

INDOOR AIR QUALITY STANDARDS: HISTORICAL DATA RESEARCH PROJECT

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Indoor air quality standards are not new. They have been in existence for over 150 years. The first indoor air quality standard was developed by German scientist Peter Koffer. His standard targeted carbon monoxide. The reason his gas was targeted had to do with the technology used for indoor lighting at that time.

In the 1800s, the gas that was burned was called "town gas." Town gas was generated by burning coal in an oxygen deficient atmosphere. The coal would break down into methane, carbon monoxide, and a little carbon dioxide. The health problem from town gas occurred when the gas pipes leaked and when the gas light would accidentally be extinguished, but the gas would still continue to leak out of the light fixture.

Peter Koffer researched the health affects of carbon monoxide and recommended an exposure standard of 50 ppm in 1849. Interestingly, the current occupational exposure limit for carbon monoxide is essentially the same today.

Following Peter Koffer's work, others also recommended various indoor air quality standards in the 1800s.

In 1874, English Army Surgeon F. deChamont conducted the first indoor air quality survey relating five levels of symptoms to indoor carbon dioxide concentrations. He proposed a carbon dioxide IAQ standard of 200 ppm above outdoor levels, approximately 500 ppm. This is very similar to today's ASHRAE standard.

In 1887, the English scientists Carnelley, Anderson and Haldane proposed "air purity" standards for carbon dioxide, organic matter, mold and bacteria. Total bacteria should be less than 19,355 cfu/m³ (with a maximum mold level of 645 cfu/m³.) If mold levels are higher, the total level of culturable bacteria and mold should be no more than 20,000 cfu/m³. These levels are extremely high compared to today's standards. They more closely reflect the degree of environmental hygiene that was considered acceptable at that time.

Since the 1800s, these indoor air quality standards as well as the ventilation standards recommended by British General, Morin in 1860, have essentially remained unchanged for almost 100 years until the 1970s. In the mid 1970s, the concern over energy use resulted in decreased ventilation rates and ventilation standards by ASHRAE. This triggered the start of a number indoor air quality problems and significantly raised the awareness of this issue. Since this time, a number of indoor air quality standards have been established by various countries and trade organizations. In addition, various regulatory bodies have established "reference concentrations" to assess the potential health risk of indoor air quality. In total, all of these bodies have established indoor air quality exposure standards for over 2,000 specific chemicals and biological substances including mold, bacteria, and allergens.

Below are lists of countries, governmental bodies, trade organizations and regulatory bodies that have established indoor air quality standards.

Countries With Indoor Air Quality Standards:

- **Australia**
- **China**
- **Hong Kong**
- **Japan**
- **Norway**
- **Kuala Lumpur**
- **Singapore**
- **Russia**

Indoor Air Quality Standards by Government Bodies

- **North Atlantic Treaty Organization**
- **World Health Organization**
- **US Occupational Safety and Health Administration (proposed)**
- **Texas Department of Health (<http://hefd.jsc.nasa.gov/toxeg.htm>)**
- **National Aeronautics and Space Administration (Spacecraft Maximum Allowable Concentration of Airborne Contaminants) (<http://hefd.jsc.nasa.gov/toxeg.htm>)**

Indoor Air Quality Standards by Trade Organizations

- **American Society of Heating, Refrigeration, and Air Conditioning Engineers Standard 62.1- 2007 Ventilation and IAQ Standards (<http://www.ashrae.com>)**
- **Green Building Council Leadership in Energy and Environmental Design (LEED) (<http://www.usgbc.org>)**
- **Berufsverband Deutscher Baubiologen (German Baubiology)**

RISK-Based Indoor Air Quality Standards by REGULATORY BODIES

- **Agency for Toxic Substances Disease Reporting (<http://www.watsdr.cdc.gov/mrls/index.html>)**
- **US Environmental Protection Agency (<http://www.epa.gov/iris/>)**
- **Michigan Department of Natural Resources (http://www.michigan.gov/deq/0,1607,7-135-3310_4105-11754--,00.html)**
- **New Jersey Department of Natural Resources (<http://www.state.nj.us/health/eoh/peoshWeb/peoshiaq.htm>)**

- **Proposition 65 (California)** (<http://www.oe-hha.ca.gov/prop65/getNSRLs.html>)
Santa Clara County Health Department (California)
- (<http://dmi-www.mc.duke.edu/oem/chem-exp.htm>)
- **Office of Health Hazard Assessment (California)**

We are considering the compilation of these standards into a guidance document to facilitate the assessment of indoor air quality and for comparing the various standards. The above list of standards is fairly comprehensive, but most likely is not all inclusive. If you know of any other indoor air quality related standards to add to this list, please contact the author by phone at

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