

Indoor Air Quality Presentation with Daikin

Introduction

Topics to Cover

INTRODUCTION

- ▶ Survey and Overview
 - IAQ Metrics and Current Market Solutions
 - Voluntary Certification and Rating Programs
 - Whole Buildings Codes and Standards
 - Voluntary Appliance Standards and Certifications
 - Sensors and Monitoring Devices
- ▶ Regulations
- ▶ Resources
 - Associations
 - Supplemental Federal, State, and Tribal Resources
 - Federal Lawmakers
- ▶ What Can We Do?

Expectations

INTRODUCTION

Filters are just one component of the IAQ industry. We expect that, through this research, we will be able to:

- ▶ Understand the variety of current IAQ solutions in the marketplace
- ▶ Understand how filters fit into and interact with these solutions
- ▶ Discuss the impact of voluntary standards/codes for other solutions and their interaction with filters
- ▶ Understand the scope of federal and state programs and how filters are involved



Standards and Testing

- ▶ To Assure Customers They Get What Is “Written on the Tin”
- ▶ At Best an Indicative Result
- ▶ How to Recreate the Real World?
- ▶ Why Bother?
- ▶ Engineering Specifications Will Change



Legislation is lacking

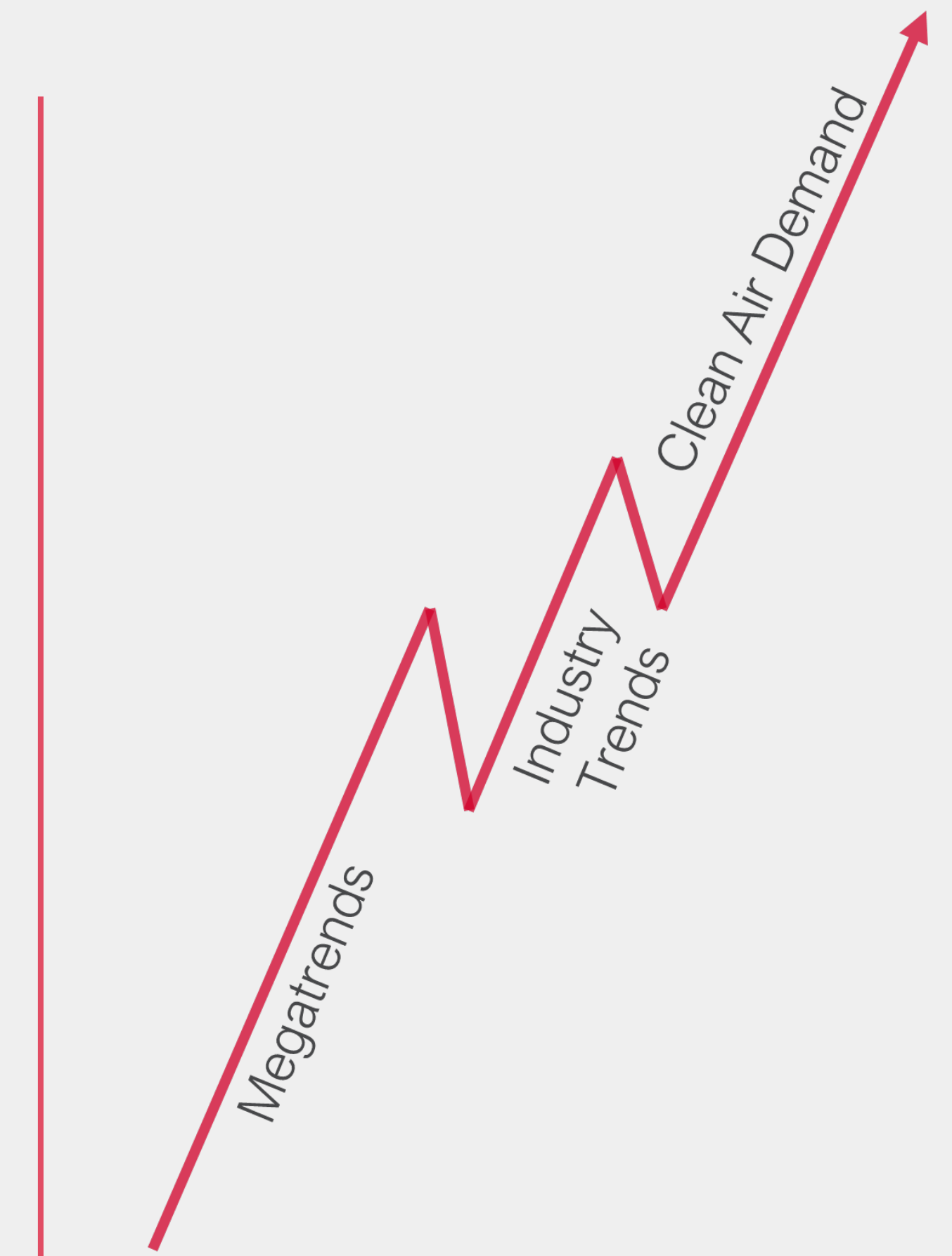
- ▶ Air = (Food + Water) X 15
- ▶ Why?
- ▶ IAQ Science Is Now Undisputed
- ▶ Practicality of Measurement
- ▶ Better Protection for All
- ▶ Market Growth



Why Now?

- ▶ Megatrends are underpinning industry trends that will drive increased global demand for filtration products for decades to come.
- ▶ These Megatrends (Urbanization, Industrialization, a Booming Middle Class, and the Proliferation of Smart Technologies) all represent strong “tail winds” for our industry.
- ▶ Technological advances go hand in hand with the increased demand for clean air and water.
- ▶ Growing populations, dwindling resources, and smarter infrastructure will drive global demand for high-performance, low-energy products across the board.

- ▶ Industry Will Boom
- ▶ Investment Will Continue to Increase
- ▶ IoT Will Drive Sensor Proliferation
- ▶ Our Business Will Be Technology & Data Driven
- ▶ Invisible Will Be Visible
- ▶ Clean Air as a Service
- ▶ *There's a Revolution Coming.*



Indoor Air Quality (IAQ) Metrics and Current Market Solutions

SURVEY AND OVERVIEW - IAQ METRICS AND SOLUTIONS

Physical, chemical, and biological factors can affect health and comfort of occupants. These include volatile organic compounds (VOCs), bacteria and viruses, mold, dust and particulates, outdoor pollution, and carbon dioxide (CO₂), relative humidity, ambient temperature, ozone and radon.

IAQ can be broadly described in three metrics:

- ▶ Ventilation (cfm)
- ▶ Particulate Matter (PM and ug/m³)
- ▶ Humidity (RH, %)

Solutions for IAQ are classified:

- ▶ Air Purifiers/Air Cleaners (whole home and portable)
- ▶ Humidifiers (whole home and portable)
- ▶ Dehumidifiers (whole home and portable)
- ▶ Energy Recovery Ventilation (ERV)/Heat Recovery Ventilation (HRV)
- ▶ Air Filters
- ▶ Sensors

Whole Building Codes and Standards

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ Building codes focus on building envelope, air tightness, energy efficiency, air filtration, passive house, sensor technologies, and IOT.
- ▶ Building codes are used to write requirements for model codes (IECC, IRC, etc.).
- ▶ Examples of Codes and Standards
 - ASHRAE (see table)
 - WELL Standard
 - California Energy Commission (CEC)
- ▶ How are these codes/standards/regulations:
 - Implemented
 - Enforced

<u>ASHRAE Standard #</u>	<u>Title</u>
62.1	Ventilation for Acceptable Indoor Air Quality
62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
90.1	Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings
90.2	Energy Efficient Design of Low-Rise Residential Buildings
185.1	Method of Testing UVC Lights for Use in Air Handling Units or Air Ducts to Inactivate Airborne Microorganisms. (This TC is Co-Cognizant with TC 7.3 lead for the following standard)
185.2	Method of Testing Ultraviolet Lamps for Use in HVAC&R Units or Air Ducts to Inactivate Microorganisms on Irradiated Surfaces
189.1	Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential

EPA Indoor airPLUS

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ Provides IAQ certification label to Energy Star-rated homes
- ▶ Could be considered the most robust program for IAQ
- ▶ Requirements (building criteria) include:
 - Moisture control – provides requirements for building materials and joints such that permeation of moisture is eliminated, minimized, or removed (by forced removal of possible stagnant or flowing water)
 - Radon – Special requirements for building material and radon venting systems if the house is build in a high radiation zone.
 - Pest Barriers – Ensure blockage of pathways for pest entries in the home.
 - HVAC Systems – Ensure proper load calculations, dehumidification, protection from debris during and after construction, mechanical ventilation compliant to 62.2-2010 or later for whole homes or localized at known pollutant sources, filtration, removal of combustion by-products and CO alarms in case of leakages, avoidance of infiltration from known pollutant sources such as attached garages.
 - Low-Emission materials – Provides requirements for minimizing formaldehyde and VOC from known sources, such as paint, carpets etc.

EPA Indoor airPLUS (Cont'd.)

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ Requirements specific to filtration:
 - Ensure sealing of filters (and installations)
 - Protect unit from construction debris with filters, replace filters after construction is over
 - MERV Rating – 8 or higher (ASHRAE 52.2-2007, @295 cfm)
 - No air filters or cleaning equipment that produces ozone.



EPA Indoor airPLUS (Cont'd.)

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ Gaps:
 - Does not provide limits or levels of RH to be maintained at all times.
 - Does not provide limits or levels of Volatile Organic Compounds (VOCs) to be controlled and/or maintained in the house
 - Uncertain how air quality is maintained after a house is first verified.
 - Owners are advised to run HVAC systems manually in cases of high outdoor air pollution. But how will the home owner know? And what if the home owner does not remember or care?
 - Program disclaimer – this program does not solve or prevent all IAQ problems, for example: occupant behavior such as smoking indoors and system maintenance.
- ▶ Are these gaps an opportunity?

WELL Building Standard: Introduction

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ Belief: The industry focuses on Green Buildings and energy conservation enough to ignore human occupancy health. The standard provides solutions.
 - Provides performance metrics and design strategies
 - Based on existing research
 - 2 verifications: On-site assessment and performance testing by 3rd party
- ▶ Scope: Commercial and institutional buildings
 - New and existing buildings
 - New and existing interiors
 - Core and shell
- ▶ Future scope:
 - Multifamily residential, educational facilities, retail, restaurants, commercial kitchens.
 - Communities, gymnasiums, public buildings (stadiums, airports, convention center, etc.), healthcare facilities.

WELL Building Standard: Source and Certification

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ Written by International WELL Building Institute (IWBI)
 - Result of implementing scientific and medical research, environmental health, behavioral factors, health outcomes and demographic risk factors.
- ▶ Certified by Green Business Certification Inc. (GBCI)
 - Same certification body for the LEED Green Building Rating System
- ▶ Works harmoniously with LEED Green Building Rating System
- ▶ Intends to protect and improve the following aspects of human health:
 - Cardiovascular system, Digestive system, Endocrine system, Immune system, Integumentary system (skin, hair and nails), Muscular system, Nervous system, Reproductive system, Respiratory system, Skeletal system, Urinary system
- ▶ WELLness Score:
 - Needs to meet all preconditions (pre-requisites)
 - If met, the percentage of optimizations achieved add to the score.

List of Pre-Conditions and Optimizations for Air Quality

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

		Core and Shell	New and Existing Interiors	New and Existing Buildings
Air				
01	Air quality standards	P	P	P
02	Smoking ban	P	P	P
03	Ventilation effectiveness	P	P	P
04	VOC reduction	P	P	P
05	Air filtration	P	P	P
06	Microbe and mold control	P	P	P
07	Construction pollution management	P	P	P
08	Healthy entrance	P	O	P
09	Cleaning Protocol		P	P
10	Pesticide management	P		P
11	Fundamental material safety	P	P	P
12	Moisture management	P		P
13	Air flush		O	O
14	Air infiltration management	O	O	O
15	Increased ventilation	O	O	O
16	Humidity control		O	O
17	Direct source ventilation	O	O	O
18	Air quality monitoring and feedback		O	O
19	Operable windows	O	O	O
20	Outdoor air systems	O	O	O
21	Displacement ventilation		O	O
22	Pest Control		O	O
23	Advanced air purification	O	O	O
24	Combustion minimization	O	O	O
25	Toxic material reduction		O	O
26	Enhanced material safety		O	O
27	Antimicrobial activity for surfaces		O	O
28	Cleanable environments		O	O
29	Cleaning equipment		O	O

WELL Building Standard: Summary of Requirements

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

FEATURE	REQUIREMENTS	PRE-CONDITION / OPTIMIZATION
Air Quality Standards	Formaldehyde<27 ppb, VOC<500ug/m ³ , CO<9 ppm, PM2.5<15ug/m ³ , PM2.5<50ug/m ³ , Ozone<51 ppb, Radon<0.148 Bq/L.	P
Smoking ban	Prohibition<25ft nearby and indoors	P
Ventilation Effectiveness	Comply to 62.1-2013, CO ₂ reduction for greater occupant density.	P
VOC Reduction	Avoidance of VOC emitting interiors including: paints, coatings, adhesives, sealants, flooring, furniture, insulation. Comply to CARB and SCAQMD.	P
Air Filtration	MERV 13.	P
Microbe and Mold Control	Avoidance and regular inspections. UV lamps at wavelength 254 nm, to avoid ozone generation.	P
Construction Pollution Management	Duct cleaning and filter replacements after construction is finished.	P
Healthy Entrance	Absorb dust and contaminants at entrances caused by shoe wear, and seal doorways to prevent pollution infiltration.	P
Cleaning Protocol	Regular cleaning and sanitizing of high touch zones and known dust collection zones.	P
Pesticide Management	Regular pest management, minimize occupant exposure	P
Fundamental Material Safety	Reduce or eliminate occupant exposure to lead, asbestos and PCBs from building materials. Comply to: U.S. EPA 40 CFR Part 745, Part 763.	P
Moisture Management	Adequate drainage, avoiding condensation on ceilings and seeping in living space to avoid potential bacterial and mold growth.	P
Air Flush	Mechanical ventilation; while maintaining at least 15C [59F], and RH<60%: - Preoccupancy: 1,066 m ³ /m ² [3,500 ft ³ /ft ²] - Post Occupancy: 3,200 m ³ /m ² [10,500 ft ³ /ft ²]; Outdoor Air intake: 0.1 m ³ /min.m ² [0.3 CFM/ft ²].	O
Air Infiltration Management	Prevent infiltration of untreated air by complying to ASHRAE Guideline 0-2005 and National Institute of Building Sciences (NIBS) Guideline 3-2012.	O
Increased Ventilation	Exceed 62.1 by 30%, prove by CIBSE AM10 design calculations that room-by-room airflows will provide effective natural ventilation.	O
Humidity Control	RH between 30% and 50% at all times.	O
Direct Source Ventilation	Provide proper ventilation to indoor pollution sources and prevent interior infiltration.	O

WELL Building Standard: Summary of Requirements (Cont'd)

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

FEATURE	REQUIREMENTS	PRE-CONDITION / OPTIMIZATION
Air Quality Monitoring and Feedback	At least once per hour; particulate contaminant (resolution 10ug/m ³), CO ₂ , Ozone. Maintain data logs for 3 years. Environmental measures display: temperature, RH and CO ₂ .	○
Operable Windows	Full control windows, but it also requires that the outdoor air pollutions levels are minimal (within 1.6 km [1mi]).	○
Outdoor Air Systems	Ability to control outdoor air supply independent of the heating/cooling equipment.	○
Displacement Ventilation	Improve air quality by ventilating near ceiling and providing low velocity air flow near the floor. Comply to ASHRAE Guidelines RP-949, ASHRAE's Underfloor Air Distribution (UFAD) Guide, ASHRAE 55-2013	○
Pest Control	Above and beyond the pre-condition requirements. Internal furnishings to avoid exposed garbage.	○
Advanced Air Purification	Activated carbon filters and portable air purifiers with carbon filters to reduce VOCs; treat recirculated air with UV germicidal irradiation and photocatalytic oxidation.	○
Combustion Minimization	Prohibition on unvented or open fireplaces, stoves, space heaters, ranges and ovens; low emission combustion HVAC equipment must meet SCAQMD rules.	○
Toxic Material Reduction	To minimize the impact of hazardous building material chemicals on indoor air quality and protect the health of manufacturing and maintenance workers.	○
Enhanced Material Safety	Avoid building materials that produce harmful gases; compliance to existing standards of material selection	○
Antimicrobial Activity for Surfaces	Reduce exposure to harmful pathogens and hazardous cleaning agents by providing coatings and regular UV cleaning of surfaces.	○
Cleanable Environment	Eliminate or reduces crevices, rough surfaces and ensure surfaces are cleanable.	○
Cleaning Equipment	Specific types of cleaning equipment and storage to reduce harm to occupants	○

ANSI/ASHRAE/USGBC/IES Standard 189.1

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS



- ▶ *Standard for the Design of High-Performance Green Buildings*
- ▶ ASHRAE 189.1 requirements are similar and in line with the WELL Standard as discussed in previous slides.
- ▶ Exceptions:
 - PM 10 – MERV 8 filter
 - PM 2.5 – MERV 13 filter
 - The requirements in WELL standard are more strict

CEC Title 24 – Building Energy Efficiency

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

Proposed changes for IAQ include:

▶ Residential:

- Ventilation in accordance with 62.2
- Increasing MERV requirement to 13.
 - Certain return grills need to accommodate 2” filter depth, to ensure that MERV 13 filters do not have an impact on system performance.
- Extending air filtration requirements to supply-only ventilation systems and supply side of balanced ventilation systems.
- HVI certification required for kitchen range hoods.

▶ Non-residential:

- Ventilation in accordance with 62.1
- Increasing MERV requirement to 13.
- Updates to efficiency requirements for cooling towers, and adding new efficiency requirements for adiabatic condensers.
- Adds airflow requirements specific to Small Duct High Velocity (SDHV) systems.
 - Resolves an issue of flow rates for standard ducting applied to SDHV systems.

CEC Title 24 – Building Energy Efficiency

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

Requirements are primarily geared towards providing ventilation.

- ▶ Calculation of airflow and ventilation requirements are based on 62.2
- ▶ Other requirements to avoid and prohibit sources of contaminated air are similar to other standards discussed above.



Voluntary Appliance Performance Rating Standards

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

ASHRAE Standards

<u>Number</u>	<u>Title</u>	<u>Scope, brief description of requirements</u>
52.2	Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size	Verification testing for Air Filters performed at the Blue Heaven Technologies using the ASHRAE 52.1 and 52.2
55	Thermal Environmental Conditions for Human Occupancy	Defines thermal comfort in terms of humidity, temperature, airflow, clothing level, activity level, and mean radiant temperature.

AHAM Standards

<u>Number</u>	<u>Title</u>	<u>Scope, brief description of requirements</u>
ANSI/AHAM AC-1-2015	Method of test for Performance measurement of Portable Air Cleaners	Testing method for portable air cleaners. Provides metrics that can be certified by AHAM. Includes air cleaning, capacity and efficiency.
AHAM HU-1-2016	Method of test for Performance measurement of Portable Household Humidifiers	Testing method for humidifiers. Provides metrics that can be certified by AHAM. Includes capacity and efficiency metrics.
ANSI/AHAM DH-1-2008	Method of test for Performance measurement of Dehumidifiers	Testing method for portable dehumidifiers, Provides metrics that can be certified by AHAM. Includes capacity, and efficiency or dehumidification.

Voluntary Appliance Performance Rating Standards (Cont'd)

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

Asthma and Allergy Friendly Standards

<u>Number</u>	<u>Title</u>	<u>Scope, brief description of requirements</u>
ASP:08:01	Portable Air Filters	<ul style="list-style-type: none"> Reducing allergens from the air; Monitoring allergen levels after use to ensure reduction of allergens is a result of removal, not just redistribution; and Monitoring ozone levels to ensure they remain within the Code of Federal Regulations Guidelines.
ASP:08:03	HVAC	<ul style="list-style-type: none"> Evaluating the capability of the filter to remove allergens and irritants from the air flow; Monitoring fiber shedding of the filter during use; and Analyzing seals.
ASP:08:04	Furnace Filter	
ASP:08:06	In-Duct Electrostatic Air Cleaners	<ul style="list-style-type: none"> Reducing allergens from the air; Monitoring allergen levels after use to ensure reduction of allergens is a result of removal, not just redistribution; and Monitoring ozone levels to ensure they remain within the Code of Federal Regulations Guidelines.
ASP:10:01	Wall Mounted	
ASP:10:02	Portable Window Air Conditioner	
ASP:18:01	Humidifier	<ul style="list-style-type: none"> Evaluating the capability of the Dehumidifier to optimize relative humidity levels. Determining that the target RH levels can be attained over a pre-determined period and that once achieved that they are maintained within a specified range. Assessing the exposure to allergen and fungal spores during filter change and water receptacle emptying procedures. Provision of a care code to indicate filter change and water receptacle emptying recommendations.

Voluntary Appliance Performance Rating Standards (Cont'd)

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS



- ▶ Air-conditioning, Heating and Refrigeration Institute (AHRI) and Home Ventilating Institute (HVI) provide performance rating standards and certification programs related to:
 - Energy Recovery Ventilator
 - Heat Recovery Ventilator
 - Dedicated Outdoor Air Systems
- ▶ The programs are primarily meant to certify ventilating equipment only.

How Standards Are Being Used In The Market

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ The performance rating standards are voluntary. Any and all manufacturers are able to rate their products using the standards.
- ▶ However the claims to product ratings may be considered more reliable if they are certified by a 3rd party certification body.
- ▶ The aforementioned standards are also used in the following certification programs:
 - Air Cleaners/Purifiers – whole home and portable types (AHAM, ASP)
 - Humidifiers (AHAM, ASP)
 - Dehumidifiers (AHAM, ASP)
 - Filters (ASP)



Whole Building IAQ Solutions

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS



- ▶ Solutions include:
 - ERV/HRV
 - Whole Home Air Cleaners
 - Whole Home Humidifiers and Dehumidifiers

- ▶ Whole building solutions mostly require filters for the protection of the equipment (such as humidifiers and dehumidifiers and ERV)

- ▶ There are companies that provide whole building IAQ solutions that use sensors and monitoring devices, but these companies do not disclose product offerings or accuracy claims.

Sensors and Monitoring Devices

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

- ▶ *Sensors make the invisible visible.* In order to regulate or standardize IAQ, sensors will play an important role, as they will allow for measuring the performance of IAQ solutions.
- ▶ However, more work needs to be done:
 - No existing standard for accuracy of measuring VOC and particulate size
 - Varied claims—including accuracy and conditions/VOCs/gases measured
 - No means of reporting IAQ levels using these sensors to a regulatory agency
- ▶ No industry approved standard is available yet.

Sensor Market Research

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

Since there are no standards for sensors, the best way to see what is being offered is to conduct market research:

Types of Sensors:

- ▶ Portable/Handheld
- ▶ Wall Mount/Localized
- ▶ Whole Home

Sensing Methods:

- ▶ Non-Dispersive Infrared Sensor
- ▶ Laser Scattering
- ▶ Electrochemical
- ▶ Metal Oxide Semiconductor
- ▶ Photo and Video Cameras

Conditions Measured and Accuracy Claimed:

- ▶ Temperature
- ▶ Relative Humidity
- ▶ VOCs
- ▶ PM2.5
- ▶ PM10
- ▶ Barometric Pressure
- ▶ Gaseous Pollutants (CO, CO₂, etc.)

Cost Range: \$25-\$3,500

Conclusions to Certification Programs

SURVEY AND OVERVIEW – VOLUNTARY CERTIFICATION AND RATING PROGRAMS

There are a variety of standards, all with different levels of adoption. There is limited consistency in terms of:

- ▶ Metrics
- ▶ Adoption rate and participation in programs
- ▶ Whole home, appliance, and sensor standards



Regulations

Existing Federal Regulations

REGULATIONS - EXISTING REGULATIONS

- ▶ The only existing entries in the Code of Federal Regulations (CFR) on IAQ are meant for industrial and federal buildings.
- ▶ ***There is no application to residential or commercial buildings.***

CFR	Text	Scope and Brief Description	History and Updates
29 CFR § 1910.94	Occupational Safety and Health Standards Ventilation (a)(1)(vi) Clean air. Air of such purity that it will not cause harm or discomfort to an individual if it is inhaled for extended periods of time.	This regulation addresses workplace indoor air quality. However, the majority of subsections address industrial matters—such as buffing and polishing wheels.	Title 29, which came into effect in 1971 and focuses on Labor, is updated as of July 1 st every calendar year. Part 1910 is one of several that addresses the scope of the Occupational Safety and Health Administration.
41 CFR § 102–80.25	What are Federal agencies' responsibilities concerning the management of indoor air quality? Federal agencies must assess indoor air quality of buildings as part of their safety and environmental facility assessments. Federal agencies must respond to tenant complaints on air quality and take appropriate corrective action where air quality does not meet applicable standards.	This regulation states that for federal buildings. Agencies—chiefly the Government Services Administration—must ensure IAQ. Chapter 102 goes on to state that agencies must inform tenants of facility safety and environment conditions. It also requires agencies perform assessments during planning, development, and accordance with repair and alteration.	Also updated as of July 1 st of every calendar year, Title 41 addresses Public Contracts and Property Management. Chapter 102 focuses on management of federal buildings and properties.

Past Regulation Efforts

REGULATIONS - EXISTING REGULATIONS

- ▶ In 1991, OSHA initiated a rulemaking procedure for IAQ but terminated the process in 2001.
- ▶ The administration solicited an RFI on issues including:
 - Ventilation systems performance
 - Exposure assessment
 - Abatement methods
- ▶ The reasons behind termination were:
 - Most states and private employers had banned smoking indoors and near buildings
 - Portions of the rulemaking not related to tobacco smoke did not receive much attention during proceedings



Existing Regulations Summary

REGULATIONS - EXISTING REGULATIONS

- ▶ Minimum Requirements
- ▶ Means of Enforcement
 - Ongoing reporting timeline and compliance
 - If violation found:
 - Onus of remediation
 - Penalties for non-compliance



Resources

LEARN!

Associations and Certification Bodies Related to IAQ

Association	Scope and Brief Description
Air-Conditioning, Heating, and Refrigeration Institute (AHRI)	Provides voluntary standards and certifications for ERVs, humidifiers, and dehumidifiers.
American Lung Association (ALA)	Runs the Lung Health & Indoor Air Quality Initiative which provides resources to healthcare professionals, schools, and patients on the connection between air quality and lung health, specifically focusing on asthma. Also provides guidance to workplaces on why it is important to have good IAQ.
American Society of Healthcare Engineering (ASHE)	Provides guidance on IAQ for health care facilities.
American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) <i>Indoor Air Quality Association (IAQA) is an affiliate</i>	Provides building codes and standards related to ventilation requirements, thermal comfort, humidification, dehumidification, and air quality.
Association of Home Appliance Manufacturers (AHAM)	Provides AHAM Verfide, a certification program for room air cleaners, humidifiers, and dehumidifiers.
Association of Nonwoven Fabrics Industry (INDA)	
Home Ventilating Institute (HVI)	Serves as a voluntary way for residential ventilation manufacturers to report product performance, including information on bathroom exhaust fans, ERVs and HRVs, integrated supply and exhaust ventilators, remote exterior mounted ventilators, static vents, utility room exhaust fans, and whole house comfort ventilators.
International WELL Building Institute	Provides the WELL Building Standard, specifically on clean air.
National Air Filtration Association (NAFA)	Publications include information and education and training material for HVAC (books, guidelines, air media magazines). Provides certification for technicians installing air filtration products.

Supplemental Governmental IAQ Resources

RESOURCES – GOVERNMENTAL RESOURCES

- ▶ Federal, state, and tribal governments all provide resources on IAQ.
- ▶ Typical offerings of these programs include:
 - Guidelines for IAQ in residential and commercial settings
 - Remediation for complaints
 - Educational programs
 - Research on IAQ



Federal IAQ Programs

RESOURCES – GOVERNMENTAL RESOURCES

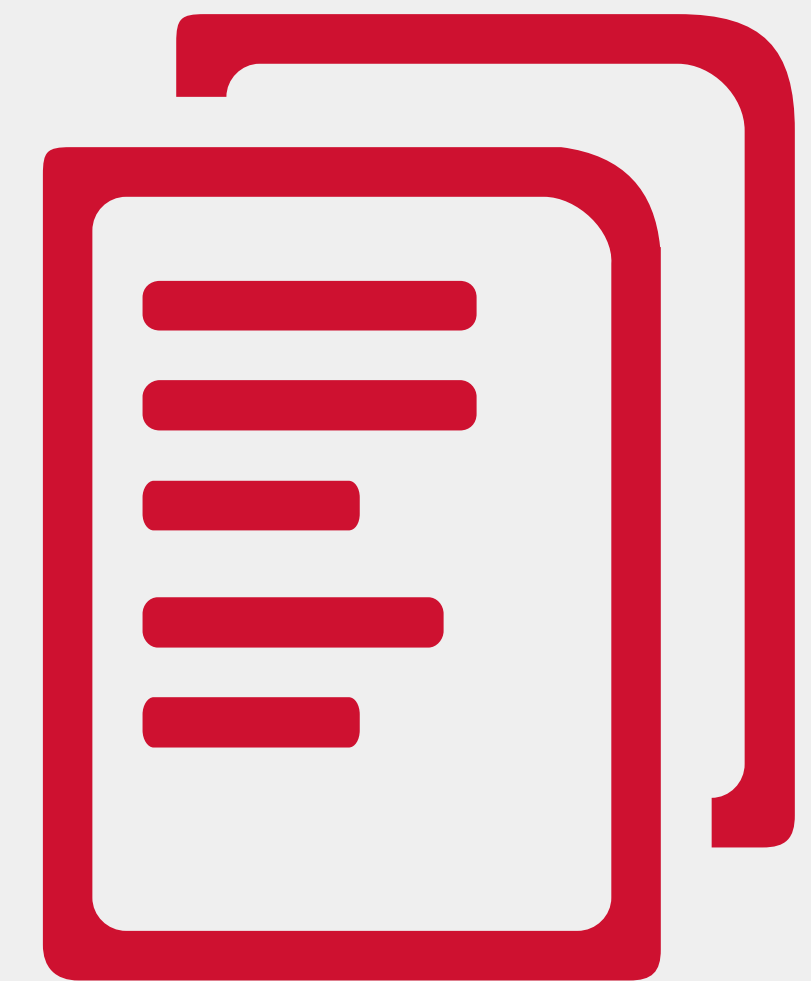
The federal government offers several IAQ programs through the Executive Branch.

Agency or Department	Program	Scope and Brief Description
AmeriCorps/VISTA	Rural Alaska Community Action Program's Vista Energy Program (VEP)	40 members in Alaska "trained in [IAQ] and provided educational supplies to their communities" (ended in 2012).
Centers for Disease Control and Prevention (CDC)	National Institute for Occupational Safety and Health (NIOSH)	Provides guidance on workplace IAQ.
Consumer Product Safety Commission (CPSC)		Produced <i>The Inside Story: A Guide to Indoor Air Quality</i> , which addresses contaminants and potential solutions.
Department of Energy (DOE)	Office of Energy Efficiency and Renewable Energy (EERE)	Sponsored research on IAQ smart solutions.
Department of Labor (DOL)	Occupational Safety and Health Administration (OSHA)	Provides guidance on IAQ for workplaces.
Environmental Protection Agency (EPA)	ENERGY STAR Program, etc.	Provides guidance and guidelines on IAQ, including for office buildings. Produced <i>Care for Your Air: A Guide to Indoor Air Quality</i> . Maintains lists of Green Building standards. AHAM is certification body for ENERGY STAR.

State IAQ Resources

RESOURCES – GOVERNMENTAL RESOURCES

- ▶ Most state programs provide IAQ guidelines that are put into motion when a complaint is received.
- ▶ They are often administered under state Departments of Health or Environmental Quality.



State IAQ Programs

RESOURCES – GOVERNMENTAL RESOURCES

The scope, funding, and management of these programs vary drastically by state.

- ▶ Active states—like **California**—provide research funding and educational resources on IAQ.
- ▶ Less active states take a more limited scope. **Georgia** focuses only on mold and is not a regulated program. **Illinois** focuses on mercury, laboratories, and mold, and even then only provides guidelines.
- ▶ Some states do not currently have programs that address IAQ. **Missouri**, for example, only focuses on ambient air quality, and **Ohio's** Indoor Environments Section is no longer active.

Examples of State IAQ Programs

RESOURCES – GOVERNMENTAL RESOURCES

State	Department	Program	Explanation	Mandatory Requirements	Other Notes	Category
California	California Air Resources Board (CARB)	Indoor Air Quality and Personal Exposure Assessment Program	The program “includes sponsored research, regulation of indoor air cleaners, exposure assessment and mitigation, development of green building criteria and indoor air quality guidelines, and public education and outreach.”	Works with CEC on Title 24, which addresses IAQ	Divisions include air cleaners, green buildings codes, and exposure to children	Particulates & contaminants, ventilation, relative humidity
Washington, DC	Department of Health	Air Quality Division	Focuses on monitoring, both for indoor and ambient air.	DC passed a law in June 2014 to amend its Air Pollution Control Act to establish an indoor air education program and strengthen legal ramifications for air pollution		Particulates & contaminants
Illinois	Department of Public Health	Indoor Air Quality	Focuses on mercury, laboratories, and mold – only guidelines			Particulate & contaminants
Indiana	Department of Health	Indoor Air Quality Program	Enforces air quality standards in government buildings, provides assistance to local departmental investigations, educates the public on IAQ	Administers OSHA rules through the Indiana State Plan		Particulate & contaminants
Kentucky	Department of Environmental Protection	Division for Air Quality	Circulates information on IAQ, specifically fireplaces, lead, mold, and radon			Particulate & contaminants, ventilation
Texas	Department of State Health Services	Indoor Air Quality Program	Provides guidance, information, and solutions on indoor air pollutants		Produced Voluntary Indoor Air Quality Guidelines for Government Buildings in 2002	Particulates & contaminants, ventilation, relative humidity

Tribal IAQ Programs

RESOURCES – GOVERNMENTAL RESOURCES

- ▶ In the 1990s and early 2000s, IAQ was identified as a prevalent issue for Native populations due to:
 - Extreme poverty
 - Lack of health services
 - Inadequate housing
 - Lack of electricity
 - The 2014 National Climate Assessment found that 14% of reservation homes were without power.

- ▶ The EPA, through its work in tribal country, has provided resources and funding to tribes and organizations to improve IAQ in these communities, specifically on reservations.

Examples of Tribal IAQ Programs

RESOURCES – GOVERNMENTAL RESOURCES

Tribe (State)	Action	Brief Description	Explanation	Others Involved
Bois Forte Band of Chippewa (MN)	Indoor Air Quality Program (present)	Provides IAQ testing and inspection equipment, hosts IAQ training sessions, and works with tribal casinos for testing.	The tribe experienced several incidents in 2000 related to mold exposure.	American Lung Association (ALA), U.S. Department of Housing and Urban Development (HUD), Communities Reducing the Environmental Triggers of Asthma (CRETA), Minnesota Department of Health (MDH)
Tulalip Tribes of Washington (WA)	Tulalip Air Quality Program (present)	Starting in 1993, the tribe developed a baseline air protection program. Public education efforts, enforcement of air quality protection ordinances, and the conducting of emissions inventory began in 1994. The program also monitors ambient air quality.	The program advocates for several steps tribal members can take to improve IAQ including, “[Using] fans or open windows to reduce moisture in bathrooms and kitchens. This air flow helps to reduce the build-up of indoor pollutants, and minimizes the potential for toxic molds that thrive on moisture.”	
Northern Arizona University Institute for Tribal Environmental Professionals (ITEP) (AZ)	Tribal Environmental Education Outreach Program (TEEOP) (present)	Provides training for educators on IAQ, conducts building assessments, and hosts an internship focused on tribal IAQ management.	ITEP originally focused on IAQ issues as part of a summer program theme for middle and high school students. TEEOP then developed this work to make it a permanent focus of ITEP.	
University of Arizona Zuckerman College of Public Health (AZ)	A Community Toolkit to Improve Asthma Care for Rural Children (2015-2016)	Engage with Navajo Nation members on addressing asthma in children. The final portion of the project would assess IAQ and ambient air quality; it would develop measurement methods and methods to reduce risks.	The focus of the research was on asthma patients, specifically children with asthma.	Navajo Nation (AZ)

Summary of Governmental Resources

RESOURCES – GOVERNMENTAL RESOURCES

Federal, state, and tribal governments provide voluntary resources on IAQ.

- ▶ Oftentimes, these resources provide educational resources on IAQ.
- ▶ They sometimes include mandatory requirements, such as CARB cooperating with CEC on Title 24.
- ▶ Funding and scope vary widely across geographic regions and between levels of government.



Federal Lawmakers Interested in IAQ

RESOURCES – FEDERAL LAWMAKERS

- ▶ Few bills introduced in Congress address IAQ—they often are folded into other types of legislation, such as energy efficiency or school improvement bills.
- ▶ In a 2011 interview when he joined Congress, **Rep. David McKinley (R-WV)** said IAQ would be a priority for him. He is a civil engineer.
- ▶ Several Members addressed IAQ in previous positions. For example, **Senator John Hoeven (R-ND)**, as then-Governor, was involved in the promotion of October's Home Indoor Air Quality Month in the early to mid-2000s.

115th Congress Bills Addressing IAQ

RESOURCES – FEDERAL LAWMAKERS

- ▶ *The Energy Savings and Industrial Competitiveness Act* (“Shaheen-Portman”), the sweeping bipartisan energy efficiency legislation first introduced in 2011, would require green building certifications to credit enhanced IAQ. It was introduced by **Sen. Jeanne Shaheen (D-NH)** and **Sen. Rob Portman (R-OH)**.
- ▶ **Rep. David Loebsack’s (D-IA) *Renew America’s Schools Act of 2017*** would provide \$100 million per year for five years to the Department of Energy for grants to improve IAQ in schools. Rep. Dave Loebsack (D-IA), whose district includes rural areas, has introduced versions of this bill for the past several years.

115th Congress Bills Addressing IAQ (Cont'd)

RESOURCES – FEDERAL LAWMAKERS

- ▶ Energy and Commerce Ranking Member **Frank Pallone (D-NJ)** introduced the *Leading Infrastructure for Tomorrow's America Act*, which includes provisions for grants to public schools for energy improvements including IAQ renovation and installation.
- ▶ *Rebuild America's Schools Act* was introduced by Education and the Workforce Ranking Member **Bobby Scott (D-VA)**. It increases federal funding for school infrastructure and requires updates of IAQ and ventilation regulations for schools.

Past Lawmaker Efforts Addressing IAQ

RESOURCES – FEDERAL LAWMAKERS

American Clean Energy and Security Act of 2009 (“Waxman-Markey”), sponsored by now-**Senator Ed Markey (D-MA)** folded in a couple bills that addressed IAQ:

- ▶ *Retrofit for Energy and Environmental Performance Program Act* – This bill would have established an EPA program to certify auditors, inspectors, and raters who tested for IAQ and would have provided incentives to retrofit buildings (non-residential buildings would have had to satisfy the most recent version of 62.1). **Rep. Peter Welch (D-VT)** introduced this bill after visiting retrofitted homes in his state, and it was supported by many groups including ACEEE, ASE, and USGBC.
- ▶ *Green Resources for Energy Efficient Neighborhoods Act* – **Rep. Ed Perlmutter (D-CO)** introduced the bill which would have created a green buildings standard, including IAQ, and would have provided financial assistance through the Department of Housing and Urban Development. The Congressman focuses most of his legislation on energy (specifically National Labs) and job creation issues.

Past Lawmaker Efforts Addressing IAQ (Cont'd)

RESOURCES – FEDERAL LAWMAKERS

In 2007, **Sen. Mark Warner (D-VA)** was a lead co-sponsor of the *High Performance Green Buildings Act*, which would have required federal building and improvement to consider IAQ and energy efficiency.



Indoor Air Quality Act

RESOURCES – FEDERAL LAWMAKERS

The *Indoor Air Quality Act* was introduced for almost a decade in the 1980s and 1990s. It would have required the EPA to research, develop, and create a program to ensure IAQ.

- ▶ The bill was introduced as a response to growing knowledge about the impacts of radon, asbestos, tobacco smoke, and molds.
- ▶ GAO published the report *Indoor Air Pollution: Federal Efforts Are Not Effectively Addressing A Growing Problem* in 1991 in response to the bill.
- ▶ The main sponsors—Senator George Mitchell (D-ME) and Representative Joseph Kennedy II (D-MA)—are no longer in office, but cosponsors from the bill include:
 - **Senate Minority Leader Chuck Schumer (D-NY)**
 - **House Minority Leader Nancy Pelosi (D-CA)**
 - **House Energy and Commerce Ranking Member Frank Pallone (D-NJ)**

Summary of Legislation

RESOURCES – FEDERAL LAWMAKERS

- ▶ IAQ is oftentimes folded into larger energy efficiency efforts. There are few IAQ-only efforts.
- ▶ Legislation:
 - Allocates funding for IAQ research
 - Allocates funding for IAQ infrastructure updates, predominately for public schools
 - Does not often reference specific standards



What Can We Do?

Recommendations/Solutions

WHAT CAN WE DO?

- ▶ Develop a lobbying/messaging strategy
- ▶ Build or join a coalition (High-Performance Buildings Coalition)
- ▶ Ensure government funding for IAQ research and solutions (grants for public schools, etc.)
- ▶ Push for the establishment of an IAQ certification program
- ▶ Leverage existing voluntary programs (WELL, ENERGY STAR, etc.)
- ▶ Expand existing regulations with OSHA
- ▶ Help Guide and /or establish state based regulation for highly populated states (CA, NY, etc.)
- ▶ Call for new mandatory programs, standards and legislation.

