

# Indoor Air Quality Testing & Control

- Introduction to Indoor Air Pollution
- Why and How to Improve IAQ
- IAQ Lab Experiment



# Indoor Air Quality Testing and Control



## Introduction

Welcome to the world of IAQ (Indoor Air Quality). This lab covers the factors affecting the IAQ of buildings and homes, why education on IAQ is an important issue to cover, and how to improve IAQ.

This lab gives you the opportunity to test the IAQ in various locations within buildings or homes. You will also be given the opportunity to experience the

dramatic improvements Air Oasis air purifiers make on IAQ.

During the course of this lab you will learn about many contaminants lurking in your air, including **mold** and **bacteria**, and how they effect your health. We explain how these contaminants spread from one person to another and from a building to you.

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## About This Lab

This lab provides education on many aspects of IAQ. It will help you become more aware of the environment you live in on a daily basis. You will begin to better understand why people catch colds and bacterial infections including **staph** and **respiratory infections**. You will also find out how molds and **VOCs** (Volatile Organic Compounds) trigger allergic reactions. More importantly, you will learn how to reduce your chances of catching a cold, infection, or having allergic reactions caused by the contaminants in your air.

As a manufacturer in the air purification industry, Air Oasis is the perfect company to design this lab. We started our business as a retailer. When we realized the need for a different type of air purification product, we created our own. Our unique technology initially focused on the IAQ of homes. As time passed by, we realized a larger problem in commercial buildings. Therefore we expanded our product line to include commercial units.

We created a simple to use air purifier. It's low maintenance, and most importantly focuses on the core issues truly effecting our health today in regards to IAQ. The majority of air purifiers on the market today rely on using HEPA filters and other filtration methods. This method is great for larger particles, but some smaller particles and contaminants simply pass through the filter. The contaminants trapped in the filter help create better breeding grounds for additional growth of bacteria and mold. Therefore, if the filters are not changed frequently the poor IAQ only becomes worse. Our proprietary technology destroys mold, bacteria, viruses, VOCs, and odors rather than simply trapping them or allowing them to circulate directly through the air purifier.

We have learned many things with our years of experience, and it thrills us to have the opportunity to share this knowledge with you. At Air Oasis we commit ourselves to the goal of a better tomorrow. This lab teaches how to improve your environment and the environment of generations to come.

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## Who This Lab Was Designed For

We designed this lab to be fun, educational, and easy to understand. We tried to write the lab so it won't take a scientist to understand how to conduct it or to understand the results achieved. In other words, this lab was written for you.

## How to Use This Lab

This lab is organized into three basics sections. Each section provides education on IAQ using factual data, stories, pictures and/or a lab experiment.

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## Section Overview

### Section 1: Introduction To Indoor Air Pollution

Learn what causes indoor air pollution.

### Section 2: Why and How To Improve IAQ

Learn about many health concerns caused by poor IAQ, and solutions to these problems. You will be given examples of real life scenarios where the IAQ is poor and how to resolve the problems.

### Section 3: IAQ Lab Experiment

Ever wondered what the air in your home is like? What about the air in public bathrooms, gyms, cafeterias, libraries, hotel rooms etc.? This section provides you with the opportunity to conduct an IAQ lab experiment involving areas of your choice. You will be able to conduct tests to prove the need and effectiveness of air purifiers.

## Icons Used in This Lab



When you see this lightning icon, we have given you an idea of how you can speed up the lab to get lightning fast results.



When this icon appears you can be sure it's important. You will want to commit these parts to memory.



This icon highlights things you will want to avoid to ensure your lab is not contaminated.



This icon is used when there is something that needs to be remembered for future use in section 3. Make a mental note of it.

Words in **bold** print are found in the glossary with their definitions. These words are important to learn.

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## Time To Get Started

Now you know what this lab is all about, let's get started. Keep in mind this is not only meant to be a learning experience and life lesson about your indoor environment, but a fun experience as well.

Remember to be creative when choosing your testing areas. Don't forget to share your results with your family and friends.

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## Section 1

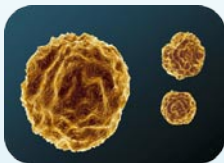
### Introduction to Indoor Air Pollution?



Concerns about indoor air quality (IAQ) have increased since the 1970's when people started doing a better job of sealing their homes and offices to conserve electricity. Sealing buildings better only reduces the amount of fresh outside air from coming into buildings and contributes to the buildup of indoor air contaminants.

Complaints about IAQ range from simple complaints, such as the air smelling odd, to more complex complaints where poor air quality results in illness and absence in school. Identifying a single reason for these complaints is difficult due to the number and variety of possible sources, causes, and individual sensitivities.

**Indoor air pollutants fall into three main categories:**



**Particulates** - Over 99% of particulate matter is invisible to the naked eye and easily infiltrates the lungs. On average, every cubic foot of untreated indoor air contains 20 million particles.



**Microbes** - Includes three major types of organisms: bacteria, **protozoa**, and **fungi/mold**. Most of these contaminants rely on a humid and moist environment for growth & survival. Some molds produce certain chemicals, such as **mycotoxins** and Volatile Organic Compounds (VOCs). (You will test for microbes in your lab.)



**Gases & Odors** - Indoor gases, such as **benzene**, **formaldehyde**, and **hydrogen sulfide**, are released into the air from furniture, carpets, hair sprays, cleaning chemicals, insulation, and pesticides.

Gases include VOCs which evaporate into the air easily. Odors are often composed of VOCs or other gases.

The chart on the following page shows a partial list of the most common air pollutants and their sources. Knowing the sources of certain pollutants help you later in deciding the best areas to conduct your IAQ testing. Knowing the sources of contaminants also helps you to determine the best method to eliminate them.



Category	Pollutants	Sources
Particulate	Dust	humans, drapes, outdoor air
Particulate	<b>Pollen</b>	clothing, outdoor air, pets
Particulate	Tobacco Smoke, <b>Hydrocarbons</b>	smokers
Particulate	<b>Dander</b>	humans, pets
Microbial	Mold Spores	HVAC ducts, carpets, outdoor air, moist places within a building
Microbial	Bacteria	Waste containers, toilets, humans, A/C coils & ducts
Microbial	Fungi	pets, foods, outdoor air, waste containers
Gas	<b>Methyl mercaptan</b>	natural gas and propane additive, feces
Gas	<b>Carbon disulfide</b>	industrial solvents
Gas	<b>Butyl acetate</b>	lacquer, synthetic fruit flavoring in foods
Gas	<b>Methyl methacrylate</b>	acrylic plastics
Gas	<b>methyl ethyl ketone</b>	paints and solvents
Gas	<b>d-Limonene</b>	cosmetic products, food additives, cleaning products, insecticides etc...
Gas	<b>Toluene</b>	adhesives, rubber, sealants, disinfectants, paint thinner etc...
Gas	<b>Hydrogen sulfide</b>	toilet vents, water

## Section 2

### Why and How To Improve Indoor Air Quality?

Why worry about indoor air quality? Are the contaminants we learned about in section 1 present in our homes and buildings? If these contaminants are present, what makes them so harmful to our health? How do we remove these contaminants from the air we breathe? This section answers these questions and more.



#### Why worry about indoor air quality?

The average American spends up to 90% of their time indoors. Think about it. When you wake up in the morning in your bed you are inside your house. Then you leave your house to get in your car. You step out of the car and enter your place of work. After several hours, you leave work to go back home, go shopping, go to a restaurant or other indoor places.

The majority of your day is spent indoors, making you one of the

many average Americans. Those more susceptible to the effects of poor IAQ spend even more time indoors. These people include infants, the elderly and critically ill.



#### Are the contaminants we learned about in Section 1 present in our homes and buildings?

Perhaps the biggest cause of poor IAQ today is energy conservation. We seal our homes and buildings as tight as possible to keep our heating and cooling costs down. This causes lack of ventilation or fresh air from entering the building. Instead of fresh air being introduced, the same contaminated air keeps circulating through the already contaminated structure. With each cycle the air becomes more contaminated. When you take a shower or boil water you fill the air with more



moisture. In return you create the perfect breeding ground for mold, bacteria, fungus and other microorganisms. The moisture builds up inside your central heating ventilation and cooling (HVAC) unit where more mold and bacteria continue to grow. As the air passes through your ducts the mold and bacteria sticks to the ducts. It begins to grow in this low light, moist environment. Over time the growth becomes worse. With every cycle your HVAC unit runs it pollutes your home or building even more by spreading the contaminants throughout the entire structure.



Mold and bacteria aren't your only concerns. Pretend you have a sister or daughter who has come down with a cold. During the first day of her cold she is still able to attend school and participate in activities at home. The first symptoms

she has is a runny nose and a cough. At school that day she is constantly sneezing and coughing. When she goes home you play games, help her with homework and eat dinner together. The whole time she is still coughing and sneezing. The virus becomes aerosolized for you to inhale. The virus lands on your food at the dinner table. As she wipes her nose with a tissue the virus gets on her hands and then you share a pencil during homework. She transfers the virus from her to you in many ways. Before you know it you have the same cold and several other students at school have also been infected.



There are several other pollutants that won't cause a cold or an infection, but can cause serious allergic reactions. When a door opens or your dog comes inside pollen also comes inside. There are many sources for dust and dander.

The main source is you. You shed billions of dead skin cells everyday. Your carpet, furniture, household cleaners, the paint on your walls, your toys, your bedding, cosmetics, perfumes, and virtually everything in your home and most buildings today releases some type of VOC or gas into your air.



Another common pollutant present in many homes today is cigarette smoke. A single cigarette alone releases over 4,000 chemicals in your air. Many places of business no longer allow smoking in the building or on their property, but many adults still smoke in their homes. This places their children and other people in their home at risk.

**If these contaminants do exist, what makes them so harmful to our health?**



Removing certain sources of contaminants does not always fix the problem. As you have already learned, there are various sources for the many different contaminants. Many illnesses can be contributed to the many contaminants in your air.



Mold spores can cause allergic reactions, serious health risks, and in some cases death. The bacteria circulating in your home can cause respiratory infections, infections in open wounds, and more.

While most people quickly overcome the common cold in a matter of a few days, the same cold can be fatal to infants, elderly and critically ill. Colds also cause absence from school or work and time away from family and friends.

As the items **off-gas** and send chemicals and VOCs into the air you inhale these chemicals. Many of the chemicals can cause allergic reactions or pose other serious health risks, such as cancer.



When a cigarette burns it releases over 4,000 chemicals into the air which places your health "up in the air." The chemicals in cigarettes can cause many different diseases of the lungs or even cancer. They also weaken your immune system and cause damage to many other vital organs in your body.

**How do we remove these contaminants from the air we breathe?**

Some items pose greater threats to your indoor air than others. One of the best ways to remove the contaminants is to eliminate the sources. Since virtually everything in homes and buildings is synthetically made out of chemicals or attract other pollutants what should you do? Completely strip your building or home of every item in it? No. Even if you did, the materials used to create buildings and homes also contain contaminants. Instead a good first step is to remove some of the larger sources of contaminants.



If a smoker resides in your home ask them to smoke outdoors. This greatly reduces your exposure to the 4,000 plus chemicals released from cigarettes. Not to mention how much better this will make your clothes, personal items and home smell.



Carpet is one of the biggest and most common sources of air pollutants. Carpet covers over 70% of the floors in America. Most new carpet contains over 31 chemicals including: volatile organic compounds, styrene, 4-PC, and formaldehyde.

Some of these chemicals are considered carcinogens. They can cause severe, even deadly neurotoxin reactions. Some carpets are glued directly to the floor using strong adhesives containing harmful chemicals. The chemicals in carpet are not the only pollutants. Overtime we spill liquids, foods, and other everyday items on the carpet. We track in pollens, molds etc. from outdoors and they become imbedded in the carpet. We cough and sneeze on the carpet. We along with our pets leave dead skin behind and much more. All which equates to one giant sized area with almost every contaminant known

to man trapped within. This is now another perfect breeding ground for mold and bacteria. Even if you clean your carpets often you only clean the surface. All the contaminants lurk deep within and resurface quickly. In fact, the act of cleaning your carpet increases the moisture under your carpet, resulting in a dark, warm, moist environment to grow more mold and bacteria. You thought your bathroom was gross. Think about it tonight as you lay and play on your soft comfortable carpet.



Another large pollution source often overlooked is the ducts and coils of your HVAC system. We have covered how mold, bacteria and other contaminants build up in your ducts. The chemicals emitted by your carpet and other items circulate through homes and buildings via air conditioners as well. Of course none of us want to live or work without cool air in the summer and warm air in the winter. Therefore, removing your HVAC system and all ducts is not an option. Generally, cleaning your coils and ducts at least once a year is recommended. This greatly reduces the amount of dust, mold, bacteria, etc., circulating through a home or building. Many companies specialize in this cleaning process.



There are other things you can do to help reduce pollutants. Anytime you cook, do laundry, or take a shower or bath you should turn on the exhaust vents in your kitchen, bathrooms, and laundry room to help remove moisture from the air. This helps to control the growth and spreading of mold and bacteria. Turning on the exhaust vents when you use high VOC products, such as hair spray, helps to eliminate pollutants. Not using an over abundance of cleaning products, cosmetics, perfumes, air freshener sprays, etc., reduces the amount of chemical pollutants present in your air. It's also a good idea to open your windows as often as possible to allow old stale air to escape and introduce new fresh air into your home or other buildings. What should a person do about all other pollutants left behind after removing the above sources? With humans and pets being two of the biggest sources in homes and buildings there must be other options. We can't exactly make ourselves disappear to have clean air. A great solution to reduce all other pollutants left behind is an Air Oasis air purifier.

Air Oasis uses an exclusive **PCO** filterless air purifier technology. The Air Oasis unit is easy to use. You simply place the air purifier where you want it and press the switch to the on position. You will learn more about how to use them later. Are you ready for the fun parts of this lab? In section 3 you get to test the air in your home or place of work and see how the Air Oasis air purifier makes a difference.

## Section 3

### IAQ Lab Experiment

Now we are ready to have some fun. Ever wondered if the air was worse in a bathroom or a kitchen? What about in a library or in a locker room? Here is your chance to find out. Follow the instructions below to conduct this lab.

#### Objectives:

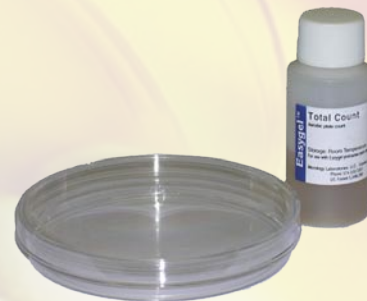
1. To understand the necessity to control indoor air pollution in homes and commercial buildings.
2. To learn how to properly conduct an IAQ test.
3. Compare the air quality in various locations of your home or building.
4. Compare the air quality in a room treated with an Air Oasis air purifier to a room with no air treatment.

#### Safety Notes:

1. To avoid electrical shock or death, never operate the Air Oasis electronic air purifier near water. The air purifier must be placed on a dry surface.
2. Once you complete the testing process dispose of used Petri dishes properly.

#### Materials needed:

2 Petri dishes (supplied with lab)  
2 bottles of Easy Gel agar (supplied with lab)  
tape  
permanent marker  
Air Oasis air purifier



## Procedure:

1. Choose one room to place an Air Oasis air purifier and one room to remain untreated.
2. Run the air purifier on high for one week.
3. After one week of continuous use follow the steps below to test both the room treated by the Air Oasis unit and the non-treated room.
  - a) Pour the bottle of Easy Gel into the pretreated Petri dish.



**Be careful *not* to contaminate your test by:**

- touching the inside of the Easy Gel bottle
- touching the inside of the Petri dish base or lid
- sneezing or coughing over the test

- b) Gently rock the Petri dish back and forth to ensure even distribution of the Easy Gel.
  - c) Place the opened Petri dish on a counter top, or other area, where it can remain undisturbed, for one hour.
  - d) Write the location tested on the outside of the Petri dish lid and lay the lid facing down to avoid contamination.
  - e) After one hour place the lid on the Petri dish and wrap tape around the edges of the Petri dish to seal the dish from contamination.
  - f) Place the Petri dishes in a dark warm place for four to five days to incubate.
4. After the incubation period view and compare the two Petri dishes. Record your results on the Evaluation page.
  5. Properly dispose of used Petri dishes.



Tip: Use an incubator to decrease growth time. Using an incubator you will see results in 24 to 36 hours.

If you have questions about this lab or any Air Oasis products please:

call Air Oasis at 1-800-936-1764  
or visit [www.AirOasis.com](http://www.AirOasis.com)

## Evaluation

1. In what area or room did you place the air purifier?  
\_\_\_\_\_
2. What room did you leave untreated for testing?  
\_\_\_\_\_
3. Which room do you think had higher contamination levels before using the air purifier?  
\_\_\_\_\_
4. After you finished the testing, which room appeared to have higher contamination levels? (Note: more growth on the Petri dish relates to higher contamination.)  
\_\_\_\_\_
5. Which room was more polluted with mold? (Mold will appear fuzzy.)  
\_\_\_\_\_
6. Which room was more polluted with bacteria? (Bacteria will appear red or pink.)  
\_\_\_\_\_
7. Were results as you expected?  
\_\_\_\_\_
8. If not, why? What may have caused these results?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Want to be a part of the ongoing Air Oasis IAQ study? Please send us a copy of your evaluation answers and photographs of your Petri dishes to:

Air Oasis  
Attn.: IAQ Study  
3401 Airway Blvd.  
Amarillo, TX 79118  
or  
[testimony@airoasis.com](mailto:testimony@airoasis.com)

Thank you!



# Glossary

**Bacteria** - microscopic unicellular prokaryotic organisms characterized by the lack of a membrane-bound nucleus and membrane-bound organelles.

**Benzene** - colorless, flammable, toxic liquid with a pleasant aromatic odor. Benzene is a hydrocarbon.

**Butyl acetate** - is commonly used as a solvent in the production of lacquers and other products. It is also used as a synthetic fruit flavoring in foods.

**Carbon disulfide** - colorless, foul-smelling, flammable, and poisonous. It is a widely used solvent, and is used to treat alkali cellulose in the viscose process (a source of rayon and cellophane).

**Dander** - old skin scales which are constantly shed. Animal dander is extremely light weight and tiny in size, (approx. 2.5 microns) and can stay airborne for hours.

**D-Limonene** - is a hydrocarbon, classified as a cyclic terpene. It is a colorless liquid at room temperatures with an extremely strong smell of oranges. D-limonene is used in food manufacturing and some medicines; it is also used as botanical insecticide. It is added to cleaning products to give a lemon-orange fragrance.

**Formaldehyde** - it is a flammable, poisonous, colorless gas with a suffocating odor. Formaldehyde is used in the preparation of dyes, in the production of Bakelite and other plastics and synthetic resins, and for several other purposes.

**Fungi** - multicellular organisms, including yeasts, molds, and mushrooms.

**Hydrocarbons** - any organic compound composed solely of the elements hydrogen and carbon. Useful hydrocarbon mixtures include cooking gas, gasoline, naphtha, benzene, kerosene, paraffin, and lubricating oils.

**Hydrogen sulfide** - a colorless, extremely poisonous gas that has a very disagreeable odor, much like that of rotten eggs.

**Methyl ethyl ketone** - is a manufactured organic chemical. It is a colorless liquid with a sharp, sweet butterscotch odor reminiscent of acetone.

**Methyl mercaptan** - volatile mercaptans that have disagreeable odors. Mercaptans are found in crude petroleum, and methyl mercaptan is produced as a decay product of animal and vegetable matter.

**Methyl methacrylate** - a colorless liquid primarily used for manufacture of polymethyl methacrylate acrylic plastics.

**Microbes** - is an organism that is microscopic (usually too small to be seen by the naked human eye). Microorganisms are incredibly diverse and include bacteria, fungi, archaea, and protists.

**Mold** - include all species of microscopic fungi that grow in the form of multicellular filaments, called hyphae. There are hundreds of known species of molds and while some can be beneficial, even used to make antibiotics, others can pose serious health risks or even death.

**Mycotoxins** - is a toxin produced by an organism of the fungus kingdom, which includes mushrooms, molds and yeasts.

**Off-gas** - the evaporation of volatile chemicals in non-metallic materials at normal atmospheric pressure. This means that building materials can release chemicals into the air through evaporation. This evaporation can continue for years after the products are initially installed.

**Particulates** - are tiny particles of solid or liquid suspended in the air.

**PCO** - Photocatalytic oxidation. A method of using a photocatalyst to create oxidizers or oxidizing ions to clean the air.

**Pollen** - minute grains, borne in the anther sac at the tip of the slender filament of the stamen of a flowering plant or in the male cone of a conifer. Pollens are often the cause of allergies when they become lodged in a person's nasal cavity.

**Protozoa** - an animal phylum comprising a large, diverse assortment of microscopic or near-microscopic one-celled heterotrophic organisms

**Respiratory infections** - symptoms commonly include nasal congestion, cough, running nose, sore throat, fever, facial pressure and sneezing. Onset of the symptoms usually begins after 1-3 days after exposure to a microbial pathogen, most commonly a virus. The duration of the symptoms is typically 7 to 10 days but may persist longer.

**Staph** - staphylococcal (staph) infections are communicable diseases caused by certain bacteria and generally characterized by the formation of abscesses. They are the leading cause of primary infections originating in hospitals in the United States

**Toluene** - colorless liquid aromatic hydrocarbon. Toluene is obtained from coal tar and petroleum by distillation. It is used as a solvent and as a starting material for the synthesis of many compounds, including dyes and explosives.

**VOCs** - volatile organic compounds are organic chemical compounds that under normal conditions to significantly vaporize and enter the atmosphere. A wide range of carbon-based molecules, such as aldehydes, ketones, and other light hydrocarbons are VOCs.

## References

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Indoor Air Quality

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