



My Drift

Title: The Air We Breathe

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We are lucky to live in Hawaii. The air quality on most of the islands is very good most of the time. In fact, Honolulu is rated, by most atmospheric experts, to have the best air quality out of all the big cities in the United states. However, it is not so good on the Big Island of Hawaii because of the active volcanoes. When we have Kona (South) winds, the “Vog” (short for volcanic smog) can move over the entire state and make it hard to breathe for people with lung related health issues.



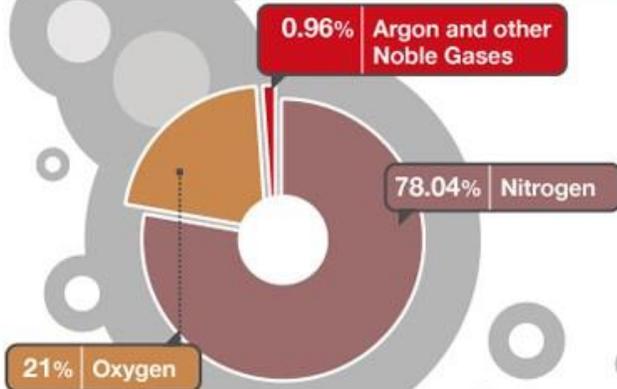
The purpose of this article is to learn more about the air we breathe. The following charts will help get us started:

WHAT'S IN THE AIR WE BREATHE?

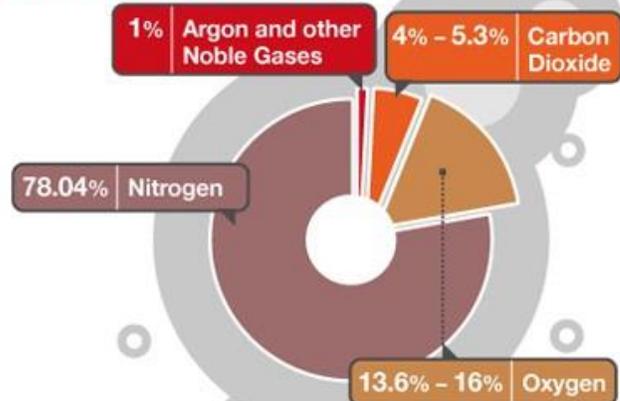
Air Composition and Pollutants

Breathing is something we do subconsciously, so we aren't always thinking about it – but that doesn't give you a pass to ignore issues of air quality! Knowing what's in the air you breathe is almost as essential as knowing what's in the food you eat or the water you drink. Did you know that around 7 million premature deaths can be attributed to air pollution worldwide? Poor air quality has also been linked to increases in mortality rates from cardiovascular disease, cystic fibrosis, lung disease, and cancer. We've compiled some essential and fun facts about the different flavors of air quality – inside, outside, from country to country – to teach you what you need to know to stay safe and healthy in the air we breathe.

THE AIR WE INHALE



THE AIR WE EXHALE



POLLUTANTS

POLLUTANT

Ozone



SOURCE

Formed when nitrogen oxides (which come from burning fossil fuels like **gasoline** and **coal**) and volatile organic compounds mix in sunlight. It's a **major component of smog** when found in the lower atmosphere. Long term exposure to high levels of ozone can be dangerous to breathe.

EFFECT

- Increases frequency of **asthma attacks**.
- Causes **sore throats, coughs, difficulty breathing, and even premature death**.
- Damages plants** and farm crops.

POLLUTANT

Particulate matter



SOURCE

This is a fancy name for "**tiny particles in the air**." There are two types: **coarse** (think dust from roads or construction, or sea spray) and **fine** (invisible particles released from burning fuels in cars or power plants).

EFFECT

- If it's small enough, particulate matter enters the lungs where it shreds and damages tissue, exacerbating **asthma** and inducing respiratory diseases like **tuberculosis**.

POLLUTANT

Asbestos



SOURCE

Clutches and brakes on **cars** or deteriorating building materials like **insulation** are common sources of exposure to asbestos. It can also be released **into ground water** through these sources, or from natural mineral deposits.

EFFECT

- Long-term exposure can cause **asbestosis**, a progressive disease that slowly suffocates a person.
- Inhaled asbestos is strongly linked to **lung cancer** and mesothelioma as well.
- When asbestos is consumed in drinking water, it can cause **cancer** in the **esophagus, stomach, or intestines**.

POLLUTANT

Methane



SOURCE

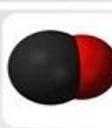
In an airless environment, methane is plentiful where **plant or animal matter** is **decomposing**. **Landfills, marshes, and mines** are common sources of methane.

EFFECT

- At high enough levels, methane can lead to **suffocation**.
- It's also **explosive** at concentrations of 5% or higher.

POLLUTANT

Carbon Monoxide



SOURCE

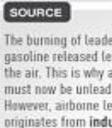
Released when **engines** (usually cars) burn **fossil fuels**. When an engine is improperly tuned or is damaged, it tends to emit extra carbon monoxide (CO).

EFFECT

- CO makes it difficult for parts of the body to get enough oxygen – that's why overexposure to it can give you a **headache** and/or make you feel **dizzy** or **tired**.
- Fatal** in high concentrations, it can exacerbate heart disease.

POLLUTANT

Lead



SOURCE

The burning of leaded gasoline released lead into the air. This is why all fuel must now be unleaded. However, airborne lead still originates from **industrial sources, lead paints, and old pipes**.



EFFECT

- Lead in the air causes **lower IQs and kidney problems** in young children...
- ... and **heart attacks or strokes** in adults.

POLLUTANT

Arsenic



SOURCE

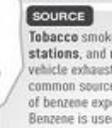
Commercial and industrial activities release inorganic Arsenic – which is the dangerous kind. Sometimes it's **found in drinking water or soil**. Some wood is treated with arsenic, and can be absorbed by the body when you touch or burn it.

EFFECT

- Persistent oral exposure in doses of 600 micrograms per kg of body weight per day is **fatal**.
- In lesser doses it damages the **nervous, gastrointestinal, and reproductive systems**, and also is strongly associated with **lung cancer**.

POLLUTANT

Benzene



SOURCE

Tobacco smoke, gas stations, and motor vehicle exhaust are all common sources of benzene exposure. Benzene is used to make **glues, plastics, nylons, furniture wax, and paints**.

EFFECT

- Benzene interferes with a cell's ability to work correctly. It can **reduce the number of red blood cells** produced by a person's bone marrow, which can cause **anemia**.
- On the white blood cell side of things, benzene can **damage the immune system** by killing white blood cells and antibodies.

POLLUTANT

Sulfur Dioxide

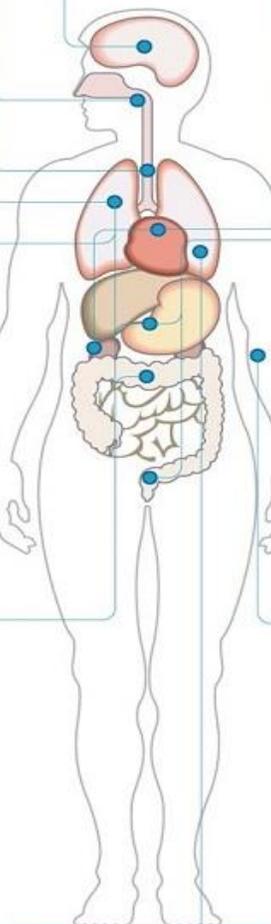


SOURCE

The largest source of sulfur dioxide comes from **fossil fuel combustion emissions**, mostly at power plants and other industrial facilities.

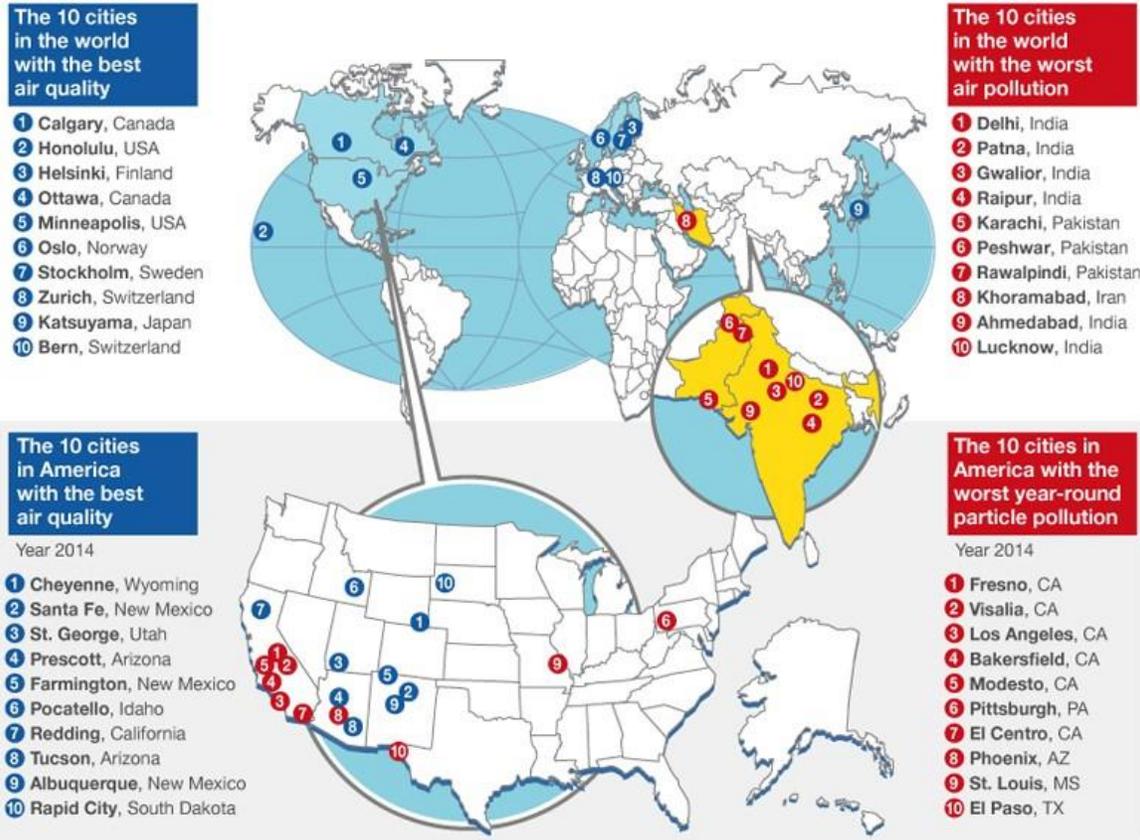
EFFECT

- Short term exposure, which is anywhere from five minutes to 24 hours, can exacerbate **asthma** symptoms and cause other respiratory damage.
- Various oxides of sulfur, not just the dioxide, can react with other compounds in the air to create super-penetrative particles that dig deep into the lungs and other sensitive parts of the body to **worsen respiratory and heart diseases**.



The Best and Worst Air in the World

Many health organizations, like the World Health Organization (WHO) or the Environmental Protection Agency (EPA), like to measure air pollution by the concentration of two types of particulate matter (PM). The first type, fine PM or PM2.5, is 2.5 micrometers or less in diameter, meaning it can only be seen by an electron microscope. The second, coarse PM or PM10, is between 2.5 and 10 micrometers in diameter. When you think of PM10, think of the particles in a cloud of dust. Concentrations of PM2.5 and PM10 are measured in micrograms per cubic meter of air (or ug/m3)



How's the air up there? A new report is out that measured the air particles in every state in the country and ranked the air quality from best to worst. According to a health care non-profit organization United Health Foundation, air quality in each state can be measured by the average person's exposure level to airborne particulate matter (PM). Air pollution is the fine particulates in the air that we breathe. Here is what they say is the best and worst states for air quality:

The best states are:	The worst states are:
Florida	California
Wyoming	Pennsylvania
North Dakota	Indiana
Montana	Illinois
Alaska	Ohio
Vermont	Kentucky
South Dakota	Georgia

GOOD AIR



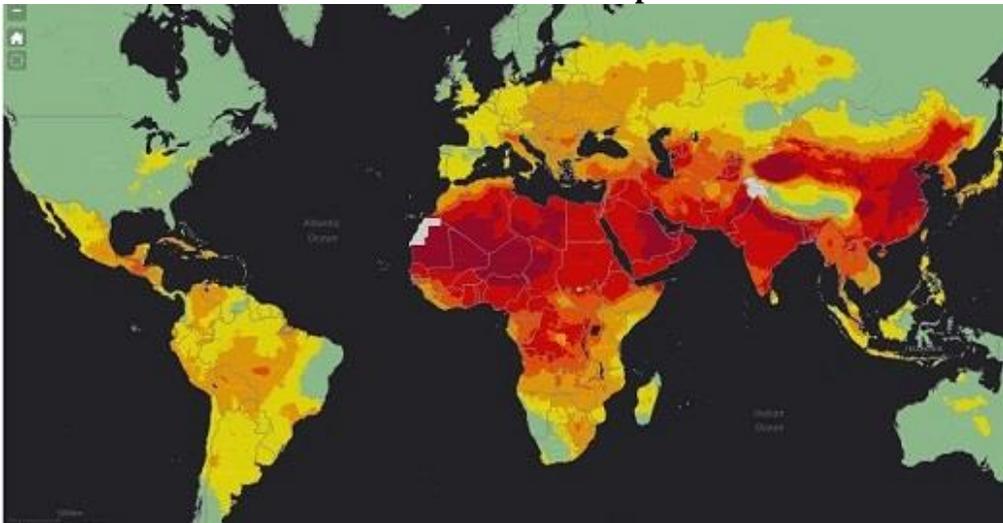
Palm Bay, Florida

BAD AIR



Southern California

World Pollution Map



Air Quality Legend:

Red = Terrible Air

Orange = Bad Air

Yellow = Not So Good Air

Green = Good Air

In general, the United States has very good air for us Americans to breathe. However, we didn't make the top 10 list of countries with the cleanest air. We came in at #13.

The Top 10 Countries with the Cleanest Air in the World

This list will show you the countries that have the cleanest air. This might be of interest for travelers planning where to go next and also for people that just want to know which are the fortunate countries that can breathe clean air.

Some of these countries rank high due to the abundance of forests in their territories which acts as natural air filters. Unsurprisingly, many countries with large, unpopulated areas covered with trees appear in the list.

For the many people who live in big cities, it would be a relief for their lungs to go to the countryside for some fresh air. You can be sure that if you are visiting the following countries, you will be rewarded with unpolluted air.

#10 Norway



#9 Australia



#8 New Zealand



#7 Ireland



#6 Sweden



#5 Estonia



#4 Denmark



#3 Finland



#2 Canada



#1 Iceland



The Top 10 Countries with the Dirtiest Air in the World

Now it is time for what me and President Trump call the “Hell Hole” countries of the world. Take another look at the map and you will probably agree. The area of the world consisting of Northern Africa, Egypt, Pakistan, Afghanistan, Iran, India, and China have the worst air in the world and probably the Universe. We have heard more about the terrible smog in Beijing and other cities in China, but it is not bad enough to make the list of the top 10 countries with the worst air in the world. China comes in at #13 on the dirtiest air list.

#10 Bangladesh



#9 Bahrain



#8 United Arab Emirates



#7 Saudi Arabia



#6 Iran



#5 Egypt



#4 Afghanistan



#3 Qatar



#2 India



#1 Pakistan



Honorable Mention goes to China – These two pictures were taken in Beijing



Various Causes of Air Pollution

Air pollution is the introduction of harmful substances in the air that have detrimental impacts to the environment and humanity. It occurs when the harmful substances such as foreign gases, odor, dust, or fumes are present in the air at levels that can harm the comfort and health of animals and humans or even destroy plant life.

Air pollution results from both human and natural activities. Emissions from power plants present a perfect example of human activities whereas volcanic eruptions and forest fires are some of the natural aspects. A closer look at the activities that cause air pollution include:

Emissions from Industrial Plants and Manufacturing Activities



Industrial Plant Smokestack

With the current rate of industrialization and increased manufacturing activities, high levels of smoke, sulfur dioxide, and particulate matter are emitted into the air. In a typical industrial plant, for instance, it is easy to notice the long chimneys or smokestacks erected into the air, emitting large amounts of fumes and smoke from it.

Industrial plants, factories, and power plants release high amounts of organic compounds, chemicals, particulate matter, and carbon monoxide into the air. Industrial plants that refine petroleum, manufacture cement, produce metals such as steel and aluminum, process plastics, or manufacture chemical products are among the industries and manufacturing activities that release lots of foreign harmful materials into the air.

Petroleum refineries, for example, emit high levels of hydrocarbons into the air. Most manufacturing plants release the pollutants in small amounts, but continuously over extended time periods that eventually leads to cumulative negative effects. In some cases, manufacturing plants have accidentally emitted high amounts of air pollution in a very short time span that has led to massive harm to human and animal health and destroyed plant life.

Combustion from Fossil Fuels



Fossil Fuel Combustion

In the modern world, fossil fuel combustion is the biggest contributor to air pollution. The leading culprit today is traffic, but factories and power plants also continue to contribute to some extent. Conventional power plants that combust fossil fuels such as coal, natural gas, or petroleum to produce energy emits hazardous gases such as oxides of nitrogen, Carbon Monoxide, particulates, and hydrocarbons into the air.

The number of cars on our roads are overwhelming and increasing, with an estimated number of more than half a billion cars on the road. Heavy duty trucks, shipping vessels, trains, and airplanes also combust lots of fossil fuels to function. All these transportation utilities are power-driven by diesel and gasoline engines that combust petroleum to produce energy.

Petroleum contains hydrocarbons. Thus, in the process of combustion, it releases Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Volatile Organic Compounds (VOCs), lead, and particulate matter into the air. Collectively, these are the major contributors to air pollution and have persisted as one of the most challenging to manage because humans heavily rely on these forms of transportation.

Farming Chemicals and Household Products



Corp Dusters

Use of household and farming chemicals produce considerable amounts of harmful foreign substances into the atmosphere and have the potential to cause air pollution. Dusting of crops, painting supplies, home fumigation, household cleaning products, fertilizer powder, insect sprays, hair sprays, and deodorant sprays release harmful chemicals into the air, causing pollution.

High concentrations of these chemicals within a confined area can be hazardous and can cause serious health and breathing problems. Since they are regularly used products, they also qualify as major causes of air pollution as they release toxic particles and chemical gases into the atmosphere.

Natural Causes of Air Pollution



Kilauea Volcano on the Big Island of Hawaii

The majority of people only perceive air pollution as a consequence of human actions. In many cases, natural events can cause much more air pollution than us humans. However, they are rarely witnessed, and some of them are very disastrous and difficult to prevent from happening. Examples of natural events that lead to air pollution include volcanic eruptions, whirlwinds, forest fires, and gaseous releases from decaying plants and animals or radioactive decay of rocks.

Forest fires often begin naturally and can release huge amounts of smoke and dust particles that float in the air. The smoke and dust can be carried for miles within a short time leading to widespread air pollution. Some of the biggest wildfires have emitted smoke that drifted several miles across bordering cities and countries.

A massive volcanic eruption has the potential of discharging huge swathe of dust into the atmosphere to an extent of obstructing sunlight from reaching the earth surface. High amounts of gases released from plant and animal decaying matter or radioactive rock decay can also result in the pollution of air. Collectively, these examples provide a clear picture of some of the natural causes of air pollution which are beyond human control.

Other Causes

The majority of developing countries burn charcoal, wood, and crop waste to produce fuel used for cooking and heating. As such, the traditional practice of wood and charcoal burning is usually a chief contributor to indoor air pollution in developing nations. Burning charcoal, wood, and crop

waste release Carbon Monoxide (CO), Carbon Dioxide (CO₂), and particulate matter into the atmosphere that potentially causes air pollution.



Burning Sugar Cane

In some regions, waste is incinerated instead of being land-filled or recycled and as such, it substantially contributes to air pollution. Some agricultural practices like burning agricultural land after harvest or burning as a mechanism for clearing land cover is also a significant cause of air pollution.

What is the difference between “Vog”, “Haze”, and “Smog”?

Vog

When a volcano erupts, it produces molten lava in various forms, but the driving force for the eruption comes from the gases that are contained in the lava. These gases come out of the molten rock at varying pressures and consist of: water vapor, carbon dioxide, sulfur dioxide (SO₂), hydrogen, and a variety of other acids (sulfuric, hydrochloric, and hydrofluoric acids) and inert gases. Scientists working near the vent must wear gas masks to protect themselves from the concentrated fumes. Once these gases enter the atmosphere, many react very quickly. Sulfuric acid aerosols (from sulfur dioxide) produce the fume clouds that are carried by the wind and become dispersed into an unpleasant cloud of vog (from the words "volcanic" and "smog"). Over time, the gases continue to react with the atmosphere and ultimately form aerosols of ammonium sulfate that are gradually washed out of the atmosphere by rainfall or a process of settling called dry deposition.

Vog is unpleasant to anyone and can produce headaches as well as irritation to the lungs and eyes at higher concentrations. For people with asthma and other respiratory problems, the effects are much more serious, causing a tightening of the airways in the lungs and making it very difficult to breathe. Studies are being done to learn the long-term effects of vog but, to date, there's been no clear evidence that vog causes lingering damage to normally healthy individuals. However, a number of strategies can be used to minimize your exposure to vog's irritations: when possible, stay indoors with windows and doors closed and sealed. If you have one available to you, use an air conditioner or even a dehumidifier; both will condense water out of the indoor air and, in doing so, will remove the particulate sulfur compounds and acid gases from your indoor air.

Haze

Haze is the result of an accumulation of fine suspended dry particles, including dust, smoke, soot, and salt. Specific sources include both fires (planned and unplanned) and wind which sweeps up

fine particles from the ground and adds them to the atmosphere. In all, the sources are wide ranging and include any activity that increases the particle count in the lower atmosphere. If the particles continue to accumulate, without a way to escape, the particles form a "blanket" that covers a region. Conditions that would allow the particles to be dispersed would include wind and air streams. Conditions that would encourage Haze include limitations to the mixing of the air (low wind or temperature inversions), moisture, and sunshine. Most of the time, haze occurs in areas far from the original source of the pollutants, which are carried by wind currents to where they ultimately gather.

Smog

Smog is similar to haze except the particles are a result of industrial pollution and emissions from combustion engines. Smog is the stuff that will make you cough and burn your eyes. It's a good thing when it's high up in the atmosphere, but not so good when we're breathing it. It can cause everything from eye irritation to chronic asthma. The effects of smog aren't limited to people, though. Smog also affects plants and animals. Smog pollution has been known to damage crops, as well as to cause health problems in pets and farm animals. Smog has also been known to cause corrosive damage to buildings and vehicles.

What are the overall health effects of air pollution on humans?

Even healthy people can experience health impacts from polluted air including respiratory irritation or breathing difficulties during exercise or outdoor activities. Your actual risk of adverse effects depends on your current health status, the pollutant type and concentration, and the length of your exposure to the polluted air.

High air pollution levels can cause immediate health problems including:

- Aggravated cardiovascular and respiratory illness
- Added stress to heart and lungs, which must work harder to supply the body with oxygen
- Damaged cells in the respiratory system

Long-term exposure to polluted air can have permanent health effects such as:

- Accelerated aging of the lungs
- Loss of lung capacity and decreased lung function
- Development of diseases such as asthma, bronchitis, emphysema, and possibly cancer
- Shortened life span

Those most susceptible to severe health problems from air pollution are:

- Individuals with heart disease, coronary artery disease or congestive heart failure
- Individuals with lung diseases such as asthma, emphysema or chronic obstructive pulmonary disease (COPD)
- Pregnant women
- Outdoor workers
- Older adults and the elderly
- Children under age 14
- Athletes who exercise vigorously outdoors

People in these groups may experience health impacts at lower air pollution exposure levels, or their health effects may be of greater intensity.

Is medical oxygen safe?

Well, finally, we are getting into the area that prompted me to write this article about the air we breathe. My wife has some health issues that require her to use medical oxygen.

We have the following equipment in our living room:

- An oxygen generating machine – this is used by my wife when she is at home.
- We have one big oxygen tank (behind the generator) and is used only for backup in case of a power outage or if the oxygen generator stops working.
- Two small oxygen tanks. One is shown being filled by the oxygen generator. We take these two oxygen tanks when we go to dialysis, the doctor, or anywhere else. She uses one of the tanks and the other is for backup.



I heard on TV that these medical oxygen tanks can explode and can be very dangerous.



PALOLO, OAHU (HawaiiNewsNow) -

A 6-year-old playing with a lighter apparently set a fire that ignited a medical oxygen tank and set off an explosion that seriously injured two people in a Palolo housing complex on Tuesday, officials have confirmed.

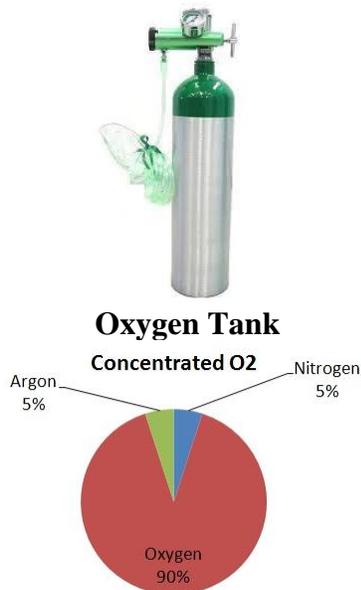
Both of those who suffered extensive burns work at the housing complex and rushed to the affected unit after hearing about the fire. Shortly after they arrived at the unit, a 3,500-liter oxygen tank exploded.

"We're just trying to all rally around our two managers. It has been tough on the whole community," said Dave Nakamura, executive director of Mutual Housing Association of Hawaii. "We'll kind of re-evaluate all that happened here and see if there's anything we can do to make things safer on our side, but I think it's kind of just a tragic and fluke accident."

The blast, about 12:30 p.m. Tuesday, was loud enough to be heard across the valley and caused significant damage in a number of units. Thirty-two people from six families have been displaced. Fire officials put the damage from the fire at more than \$1.1 million.

What is Medical Grade Oxygen?

Oxygen is a colorless, odorless, and tasteless gas that makes up about 20% of the air that we breathe. It combines with most of the other elements to form oxides. Oxygen is essential to the life processes of man, animal, and plant life. In humans, oxygen is transported in the bloodstream by hemoglobin, which is the compound in red blood cells that carries oxygen from the lungs to body cells, where metabolic reactions occur. The oxygen combines readily with the iron in hemoglobin (hemoglobin can carry more than twenty times its own volume in oxygen). After releasing oxygen to the cells, hemoglobin collects carbon dioxide and carries it to the lungs where it is exhaled.



Medical Oxygen Composition

Chemically, although oxygen is not itself flammable, it is extremely reactive as an accelerant in the combustion process. Anything that will burn in air will burn far more rigorously in an oxygen enriched environment. Great care should be taken to ensure that oxygen does not come into contact with hydrocarbon materials such as rubber, polyethylene, polypropylene, and lubricating oils and greases. Liquid oxygen should be handled very carefully and must not be allowed to come in contact with exposed skin as it will cause severe cold burns.

Oxygen can be manufactured in a number of different ways, but virtually all medical oxygen is produced by the fractional distillation of air, which is the most economical process for large scale manufacture. Medical grade oxygen can be stored for use by a facility in the form of a compressed gas, as in high pressure cylinders, or as a liquid, as in bulk liquid storage tanks.

What can cause a medical oxygen tank to explode?

Smoking

One of the primary uses of oxygen in patients is chronic obstructive pulmonary disease, which is a side effect of smoking. Some patients on oxygen continue to smoke because they find it difficult to quit and put their lives at risk every time they light up. In many cases, the oxygen is contained in its cylinder and will not ignite. However, if the person removes his cannula and allows the cigarette to get too close to the oxygen source, the heat can ignite the oxygen and lead to a tank explosion.

Vibration

While some patients who require an oxygen tank are happy to stay at home, others like to venture out and live an active life. However, vibrations can cause an oxygen tank to explode when it is combined with a heat source. For instance, when a person on oxygen rides in a vehicle on a sunny day, the sun's rays heat up the canister. As the vehicle travels along, the bumps in the road cause the tank to vibrate. The combination of vibration and heat can create a spark, which in turn ignites and explodes the oxygen tank. Therefore, it is important to secure the tank well when traveling and protect it from direct sunlight.

Oil

Although not a common cause, if there is any oil present in an oxygen tank, the tank can explode, especially as it is filled. The oil is usually introduced into the canister when the valves are oiled as

routine maintenance. Oil from your skin can also serve as a trigger. When you turn the oxygen tank back on, the pressure compresses the oil, which then explodes and causes a fire. While this explosion is generally a small one, a large amount of oil can create a much bigger explosion.

Leaks

When dealing with an oxygen tank, it is important to take care of it and have it inspected regularly for safety. A leak in the valve or any other part of the canister can be a fire hazard. Since oxygen is necessary for a fire to burn, all it needs is a small spark to create a fire. Because the oxygen found in these canisters is more concentrated than room air, it causes a fire to burn much hotter. If there is a leak in the canister and a spark or fire starts, the fire can travel into the canister and cause an explosion.

Are oxygen tanks flammable?

Oxygen does not burn. It is not flammable, but it is an oxidizer. Oxygen feeds a fire, so it's dangerous to use around something that is burning, because it will burn much more quickly.

Can oxygen explode?

That match would burn like hell, but no explosion. Oxygen works as the oxidizer to flammable material. It is not flammable itself. Oxygen is not the only material that is a good oxidizer, but the most common, as there is plenty of it in the air we breathe (but not enough hydrogen to make it explosive).

Can you leave oxygen tank in a car?

Oxygen in the cylinder is stored under pressure and if damaged, it can become a missile and shoot off at a high rate of speed. Oxygen cylinders should not be stored in an area where the temperature goes above 125 degrees Fahrenheit. Never store oxygen cylinders in a car trunk or a hot vehicle.

Conclusions

The oxygen equipment and tanks in our house are not dangerous unless there is a fire or a direct flame to the oxygen. The spare oxygen tank I have in my truck should not be left there on hot days or when I'm parked in the sun.

Since most of the world's terrorists (with the possible exception of China) come from countries with the worst polluted air, breathing bad air must contribute to the desire to kill innocent people.

We (most of my readers) are lucky to be living in the United States of America!

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