HOW SICK BUILDING SYNDROME AFFECTS HOSPITALS, HEALTHCARE FACILITIES AND COMMERCIAL FACILITIES.

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Abstract

Sick building syndrome (SBS) can be catastrophic for commercial facilities and hospitals. It adversely affects employee performance, worker health, and in healthcare facilities and hospitals, patient outcomes. From an epidemiological standpoint, incidents of sick building syndrome are rising rapidly. What can hospital administrators, healthcare decision makers, and commercial facilities managers do in response? Download our new whitepaper to find out.

The white paper includes information on:

- What causes sick building syndrome
- The effects of building related illness
- Bad indoor air quality: HVAC and plumbing related causes
- Worker productivity losses and costs
- How SBS can affect healthcare
- What LEED Has to Say
- Solutions and Next Steps

Sick building syndrome (SBS) can be catastrophic for commercial facilities and hospitals. It adversely affects employee performance, worker health, and in healthcare facilities and hospitals, patient outcomes. From an epidemiological standpoint, incidents of sick building syndrome are rising rapidly. What can hospital administrators, healthcare decision makers, and commercial facilities managers do in response? Read on to find out.

WHAT IS SICK BUILDING SYNDROME?

A medical phenomena commonly known as Sick Building Syndrome (SBS) affects people around the world and has been gaining attention in recent years. This is an umbrella term that describes an assortment of acute symptoms that can't be attributed to an obvious cause. Furthermore, any medical tests directed at finding the cause of these symptoms prove to be inconclusive.

Individuals report experiencing these symptoms while they are inside a particular building, or buildings. The symptoms subside when the patients leave the building, or shortly thereafter.

Many times, individuals also report ambiguous complaints about the environment in question like the air being stale or stuffy. Individuals have reported experiencing ill effects throughout the entire building, but have also reported feeling these effects in specific room or areas.

The exact source of the reported symptoms usually remains unidentified. These problems can occur when a building is not operated or maintained properly, or can simply be the result of poor design and construction.

Sometimes these issues can be resolved by identifying and correcting problems involving the building's HVAC, ventilation, and plumbing systems. Changing or improving the practices and activities of those occupying the building can also alleviate these symptoms.

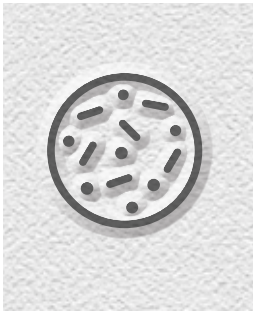
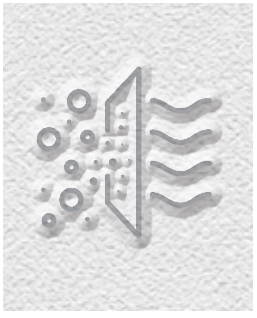
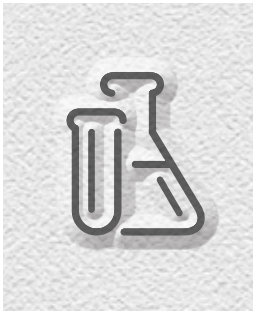
HOW IS SBS DIFFERENT FROM BUILDING RELATED ILLNESSES?

Unlike Sick Building Syndrome, building related illness (BRI) is a term used to describe numerous identifiable illnesses that result from exposure to contaminants in the air of a building. Another important distinction is that the source of these health issues can be determined relatively easily.

WHAT DO SBS AND BRI HAVE IN COMMON?

The source of the contaminants that cause both Sick Building Syndrome and building related illnesses can be either biological or chemical. Some symptoms can be specific to the contaminant, while others might mimic those of a viral or bacterial infection.

It's possible that serious respiratory and lung conditions can develop as a result of exposure to certain contaminants. Those subject to long-term or repeated exposure to these pollutants are at increased risk of suffering from serious health problems.
Health issues related to the air quality of workplace environments have been estimated to cost businesses around $20 – $70 billion every year. These losses can be attributed, in part, to increased employee absences due to sickness. A decrease in the quality of work and lowered productivity are also to blame.

AN OVERVIEW OF THE CAUSES OF SICK BUILDING SYNDROME

Sick building syndrome can be caused by pollutants that fall into one of two distinctly different categories. These two categories are biological contaminants and chemical contaminants.

BIOLOGICAL CONTAMINANTS THAT CAN POTENTIALLY CAUSE SBS

All manner of pollen, molds, viruses, and bacteria are capable of infiltrating buildings by various means. These are examples of biological contaminants, most of which develop and thrive in stagnant water. Water can accumulate in numerous places throughout healthcare and commercial facilities.

Common sources of stagnant water include drain pans, ducts, and humidifiers. Surfaces that can absorb water, such as carpeting, insulation, drywall, or ceiling tiles, can also harbor biological contaminants, Additional sources of biological contamination include insects, such as dust mites, and the droppings of rodents or birds.

A fair number of physical symptoms are associated with this type of contamination. These symptoms include chest tightness, fever, chills, muscle aches, and coughing. Individuals might also develop allergic responses, such as upper respiratory congestion or irritation to the mucous membrane. Legionella is a common form of bacterium that's responsible for both Pontiac Fever and Legionnaires' disease.

CHEMICAL CONTAMINANTS THAT CAN POTENTIALLY CAUSE SBS

Chemical pollutants responsible for making people sick can be divided into two main groups. The first of these groups is made up of volatile organic compounds. The second group consists of combustion pollutants.

VOLATILE ORGANIC COMPOUNDS ARE FOUND IN MANY COMMON PRODUCTS

There are many liquids, and even solids, that release gases containing volatile organic compounds (VOCs). This category of airborne pollutants consists of a wide range of chemicals, numbering in the thousands.

A significant number of these can cause both long-term and short-term health issues. The levels of volatile organic compounds are consistently higher inside buildings than outside. In fact, indoor levels can be up to 10 times higher than outdoor levels.
There are countless everyday household products that contain organic chemicals. These products include:

_ Insect repellents, pesticides, and herbicides
_ Wood preservatives, sealants, stains, varnishes, waxes, paints, and dyes
_ Aerosol sprays, disinfectants, degreasers, and other household cleaning supplies
_ Adhesives, solvents, lubricants, and hobby supplies
_ Certain art and photography supplies
_ Plastics and fuels made from organic chemicals
_ Air fresheners, perfumes, and cosmetic products
_ Dry cleaning products and dry-cleaned clothes
_ Building materials, carpeting, upholstery, and furnishings

These products not only emit organic compounds when you use them, they can also release pollutants into the air while they're being stored. The EPA's Office of Research and Development conducted a study involving organic pollutants commonly found in households.

The levels of around a dozen of these contaminants were found to be two to five times higher inside homes than outside. The study included homes in rural areas and highly industrial areas, with the findings for both being comparable.

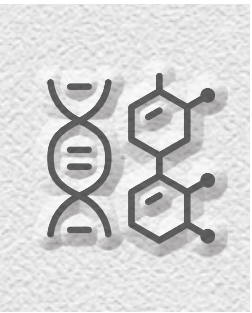
Products containing organic chemicals can release extremely high levels of pollutants while they are being used. Elevated concentrations of pollutants can continue to linger in the air for a long time.

COMBUSTION POLLUTANTS COME FROM BURNING A VARIETY OF FUELS

Combustion pollutants consist of gases and microscopic particles produced by the burning of fuels or other household products. The sources for these contaminants include fossil fuels, natural gas, kerosene, charcoal, wood, tobacco, incense, and candles. Common indoor combustion pollutants include carbon monoxide, nitrogen dioxide, polycyclic aromatic hydrocarbons, and particulate matter.

CARBON MONOXIDE

Exposure to high levels of carbon monoxide can cause nausea, headaches, and fatigue. Extremely high levels of carbon monoxide can damage the heart or brain and can even cause death. This pollutant can come from many sources including:



- Unvented kerosene and gas space heaters
- Gas, oil, charcoal, or wood-burning furnaces and boilers
- Gas and oil water heaters
- Exhaust from automobile in underground or attached garages
- Gas stoves and ovens
- Generators and other gasoline powered equipment
- Woodstoves and fireplaces
- Tobacco smoke

NITROGEN DIOXIDE

Short periods of exposure to high levels of nitrogen dioxide can exacerbate respiratory disorders, especially asthma. People may experience a number of symptoms including wheezing, coughing, sneezing or difficulty breathing.

Longer periods of exposure to elevated levels of nitrogen dioxide can increase susceptibility to respiratory infections. Being subjected to elevated levels for extended periods of time could also lead to the development of asthma.

Those with asthma or other respiratory disorders, the elderly, and children are at greater risk of suffering from these health issues. Nitrogen dioxide, and other nitrogen oxides, can react with chemicals in the air to form particulate matter. Nitrogen dioxide comes from many of the same sources as carbon monoxide.

POLYCYCLIC AROMATIC HYDROCARBONS

Polycyclic aromatic hydrocarbons occur naturally in coal, gasoline, and oil. These chemicals are released into the air when we burn tobacco, wood, coal, oil, gas, and garbage. These pollutants can bind to, or even form, small airborne particles.

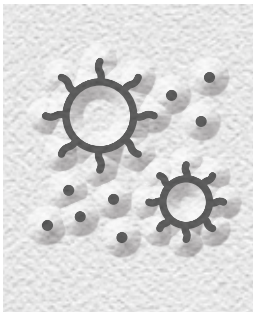
A commercially produced polycyclic aromatic hydrocarbon is naphthalene. It is used to make mothballs and various other chemicals. Cigarette smoke can be particularly harmful, since it contains numerous polycyclic aromatic hydrocarbons.

PARTICULATE MATTER

Particulate matter can be found floating through the air nearly anywhere, most of which is not observable with the naked eye. Despite their small size, these particles are responsible for causing many common health issues.

This form of air pollution can be produced by a multitude of means, involving either chemical or mechanical processes. In mechanical processes, larger matter is broken down into smaller particles without any chemical change occurring.
Construction, agriculture, and industrial processing plants release particles into the air ranging in size from coarse to fine. Particulate matter that forms as a result of a chemical process can come from burning fuel or other sources that release gases.

These contaminants vaporize and then condense to form small particles. The resulting particles can further react with other airborne compounds. Sometimes they will combine to form larger particles.



THE SIZE OF PARTICULATE MATTER MAKES A DIFFERENCE

These pollutants come in a wide range of shapes and sizes. The size of the matter can be linked directly to its potential for causing health issues. These airborne particles have traditionally been divided into two main categories that differ in significant ways. One group consists of particles between 2.5 and 10 microns in diameter and the other consists of particles smaller than 2.5 microns. Modern equipment can distinguish the size and amount of individual particles.

Size is not the only factor involved in differentiating individual types of particles. These various types of particles are composed of different materials and chemicals, originating from an array sources. Smaller particles remain suspended in the air for longer periods of time before finally settling on the ground or other surfaces.

Particles smaller than 2.5 microns can potentially linger in the air for weeks and travel long distances. Those between 2.5 and 10 microns can potentially stay in the air for hours and are capable of traveling shorter distances.

When you inhale particulate matter less than 2.5 microns in size, the contaminants can travel deep into the lungs, making their way into the alveoli. Particles smaller than 2.5 microns are the most dangerous because our lungs do not have an efficient means of expelling them. Smoke from cigarettes or the burning of wood contains an especially toxic mixture of pollutants that can cause extreme irritation or cancer.

EFFECTS OF PARTICULATE MATTER THAT ENTERS THE BLOODSTREAM

The problem is compounded when the particles are water soluble because they can pass into the bloodstream in a matter of minutes. If they are not water soluble, they can remain in the alveoli indefinitely. Pollutants that make it into the bloodstream can cause many medical issues and symptoms including:

_ Acute respiratory symptoms
_ Chronic bronchitis
_ Lung disease including cancer and emphysema
_ Aggravation of cardiovascular or respiratory disorders
_ Increased risk of a heart attack
_ Decreased lung function
_ Shortened lifespan
_ Complications with pregnancy or diabetes

Those who are particularly vulnerable to the toxic effects of combustion pollutants include people with heart or lung disease, anemia, and asthma. The elderly can be at increased risk due to the possibility of having undiagnosed heart and lung disorders or diabetes. Children and infants are at greater risk because their lungs are still developing and because they are more active.

INADEQUATE VENTILATION IS A MAJOR CONTRIBUTOR TO SBS AND BRI

During the oil embargo in the early 1970s, buildings were designed to be much more tightly sealed with less ventilation. This was an attempt to improve the energy efficiency of these newly constructed buildings. The ventilation was reduced substantially and was found to be inadequate for maintaining an appropriate level of health and comfort.

Malfunctioning, outdated, or under-performing cooling, heating, and ventilation systems can also act to increase indoor air pollution. The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) is an organization dedicated to developing and refining sustainable building technologies and practices.

To attain an acceptable level of indoor air quality and minimize energy consumption, ASHRAE greatly increased their standards for the minimum outdoor airflow rate. Facilities built more recently are often poorly designed and constructed with a greater number of offices occupying the building. This is done to increase the salable area of the building, but also contributes to the problem of inadequate ventilation.

SBS IN HOSPITALS AND HEALTHCARE FACILITIES

Healthcare facilities, in particular hospitals, are a community's first line of defense against infection. Medical professionals use advanced methods of diagnosing and treating issues along with thorough sterilization to improve the health of patients.

However, the construction and design of the facility along with activities of the occupants also heavily influence the quality of the environment. The largest hospitals in the U.S. were built according to what is known as a deep plan.
In such a plan, the distance from one external wall to another is far greater than the height between floors. While this type of construction costs less and uses the site more

efficiently, core areas lack natural lighting and must be lit using electricity.

This kind of layout also requires extensive mechanical air conditioning and ventilation systems. Hospitals usually have multiple backup systems so the facility can continue to operate during a power outage.

In buildings constructed according to a deep plan, it's nearly impossible to escape the effects of SBS or BRI. Hospital workers and patients alike are exposed to health hazards that are in direct opposition to the facility's intended function.

SBS IN COMMERCIAL BUILDING FACILITIES

SBS has been studied for decades and has the potential to affect countless employees and tenants who occupy commercial buildings. Once again, the design and construction of the building, in addition to the occupants' activities, have a large impact on the quality of the environment.

The cumulative effect of airborne pollutants on a facility's occupants can be overwhelming. This is especially true when they must deal with such discomfort and illnesses for long periods of time.

Businesses whose buildings foster SBS or RBI can end up losing copious amounts of money. A decrease in morale and productivity along with increased turnover rates and instances of sick leave are estimated to cost employers around $15 billion a year in SBS-related issues alone.

The longer air conditioning and ventilation systems go without addressing possible hazards, the more likely it is that they will become contaminated. Fans, filters, intake vents, and ducts can all become infested with fungus, mold, and bacteria over time.

EARLY WARNING SIGNS OF SBS

Administrators in charge of businesses, and those in charge of managing any properties, should be aware of the potential warning signs of SBS. They should also be ready to address and correct these issues. An early sign that your building could have SBS is that you receive an increasing amount occupant complaints involving discomfort and acute symptoms including:

_ Irritation of the skin, eyes, nose or throat
_ Headaches
_ Dry cough
_ Dizziness or nausea
_ Difficulty concentrating
_ Fatigue
_ Sensitivity to odors

Even if your building doesn't exhibit warning signs, getting an air quality assessment is still a wise move. When you do so, an indoor air quality expert can help you to:

- Evaluate your building's HVAC system and plumbing
- Determine whether it could be contributing to poor indoor air quality
- Prevent, diagnose, and resolve indoor air quality issues, plumbing vent issues, and leaks
- Assess the presence and quantity of potentially harmful chemicals, particles, organisms
- Apply current industry guidelines to the building and the performance of its systems

DETERMINING THE PROPER SOLUTIONS FOR SBS

The three main strategies for correcting SBS are removing the source of the pollution, increasing the ventilation, and instituting air purification measures. The most effective solutions usually involve a combination of these strategies.

Removing or modifying the source of the pollution is extremely effective in resolving air quality issues when the source can be identified. Depending on the contaminants and their sources, there are many different ways of achieving this goal. Examples of source removal include:

- Routine maintenance and cleaning of all HVAC system components, including ductwork
- Maintenance and repair for plumbing vents and leakages
- Cleaning or replacing filters
- Replacing water-stained ceiling tile, drywall, or carpeting
- Instituting smoking restrictions
- Venting of chemical emissions
- Removing or relocating paints, adhesives, solvents, or pesticides to well-ventilated areas
- Using these pollutant sources properly
- Allowing time for building materials to off-gas pollutants

Increasing the ventilation and air distribution can also be an effective means of improving your indoor air quality. Any HVAC system needs to be designed to meet or exceed the ventilation standards for local building codes.

It's important to be sure that you are operating and maintaining these systems in accordance with their original design. Doing so will usually alleviate at least some of your building's air quality issues. In some cases, this simple act could solve the problem altogether.

You may need local exhaust ventilation to remove high levels of contaminants from the building. This form of exhaust ventilation is especially effective at removing pollutants that build up in specific areas like restrooms, copy rooms, or printing facilities.

Air purification can be particularly useful alongside source control and ventilation measures. This strategy is, however, beholden to certain limitations. All HVAC systems include filters that are inexpensive and easy to replace.

Unfortunately, these filters aren't very effective at capturing small particles. High-

performance air filters capture these smaller particles before they are inhaled. Mechanical filters can't remove gaseous pollutants, but some of these be removed by adsorbent beds.

TURN TO THE COMMERCIAL HVAC & PLUMBING EXPERTS AT SAGAMORE

Some of New England's largest commercial builders and most prominent healthcare facilities have turned to Sagamore for our help. We provide expertly-designed and reliably-installed heating, air conditioning, and ventilation systems for facilities of all sizes.

Given current demands for energy efficiency, sustainability, and near-zero downtime in competitive environments, we understand the requirements of today's organizations. We also have the resources and experience to meet these demands head-on.
The experts at Sagamore are available for consultation regarding the air quality of any building. We can also help develop innovative, customized solutions. Call us today to discuss your project.

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