

## 5.6 CONTROL AND PREVENTIVE MEASURES OF NOISE POLLUTION

### CONTROL METHODS OF NOISE POLLUTION

The noise pollution is controlled at source, transmission path and using protection equipments.

#### 1. Control at Source

- **Reducing the noise levels from domestic sectors: –**

The domestic noise coming from radio, tape recorders, television sets, mixers, washing machines, cooking operations can be minimized by their selective and judicious operation. By usage of carpets or any absorbing material, the noise generated from felling of items in house can be minimized.

- **Maintenance of automobiles: –**

Regular servicing and tuning of vehicles will reduce the noise levels. Fixing of silencers to automobiles, two wheelers etc., will reduce the noise levels.

- **Control over vibrations: –**

The vibrations of materials may be controlled using proper foundations, rubber padding etc. to reduce the noise levels caused by vibrations.

- **Low voice speaking: –**

Speaking at low voices enough for communication reduces the excess noise levels.

- **Prohibition on usage of loud speakers: –**

By not permitting the usage of loudspeakers in the habitant zones except for important meetings / functions. Now-a-days, the urban Administration of the metro cities in India, is becoming stringent on usage of loudspeakers.

- **Selection of machinery: –**

Optimum selection of machinery tools or equipment reduces excess noise levels. For example selection of chairs, or selection of certain machinery/equipment which generate less noise (Sound) due to its superior technology etc. is also an important factor in noise minimization strategy.

- **Maintenance of machines: –**

Proper lubrication and maintenance of machines, vehicles etc. will reduce noise levels. For example, it is a common experience that, many parts of a vehicle will become loose while on a rugged path of journey. If these loose parts are not properly fitted, they will generate noise and cause annoyance to the driver/passenger. Similarly is the case of machines. Proper handling and regular maintenance is essential not only for noise control but also to improve the life of machine.

## 2. Control in the transmission path

- **Installation of barriers: –**

Installation of barriers between noise source and receiver can attenuate the noise levels.

- **Installation of panels or enclosures: –**

A sound source may be enclosed within a paneled structure such as room as a means of reducing the noise levels at the receiver. The actual difference between the sound pressure levels inside and outside an enclosure depends not only on the transmission loss of the enclosure panels but also on the acoustic absorption within the enclosure and the details of the panel penetrations which may include windows or doors. The product of frequency of interest and surface weight of the absorbing material is the key parameter in noise reduction through transmission loss.

- **Green belt development: –**

Green belt development can attenuate the sound levels. The degree of attenuation varies with species of greenbelt. The statutory regulations direct the industry to develop greenbelt four times the built-up area for attenuation of various atmospheric pollutants, including noise.

- **Using protection equipment:-**

The following are noise control techniques that have wide applications across the whole of industry. In many cases, they will produce substantial noise

reductions quickly and cheaply –with little or no effect on normal operation or use.

## **DAMPING**

Normally required on steel sheeting that will ‘ring’ when struck with a hard solid object. This is because the sheeting vibrates and resonates generating and adding to any existing noise already in evidence. This is more usually a problem with steel guards surrounding machinery and if left untreated, can considerably add to any existing noise problems.

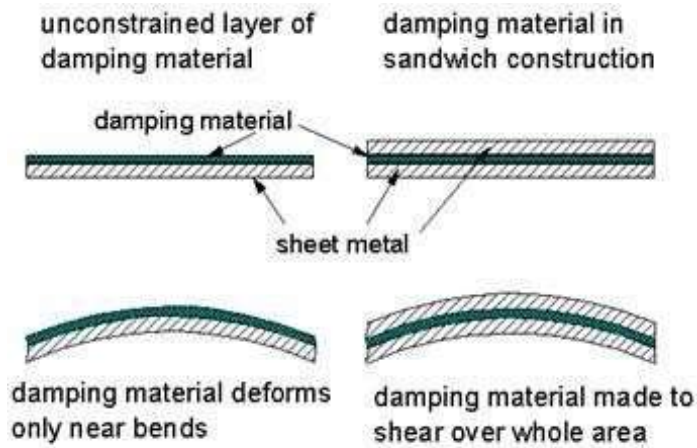
### **1. Typical applications**

- Chutes
- Hoppers
- Machine guards
- Panels
- Conveyors
- Tanks

### **2. Technique**

There are 2 basic techniques:-

- The unconstrained layer damping where a layer of bitumastic (or similar) high damping material is stuck to the surface.
- The constrained layer damping where a laminate is constructed.



**Figure 5.6.1 Damping**

[Source: [http://www.soundservice.co.uk/images/clip\\_image002\\_018.jpg](http://www.soundservice.co.uk/images/clip_image002_018.jpg)]

Constrained layer damping is more rugged and generally more effective. Either remanufactured steel (or aluminium) guards, panels or other components from commercially available sound deadened steel or buy self adhesive steel sheet. The latter can simply be stuck on to existing components (inside or outside) covering about 80% of the flat surface area to give a 5 – 25dB reduction in the noise radiated (use a thickness that is 40% to 100% of the thickness of the panel to be treated).

### **3.Limitations :**

The efficiency falls off for thicker sheets. Above about 3mm sheet thickness it becomes increasingly difficult to achieve a substantial noise reduction.

## **FAN INSTALLATIONS**

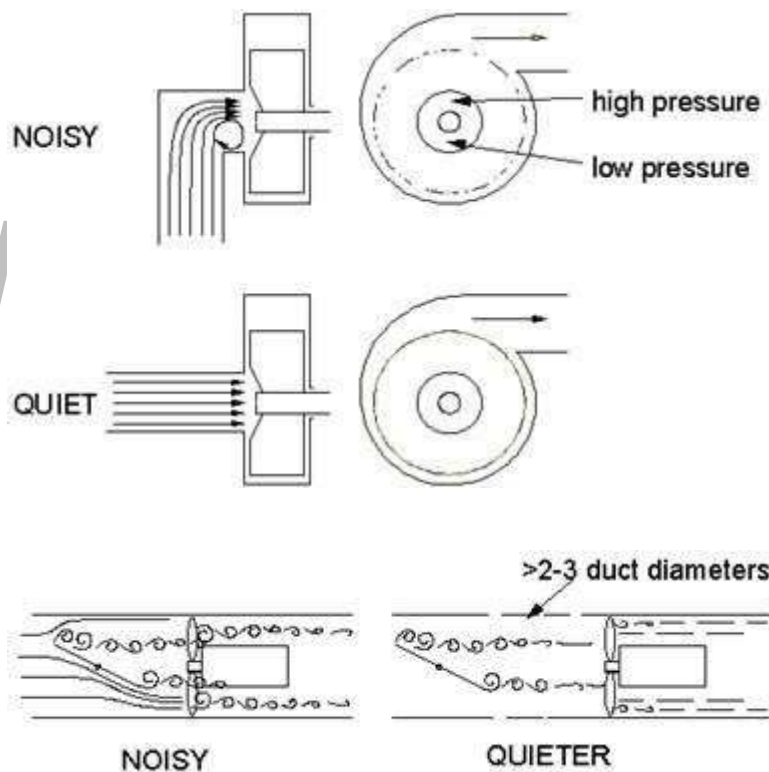
Fan noise is a common problem and can vary from small fans used to ventilate areas to much larger air movement fans often used for cooling equipment such as air conditioning plants. This article will deal with fans that rely on ducting that is more easily soundproofed.

### **1. Typical applications**

Axial flow or centrifugal fans.

## 2. Technique

- Maximum fan efficiency coincides precisely with minimum noise. Any fan installation feature that tends to reduce fan efficiency is therefore likely to increase noise.
- Two of the most common examples are bends close to the fan (intake side in particular) and dampers (close to the fan intake or exhaust).
- For maximum fan efficiency and minimum noise, make sure there is at least 2 – 3 duct diameters of straight duct between any feature that may disturb the flow and the fan itself.
- Noise reductions of 3 – 12dB are often then possible



**Figure 5.6.2 Fan Installation**

[Source:[http://www.soundservice.co.uk/images/clip\\_image004\\_001.jpg](http://www.soundservice.co.uk/images/clip_image004_001.jpg)]

## DUCTWORK

A lot of noise can break out through the walls of any uninsulated ducting as well as from any vents they may serve. Large air conditioning ducts are the main culprit and due to their thin steel walls can resonate and transmit noise along its length.

## 1. Typical applications

- Extraction
- Ventilation
- Cooling
- Openings in walls and enclosures.

## 2. Technique

- Instead of fitting silencers, it is often possible to achieve a 10 – 20dB reduction in airborne noise from a duct or opening by lining the last bend in the ductwork with non-flammable FR type acoustic absorbent foam.
- Construct a simple absorbent lined right-angled bend to fit on the opening.
- Ideally, either side of the bend should be lined along a length equivalent to twice the duct diameter.
- Where flow velocities are high ( $> 3\text{m/s}$ )
  - Consider using a film faced acoustic foam. Duct vibration can usually be treated by damping (as above).
  - To stop noise being transmitted along the steel sections of ducting, acoustic resilient duct connectors can be fitted instead of the usual rigid fixing method.

## FAN SPEED

### 1. Typical applications

Axial or centrifugal flow fans.

### 2. Technique

Fan noise is roughly proportional to the 5th power of fan speed. So in many cases it is possible to achieve a large noise reduction from a small drop in fan speed by changing control systems or pulley sizes and re-setting dampers.

The following table provides a guide to the trade-off that can be expected.

FAN SPEED REDUCTION	NOISE REDUCTION
10%	2dB
20%	5dB
30%	8dB
40%	11dB
50%	15dB

**Table 5.6.1 Fan Speed Reduction & Noise Reduction**

### **PNEUMATIC EXHAUSTS**

- A well designed silencer will not increase system back pressure.
  - Almost invariably it is possible to reduce pneumatic exhaust noise permanently by 10 – 30dB by fitting effective silencers.
  - The following are the practical points that can make the difference between success and failure.
- Back pressure : Fit a larger coupling and silencer

## 1.Clogging:

Fit a straight-through silencer that cannot clog (and has no back pressure)

## 2. Multiple exhausts :

- Manifold them into a single, larger diameter pipe fitted with the rear silencer from virtually any make of car (from your local tyre and exhaust fitter).
- Typically 25dB reduction.

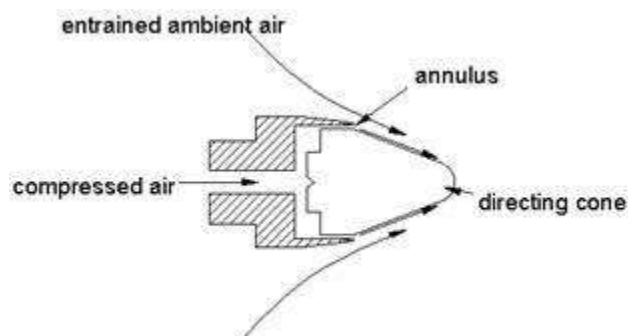
## PNEUMATIC NOZZLES

### 1. Typical applications

- Cooling
- Drying
- Blowing

### 2. Technique

- In most cases, it is possible to replace existing nozzles (usually simple copper pipe outlets) for quiet, high efficiency units.
- These not only reduce noise levels by up to 10dB, but also use less compressed air.
- The types of nozzle to look out for are entraining units (schematic below) from various manufacturers and in a variety of sizes.



**Figure 5.6.3 Pneumatic Nozzle**

[Source:[http://www.soundservice.co.uk/images/clip\\_image008.jpg](http://www.soundservice.co.uk/images/clip_image008.jpg)]



## VIBRATION ISOLATION PADS

### 1. Typical applications

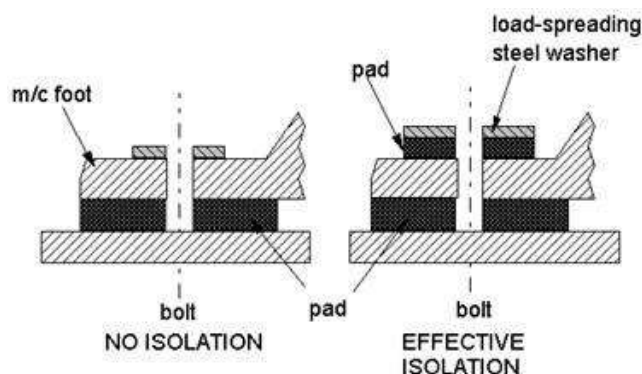
Machine feet, pumps and mezzanine installations .

### 2. Technique

Mounting motors, pumps, gearboxes and other items of plant on rubber bonded cork or rubber Anti-vibration pads can be a very effective way of reducing transmission of vibration and therefore noise radiated by the rest of the structure.

This is particularly the case where vibrating units are bolted to steel supports or floors. However, a common error with the use of these pads is for the bolt to "short-circuit" the pad, resulting in no isolation.

- Additional resilient pads must be fitted under the bolt heads as shown below to stop any fixing bolts from bridging any other form of isolation.
- There are many types of off-the-shelf anti-vibration mounts available, for instance rubber/neoprene or spring types.
- The type of isolator that is most appropriate will depend on, among other factors, the mass of the plant and the frequency of vibration to be isolated.
- Any supplier of anti-vibration mounts will be able to advise you on this.



## **Figure 5.6.4 Vibration isolation pads**

[Source:[http://www.soundservice.co.uk/images/clip\\_image010.jpg](http://www.soundservice.co.uk/images/clip_image010.jpg)]

### **EXISTING MACHINE GUARDS**

#### **1. Technique**

The existing guards on many machines can often be improved to provide a significant noise reduction. The two principles involved, which must be used in combination, are:-

##### **(i) Minimize gaps**

Reducing by half the “gap” open area in a set of guards can reduce the noise by 3dB. If you can reduce the openings (flexible seals, additional close fitting panels etc) by 90%, then a 10dB noise reduction is possible.

##### **(ii) Acoustic absorbent**

Lining a significant proportion of the inside of the guards with sound absorbing foam will reduce the noise “trapped” by the guards. Consequently, less noise will escape through any gaps. Failure to line the inside of the guards could result in an increase in noise at the operator’s position if the gaps have been minimised as in (i) above.

##### **(iii) Eliminate rattles**

It is important that any guards or screening of machinery is tight and does not rattle because if left untreated can substantially add to the levels of noise pollution an operator and nearby personnel can be subjected to. Large thin panels may also resonate (vibrate) and this will also contribute to noise pollution. Panels such as this can be stiffened as described in the first chapter at the start of this document.

In the first two cases, both sets of modifications can be tested in mock-up form using cardboard (and wide tape) to extend the guarding and temporarily fitting areas of acoustic foam inside. Not only does this process help with the practical aspects (access, visibility etc), but it usually also provides a very good indication of the noise reduction that can be expected. Very “Blue Peter” but very effective. Guard vibration radiated as noise can also be treated via damping (as detailed at the beginning)

## **PREVENTIVE MEASURES**

- Construction of soundproof rooms for noisy machines in industrial and manufacturing installations must be encouraged.
- This is also important for residential building noisy machines should be installed far from sleeping and living rooms, like in a basement or garage.
- Use of horns with jarring sounds, motorbikes with damaged exhaust pipes, noisy trucks to be banned.
- Noise producing industries, airports, bus and transport terminals and railway stations to be sighted far from where living places.
- Community law enforcers should check the misuse of loudspeakers, worshipers, outdoor parties and discos, as well as public announcements systems.
- Community laws must silence zones near schools / colleges, hospitals etc.
- Vegetation (trees) along roads and in residential areas is a good way to reduce noise pollution as they absorb sound.

## 5.4 MEASUREMENT OF NOISE POLLUTION

Noise assessment is an examination of the nature and characteristics of a noise. It may involve verifying aural factors such as:

- The location of the noise source
- Its audibility at certain locations
- The time of the noise is made and its duration
- Its characteristics
- The reported effect it has on people A.

### **Duration of noise test for intruder alarms:**

- It does not matter whether the alarm sounds continuously or intermittently.

### **Example:**

A car alarm that sounds for 30 seconds , stops for 1 minute and then sounds again for another 30 seconds is taken to sound for 60 seconds, which is more than the 45 seconds prescribed for a vehicle alarm manufactured on or after 1 September 1997.

- For building intruder alarms, the assessment needs to be made inside a habitable room in a neighbor's residence. For vehicle intruder alarms the assessment can be made anywhere.
- The times of use or duration of the noise automatically make the noise offensive
- In other cases, it will be necessary to consider a range of factors to determine whether the noise is offensive, including the following:
  - The loudness of the noise, especially compared with other noise in the area
  - The character of the noise
  - The time and duration of the noise
  - Whether the noise is typical for the area
  - How often the noise occurs
  - The number of people affected by the noise

## Assessing noise with a sound level meter

- A sound level meter should be used to measure noise levels when:
  - Determining an acceptable noise level for inclusion in a planning approval or a Noise Control Notice or Prevention Notice
  - Testing whether a particular noise complies with a level prescribed in a planning approval or notice
- Gathering evidence to support an offensive noise test, such as :
  - Quantifying how loud the noise
  - Assessing how loud it is relative to the background noise
  - Determining the presence of annoying characteristics such as tones supporting a prosecution or disputed Penalty Notice.

### 1. Intrusive noise

- Noise is identified as 'intrusive' if it is noticeably louder than the background noise and considered likely to disturb or interfere with those who can hear it.
- Councils may have local policies about what they consider constitutes intrusive noise from specified activities in particular situations or locations.
- In these circumstances, it may be council policy that a particular intrusive noise is treated as offensive.
- It is into account the factors in the offensive noise checklist when setting local intrusive noise levels and descriptors.
- In the absence of a council policy, intrusive noise would not automatically be considered offensive.

### 2. Measuring noise

Noise measurements should be undertaken by officers properly trained to use noise equipment.

- If you are inexperienced with noise measurements, it is desirable that you get to know what typical decibel levels sound like.
- Become familiar with the sound level meter and its controls.
- Decide when the noise is representative of the worst case level of noise from the source or activity being investigated and take measurements at this time.

- Avoid taking measurements when it is raining or the average wind speed exceeds 5 metres per second at microphone height.
- Calibrate the sound level meter before and after each set of noise measurements
- Ensure the sound level meter is in the correct position.
- Measure the noise under investigation for long enough to establish that the measured value is representative of the subject noise.
- Measure the noise at the location where the impact occurs.
- When the noise under investigation is affected by extraneous noise be sure that the subject noise is what you are measuring.
- Use correction factors.

### **Sequence of steps for measuring noise**

- Before going out to take a measurement, check that the sound level meter has a current calibration certificate issued by an accredited laboratory (for example, NATA).
- Familiarise yourself with the meter and its settings.
  - Select a representative location and time of day to take measurements, taking into account information about the subject noise and any complaints received.
  - Set the microphone at 1.2 to 1.5 metres above the ground and, where feasible, avoid measurements within 3 metres of any walls, buildings and other reflecting surfaces.
  - Ensure weather conditions are suitable: no rain and a wind speed of less than 5 m/s and note these prevailing conditions in a log book.
- Do a field calibration of the sound level meter .
  - Measure the subject noise for a pre-determined period (such as 15 minutes) and check that the selected descriptor (for example LAeq) is suitable.
  - If there is variation in the source noise level during the set period of measurement, increase your confidence in the value being representative of the worst case by taking a second and perhaps a third reading for the same period of time.

- If necessary, measure the LA90 background noise level for the same set period in the absence of the subject noise.
- Where noise other than that under consideration occurs during measurement, take another reading to avoid the readings being contaminated.
- At the end of the measurements do another field calibration of the sound level meter.
  - If there is more than a 1 decibel variation between the calibrated level and the first calibrated level, the measurements may be invalid, in which case the measurement procedure will need to be repeated.
- Document observations of weather and noise that were heard during the measurements, including the time of specific events that may affect readings, such as a frog croaking or a dog barking.

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## 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.

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### 5.3 NOISE POLLUTION

- Noise Pollution takes place when there is either an excessive amount of noise or an unpleasant sound that causes a temporary disruption in the natural balance.
- This definition is usually applicable to sounds or noises that are unnatural in either their volume or their production.
- Our environment is such that it has become difficult to escape the noise. Even electrical appliances at home have a constant hum or beeping sound.
- By and large, lack of urban planning increases the exposure to unwanted sounds. This is why understanding noise pollution is necessary to curb it in time.



**Figure 5.3.1 Noise Pollution**

[Source:<http://cpbenvi.nic.in/noisepollution/noise.png>]

#### **Definition:**

Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms.

According to the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, regardless of how long or consistent the exposure is.

- Exposure for more than 8 hours to constant noise beyond 85 dB may be hazardous.

- If you work for 8 hours daily in close proximity to a busy road or highway, you are very likely exposed to traffic noise pollution around 85dB

## Types of Noise Pollution

There are two primary types of noise.

### ➤ **Man-Made Noise :**

This refers to the noise created due to man-made activities. It can be anything from construction work, noise from the air, vehicular traffic, household noise, noise from pubs and bars, to name a few. Ranging from 30 to a whopping 140 dB, this form of noise is extremely harmful to humans.

### ➤ **Environmental Noise :**

Environmental Noise refers to the kind of noise occurring from a range of environmental activities. This can be anything from the mating call of animals to the sound of thunderstorms that often go up to 140 dB.

## Source of Noise Pollution:

Multiple causes may attribute to noise pollution. Some of the most popular causes are listed below.

### 1. Industrialization

- Most of the industries use big machines which are capable of producing a large amount of noise.
- Apart from that, various equipment like compressors, generators, exhaust fans, grinding mills also participates in producing big noise.
- You're probably familiar with the sight of workers in these factories and industries wearing earplugs to minimize the effect of noise.
- However, even after taking precautionary measures like these, extensive exposure to high levels of noise might damage their hearing abilities in the long run.

## 2. Poor Urban Planning

- In most of the developing countries, poor urban planning also plays a vital role.
- Congested houses, large families sharing small space, fight over parking, frequent fights over basic amenities lead to noise pollution, which may disrupt the environment of society.
- Noise pollution in urban settings may also be caused when residential properties and industrial buildings are in proximity. In situations like these, the noise from the nearby industrial property might hinder the basic well-being of the individuals living in residential properties.
- It doesn't just affect their sleep and hours of rest but also has an adverse effect on the development and well-being of children.

## 3. Social Events

- Noise is at its peak in most of the social events.
- Whether it is marriage, parties, pub, disc or place of worship, people normally flout rules set by the local administration and create a nuisance in the area.
- People play songs on full volume and dance till midnight, which makes the condition of people living nearby pretty worse.
- In markets, you can see people selling clothes via making a loud noise to attract the attention of people.
- While this may not seem like much at the outset, over time, it affects the hearing abilities of the individuals who are constantly exposed to these sounds.

## 4. Transportation

- A large number of vehicles on roads, airplanes flying over houses, underground trains produce heavy noise, and people find it difficult to get accustomed to that.
- The high noise leads to a situation where in a normal person loses the ability to hear properly.



- Under construction activities like mining, construction of bridges, dams, buildings, stations, roads, flyovers takes place in almost every part of the world.
- These construction activities take place every day as we need more buildings, bridges to accommodate more people.
- However, while this does help us to some degree, in the long run, the noise from construction activities hinders the hearing abilities of individuals exposed to this sound.
- A part of it includes construction workers who participate in these activities, while another part of it consists of people who encounter these noise either from their homes or while traveling.

## 6. Household Chores

- People are surrounded by gadgets and use them extensively in our daily life.
- Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are minor contributors to the amount of noise that is produced. Still, it affects the quality of life of your neighborhood in a bad way.
- This form of pollution may seem harmless, it, in fact, has far-reaching consequences.
- The adverse effects on the health of the environment are quite severe. Not only is the local wildlife affected by pollution, but humans also face a number of problems due to it.

## 7. Noise from Air Traffic

- While many find it difficult to believe, air traffic too contributes to significant levels of noise pollution. Noise from a single aircraft may produce sounds of up to 130 dB.

Now, imagine the amount of noise produced by the numerous aircraft traveling ourairspace

### **8. 8. Catering and Nightlife**

- When the weather is good, restaurants, bars, and terraces spill outside.
- Late night parties continue with loud music and unnecessary noise made by the party mongers. These can produce more than 100 dB.
- The noise from pubs and clubs are also included.

### **9. Animals' Sound**

- The noise made by animals cannot go unnoticed, particularly a howling or barking dog. These can produce noise around 60-80 dB.

## **Effects of Noise Pollution on human health**

### **1. Hearing Problems**

- Any unwanted sound that our ears have not been built to filter can cause problems within the body. Our ears can take in a certain range of sounds without getting damaged.
- Man-made noises such as jackhammers, horns, machinery, airplanes, and even vehicles can be too loud for our hearing range.
- Constant exposure to loud levels of noise can easily result in the damage of our eardrums and loss of hearing, causing tinnitus or deafness.

- It also reduces our sensitivity to sounds that our ears pick up unconsciously to regulate our body's rhythm.

## **2. Psychological Issues**

- Excessive noise pollution in working areas such as offices, construction sites, bars and even in our homes can influence psychological health.
- Studies show that the occurrence of aggressive behavior, disturbance of sleep, constant stress, fatigue, depression, anxiety, hysteria and hypertension in humans as well as animals can be linked to excessive noise levels.

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The level of irritation increases with increased noise, and people tend to become less and less patient. These, in turn, can cause more severe and chronic health issues later in life.

### **3. Physical Problems**

- Noise pollution can cause headaches, high blood pressure, respiratory agitation, racing pulse, and, in exposure to extremely loud, constant noise, gastritis, colitis and even heart attacks may occur.

### **4. Cognitive Issues & Behavioral Changes**

- Noise affects brain responses and people's ability to focus, which can lead to low-performance levels over time. Like other sound waves, too much noise when it goes to the brain leads to lower response rates as well as making the mind dull.
- It is also poor for memory, making it hard to study. The studies have shown that school children living near railway stations or airports have problems in learning.
- Research has shown that people who live near airports or busy roads, usually have a higher incidence of headaches, take more sleeping pills and sedatives, are more prone to minor accidents, and are more likely to seek psychiatric treatment.

### **5. Sleeping Disorders**

- While it may not seem like much at this point, excessively high levels of noise are likely to hamper your sleeping pattern, thereby leading to irritation and uncomfortable situations.
- Without a good night's sleep, you might experience multiple problems related to fatigue. This will affect your performance in the office as well as at home.
- It is therefore recommended to take a sound sleep to give your body proper rest.
- If a certain noise is disturbing your sleep, take an actionable measure to reduce it. While in some instances, it is completely unavoidable; there are other instances (like noise from TV or gadgets) that can be easily avoided by making good lifestyle changes.

- Interestingly, our ears need rest for 16 hours and even more to make up for two hours of exposure to 100 dB.

## **6. Cardiovascular Issues**

- Blood pressure levels, cardiovascular disease, and stress-related heart problems are on the rise.
- Studies suggest that high-intensity noise causes high blood pressure and increases heartbeat rate as it disrupts the normal blood flow.
- Since bringing these rates to a manageable level depends on our understanding of noise pollution, we need to be wary of the ill-effects and tackle these situations mindfully.

## **7. Trouble Communicating**

- High decibel noise can put trouble and affect free communication between people.
- This may lead to misunderstanding, and you may get difficult understanding the other person.
- Constant sharp noise can give you a severe headache and disturb your emotional balance.

## **Effects of noise pollution on Wildlife**

- Wildlife faces far more problems than humans because of noise pollution since they are more dependent on sound.
- Animals develop a better sense of hearing than us since their survival depends on it.
- A recent study published in Biology Letters found that human-created noise affects a wide range of animals.
- The ill-effects of excessive noise begin at home.
- Pets react more aggressively in households where there is constant noise.

- They become disoriented more easily and face many behavioral problems. In nature, animals may suffer from hearing loss, which makes them easy prey and leads to dwindling populations. Others become inefficient at hunting, disturbing the balance of the eco-system.
- Other than marine life, land animals are also affected by noise pollution in the form of traffic, firecrackers etc., and birds are especially affected by the increased air traffic.

### **Effects of Noise Pollution on Marine Life**

- Our oceans are no longer quiet.
- Thousands of oil drills, sonars, seismic survey devices, coastal recreational watercraft and shipping vessels are now populating our waters, and that is a serious cause of noise pollution for marine life.
- Whales are among the most affected, as their hearing helps them orient themselves, feed and communicate.
- Noise pollution thus interferes with cetaceans' (whales and dolphins) feeding habits, reproductive patterns and migration routes, and can even cause hemorrhage and death.

### **Solutions for Noise Pollution:**

- Planting bushes and trees in and around sound generating sources is an effective solution for noise pollution.
- Regular servicing and tuning of automobiles can effectively reduce the noise pollution.
- Buildings can be designed with suitable noise absorbing material for the walls, windows, and ceilings.
- Workers should be provided with equipments such as ear plugs and earmuffs for hearing protection.

- Similar to automobiles, lubrication of the machinery and servicing should be done to minimize noise generation
- Soundproof doors and windows can be installed to block unwanted noise from outside.
- Regulations should be imposed to restrict the usage of play loudspeakers in crowded areas and public places.
- Factories and industries should be located far from the residential areas.

#### Solutions for Noise Pollution

- Community development or urban management should be done with long- term planning, along with an aim to reduce noise pollution.
- Social awareness programs should be taken up to educate the public about the causes and effects of noise pollution.

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## 5.1 SOURCES, TYPES AND CONTROL OF INDOOR AIR POLLUTANTS

According to EPA, scientific evidence has indicated that the air within homes and other buildings can be more seriously polluted than the outdoor air in even the largest and most industrialized cities. Other research indicates that people spend approximately 90 percent of their time indoors. Thus, for many people, the risks to health may be greater due to exposure to air pollution indoors than outdoors.

Effects may show up after a single exposure or repeated exposures. These include irritation of the eyes, nose and throat, headaches, dizziness, and fatigue. Such immediate effects are usually short-term and treatable. Sometimes the treatment is simply eliminating the person's exposure to the source of the pollution, if it can be identified.

- Other health effects may show up either years after exposure has occurred or only after long or repeated periods of exposure.
- These effects, which include some respiratory diseases, heart disease and cancer, can be severely debilitating or fatal.
- It is important to try to improve the indoor air quality in your home even if symptoms are not noticeable.

### 1. Asbestos

Asbestos is a mineral fiber that occurs in rock and soil. Because of its fiber strength and heat resistance it has been used in a variety of building construction materials for insulation and as a fire-retardant. Asbestos has been used in a wide range of manufactured goods, mostly in:

- Building materials
  - ✚ Roofing shingles
  - ✚ Ceiling and floor tiles
  - ✚ Paper products
  - ✚ Asbestos cement products
- Friction products



- ✚ Automobile clutch
  - ✚ Automobile brake
  - ✚ Transmission parts
- Heat-resistant fabrics
  - Packaging
  - Gaskets
  - Coatings

Elevated concentrations of airborne asbestos can occur after asbestos-containing materials are disturbed by cutting, sanding or other remodeling activities. Improper attempts to remove these materials can release asbestos fibers into the air in homes, increasing asbestos levels and endangering people living in those homes.

## 2. Biological contaminants

- Some biological contaminants trigger allergic reactions, including:
  - Hypersensitivity Pneumonitis
  - Allergic rhinitis
  - Some types of asthma
- Infectious illnesses, such as influenza, measles and chicken pox are transmitted through the air. Molds and mildews release disease-causing toxins.
- Symptoms of health problems caused by biological pollutants include:
  - Sneezing
  - Watery eyes
  - Coughing
  - Shortness of breath
  - Dizziness
  - Lethargy
  - Fever
  - Digestive problems

Allergic reactions occur only after repeated exposure to a specific biological allergen. However, that reaction may occur immediately upon re-exposure or after

multiple exposures over time. As a result, people who have noticed only mild allergic reactions, or no reactions at all, may suddenly find themselves very sensitive to particular allergens.

Some diseases, like humidifier fever, are associated with exposure to toxins from microorganisms that can grow in large building ventilation systems. However, these diseases can also be traced to microorganisms that grow in home heating and cooling systems and humidifiers.

Children, elderly people and people with breathing problems, allergies, and lung diseases are particularly susceptible to disease-causing biological agents in the indoor air.

Mold, dust mites, pet dander and pest droppings or body parts can trigger asthma. Biological contaminants, including molds and pollens can cause allergic reactions for a significant portion of the population. Tuberculosis, measles, staphylococcus infections, Legionella and influenza are known to be transmitted by air.

### **Reducing Exposure to Biological Contaminants:**

General good housekeeping, and maintenance of heating and air conditioning equipment, are very important. Adequate ventilation and good air distribution also help. The key to mold control is moisture control. If mold is a problem, clean up the mold and get rid of excess water or moisture. Maintaining the relative humidity between 30% - 60% will help control mold, dust mites and cockroaches. Employ integrated pest management to control insect and animal allergens. Cooling tower treatment procedures exist to reduce levels of Legionella and other organisms.

- **Install and use exhaust fans that are vented to the outdoors in kitchens and bathrooms and vent clothes dryers out doors.**

These actions can eliminate much of the moisture that builds up from everyday activities. There are exhaust fans on the market that produce little noise, an important consideration for some people. Another benefit to using kitchen and bathroom exhaust fans is that they can reduce levels of organic pollutants that vaporize from hot water used in showers and dishwashers.

➤ **Ventilate the attic and crawl spaces to prevent moisture build-up.**

Keeping humidity levels in these areas below 50 percent can prevent water condensation on building materials.

➤ **If using cool mist or ultrasonic humidifiers, clean appliances according to manufacturer's instructions and refill with fresh water daily.**

Because these humidifiers can become breeding grounds for biological contaminants, they have the potential for causing diseases such as hypersensitivity pneumonitis and humidifier fever. Evaporation trays in air conditioners, dehumidifiers and refrigerators should also be cleaned frequently.

➤ **Thoroughly clean and dry water-damaged carpets and building materials (within 24 hours if possible) or consider removal and replacement.**

Water-damaged carpets and building materials can harbor mold and bacteria. It is very difficult to completely rid such materials of biological contaminants.

➤ **Keep the house clean. House dust mites, pollens, animal dander and other allergy-causing agents can be reduced, although not eliminated, through regular cleaning.**

People who are allergic to these pollutants should use allergen-proof mattress encasements, wash bedding in hot (130° F) water and avoid room furnishings that accumulate dust, especially if they cannot be washed in hot water. Allergic individuals should also leave the house while it is being vacuumed because vacuuming can actually increase airborne levels of mite allergens and other biological contaminants. Using central vacuum systems that are vented to the outdoors or vacuums with high efficiency filters may also be of help.

➤ **Take steps to minimize biological pollutants in basements.**

Clean and disinfect the basement floor drain regularly. Do not finish a basement below ground level unless all water leaks are patched and outdoor ventilation and adequate heat to prevent condensation are provided. Operate a dehumidifier in the basement if needed to keep relative humidity levels between 30 - 50 percent.

### 3. Carbon Monoxide

#### Sources of CO include:

- + Unvented kerosene and gas space heaters
- + Leaking chimneys and furnaces
- + Back-drafting from furnaces, gas water heaters, wood stoves and fireplaces
- + Gas stoves
- + Generators and other gasoline powered equipment
- + Automobile exhaust from attached garages
- + Tobacco smoke
- + Auto, truck, or bus exhaust from attached garages, nearby roads, or parking areas
- + Incomplete oxidation during combustion in gas ranges, and unvented gas or kerosene heaters
- + Worn or poorly adjusted and maintained combustion devices (e.g., boilers, furnaces)
- + If the flue is improperly sized, blocked or disconnected
- + If the flue is leaking

#### Health Effects Associated with Carbon Monoxide :

- At low concentrations:
  - + Fatigue in healthy people
  - + Chest pain in people with heart disease
- At moderate concentrations:
  - + Angina
  - + Impaired vision
  - + Reduced brain function
- At higher concentrations:
  - + Impaired vision and coordination
  - + Headaches
  - + Dizziness

## Confusion

Nausea

- Flu-like symptoms that clear up after leaving home
- Fatal at very high concentrations

Acute effects are due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake.

At low concentrations, fatigue in healthy people and chest pain in people with heart disease. At higher concentrations, impaired vision and coordination; headaches; dizziness; confusion; nausea. Can cause flu-like symptoms that clear up after leaving home. Fatal at very high concentrations. Acute effects are due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake. At moderate concentrations, angina, impaired vision, and reduced brain function may result. At higher concentrations, CO exposure can be fatal.

### Steps to Reduce Exposure to Carbon Monoxide

It is most important to be sure combustion equipment is maintained and properly adjusted. Vehicular use should be carefully managed adjacent to buildings and in vocational programs. Additional ventilation can be used as a temporary measure when high levels of CO are expected for short periods of time.

- Keep gas appliances properly adjusted.
- Consider purchasing a vented space heater when replacing an unvented one.
- Use proper fuel in kerosene space heaters.
- Install and use an exhaust fan vented to outdoors over gas stoves.
- Open flues when fireplaces are in use.
- Choose properly sized wood stoves that are certified to meet EPA emission standards. Make certain that doors on all wood stoves fit tightly.
- Have a trained professional inspect, clean and tune-up central heating system (furnaces, flues and chimneys) annually.
- Repair any leaks promptly.

Do not idle the car inside garage.

#### **4. Lead**

Lead has long been recognized as a harmful environmental pollutant. Lead is particularly dangerous to children because their growing bodies absorb more lead than adults do and their brains and nervous systems are more sensitive to the damaging effects of lead. Babies and young children can also be more highly exposed to lead because they often put their hands and other objects that can have lead from dust or soil on them into their mouths. Children may also be exposed to lead by eating and drinking food or water containing lead or from dishes or glasses that contain lead, inhaling lead dust from lead-based paint or lead-contaminated soil or from playing with toys with lead paint. Before it was known how harmful lead could be, it was used in paint, gasoline, water pipes, and many other products.

Old lead-based paint is the most significant source of lead exposure in the U.S. today. Harmful exposures to lead can be created when lead-based paint is improperly removed from surfaces by dry scraping, sanding, or open-flame burning. High concentrations of airborne lead particles in homes can also result from lead dust from outdoor sources, including contaminated soil tracked inside, and use of lead in certain indoor activities such as soldering and stained-glass making.

#### **5. Nitrogen Dioxide:**

##### **Sources of Nitrogen Dioxide**

- The primary sources indoors are combustion processes, such as:
  - ✚ Unvented combustion appliances, e.g. gas stoves
  - ✚ Vented appliances with defective installations
  - ✚ Welding
  - ✚ Tobacco smoke
  - ✚ Kerosene heaters.

## Health Effects Associated with Nitrogen Dioxide :

- NO<sub>2</sub> acts mainly as an irritant affecting the mucosa of the eyes, nose, throat and respiratory tract.
- Extremely high-dose exposure (as in a building fire) to NO<sub>2</sub> may result in pulmonary edema and diffuse lung injury.
- Continued exposure to high NO<sub>2</sub> levels can contribute to the development of acute or chronic bronchitis.
- Low level NO<sub>2</sub> exposure may cause:
  - ✚ Increased bronchial reactivity in some asthmatics
  - ✚ Decreased lung function in patients with chronic obstructive pulmonary disease
  - ✚ Increased risk of respiratory infections, especially in young children

## Steps to Reduce Exposure :

- ✚ Venting the NO<sub>2</sub> sources to the outdoors, and assuring that combustion appliances are correctly installed, used and maintained are the most effective measures to reduce exposures.
  - ✚ (These are the same steps as those used to reduce exposure to carbon monoxide).
  - ✚ Keep gas appliances properly adjusted.
  - ✚ Consider purchasing a vented space heater when replacing an un-vented one.
  - ✚ Use proper fuel in kerosene space heaters.
  - ✚ Install and use an exhaust fan vented to outdoors over gas stoves.
  - ✚ Open flues when fireplaces are in use.
  - ✚ Choose properly sized wood stoves that are certified to meet EPA emission standards. Make certain that doors on all wood stoves fit tightly.
- Have a trained professional inspect, clean and tune-up central heating system (furnaces, flues and chimneys) annually. Repair any leaks promptly.

- ✚ Do not idle the car inside garage.

## 6. Pesticides

Pesticides are chemicals that are used to kill or control pests which include bacteria, fungi and other organisms, in addition to insects and rodents. Pesticides are inherently toxic.

According to a recent survey, 75 percent of U.S. households used at least one pesticide product indoors during the past year. Products used most often are insecticides and disinfectants. Another study suggests that 80 percent of most people's exposure to pesticides occurs indoors and that measurable levels of up to a dozen pesticides have been found in the air inside homes.

The amount of pesticides found in homes appears to be greater than can be explained by recent pesticide use in those households; other possible sources include:

- ❖ Contaminated soil or dust that floats or is tracked in from outside
- ❖ Stored pesticide containers
- ❖ Household surfaces that collect and then release the pesticides
- ❖ Pesticides used in and around the home include products to control:
  - ✚ Insects (insecticides)
  - ✚ Termites (termiticides)
  - ✚ Rodents (rodenticides)
  - ✚ Fungi (fungicides)
  - ✚ Microbes (disinfectants)

They are sold as sprays, liquids, sticks, powders, crystals, balls and foggers.

### Sources of Pesticides :

- ✚ Products used to kill household pests (insecticides, termiticides and disinfectants)
- ✚ Products used on lawns and gardens that drift or are tracked inside the house
- ✚ Pesticides are classed as semi-volatile organic compounds and include a variety of chemicals in various forms.



## Health Effects

- Exposure to pesticides may result in
  - ✚ Irritation to eye, nose and throat
  - ✚ Damage to central nervous system and kidney
  - ✚ Increased risk of cancerSymptoms may include
  - ✚ Headache
  - ✚ Dizziness
  - ✚ Muscular weakness
  - ✚ Nausea
- Chronic exposure to some pesticides can result in damage to the:
  - ✚ Liver
  - ✚ Kidneys
  - ✚ Endocrine and nervous systems

Both the active and inert ingredients in pesticides can be organic compounds; therefore, both could add to the levels of airborne organics inside homes. Both types of ingredients can cause the type of effects discussed in Household Chemicals/Products. However, as with other household products, there is insufficient understanding at present about what pesticide concentrations are necessary to produce these effects.

Exposure to high levels of cyclodiene pesticides, commonly associated with misapplication, has produced various symptoms, including:

- Headaches
- Dizziness
- Muscle twitching
- Weakness
- Tingling sensations
- Nausea

In addition, EPA is concerned that cyclodienes might cause long-term damage to the liver and the central nervous system, as well as an increased risk of cancer.

There is no further sale or commercial use permitted for the following cyclodiene or related pesticides: chlordane, aldrin, dieldrin and heptachlor. The only exception is the use of heptachlor by utility companies to control fire ants in underground cable boxes.

### **Steps to Reduce Exposure :**

- Use strictly according to manufacturer's directions.
- Mix or dilute outdoors.
- Apply only in recommended quantities.
- Increase ventilation when using indoors. Take plants or pets outdoors when applying pesticides/flea and tick treatments.
- Use non-chemical methods of pest control where possible.
- If you use a pest control company, select it carefully.
- Do not store unneeded pesticides inside home; dispose of unwanted containers safely.
- Store clothes with moth repellents in separately ventilated areas, if possible.
- Keep indoor spaces clean, dry and well ventilated to avoid pest and odor problems.

#### **(A) Ventilate the area well after pesticide use.**

Mix or dilute pesticides outdoors or in a well-ventilated area and only in the amounts that will be immediately needed. If possible, take plants and pets outside when applying pesticides/flea and tick treatments.

#### **(B) Use non-chemical methods of pest control when possible.**

Since pesticides can be found far from the site of their original application, it is prudent to reduce the use of chemical pesticides outdoors as well as indoors. Depending on the site and pest to be controlled, one or more of the following steps can be effective:

- ❖ Use of biological pesticides, such as *Bacillus thuringiensis*, for the control of gypsy moths
- ❖ Selection of disease-resistant plants

❖ Frequent washing of indoor plants and pets

Termite damage can be reduced or prevented by making certain that wooden building materials do not come into direct contact with the soil and by storing firewood away from the home. By appropriately fertilizing, watering and aerating lawns, the need for chemical pesticide treatments of lawns can be dramatically reduced.

**(C) If you decide to use a pest control company, choose one carefully.**

Ask for an inspection of your home and get a written control program for evaluation before you sign a contract. The control program should list specific names of pests to be controlled and chemicals to be used; it should also reflect any of your safety concerns. Insist on a proven record of competence and customer satisfaction.

**(D) Dispose of unwanted pesticides safely.**

If you have unused or partially used pesticide containers you want to get rid of, dispose of them according to the directions on the label or on special household hazardous waste collection days. If there are no such collection days in your community, work with others to organize them.

**(E) Keep exposure to moth repellents to a minimum.**

One pesticide often found in the home is paradichlorobenzene, a commonly used active ingredient in moth repellents. This chemical is known to cause cancer in animals, but substantial scientific uncertainty exists over the effects, if any, of long-term human exposure to paradichlorobenzene. EPA requires that products containing paradichlorobenzene bear warnings such as "avoid breathing vapors" to warn users of potential short-term toxic effects. Where possible, paradichlorobenzene and items to be protected against moths, should be placed in trunks or other containers that can be stored in areas that are separately ventilated from the home, such as attics and detached garages. Paradichlorobenzene is also the key active ingredient in many air fresheners (in fact, some labels for moth repellents recommend that these same products be used as air fresheners or deodorants). Proper ventilation and basic household cleanliness will go a long way toward preventing unpleasant odors.

## 7. Particulate matter

Particulate matter (also referred to as PM or particle pollution) is a complex mixture of solid and/or liquid particles suspended in air. These particles can vary in size, shape and composition. EPA is especially concerned about particles that are 10 micrometers in diameter or smaller because these particles are inhalable. Once inhaled, particles can affect the heart and lungs and in some cases cause serious health effects. The human health effects of outdoor PM are well-established and are used to set health-based standards for outdoor air (National Ambient Air Quality Standards, NAAQS). PM is also found in all indoor environments. Indoor PM levels have the potential to exceed outdoor PM levels and the NAAQS. However, less is known about the specific impacts of indoor PM on health.

### **Health Effects of Inhalable Particles:**

Exposure to inhalable particles can affect both your lungs and your heart. Many studies directly link the size of particles to their potential for causing health problems. Small particles (less than 10 micrometers in diameter) can get deep into your lungs, and some may even get into your bloodstream. People with heart or lung diseases such as coronary artery disease, congestive heart failure, and asthma or chronic obstructive pulmonary disease (COPD), children and older adults may be at greater risk from PM exposure. Scientific studies have linked PM exposure to a variety of health impacts, including:

- ❖ Eye, nose and throat irritation
- ❖ Aggravation of coronary and respiratory disease symptoms; and
- ❖ Premature death in people with heart or lung disease.

### **Indoor PM Sources :**

PM found indoors will include particles of outdoor origin that migrate indoors and particles that originate from indoor sources. Indoor PM can be generated through cooking, combustion activities (including burning of candles, use of fireplaces, use of unvented space heaters or kerosene heaters, cigarette smoking) and some hobbies.

Indoor PM can also be of biological origin. For more information on major indoor combustion related sources see also:

- ❖ Stoves, Heaters, Fireplaces and Chimneys
- ❖ Environmental Tobacco Smoke

### **Steps to Reduce Exposure to Indoor PM :**

- + Vent all fuel-fired combustion appliances to the outdoors (including stoves, heaters and furnaces)
- + Install and use exhaust fans vented to the outside when cooking
- + Avoid the use of unvented stoves, fireplaces or space heaters indoors. If you must use unvented appliances follow manufacturers' instructions especially related to ventilation..
- + Choose properly sized woodstoves, certified to meet EPA emission standards; make certain that doors on all woodstoves fit tightly.
- + Use appropriate wood in stoves and fireplaces. Check EPA's BurnWise program for Safe Wood-burning Practices
- + Have a trained professional inspect, clean and tune-up central heating system (furnace, flues and chimneys) annually. Repair any leaks properly.
- + Change filters on central heating and cooling systems and air cleaners according to manufacturer's directions.

## **8. Secondhand smoke**

Secondhand smoke is a mixture of the smoke given off by the burning of tobacco products, such as cigarettes, cigars or pipes and the smoke exhaled by smokers. Secondhand smoke is also called environmental tobacco smoke (ETS). Exposure to secondhand smoke is sometimes called involuntary or passive smoking. Secondhand smoke, classified by EPA as a Group A carcinogen, contains more than 7,000 substances. Secondhand smoke exposure commonly occurs indoors, particularly in homes and cars. Secondhand smoke can move between rooms of a home and between apartment units. Opening a window or increasing ventilation in a home or car is not protective from secondhand smoke.

## **Health Effects of Secondhand Smoke:**

The health effects of secondhand smoke on nonsmoking adults and children are harmful and numerous. Secondhand smoke causes cardiovascular disease (heart disease and stroke), lung cancer, sudden infant death syndrome, more frequent and severe asthma attacks, and other serious health problems. Several landmark health assessments regarding secondhand smoke have been conducted.

- ✚ Secondhand smoke poses particular health risks to children with asthma.
- ✚ Secondhand smoke is a universal asthma trigger and can elicit an asthma attack or make asthma symptoms more severe.
- ✚ Asthma is a chronic disease that affects the airways of the lungs and can lead to coughing, trouble breathing, wheezing and tightness in the chest.
- ✚ Asthma is the most common chronic childhood disease affecting, on average, 1 in 13 school aged children.
- ✚ Exposure to secondhand smoke may cause new cases of asthma in children who have not previously shown symptoms.
- ✚ More than half of US children with asthma are exposed to secondhand smoke (quinto, 2013).

## **Reduce Exposure to Secondhand Smoke:**

Eliminating secondhand smoke in the indoor environment will reduce its harmful health effects, improve the indoor air quality and the comfort or health of occupants. Secondhand smoke exposure can be reduced through mandated or voluntary smoke-free policy implementation. Some workplaces and enclosed public spaces such as bars and restaurants are smoke-free by law. People can establish and enforce smoke-free rules in their own homes and cars. For multifamily housing, smoke-free policy implementation could be mandatory or voluntary, depending on the type of property and location (e.g., ownership and jurisdiction).

- The home is becoming the predominant location for the exposure of children and adults to secondhand smoke. (Surgeon General's Report, 2006)
- Households within buildings with smoke-free policies have lower PM<sub>2.5</sub> compared to buildings without these policies. PM<sub>2.5</sub> is a unit of measure for small particles in the air and is used as one indication of air quality. High levels of fine particles in the air can lead to negative health impacts. (Russo, 2014)
- Prohibiting smoking indoors is the only way to eliminate secondhand smoke from the indoor environment. Ventilation and filtration techniques can reduce, but not eliminate, secondhand smoke. (Bohoc, 2010)

## 9. Volatile organic compounds (VOCs)

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands.

Organic chemicals are widely used as ingredients in household products. Paints, varnishes and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic, degreasing and hobby products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and, to some degree, when they are stored.

### Sources of VOCs

Household products, including:

- ✚ Paints, paint strippers and other solvents
- ✚ Wood preservatives
- ✚ Aerosol sprays
- ✚ Cleansers and disinfectants
- ✚ Moth repellents and air fresheners
- ✚ Stored fuels and automotive products

- ✚ Hobby supplies
- ✚ Dry-cleaned clothing
- ✚ Pesticide

Other products, including:

- ✚ Building materials and furnishings
- ✚ Office equipment such as copiers and printers, correction fluids and carbonless copy paper
- ✚ Graphics and craft materials including glues and adhesives, permanent markers and photographic solutions.

### **Health Effects :**

Health effects may include:

- Eye, nose and throat irritation
- Headaches
- Loss of coordination and nausea
- Damage to liver, kidney and central nervous system
- Some organics can cause cancer in animals
- Some are suspected or known to cause cancer in humans.

The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those with no known health effect.

As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Among the immediate symptoms that some people have experienced soon after exposure to some organics include:

- Eye and respiratory tract irritation
- Headaches
- Dizziness
- Visual disorders and memory impairment



## Steps to Reduce Exposure

- Increase ventilation when using products that emit VOCs.
- Meet or exceed any label precautions.
- Do not store opened containers of unused paints and similar materials within the school.
- Formaldehyde, one of the best known VOCs, is one of the few indoor air pollutants that can be readily measured.
- Identify, and if possible, remove the source.
- If not possible to remove, reduce exposure by using a sealant on all exposed surfaces of paneling and other furnishings.
- Use integrated pest management techniques to reduce the need for pesticides.
- Use household products according to manufacturer's directions.
- Make sure you provide plenty of fresh air when using these products.
- Throw away unused or little-used containers safely; buy in quantities that you will use soon.
- Keep out of reach of children and pets.
- Never mix household care products unless directed on the label.

## 10. Wood Smoke

Smoke is made up of a complex mixture of gases and fine, microscopic particles produced when wood and other organic matter burn. The biggest health threat from wood smoke comes from fine particles (also called particulate matter). They are small enough to enter the lungs where they can cause bronchitis, pneumonia, asthma, or other serious respiratory diseases. Fine particles can also aggravate chronic heart and lung diseases, and are linked to premature deaths in people with these chronic conditions.

Many old, pot-bellied wood stoves are still functioning to provide warmth and a cooking fire in tribal communities; but they may also be releasing wood smoke that is harmful to the health of everyone exposed to it, especially the young and the old. To avoid these inevitable health risks and gain the greater efficiency and effectiveness of

new, cleaner burning technology wood stoves it is recommended that old stoves be gradually replaced or “changed out.”

Changing out wood stoves requires a financial investment; however, there are programs that provide financial assistance and manufacturers that provide discounts.

The results of replacement speak for themselves with improvements in the health of children and community, home safety, visibility, and indoor air quality .

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## 5.5 STANDARDS OF NOISE POLLUTION

### Ambient Noise Pollution Standards:

Whereas the increasing ambient noise levels in public places from various sources, inter-alia,

- Industrial activity
- Construction activity
- Fire crackers
- Sound producing instruments
- Generator sets
- Loud speakers
- Public address systems
- Music systems
- Vehicular horns
- Other mechanical devices have deleterious effects on human health and the psychological well being of the people.

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

**Table 5.5.1 Ambient Air Quality Standards in respect of Noise**

- Day time shall mean from 6.00 a.m. to 10.00 p.m.
- Night time shall mean from 10.00 p.m. to 6.00 a.m.

- dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.
- A “decibel” is a unit in which noise is measured.
- “A”, in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

### **Responsibility as to enforcement of noise pollution control measures.-**

- The noise levels in any area / zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule.
- The authority shall be responsible for the enforcement of noise pollution control measures and the due compliance of the ambient air quality standards in respect of noise.
- The respective State Pollution Control Boards or Pollution Control Committees in consultation with the Central Pollution Control Board shall collect, compile and publish technical and statistical data relating to noise pollution and measures devised for its effective prevention, control and abatement.

### **Restrictions on the use of loud speakers / public address system and sound producing instruments.-**

- A loud speaker or a public address system shall not be used except after obtaining written permission from the authority.
- A loud speaker or a public address system or any sound producing instrument or a musical instrument or a sound amplifier shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency.
- Not with standing anything contained in sub-rule (2), the State Government may subject to such terms and conditions as are necessary to reduce noise pollution, permit use of loud speakers or public address system and the like during night hours (between 10.00 p.m. to 12.00 midnight) on or during any cultural or religious festive occasion of a limited duration not exceeding fifteen days in all

during a calendar year. The concerned State Government shall generally specify in advance, the number and particulars of the days on which such exemption would be operative.

- The noise level at the boundary of the public place, where loudspeaker or public address system or any other noise source is being used shall not exceed 10 dB (A) above the ambient noise standards for the area or 75 dB (A) whichever is lower;
- The peripheral noise level of a privately owned sound system or a sound producing instrument shall not, at the boundary of the private place, exceed by more than 5 dB (A) the ambient noise standards specified for the area in which it is used.

**Restrictions on the use of horns , sound emitting construction equipments and bursting of fire crackers:-**

- No horn shall be used in silence zones or during night time in residential areas except during a public emergency.
- Sound emitting fire crackers shall not be burst in silence zone or during night time.
- Sound emitting construction equipments shall not be used or operated during night time in residential areas and silence zones.

**Consequences of any violation in silence zone / area.-**

In any place covered under the silence zone / area commits any of the following offence, he shall be liable for penalty under the provisions of the Act:-

- Whoever, plays any music or uses any sound amplifiers,
- Whoever, beats a drum or tom-tom or blows a horn either musical or pressure, or trumpet or beats or sounds any instrument, or
- Whoever exhibits any mimetic, musical or other performances of a nature to attract crowds.
- Whoever, bursts sound emitting fire crackers; or
- Whoever, uses a loud speaker or a public address system.

**Noise limits for vehicles applicable at manufacturing stage:**

S.No.	Type of vehicle	Noise Limits from 1 <sup>st</sup> January, 2003, dB(A)	Date of implementation
(1)	(2)	(3)	(4)
1.	Two wheeler <ul style="list-style-type: none"> <li>• Displacement upto 80 cm<sup>3</sup></li> <li>• Displacement more than 80 cm<sup>3</sup> but upto 175 cm<sup>3</sup></li> <li>• Displacement more than 175 cm<sup>3</sup></li> </ul>	75 77 80	Ist January,2003
2.	Three wheeler <ul style="list-style-type: none"> <li>• Displacement upto 175 cm<sup>3</sup></li> <li>• Displacement more than 175 cm<sup>3</sup></li> </ul>	77 80	Ist January,2003
3.	Passenger car	75	Ist January,2003
4.	Passenger or commercial vehicle <ul style="list-style-type: none"> <li>• Gross vehicle weight upto 4 tonne</li> <li>• Gross vehicle weight more than 4 tonne but upto 12 tonne</li> <li>• Gross vehicle weight more than 12 tonne</li> </ul>	80 83 85	Ist July,2003

**Table 5.5.2 Noise limits for vehicles**