WIKIPEDIA

Sick building syndrome

Sick building syndrome	
Specialty	Environmental medicine, Immunology

Sick building syndrome (**SBS**) is a medical condition where people in a building suffer from symptoms of illness or feel unwell for no apparent reason.[1] The symptoms tend to increase in severity with the time people spend in the building, and improve over time or even disappear when people are away from the building. The main identifying observation is an increased incidence of complaints of symptoms such as headache, eye, nose, and throat irritation, fatigue, and dizziness and nausea.[2] These symptoms appear to be linked to time spent in a building, though no specific illness or cause can be identified. SBS is also used interchangeably with "building-related symptoms", which orients the name of the condition around patients rather than a "sick" building. A 1984 World Health Organization (WHO) report suggested up to 30% of new and remodeled buildings worldwide may be subject of complaints related to poor indoor air quality.[3]

Sick building causes are frequently pinned down to flaws in the heating, ventilation, and air conditioning (HVAC) systems. However, there have been inconsistent findings on whether air conditioning systems result in SBS or not.[4] Other causes have been attributed to contaminants produced by outgassing of some types of building materials, volatile organic compounds (VOC), molds (see mold health issues), improper exhaust ventilation of ozone (byproduct of some office machinery), light industrial chemicals used within, or lack of adequate fresh-air intake/air filtration (see Minimum efficiency reporting value).

Contents

Signs and symptoms

Human exposure to bioaerosols has been documented to give rise to a variety of adverse health effects.[5] Building occupants complain of symptoms such as sensory irritation of the eyes, nose, or throat; neurotoxic or general health problems; skin irritation; nonspecific hypersensitivity reactions; infectious diseases;[6] and odor and taste sensations.[7] Exposure to poor lighting conditions has led to general malaise.[8]

Extrinsic allergic alveolitis has been associated with the presence of fungi and bacteria in the moist air of residential houses and commercial offices.[9] A very large 2017 Swedish study [10] correlated several inflammatory diseases of the respiration tract with objective evidence of damp-caused damage in homes.

The WHO has classified the reported symptoms into broad categories, including: mucous membrane irritation (eye, nose, and throat irritation), neurotoxic effects (headaches, fatigue, and irritability), asthma and asthma-like symptoms (chest tightness and wheezing), skin dryness and irritation, gastrointestinal complaints and more.[11]

Several sick occupants may report individual symptoms which do not appear to be connected. The key to discovery is the increased incidence of illnesses in general with onset or exacerbation within a fairly close time frame—usually within a period of weeks. In most cases, SBS symptoms will be relieved soon after the occupants leave the particular room or zone.[12] However, there can be lingering effects of various neurotoxins, which may not clear up when the occupant leaves the building. In some cases—particularly in sensitive individuals—there can be long-term health effects.

Cause

It has been suggested that sick building syndrome could be caused by inadequate ventilation, deteriorating fiberglass duct liners, chemical contaminants from indoor or outdoor sources, and biological contaminants, air recycled using fan coils, traffic noise, poor lighting, and buildings located in a polluted urban area.[8] Many volatile organic compounds, which are considered chemical contaminants, can cause acute effects on the occupants of a building. "Bacteria, molds, pollen, and viruses are types of biological contaminants" and can all cause SBS. In addition, pollution from outdoors, such as motor vehicle exhaust, can contribute to SBS.[3] Adult SBS symptoms were associated with a history of allergic rhinitis, eczema and asthma.[13]

A 2015 study concerning the association of SBS and indoor air pollutants in office buildings in Iran found as carbon dioxide levels increase in a building, symptoms like nausea, headaches, nasal irritation, dyspnea, and throat dryness have also been shown to increase.[8] Certain work conditions have been found to be correlated with specific symptoms. For example, higher light intensity was significantly related to skin dryness, eye pain, and malaise.[8] Higher temperature has also been found to correlate with symptoms such as sneezing, skin redness, itchy eyes and headache, while higher relative humidity has been associated with sneezing, skin redness, and pain of the eyes.[8]

ASHRAE has recognized that polluted urban air, designated within the United States Environmental Protection Agency (EPA)'s air quality ratings as unacceptable requires the installation of treatment such as filtration for which the HVAC practitioners generally apply carbon-impregnated filters and their like.

In 1973, in response to the 1973 oil crisis and conservation concerns, ASHRAE Standards 62-73 and 62-81 reduced required ventilation from 10 cubic feet per minute (4.7 L/s) per person to 5 cubic feet per minute (2.4 L/s) per person, but this was found to be a contributing factor to sick building syndrome.[14] As of the 2016 revision, ASHRAE ventilation standards call for 5 to 10 cubic feet per minute of ventilation per occupant (depending on the occupancy type) in addition to ventilation based on the zone floor area delivered to the breathing zone.[15]

Psychological factors

One study looked at commercial buildings and their employees, comparing some environmental factors suspected of inducing SBS to a self-reported survey of the occupants,[16] finding that the measured psycho-social circumstances appeared more influential than the tested environmental factors.[17] The list of environmental factors in the study can be found here.[18] Limitations of the study include that it only measured the indoor environment of commercial buildings, which have different building codes than residential buildings, and that the assessment of building environment was based on layman observation of a limited number of factors.

Research has shown that SBS shares several symptoms common in other conditions thought to be at least partially caused by psychosomatic tendencies. The umbrella term "autoimmune/inflammatory syndrome induced by adjuvants" has been suggested. Other members of the suggested group include Silicosis, Macrophagic myofascitis,Gulf War syndrome, Post-vaccination phenomena.[19]

Workplace

Greater effects were found with features of the psychosocial work environment including high job demands and low support. The report concluded that the physical environment of office buildings appears to be less important than features of the psychosocial work environment in explaining differences in the prevalence of symptoms. However, there is still a relationship between sick building syndrome and symptoms of workers regardless of workplace stress.[20]

Excessive work stress or dissatisfaction, poor interpersonal relationships and poor communication are often seen to be associated with SBS, recent studies show that a combination of environmental sensitivity and stress can greatly contribute to sick building syndrome.

Specific work-related stressors are related with specific SBS symptoms. Workload and work conflict are significantly associated with general symptoms (headache, abnormal tiredness, sensation of cold or nausea). While crowded workspaces and low work satisfaction are associated with upper respiratory symptoms.[21]

Specific careers are also associated with specific SBS symptoms. Transport, communication, healthcare, and social workers have highest prevalence of general symptoms. Skin symptoms such as eczema, itching, and rashes on hands and face are associated with technical work. Forestry, agriculture, and sales workers have the lowest rates of sick building syndrome symptoms.[22]

Milton et al. determined the cost of sick leave specific for one business was an estimated $480 per employee, and about five days of sick leave per year could be attributed to low ventilation rates. When comparing low ventilation rate areas of the building to higher ventilation rate areas, the relative risk of short-term sick leave was 1.53 times greater in the low ventilation areas.[23]

Work productivity has been associated with ventilation rates, a contributing factor to SBS, and there's a significant increase in production as ventilation rates increase, by 1.7% for every two-fold increase of ventilation rate.[24]

Home

Sick building syndrome can also occur due to factors of the home. Laminated flooring can cause more exposure to chemicals and more resulting SBS symptoms compared to stone, tile, and cement flooring.[13] Recent redecorating and new furnishings within the last year were also found to be associated with increased symptoms, along with dampness and related factors, having pets, and the presence of cockroaches.[13] The presence of mosquitoes was also a factor related to more symptoms, though it is unclear whether it was due to the presence of mosquitoes or the use of repellents.[13]

Diagnosis

While sick building syndrome (SBS) encompasses a multitude of non-specific symptoms, building-related illness (BRI) comprises specific, diagnosable symptoms caused by certain agents (chemicals, bacteria, fungi, etc.). These can typically be identified, measured, and quantified.[25] There are usually 4 causal agents in BRI; 1.) Immunologic, 2.) Infectious, 3.) toxic, and 4.) irritant.[25] For instance, Legionnaire's disease, usually caused by *Legionella pneumophila*, involves a specific organism which could be ascertained through clinical findings as the source of contamination within a building. SBS does not have any known cure; alleviation consists of removing the affected person from the building associated with non-specific symptoms. BRI, on the other hand, utilizes treatment appropriate for the contaminant identified within the building (e.g., antibiotics for Legionnaire's disease). In most cases, simply improving the indoor air quality (IAQ) of a particular building will attenuate, or even eliminate, the acute symptoms of SBS, while removal of the source contaminant would prove more effective for a specific illness, as in the case of BRI.[26] Building-Related Illness is vital to the overall understanding of Sick Building Syndrome because BRI illustrates a causal path to infection, theoretically. Office BRI may more likely than not be explained by three events: “Wide range in the threshold of response in any population (susceptibility), a spectrum of response to any given agent, or variability in exposure within large office buildings."[27] Isolating any one of the three aspects of office BRI can be a great challenge, which is why those who find themselves with BRI should take three steps, history, examinations, and interventions. History describes the action of continually monitoring and recording the health of workers experiencing BRI, as well as obtaining records of previous building alterations or related activity. Examinations go hand in hand with monitoring employee health. This step is done by physically examining the entire workspace and evaluating possible threats to health status among employees. Interventions follow accordingly based off the results of the Examination and History report.[27]

Prevention

- Toxin-absorbing plants, such as sansevieria.[28][29][30][31][32][33][34]
- Roof shingle non-pressure cleaning for removal of algae, mold, and *Gloeocapsa magma*.
- Using ozone to eliminate the many sources, such as VOC, molds, mildews, bacteria, viruses, and even odors. However, numerous studies identify High-ozone shock treatment as ineffective despite commercial popularity and popular belief.
- Replacement of water-stained ceiling tiles and carpeting.
- Only using paints, adhesives, solvents, and pesticides in well-ventilated areas or only using these pollutant sources during periods of non-occupancy.
- Increasing the number of air exchanges; the American Society of Heating, Refrigeration and Air-Conditioning Engineers recommend a minimum of 8.4 air exchanges per 24-hour period.
- Proper and frequent maintenance of HVAC systems.
- UV-C light in the HVAC plenum.
- Installation of HVAC Air Cleaning systems or devices to remove VOC's, bioeffluents (people odors) from HVAC systems conditioned air.
- Regular vacuuming with a HEPA filter vacuum cleaner to collect and retain 99.97% of particles down to and including 0.3 micrometers.
- Place bedding in sunshine, which is related to a study done in a high-humidity area where damp bedding was common and associated with SBS.[13]
- Increased ventilation rates that are above the minimum guidelines.[24]
- Lighting in the workplace should be designed to give individuals control, and be natural when possible.[35]

Epidemiology

Some studies have shown a small difference between genders, with women having slightly higher reports of SBS symptoms compared to men.[13] However, many other studies have shown an even higher difference in the report of sick building syndrome symptoms in women compared to men.[8] It is not entirely clear, however, if this is due to biological, social, or occupational factors.

A 2001 study published in the Journal Indoor Air 2001 gathered 1464 office-working participants to increase the scientific understanding of gender differences under the Sick Building Syndrome phenomenon.[36] Using questionnaires, ergonomic investigations, building evaluations, as well as physical, biological, and chemical variables, the investigators obtained results that compare with past studies of SBS and gender. The study team found that across most test variables, prevalence rates were different in most areas, but there was also a deep stratification of working conditions between genders as well. For example, men's workplace tend to be significantly larger and have all around better job characteristics. Secondly, there was a noticeable difference in reporting rates, finding that women have higher rates of reporting roughly 20% higher than men. This information was similar to that found in previous studies, indicating a potential difference in willingness to report.[36]

There might be a gender difference in reporting rates of sick building syndrome because women tend to report more symptoms than men do. Along with this, some studies have found that women have a more responsive immune system and are more prone to mucosal dryness and facial erythema. Also, women are alleged by some to be more exposed to indoor environmental factors because they have a greater tendency to have clerical jobs, wherein they are exposed to unique office equipment and materials (example: blueprint machines), whereas men often have jobs based outside of offices.[37]

History

In the late 1970s, it was noted that nonspecific symptoms were reported by tenants in newly constructed homes, offices, and nurseries. In media it was called "office illness". The term "Sick Building Syndrome" was coined by the WHO in 1986, when they also estimated that 10-30% of newly built office buildings in the West had indoor air problems. Early Danish and British studies reported symptoms.

Poor indoor environments attracted attention. The Swedish allergy study (SOU 1989:76) designated "sick building" as a cause of the allergy epidemic as was feared. In the 1990s, therefore, extensive research into "sick building" was carried out. Various physical and chemical factors in the buildings were examined on a broad front.

The problem was highlighted increasingly in media and was described as a "ticking time bomb". Many studies were performed in individual buildings.

In the 1990s "sick buildings" were contrasted against "healthy buildings". The chemical contents of building materials were highlighted. Many building material manufacturers were actively working to gain control of the chemical content and to replace criticized additives. The ventilation industry advocated above all more well-functioning ventilation. Others perceived ecological construction, natural materials, and simple techniques as a solution.

At the end of the 1990s came an increased distrust of the concept of "sick building". A dissertation at the *Karolinska Institutet* in Stockholm 1999 questioned the methodology of previous research, and a Danish study from 2005 showed these flaws experimentally. It was suggested that sick building syndrome was not really a coherent syndrome and was not a disease to be individually diagnosed. In 2006 the Swedish National Board of Health and Welfare recommended in the medical journal *Läkartidningen* that "sick building syndrome" should not be used as a clinical diagnosis. Thereafter, it has become increasingly less common to use terms such as "sick buildings" and "sick building syndrome" in research. However, the concept remains alive in popular culture and is used to designate the set of symptoms related to poor home or work environment engineering. "Sick building" is therefore an expression used especially in the context of workplace health.

Sick building syndrome made a rapid journey from media to courtroom where professional engineers and architects became named defendants and were represented by their respective professional practice insurers. Proceedings invariably relied on expert witnesses, medical and technical experts along with building managers, contractors and manufacturers of finishes and furnishings, testifying as to cause and effect. Most of these actions resulted in sealed settlement agreements, none of these being dramatic. The insurers needed a defense based upon Standards of Professional Practice to meet a court decision that declared—that in a modern, essentially sealed building, the HVAC systems must produce breathing air for suitable human consumption. ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers, currently with over 50,000 international members) undertook the task of codifying its IAQ (Indoor Air Quality) standard.

ASHRAE empirical research determined that "acceptability" was a function of outdoor (fresh air) ventilation rate and used carbon dioxide as an accurate measurement of occupant presence and activity. Building odors and contaminants would be suitably controlled by this dilution methodology. ASHRAE codified a level of 1,000 ppm of carbon dioxide and specified the use of widely available sense-and-control equipment to assure compliance. The 1989 issue of ASHRAE 62.1-1989 published the whys and wherefores and overrode the 1981 requirements that were aimed at a ventilation level of 5,000 ppm of carbon dioxide, (the OAHA workplace limit), federally set to minimize HVAC system energy consumption. This apparently ended the SBS epidemic.

Over time, building materials changed with respect to emissions potential. Smoking vanished and dramatic improvements in ambient air quality, coupled with code compliant ventilation and maintenance, per ASHRAE standards have all contributed to the acceptability of the indoor air environment. Only time and the courts will tell how right, or wrong ASHRAE is.[38][39]

See also

- Aerotoxic syndrome
- Healthy building
- Multiple chemical sensitivity
- NASA Clean Air Study
- Somatization disorder

References

1. "Sick Building Syndrome" (https://www.wondermakers.com/Portals/0/docs/Sick%20building%20syndrome%20by%20WHO.pdf) (PDF). *World Health Organization*. n.d.
2. Stolwijk, J A (1991-11-01). "Sick-building syndrome" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1568418). *Environmental Health Perspectives*. **95**: 99–100. doi:10.1289/ehp.919599 (https://doi.org/10.1289%2Fehp.919599). ISSN 0091-6765 (https://www.worldcat.org/issn/0091-6765). PMC 1568418 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1568418). PMID 1821387 (https://www.ncbi.nlm.nih.gov/pubmed/1821387).
3. "Sick Building Syndrome" (http://www.epa.gov/iaq/pubs/sbs.html). United States Environmental Protection Agency (EPA). Retrieved 2009-02-19.
4. Shahzad, Sally S.; Brennan, John; Theodossopoulos, Dimitris; Hughes, Ben; Calautit, John Kaiser (2016-04-06). "Building-Related Symptoms, Energy, and Thermal Control in the Workplace: Personal and Open Plan Offices" (http://www.mdpi.com/2071-1050/8/4/331). *Sustainability*. **8** (4): 331. doi:10.3390/su8040331 (https://doi.org/10.3390%2Fsu8040331).
5. Sundell, J; Lindval, T; Berndt, S (1994). "Association between type of ventilation and airflow rates in office buildings and the risk of SBS-symptoms among occupants". *Environ.Int*. **20** (2): 239–251. doi:10.1016/0160-4120(94)90141-4 (https://doi.org/10.1016%2F0160-4120%2894%2990141-4).
6. Rylander, R (1997). "Investigation of the relationship between disease and airborne (1P3)-b-D-glucan in buildings". *Med. Of Inflamm.* (6): 275–277.
7. Godish, Thad (2001). *Indoor Environmental Quality.* New York: CRC Press. pp. 196–197. ISBN 1-56670-402-2

8. Jafari, Mohammad Javad; Khajevandi, Ali Asghar; Mousavi Najarkola, Seyed Ali; Yekaninejad, Mir Saeed; Pourhoseingholi, Mohammad Amin; Omidi, Leila; Kalantary, Saba (2015-01-01). "Association of Sick Building Syndrome with Indoor Air Parameters" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4515331). *Tanaffos*. **14** (1): 55–62. ISSN 1735-0344 (https://www.worldcat.org/issn/1735-0344). PMC 4515331 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4515331). PMID 26221153 (https://www.ncbi.nlm.nih.gov/pubmed/26221153).
9. Teculescu, D.B. (1998). "Sick Building Symptoms in office workers in northern France: a pilot study". *Int Arch. Occup. Environ. Health*. **71** (5): 353–356. doi:10.1007/s004200050292 (https://doi.org/10.1007%2Fs004200050292).
10. Pind C. Ahlroth (2017). "Patient-reported signs of dampness at home may be a risk factor for chronic rhinosinusitis: A cross-sectional study". *Clinical & Experimental Allergy*. **47** (11): 1383–1389. doi:10.1111/cea.12976 (https://doi.org/10.1111%2Fcea.12976). PMID 28695715 (https://www.ncbi.nlm.nih.gov/pubmed/28695715).
11. Apter, A (1994). "Epidemiology of the sick building syndrome". *J. Allergy Clin. Immunol.* (94): 277–288.
12. "Sick Building Syndrome" (http://www.nsc.org/resources/Factsheets/environment/sbs.aspx). *NSC.org*. National Safety Council. 2009. Retrieved April 27, 2009.
13. Wang, Juan; Li, BaiZhan; Yang, Qin; Wang, Han; Norback, Dan; Sundell, Jan (2013-12-01). "Sick building syndrome among parents of preschool children in relation to home environment in Chongqing, China". *Chinese Science Bulletin*. **58** (34): 4267–4276. Bibcode:2013ChSBu..58.4267W (http://adsabs.harvard.edu/abs/2013ChSBu..58.4267W). doi:10.1007/s11434-013-5814-2 (https://doi.org/10.1007%2Fs11434-013-5814-2). ISSN 1001-6538 (https://www.worldcat.org/issn/1001-6538).
14. Joshi S. M. (2008). "The sick building syndrome" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796751). *Indian J. Occup. Environ. Med*. **12** (2): 61–4. doi:10.4103/0019-5278.43262 (https://doi.org/10.4103%2F0019-5278.43262). PMC 2796751 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796751). PMID 20040980 (https://www.ncbi.nlm.nih.gov/pubmed/20040980). in section 3 "Inadequate ventilation".
15. ANSI/ASHRAE Standard 62.1-2016.
16. Taken from another study: Whitehead II.
17. Marmot A. F., Eley J., Stafford M., Stansfeld S. A., Warwick E., Marmot M. G. (2006). "Building health: an epidemiological study of "sick building syndrome" in the Whitehall II study" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078095). *Occup. Environ. Med*. **63** (4): 283–9. doi:10.1136/oem.2005.022889 (https://doi.org/10.1136%2Foem.2005.022889). PMC 2078095 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078095). PMID 16556750 (https://www.ncbi.nlm.nih.gov/pubmed/16556750).
18. Marmot A. F., Eley J., Stafford M., Stansfeld S. A., Warwick E., Marmot M. G. (2006). "Building health: an epidemiological study of "sick building syndrome" in the Whitehall II study" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078095/table/tbl1/). *Occup. Environ. Med*. **63** (4): 283–9. doi:10.1136/oem.2005.022889 (https://doi.org/10.1136%2Foem.2005.022889). PMC 2078095 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078095). PMID 16556750 (https://www.ncbi.nlm.nih.gov/pubmed/16556750).
19. The sick building syndrome as a part of the autoimmune (auto-inflammatory) syndrome induced by adjuvants (https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=21188456). ncbi.nlm.nih.gov].
20. Bauer R. M., Greve K. W., Besch E. L., Schramke C. J., Crouch J., Hicks A., Lyles W. B. (1992). "The role of psychological factors in the report of building-related symptoms in sick building syndrome". *Journal of Consulting and Clinical Psychology*. **60** (2): 213–219. doi:10.1037/0022-006x.60.2.213 (https://doi.org/10.1037%2F0022-006x.60.2.213).
21. Azuma K., Ikeda K., Kagi N., Yanagi U., Osawa H. (2014). "Prevalence and risk factors associated with nonspecific building-related symptoms in office employees in Japan: Relationships between work environment, Indoor Air Quality, and occupational stress". *Indoor Air*. **25** (5): 499–511. doi:10.1111/ina.12158 (https://doi.org/10.1111%2Fina.12158). PMID 25244340 (https://www.ncbi.nlm.nih.gov/pubmed/25244340).
22. Norback D., Edling C. (1991). "Environmental, occupational, and personal factors related to the prevalence of sick building syndrome in the general population" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1035398). *Occupational and Environmental Medicine*. **48** (7): 451–462. doi:10.1136/oem.48.7.451 (https://doi.org/10.1136%2Foem.48.7.451). PMC 1035398 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1035398). PMID 1854648 (https://www.ncbi.nlm.nih.gov/pubmed/1854648).

23. Milton D. K., Glencross P. M., Walters M. D. (2000). "Risk of Sick Leave Associated with Outdoor Air Supply Rate, Humidification, and Occupant Complaints". *Indoor Air*. **10** (4): 212–221. doi:10.1034/j.1600-0668.2000.010004212.x (https://doi.org/10.1034%2Fj.1600-0668.2000.010004212.x).
24. Wargocki P., Wyon D. P., Sundell J., Clausen G., Fanger P. O. (2000). "The Effects of Outdoor Air Supply Rate in an Office on Perceived Air Quality, Sick Building Syndrome (SBS) Symptoms and Productivity". *Indoor Air*. **10** (4): 222–236. doi:10.1034/j.1600-0668.2000.010004222.x (https://doi.org/10.1034%2Fj.1600-0668.2000.010004222.x).
25. Seltzer, J. M. (1994-08-01). "Building-related illnesses". *The Journal of Allergy and Clinical Immunology*. **94** (2 Pt 2): 351–361. doi:10.1016/0091-6749(94)90096-5 (https://doi.org/10.1016%2F0091-6749%2894%2990096-5). ISSN 0091-6749 (https://www.worldcat.org/issn/0091-6749). PMID 8077589 (https://www.ncbi.nlm.nih.gov/pubmed/8077589).
26. Indoor Air Facts No. 4 (revised) Sick building syndrome. Available from: http://www.epa.gov/iaq/pubs/sbs.html.
27. Menzies, Dick; Bourbeau, Jean (1997-11-20). "Building-Related Illnesses". *New England Journal of Medicine*. **337** (21): 1524–1531. doi:10.1056/NEJM199711203372107 (https://doi.org/10.1056%2FNEJM199711203372107). ISSN 0028-4793 (https://www.worldcat.org/issn/0028-4793). PMID 9366585 (https://www.ncbi.nlm.nih.gov/pubmed/9366585).
28. nasa techdoc 19930072988 (https://archive.org/details/nasa_techdoc_19930072988)
29. https://www.uts.edu.au/about/faculty-science/news-and-event-archive/news/sick-building-syndrome-how-indoor-plants-can-help
30. https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19930073077.pdf
31. Joshi, S. M (2008). "The sick building syndrome" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796751). *Indian Journal of Occupational and Environmental Medicine*. **12** (2): 61–64. doi:10.4103/0019-5278.43262 (https://doi.org/10.4103%2F0019-5278.43262). PMC 2796751 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796751). PMID 20040980 (https://www.ncbi.nlm.nih.gov/pubmed/20040980).
32. https://www.ieqindoorplants.com.au/health-relationship-to-plants/benefits-of-office-plants/
33. http://www.chrisbyrnes.com/plants-purify-air-sick-building-syndrome/
34. https://www.houseofplants.co.uk/sick-building-syndrome-plants-help.php
35. How to deal with sick building syndrome: Guidance for employers, building owners and building managers. (1995). Sudbury: The Executive.
36. Brasche, S.; Bullinger, M.; Morfeld, M.; Gebhardt, H. J.; Bischof, W. (2001-12-01). "Why do women suffer from sick building syndrome more often than men?--subjective higher sensitivity versus objective causes". *Indoor Air*. **11** (4): 217–222. doi:10.1034/j.1600-0668.2001.110402.x (https://doi.org/10.1034%2Fj.1600-0668.2001.110402.x). ISSN 0905-6947 (https://www.worldcat.org/issn/0905-6947). PMID 11761596 (https://www.ncbi.nlm.nih.gov/pubmed/11761596).
37. Godish, Thad (2001). *Indoor Environmental quality.* New York: CRC Press. pp. 196-197. ISBN 1-56670-402-2
38. "Sick Building Syndrome - Fact Sheet" (http://www.epa.gov/iaq/pdfs/sick_building_factsheet.pdf) (PDF). United States Environmental Protection Agency. Retrieved 2013-06-06.
39. "Sick Building Syndrome" (http://www.nhs.uk/conditions/sick-building-syndrome/Pages/Introduction.aspx). National Health Service, England. Retrieved 2013-06-06.

Further reading

- Martín-Gil J., Yanguas M. C., San José J. F., Rey-Martínez and Martín-Gil F. J. "Outcomes of research into a sick hospital". *Hospital Management International*, 1997, pp. 80–82. Sterling Publications Limited.
- Åke Thörn, *The Emergence and preservation of sick building syndrome*, KI 1999.
- Charlotte Brauer, *The sick building syndrome revisited*, Copenhagen 2005.
- Michelle Murphy, *Sick Building Syndrome and the Problem of Uncertainty*, 2006.
- Johan Carlson, "*Gemensam förklaringsmodell för sjukdomar kopplade till inomhusmiljön finns inte*" [Unified explanation for diseases related to indoor environment not found]. *Läkartidningen* 2006/12.
- Research Committee Report on Diagnosis and Treatment of Chronic Inflammatory Response Syndrome Caused by Exposure to the Interior Environment of Water-Damaged Buildings (PDF) (https://www.survivingmold.com/docs/POA_

MOLD_7_27_10_final.pdf).

External links

Classification	D
External resources	**Patient UK**: Sick building syndrome (https://patient.info/doctor/sick-building-syndrome-pro)

Retrieved from "https://en.wikipedia.org/w/index.php?title=Sick_building_syndrome&oldid=869986113"