for all spaces. All paints, Sealants etc used are low VOC. Temperature & Humidity is maintained throughout the year as per ASHARE 62.1 More than 75% areas have natural daylight. The building has more than 90% outside views.

● **Villa By IGBC**

This proposed villa is being developed at Noida, UP at sector 44. This villa is spread across in 300 sq meters and is structurally constructed having a basement and G+2 premises which is aspiring IGBC Green Homes Certification. Godrej and Boyce fully appreciate this excellent initiative of the project team^[5]. The owners and the users have tremendous benefits in pursuing for Green Homes Ratings such as health and safety of the building occupants, enhanced air quality,

excellent day lighting, water efficiency which saves 30% - 50% of portable water, adequate parking capacity, use of recycled materials, high efficient glazing, latest techniques and technologies used, roofing with high solar reflectance index. The proposed villa at G-98, sector 44, Noida projects is likely to get platinum rating. Features of Green Homes are roofing with high solar reflectance index or green roof; Water efficient fixtures with low flow; Designing landscaping more than 25% of the site area; All the materials used are eco-friendly; and, all adhesives, sealants, carpets and paints would meet LEED recommended permissible voc limits. As now we talk about indoor air quality in this building they have provide better ventilation, high ratio of filtered fresh air^[5].

- **TOBACCO Smoke Control**

The projects teams has confirmed that common areas would be “NO SMOKING” zone and signage would be placed at all locations to educate the building occupants and visitors.

- **Fresh Air Ventilation**

Most of the areas would be conditioned and treated fresh air would be provided to all the spaces. The design is sufficient to meet the requirements of 5cfm/person. For non air-conditioned systems, the openable windows are designed to ensure sufficient air changes per hour.

- **LOW VOC Materials**

They use the materials with low emissions to reduce health impact for building occupants. Use paint with low or no VOC content to the extent of 100% of interior wall surface area.

TECHNIQUES AND APPROACHES FUTURE

Techniques which is used provides IAQ meter i.e. indoor air quality meter which identify all

the air pollutants that is there in the buildings and this meter also find out the tobacco smokes that is in the buildings. This makes the quality of room fresh^[6]. It also easily identifies the quantity of CO, CO₂, volatile organic compounds, and humidity level from the atmosphere that generate. This meter is placed in the enclosed working space with a height of 2.2m from the ground level in order to simulate the height of the, at rest person on the chair. The occupant density was kept at zero in order to isolate the effect of pollutants. We can also provide CO₂ measurement device which can scan the quality of air in your home, offices or indoor greenhouse. When it comes to IAQ, carbon dioxide is the “canary in the mineshaft”^[7]. As CO levels rise, the total amount of volatile organic compounds and micro-organisms in the air rise too. That's why HVAC engineers use carbon dioxide level transmitters to control airflow in modern buildings^[7]. And for growing fresh air indoors inside buildings we can grow 3 varieties of plants i.e.^[8,9] The Living Room Plant i.e. **Areca Palm**; The Bedroom Plant i.e. **Mother-in-Law's Tongue and** ; The Specialist Plant i.e. **Money Plant**.^[8]

The most essential strategy for minimizing indoor air pollution is to reduce the sources of products or the materials used in the daily use. We must also provide good or adequate ventilation since it increases the amount of clean outdoor air, and removes pollutants through filtration^[10].

- **Minimize Chemical Pollutants**

Smoking inside the building or in the room should be avoided because it consists of thousands of indoor pollutants at higher concentrations which cause harmful effect in our health. Use of rough cleaner, cleaners with strong fragrances or solvent based cleaners should be minimized at any cost. All those activities which create high levels of pollution should be made outside the buildings such as paint stripping, sanding and rock polishing.

- **Keep It Clean**

To keep the indoor environment clean we should wash pillows weekly to reduce the exposure to allergies which includes dust mites. For minimizing the dust we must remove our shoes at the door and placed all the mats at all entrances to your home. And for surface dust removal use high efficiency particulate air vacuum cleaners with disposable bags.

- **Control Moisture**

We can control moisture by repairing all leaks promptly and control relative humidity levels to less than 60% by using dehumidifiers. We must run bathroom exhaust fan while showering. We must remove the water quickly and take an immediate action if we saw that there has been a flood related problem and must damp all the porous materials and furnishings used within 48 hours. If we saw that there has been a mold that enlarge on any porous materials, such as ceiling tiles or wood then it should be rejected and replace. House plants can improve the indoor air quality by filtering carbon dioxide.

- **Ensure Proper Ventilation**

We should make sure that all the mechanical filters are in place and according to manufacturer's instructions they are changed periodically. We must make use of good filtration mechanical air systems and good quality air cleaners which can control dust levels. We should also need to take care that fuel burning furnaces, fireplaces, heaters, exhaust fans and all the other appliances that are used should be vented to the outside of the buildings away from windows and all the doors should be closed for proper ventilation.

CONCLUSION

This study revealed that enclosed space may restrict the dispersion of indoor pollutants such as air fresheners, tobacco smoke etc. Indoor air quality guidance in general is challenged by the current limits of knowledge and the inability to be quantitative on all issues i.e. VOC concentration limits and emissions guidelines. Indoor air quality is an important feature in almost all discussion of green building and is featured in current green building rating systems. The opening windows which we used

in free running space would dilute the most of the indoor pollutants in the buildings. If we promote opening of windows and openings in free running ventilation, we need to provide a better micro climate with a desirable and proper tree cover outside the buildings.

ACKNOWLEDGEMENT

Author are thankful to the Indian Green Building Council for providing a platform to interact with various experts of the area. They are thankful to Ms. Dimpy Daroch who is senior executive Environmental services at SGS, Gurgaon for discussing about the various indoor air quality features and techniques for improving indoor air quality in the buildings. Also Author are thankful to Mr. Barun Aggarwal, Director of Paharpur Business Centre, he gave knowledge about various VOC and chemical pollutants which occur in the building.

REFERENCES

- [1] Ventilation for acceptable indoor air quality. Atlanta: American society of Heating, Refrigerating and Air Conditioning Engineers, ASHRAE. 1989. ANSI/ASHRAE standards62-1989.
- [2] William W. Nazaroff, Charles J. Weschler, "Cleaning products and air freshener: exposure to primary and secondary air pollutants", Atmospheric Environment Vol. 38, pp (2004) 2841-2865,
- [3] Raiph Scott, "Air Freshener, Indoor Air Quality & Federal Policy", National Healthy Homes Conference: September 15-17, 2008 in Baltimore, MD.
- [4] Romi Khosla, Volvo Eicher Headquarters, LEED rated building.
- [5] IGBC Green Home Certification, IGBC Green Landscape rating system by "Godrej".
- [6] Building air quality- A guide for building owners and facility managers. Washington, DC. US environmental Protection Agency, EPA, 1991.
- [7] Th. Lang, H.-D. Wiemhöfer and W. Göpel, "Carbonate Based CO₂ Sensors with High Performance", Conf. Proc. Eurosensors

IX, Stockholm (S) (1995); Sensors and Actuators, Vol. 34, pp. 383-387, 1996.

[8] Dimpy Daroch, 'Evaluating Indoor air quality in Existing Buildings'.

[9] Barun Aggarwal, 'Indoor Environmental Quality and Thermal Comfort in Existing

Building, IGBC (Indian Green Building Council).

[10] USGBC LEED Building rating system criteria, San Francisco: United States Green Building Council, USGBC, 1996.