5.2 SICK BUILDING SYNDROME AND BUILDING RELATED ILLNESS

The term "sick building syndrome" (SBS) is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified.

The complaints may be localized in a particular room or zone, or may be widespread throughout the building. In contrast, the term "building related illness" (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants.

Indicators of Sick Building Syndrome

- Building occupants complain of symptoms associated with acute discomfort, e.g., headache, eye, nose, or throat irritation, dry cough, dry or itchy skin, dizziness and nausea, difficulty in concentrating, fatigue, and sensitivity to odors.
- The cause of the symptoms is not known.
- Most of the complainants report relief soon after leaving the building.

Indicators of Building Related Illness:

- Building occupants complain of symptoms such as cough, chest tightness, fever, chills, and muscle aches.
- The symptoms can be clinically defined and have clearly identifiable causes.
- Complainants may require prolonged recovery times after leaving the building. It is important to note that complaints may result from other causes.

These may include an illness contracted outside the building, acute sensitivity (e.g., allergies), job related stress or dissatisfaction, and other psychosocial factors. Nevertheless, studies show that symptoms may be caused or exacerbated by indoor air quality problems.

Causes of Building Syndrome:

The following have been cited causes of or contributing factors to sick building syndrome:

1. Inadequate ventilation:

In the early and mid 1900's, building ventilation standards called for approximately 15 cubic feet per minute (cfm) of outside air for each building occupant, primarily to dilute and remove body odors. As a result of the 1973 oil embargo, however, national energy conservation measures called for a reduction in the amount of outdoor air provided for ventilation to 5 cfm per occupant. In many cases these reduced outdoor air ventilation rates were found to be inadequate to maintain the health and comfort of building occupants.

- Inadequate ventilation, which may also occur if heating, ventilating, and air conditioning (HVAC) systems do not effectively distribute air to people in the building, is thought to be an important factor in SBS.
- In an effort to achieve acceptable IAQ while minimizing energy consumption, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recently revised its ventilation standard to provide a minimum of 15 cfm of outdoor air per person (20 cfm/person in office spaces).
- Up to 60 cfm/person may be required in some spaces (such as smoking lounges) depending on the activities that normally occur in that space (see ASHRAE Standard 62-1989).

2. Chemical contaminants from indoor sources:

Most indoor air pollution comes from sources inside the building.

Example:

Adhesives, carpeting, upholstery, manufactured wood products, copy machines, pesticides, and cleaning agents may emit volatile organic compounds (VOCs), including formaldehyde.

Environmental tobacco smoke contributes high levels of VOCs, other toxic compounds, and respirable particulate matter. Research shows that some VOCs can

cause chronic and acute health effects at high concentrations, and some are known carcinogens.

Low to moderate levels of multiple VOCs may also produce acute reactions. Combustion products such as carbon monoxide, nitrogen dioxide, as well as respirable particles, can come from unvented kerosene and gas space heaters, woodstoves, fireplaces and gas stoves.

3. Chemical contaminants from outdoor sources:

The outdoor air that enters a building can be a source of indoor air pollution.

Example:

Pollutants from motor vehicle exhausts; plumbing vents, and building exhausts (e.g., bathrooms and kitchens) can enter the building through poorly located air intake vents, windows, and other openings. In addition, combustion products can enter a building from a nearby garage.

4.Biological contaminants:

- Bacteria, molds, pollen, and viruses are types of biological contaminants.
- These contaminants may breed in stagnant water that has accumulated in ducts, humidifiers and drain pans, or where water has collected on ceiling tiles, carpeting, or insulation.
- Sometimes insects or bird droppings can be a source of biological contaminants.
    - Physical symptoms related to biological contamination include cough, chest tightness, fever, chills, muscle aches
    - Allergic responses such as mucous membrane irritation and upper respiratory congestion.
    - One indoor bacterium, Legionella, has caused both Legionnaire's Disease and Pontiac Fever.
- These elements may act in combination, and may supplement other complaints such as inadequate temperature, humidity, or lighting.

- After a building investigation, however, the specific causes of the complaints may remain unknown.

Building Investigation Procedures

- The goal of a building investigation is to identify and solve indoor air quality complaints in a way that prevents them from recurring and which avoids the creation of other problems.
- To achieve this goal, it is necessary for the investigator(s) to discover whether a complaint is actually related to indoor air quality, identify the cause of the complaint, and determine the most appropriate corrective actions.
- An indoor air quality investigation procedure is best characterized as a cycle of information gathering, hypothesis formation, and hypothesis testing.
- It generally begins with a walkthrough inspection of the problem area to provide information about the four basic factors that influence indoor air quality:
  - The occupants
  - The HVAC system
  - Possible pollutant pathways
  - Possible contaminant sources.

Solutions to Sick Building Syndrome

Solutions to sick building syndrome usually include combinations of the following:

1. Pollutant source removal or modification:

Pollutant source removal or modification is an effective approach to resolving an IAQ problem when sources are known and control is feasible.

Examples:

- ❖ Include routine maintenance of HVAC systems
- ❖ Periodic cleaning or replacement of filters
- ❖ Replacement of water-stained ceiling tile
- ❖ Carpeting
- ❖ Institution of smoking restrictions

- ❖ Venting contaminant source emissions to the outdoors
- ❖ Storage and use of paints
- ❖ Adhesives
- ❖ Solvents
- ❖ Pesticides in well ventilated areas
- ❖ Use of these pollutant sources during periods of non-occupancy

- Allowing time for building materials in new or remodeled areas to off-gas pollutants before occupancy.
- Several of these options may be exercised at one time.

2. Increasing ventilation rates

- Increasing ventilation rates and air distribution often can be a cost effective means of reducing indoor pollutant levels.
- HVAC systems should be designed, at a minimum, to meet ventilation standards in local building codes.
- Many systems are not operated or maintained to ensure that these design ventilation rates are provided.
- In many buildings, IAQ can be improved by operating the HVAC system to at least its design standard, and to ASHRAE Standard 62-1989 if possible.
- When there are strong pollutant sources, local exhaust ventilation may be appropriate to exhaust contaminated air directly from the building.
- Local exhaust ventilation is particularly recommended to remove pollutants that accumulate in specific areas such as rest rooms, copy rooms, and printing facilities.

3. Air cleaning

- Air cleaning can be a useful adjunct to source control and ventilation but has certain limitations.
- Particle control devices such as :
  - ❖ The typical furnace filter are inexpensive but do not effectively capture small particles;

- ❖ High performance air filters capture the smaller,
- ❖ Respirable particles but are relatively expensive to install and operate.
- ❖ Mechanical filters do not remove gaseous pollutants.

Some specific gaseous pollutants may be removed by adsorbent beds, but these devices can be expensive and require frequent replacement of the adsorbent material. In sum, air cleaners can be useful, but have limited application.

4. Education and communication

- Education and communication are important elements in both remedial and preventive indoor air quality management programs.
- When building occupants, management, and maintenance personnel fully communicate and understand the causes and consequences of IAQ problems, they can work more effectively together to prevent problems from occurring, or to solve them if they do.