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Ventilation:
ASHRAE 62.2 - 2019
&
CSA F326

2024 MBOIA

Office of the State Fire Marshal

Welcome to the Maine State Fire Marshal's Office website. Our intention is to provide you with a source of information about our role as a public safety organization in state government. As one of nine bureaus in the Department of Public Safety, we act as the State's primary enforcer of fire and life safety codes.

Let's look at some stats:

Residential House fire deaths
About 4.5 deaths per 1000 fires
Crude rate 19.6 deaths per 1 million (Maine has 1.6 Million people
Actual average over the last 10 years 18.2

Residential Fires kill 18.2 people per year in Maine.
Sprinkler Systems cost $10,000 - $15,000

Rates seem to be higher in the north
Maine has lower rates than the National Average - Good Job!!

3 areas of Safety Concern

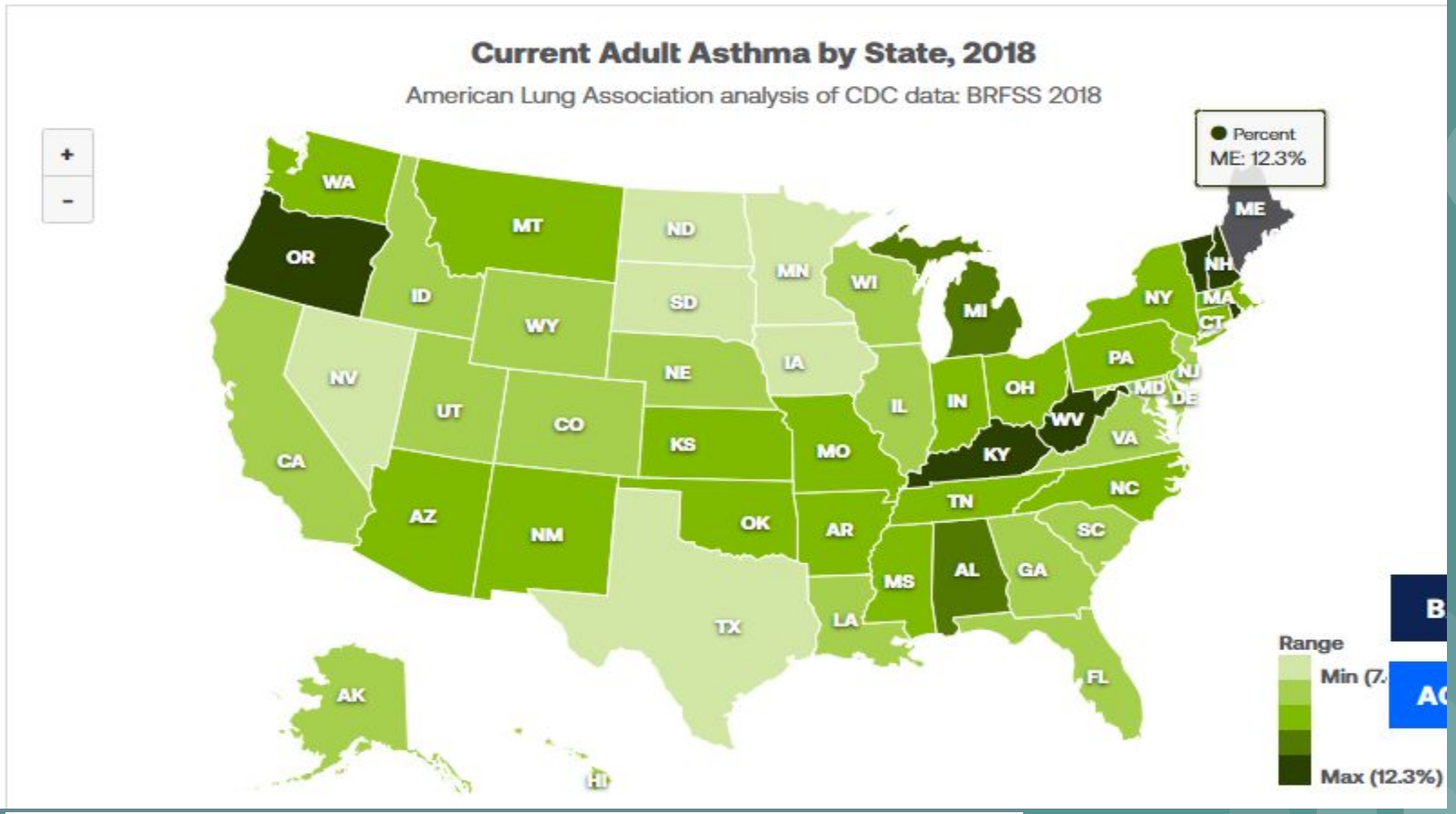
There are others…

- Asthma - 1 in 9 & Allergies
- Lung/Bronchus Cancers - Leading Cancer Killer….. second place is not even close
- Autism - 1 in 36

Not Always Good to be #1

Current Adult Asthma by State

- In 2018, current asthma rates among adults ranged from 7.4 percent in Texas to 12.3 percent in Maine and West Virginia. Show data table



Asthma causes an average of 13 deaths in Maine each year

Seasonal and Environmental Allergies

50+
MILLION
Americans diagnosed

24
MILLION
Americans have seasonal allergic rhinitis

3.1
MILLION
missed work days per year

$8
BILLION
annual costs

85%
of asthma patients have allergic rhinitis

1 parent with allergies = children **50%** more likely to have allergies

2 parents with allergies = children **75%** more likely to have allergies

ENVIRONMENTAL FACTORS: Pollen, Mold, Dust Mites, Animal Dander, Cockroaches/Mice

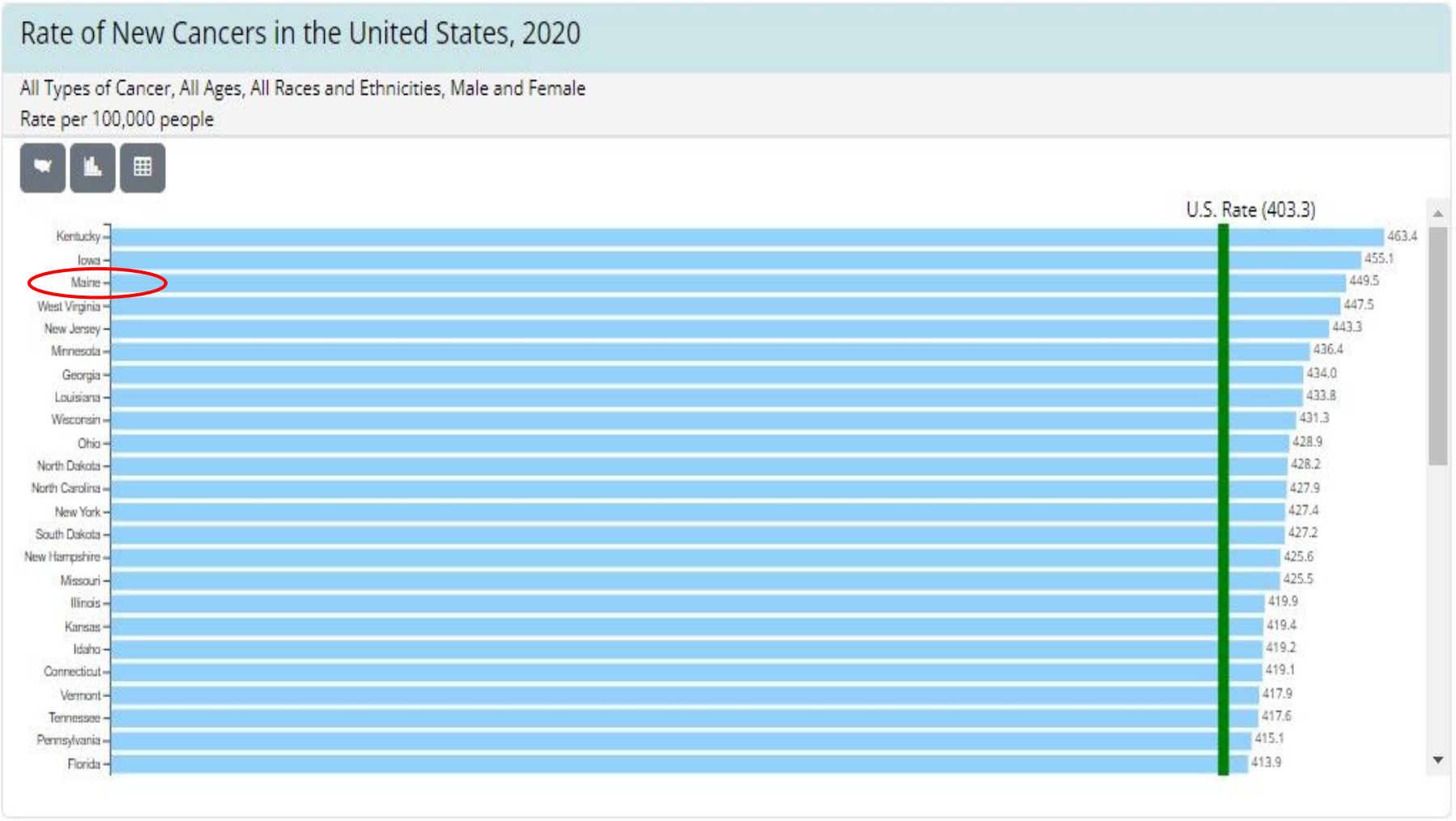
COMMON SYMPTOMS: Runny or Stuffy Nose; Sneezing; Coughing; Watery, Red or Swollen Eyes; Itchy Nose or Eyes; Hives/Rash; Feeling Tired

Asthma Costs

Economic Cost

- From 2008 to 2013, asthma accounted for $81.9 billion each year in total economic cost in the United States:
  - Health care costs – $50.3 billion per year
  - Mortality – $29.0 billion per year
  - Missed school and work days – $3.0 billion per year

Cancer Rates



Lung and Bronchus Leading the way

Scientifically rigorous peer-reviewed epidemiologic studies (described in the section "The Science Behind the Risk Estimates") performed since the 1960s provided a solid scientific foundation for the U.S. Environmental Protection Agency's (EPA) 2003 risk assessment,[4] which estimates that out of a total of 157,400 lung cancer deaths nationally in 1995, 21,100 (13.4%) were radon related. More recent direct estimates of the risk posed by radon, obtained from residential case-control studies performed globally, closely align with the 2003 EPA risk estimates. When compared to cancer mortality from all causes, radon-related lung cancer, if it were treated as a distinct disease category, would rank among the top 10 causes of cancer mortality and is considered a leading environmental cause of cancer mortality in the United States.[1]

Cancer Mortality 2020	
Cancer Type	Estimated U.S. Deaths in 2020[4,5]
1. Lung and Bronchus	135,720
2. Colon and Rectum	53,200
3. Pancreas	47,050
4. Breast	42,690
5. Prostate	33,330
6. Liver and Intrahepatic Bile Duct	30,160
7.Leukemia	23,100
Radon-Induced Lung Cancer	**21,100***
8. Lymphoma (Combined Hodgkin & Non-Hodgkin)	20,910
9. Brain & Other Nervous System	18,020
10. Urinary Bladder	17,980
11. Esophagus	16,170
12. Kidney and Renal Pelvis	14,830
13. Ovary	13,940

* The 21,100 radon-induced lung cancer deaths, based on risk estimates using U.S. demographic information from 1995, are included in the estimate of lung and bronchus cancer deaths.

Radon only?

"It's a serious problem," said Maine Radon Coordinator, Jonathan Dyer. He said studies show, "165 Mainers die each year, non-smokers, due to radon. Lung cancer due to radon."

Mortality: Top 10 Cancers, Maine 2020

Red Rate= ME is significantly higher than U.S.

Cancer Type	Maine (all sexes)				U.S.		
	Count	AA Rate	AA Lower 95% CL	AA Upper 95% CL	AA Rate	AA Lower 95% CL	AA Upper 95% CL
All Sites	3,433	**161.3**	155.8	167.1	**144.1**	143.8	144.5
Lung and Bronchus	896	**41.1**	38.4	44.0	**31.8**	31.7	32.0
Colon and Rectum	280	**13.6**	12.0	15.4	**13.1**	12.9	13.2
Pancreas	247	**11.4**	10.0	13.1	**11.1**	11.0	11.2
Female Breast	196	**17.5**	15.0	20.4	**19.1**	18.9	19.3
Prostate	171	**19.1**	16.3	22.4	**18.5**	18.3	18.7
Urinary Bladder	123	**5.7**	4.7	6.9	**4.0**	3.9	4.0
Leukemia	119	**5.9**	4.9	7.2	**5.8**	5.7	5.9
Esophagus	110	**5.0**	4.1	6.2	**3.7**	3.6	3.7
Brain and Other Nervous System	109	**5.4**	4.4	6.6	**4.5**	4.4	4.5
Non-Hodgkin Lymphoma	106	**5.1**	4.2	6.3	**4.9**	4.8	4.9

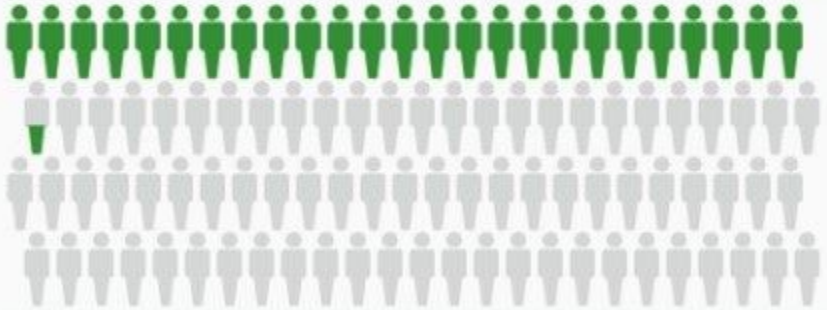
Cost to install Radon Reduction System - $1500 - $2500

Survival Rates

80% are diagnosed late, ½ don't survive 1 year

How Many People Survive 5 Years Or More after Being Diagnosed with Lung and Bronchus Cancer?

Relative survival is an estimate of the percentage of patients who would be expected to survive the effects of their cancer. It excludes the risk of dying from other causes. Because survival statistics are based on large groups of people, they cannot be used to predict exactly what will happen to an individual patient. No two patients are entirely alike, and treatment and responses to treatment can vary greatly.

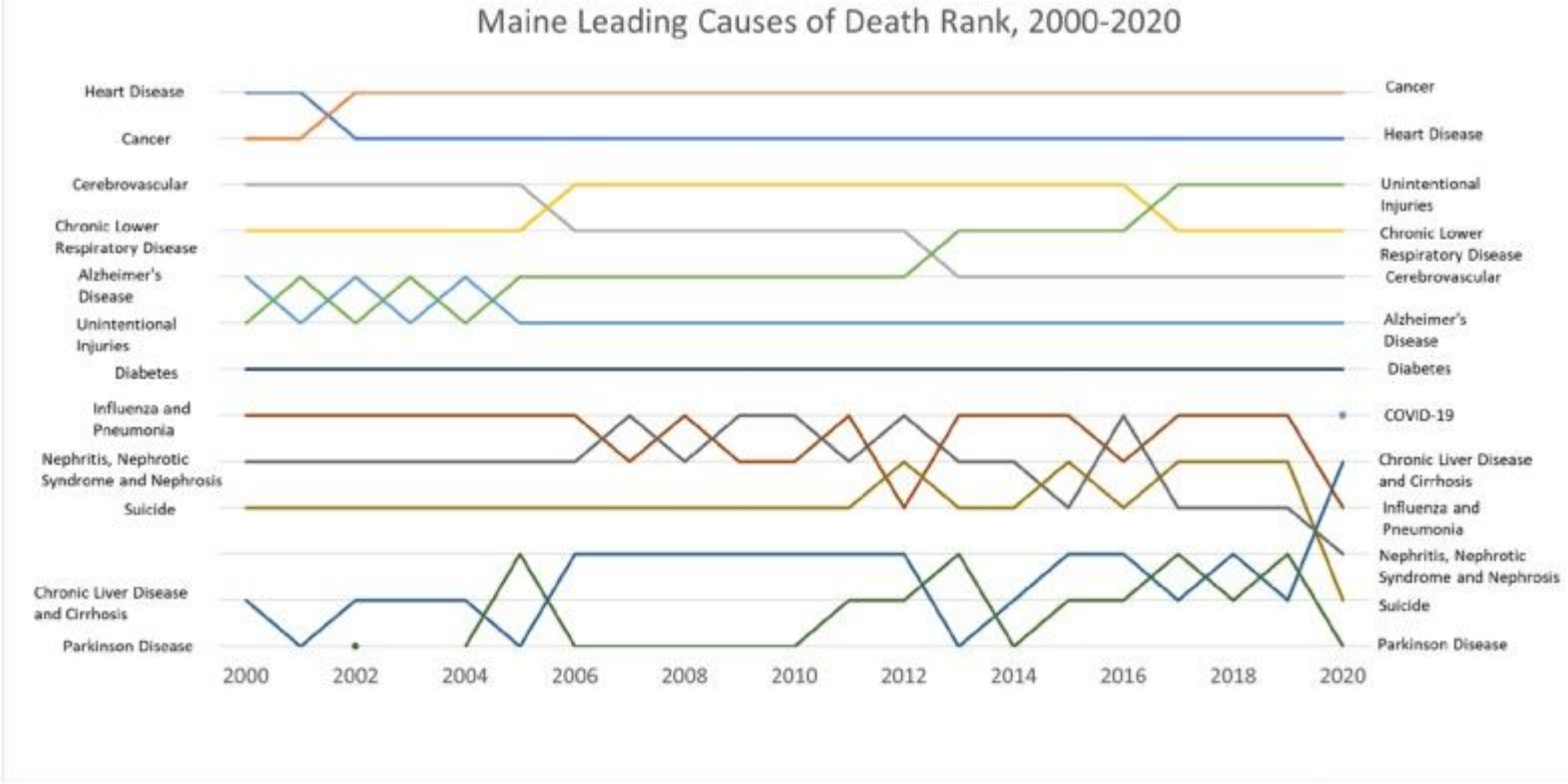


5-Year Relative Survival

25.4%

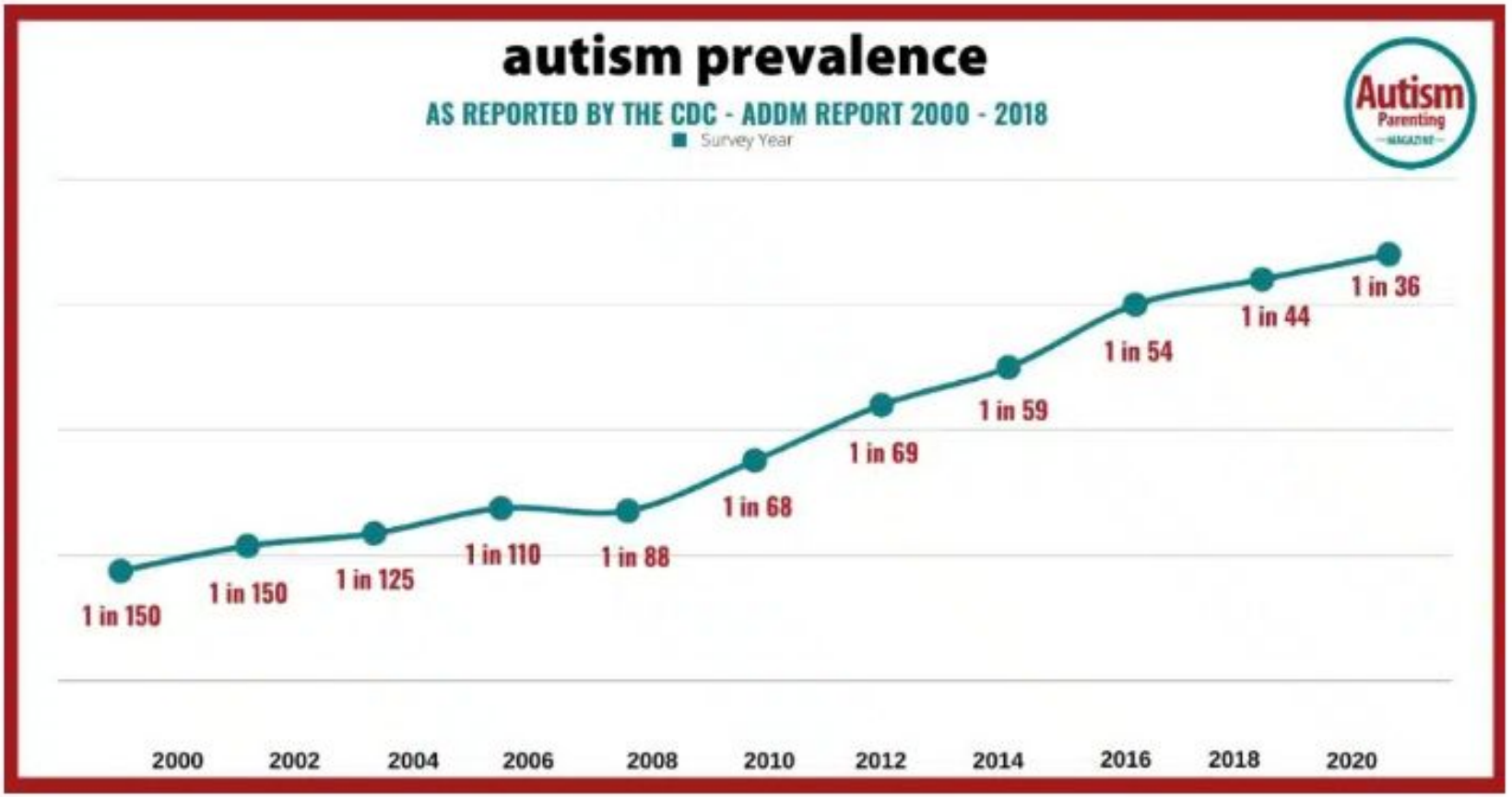
Based on data from SEER 22 (Excluding IL/MA) 2013–2019. Gray figures represent those who have died from lung and bronchus cancer. Green figures represent those who have survived 5 years or more.

Cancer has become Maine's Leading Cause of Death



Causes of death listed are those that ranked in the leading causes of death in 2020.

If this was the only issue, would it be enough?



Below is a break-down of the prevalence rates per year since 2000:

Do we have any insight for a link?

HEALTH

Scientists Find 'Baffling' Link between Autism and Vinyl Flooring

Swedish children who live in homes with vinyl floors are more likely to have autism, according to a new study, but what's behind the link is unclear

By Marla Cone, Environmental Health News on March 31, 2009

Autism and phthalates: Exposure in womb linked to autistic traits in boys

New study bolsters evidence that certain chemicals may alter social development—but also reinforces the protective effect of folic acid during pregnancy

by Brian Bienkowski • February 20, 2020 • 4 min read

Multiple Studies showing links

Environ Health. 2018; 17: 85.
Published online 2018 Dec 5. doi: 10.1186/s12940-018-0428-4

PMCID: PMC6280477
PMID: 30518373

Prenatal exposure to phthalates and autism spectrum disorder in the MARBLES study

Hyeong-Moo Shin,[1,2] Rebecca J. Schmidt,[1,4] Daniel Tancredi,[3] Jacqueline Barkoski,[1] Sally Ozonoff,[4,5] Deborah H. Bennett,[1] and Irva Hertz-Picciotto[1,4]

Same Environment may cause same result
Genetic links may really be Environment

PEDIATRICS PERSPECTIVES | DECEMBER 01 2021

Considering Toxic Chemicals in the Etiology of Autism FREE

Heather E. Volk, PhD ✉; Jennifer L. Ames, PhD; Aimin Chen, PhD; M. Daniele Fallin, PhD; Irva Hertz-Picciotto, PhD; Alycia Halladay, PhD; Deborah Hirtz, MD; Arthur Lavin, MD; Beate Ritz, MD, PhD; Tom Zoeller, PhD; Maureen Swanson, MPA

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

POTENTIAL CONFLICT OF INTEREST: Dr. Ritz is a consulting expert in litigation involving exposure to heavy metals in baby food and autism. The remaining authors have no conflicts of interest relevant to disclose.

Scientists long recognized that genetic factors contribute to autism etiology, as indicated in family, twin, and genetic studies.[2] Yet twin studies, from which heritability estimates are primarily derived, may inflate the role of genetics as both gene-only and genetic-x–shared-environment influences are summarized as genetic. This pervasive problem (of identifying genetic contributions and assuming their effects cannot result from genes acting in concert with environmental agents) also applies to a recent analysis of twin and family studies purporting to demonstrate that the environmental component is an unlikely explanation of both ASD risk and the increase in ASD over time.[3] The environment may act in concert with genetic risk pathways or affect the intrauterine environment directly. In addition, the environment may induce similar epigenetic signatures in twins during gestation.[4] Thus, the shared environment is itself complex and not easily disentangled from shared genetics.

Swedish Studies and Allergy Risk

OPEN ACCESS Freely available online

PLoS one

Common Household Chemicals and the Allergy Risks in Pre-School Age Children

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1 Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts, United States of America, **2** Norwegian Institute for Air Research, Kjeller, Norway, **3** Department of Building Science, School of Architecture, Tsinghua University, Beijing, China, **4** Primary Care Research Unit, County Council of Varmland, Karlstad, Sweden, **5** Public Health Sciences, Karlstad University, Karlstad, Sweden, **6** SP Technical Research Institute of Sweden, Boras, Sweden

Abstract

Background: The risk of indoor exposure to volatile organic compounds (VOCs) on allergic airway diseases in children remains unknown.

Objective: We examined the residential concentrations of VOCs, emitted from building materials, paints, furniture, and other lifestyle practices and the risks of multiple allergic diseases as well as the IgE-sensitization in pre-school age children in Sweden.

Methods: In a case-control investigation (198 case children with asthma and allergy and 202 healthy controls), air samples were collected in the room where the child slept. The air samples were analyzed for the levels of eight classes of VOCs.

Results: A natural-log unit of summed propylene glycol and glycol ethers (PGEs) in bedroom air (equal to interquartile range, or 3.43 – 15.65 $\mu g/m^3$) was associated with 1.5-fold greater likelihood of being a case (95% CI, 1.1 – 2.1), 1.5-fold greater likelihood of asthma (95% CI, 1.0 – 2.3), 2.8-fold greater likelihood of rhinitis (95% CI, 1.6 – 4.7), and 1.6-fold greater likelihood of eczema (95% CI, 1.1 – 2.3), accounting for gender, secondhand smoke, allergies in both parents, wet cleaning with chemical agents, construction period of the building, limonene, cat and dog allergens, butyl benzyl phthalate (BBzP),

October 2010 | Volume 5 | Issue 10 | e13423

cont. Swedish Study, 2010

An emerging body of evidence suggests that environmental conditions during early life are important. In particular, early-life exposure to chemicals commonly found at home, and their possible roles in allergic airway disease, allergic asthma, and rhinitis are speculated [3,4,5,6].

Global secular trend in asthma and the allergy disease prevalence draw a parallel with vast shift in diet, lifestyle, and consumer product uses within the western societies since the World War II [7]. Enormous quantity and array of chemical compounds have been introduced in the societies which adopted western lifestyles [8]. Consumer products, such as computer, TV, and synthetic building materials, including artificial carpets, composite wood, polyvinyl chloride (PVC) flooring, foam cushions, and PVC pipes emit an array of volatile organic compounds (VOCs), semi-volatile organic compounds (sVOCs) and non-organic compounds [8]. VOCs, which predominantly exist in the vapor phase in the atmosphere, and sVOCs, which exist in both vapor and condensed phase, redistribute to indoor surfaces and

-Fire retardants
-Laundry sheets
-Plastic bedding
-Plastic toys
-New furniture voc
-New paint voc
-New carpet voc
- Odor covering fragrances

may persist from several months to years [8]. Both adults and children spend an estimated >90% of daily hours in indoor setting [9]. In addition, energy conservation measures for buildings have led to reduced air exchange rates and promotion of indoor moisture buildup [7,9].

In infants and children, the role of indoor VOCs as allergens, adjuvants, or mere correlates in development of allergic asthma, and rhinitis remains an open question [6]. Two recent reviews of the literature identified indoor residential chemicals, emitted from particle board, plastic materials, recent painting, home cleaning agents, air freshener, pesticide, and insecticide, consistently increase the risks of multiple allergic symptoms and asthma-like symptoms [10,11]. However, these studies were limited by small sample sizes, measurement of the complex VOC mixture in terms of the total concentration, and presumption of personal exposure based on the identification of emission related-material or the human activities [11]. Nevertheless, the authors concluded that these epidemiologic studies overall point to a new class of little recognized residential chemical risk factors [11].

Evidence for Environmental Influence on ASD Risk

A large body of evidence, including decades of research on lead and child IQ, indicate a link between toxic environmental exposures and poorer neurodevelopmental outcomes.[5] In animal models and human studies, several toxic chemicals have been implicated in ASD and ASD-related traits and biological markers.[2] Specifically, scientists have found that air pollution exposures during pregnancy and early infancy, at levels typically found in large cities, are associated with autism.[6-8] Several studies suggest that gestational exposures to some neurotoxic and endocrine-disrupting pesticides, including organochlorines, organophosphates, and pyrethroids, increase the chances of an autism diagnosis or autism-related behaviors in children.[9] Evidence is emerging that other toxic chemicals are associated with autism or autism-related behaviors, notably phthalates, ubiquitous chemicals that cause a decrease in testosterone.[10]

Autism Statistics You Need To Know in 2023

By Yolande Loftus, BA, LLB
September 20, 2023

When your child is diagnosed with autism, it can feel very lonely. But knowing the latest autism statistics can make you feel less isolated. You will soon realize you are part of a much bigger autism community.

The latest research in 2023 from the CDC shows that one in 36 children is now diagnosed with autism. This is an increase from one in 44 children two years ago. Since the report was recently released, the data is likely to stay the same through 2024.

From 4-5 in every 10,000 in the 70s to half of all kids in 2025

Will half of US kids have autism by 2025? This prediction made by Dr. Stephanie Seneff, Research Scientist from the Massachusetts Institute of Technology (MIT), may be scoffed at by some, but the latest CDC statistics do indicate rising prevalence rates:

These are our children and Grandchildren
1 in 36 …. soon to be 1 in 2?

Grandma & Grandpa

My Mom

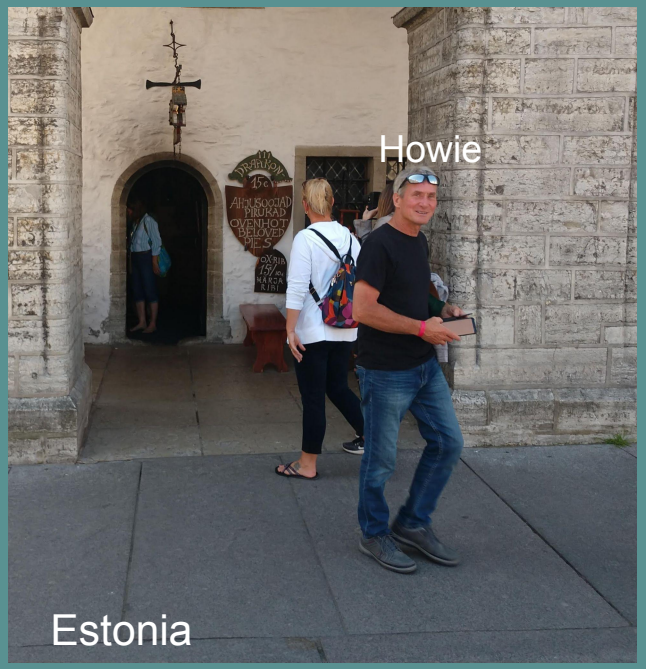
Nurse
Mother of 5
Grandmother 14
GG -2

Died at 92
Full life

Was on NO medication.

Hal
Athlete
always in
shape.
Exercised
Never
drank or
smoked

10 Years hauling chemicals - Retired at 65
At 66 diagnosed with ALS - dead @ 70



My Brother

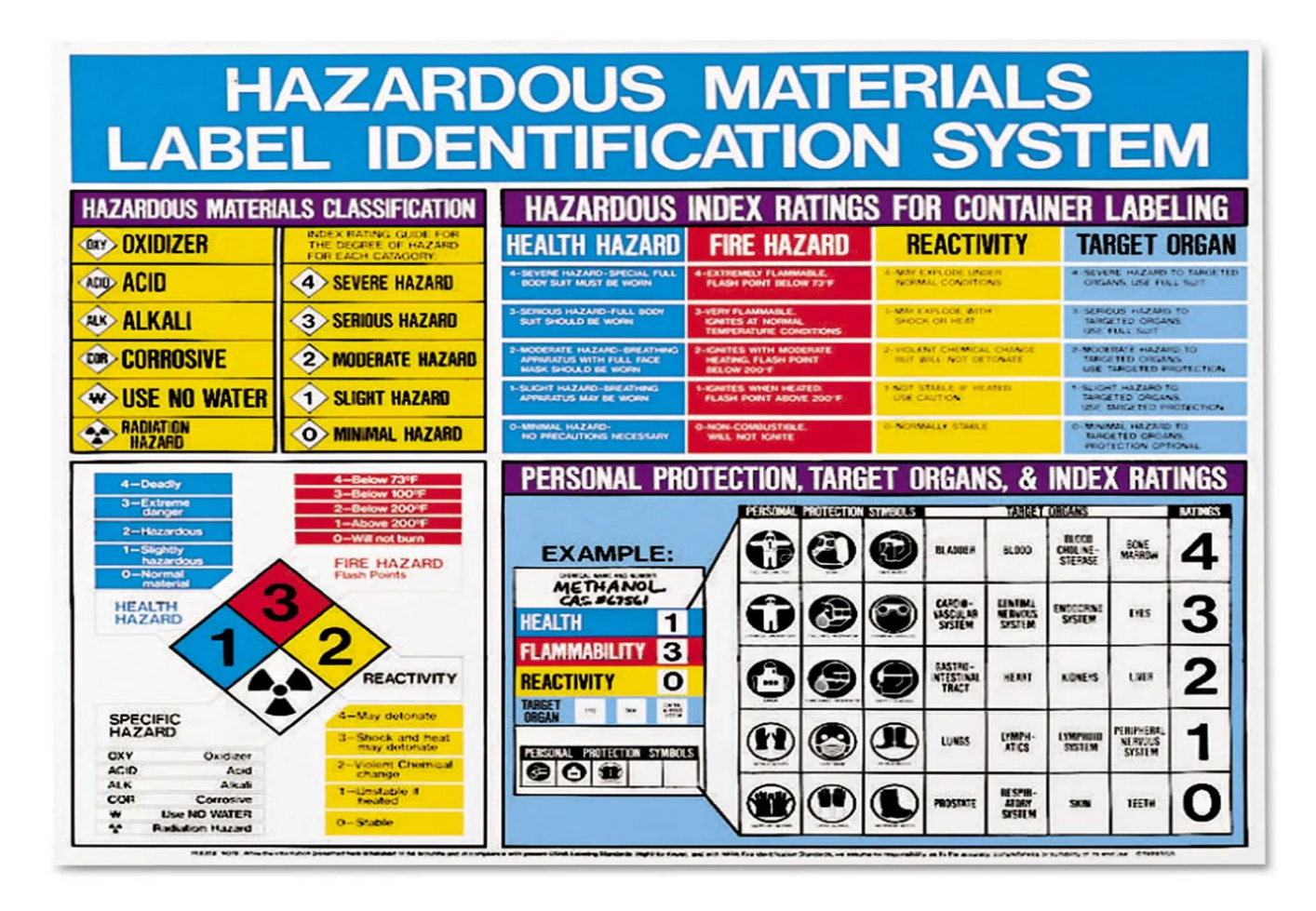
We liked to ski together

Always Loved Cars….. So he became an Autobody Expert

But

He died last year at 64 of ALS and dementia. From diagnosis to death: 5mths

How many everyday items have these types chemicals?



What about everyday products?

Cleaning

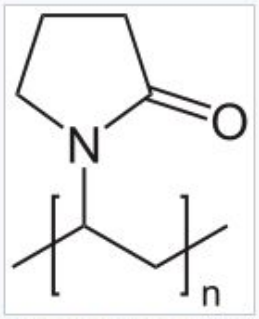
Auto Care

Hair Spray

Hair spray (also **hair lacquer** or **spritz**) is a common cosmetic hairstyling product that is sprayed onto hair to protect against humidity and wind and have it stay in a desired shape. Hair sprays typically consist of several components for the hair as well as a propellant.[1]

Ingredients and operation [edit]

Hair sprays consist of the following components: concentrate, plasticizers, luster agents, and fragrances, as well as propellants.



Polyvinylpyrrolidone is a common component of hair spray that confers stiffness to hair.

Concentrate [edit]

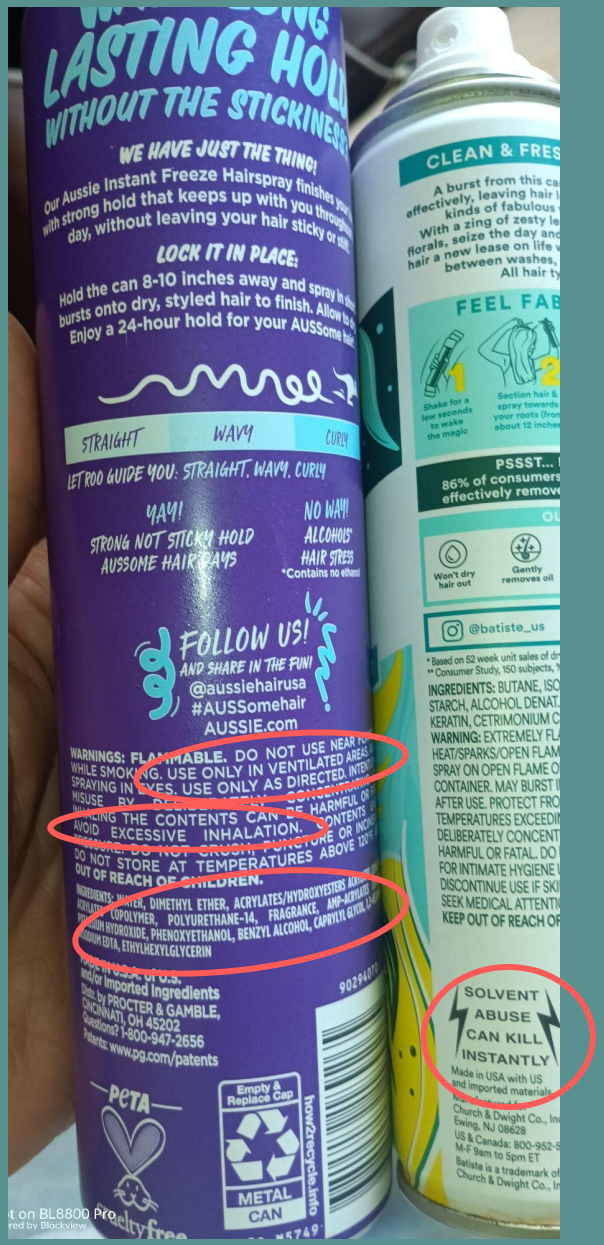
Hair spray are a blend of polymers that provide structural support to hair. These frequently include copolymers of polyvinylpyrrolidone (PVP) and polyvinyl acetate (PVAc). Vinyl acetate-crotonic acid copolymers give harder films. In this way hairsprays can be formulated as flexible, medium, and maximum hold.[2] The copolymer mixture is usually adjusted to achieve the desired physical properties (adhesive strength, foaming, etc.), using plasticizers such as aminomethyl propanol, surfactants such as benzalkonium chloride, and other agents like dimethicone.

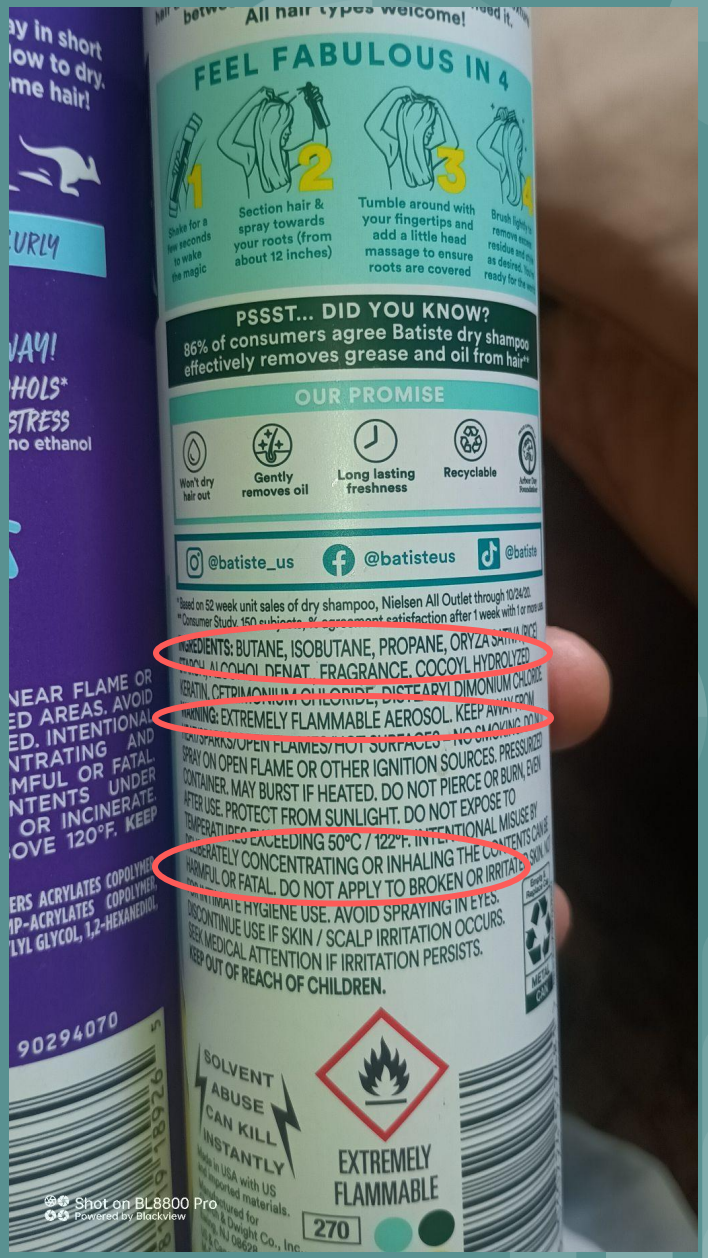
Two varieties of modern hair sprays.

Propellants [edit]

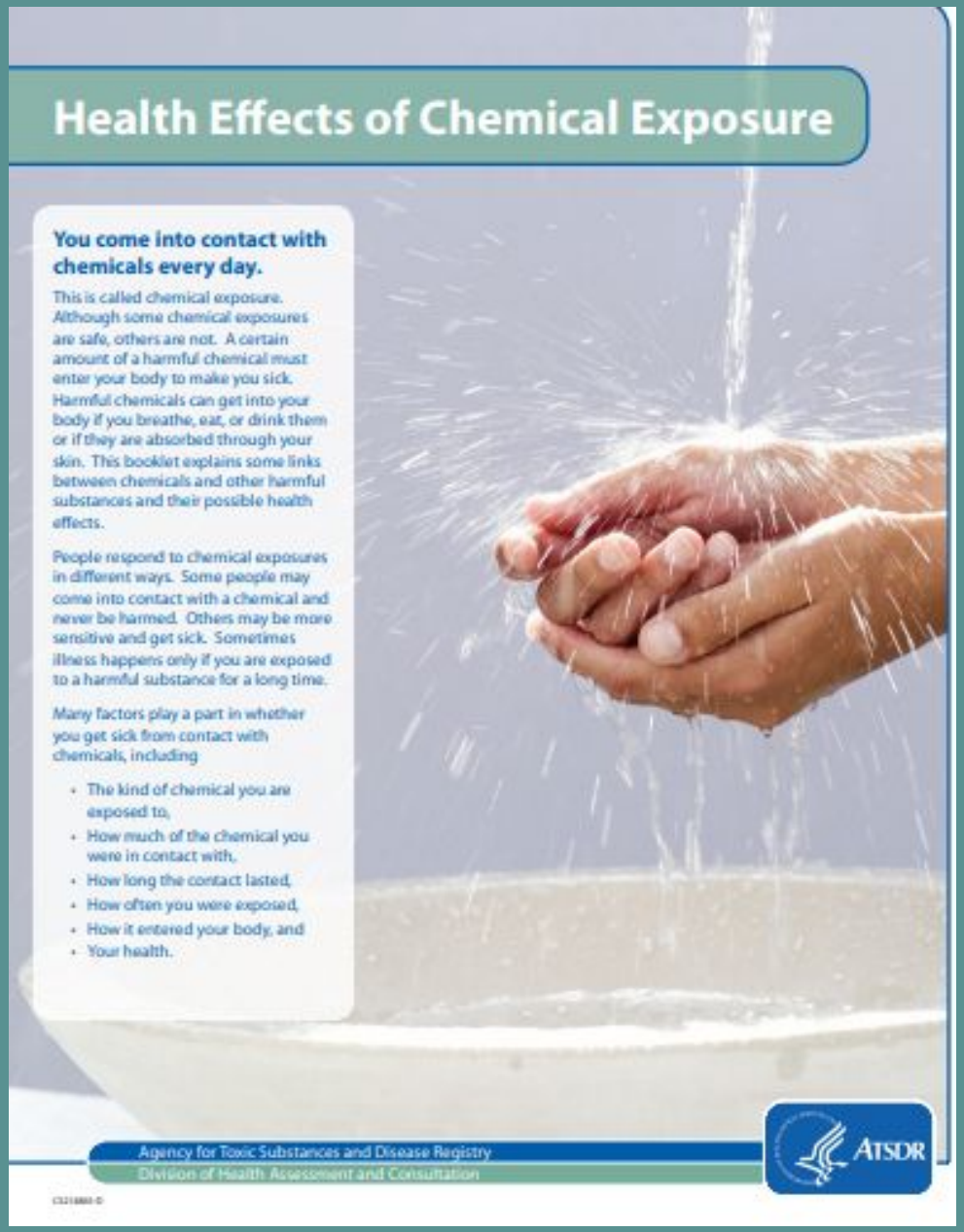
Since the phase-out of CFCs in the 1980s, hydrocarbons are popular propellants. These include propane, butane, isobutane, and related volatile hydrocarbons, as well as other mixtures. Such hydrocarbons are poor solvents for the active ingredients such as the polymers. For this reason dimethyl ether is often added as well. It functions both as a propellant and a solvent.[1]

Right off the Bathroom Counter





The Agency for Toxic Substances and Disease Registry (ATSDR)



You come into contact with chemicals every day.

This is called chemical exposure. Although some chemical exposures are safe, others are not. A certain amount of a harmful chemical must enter your body to make you sick. Harmful chemicals can get into your body if you breathe, eat, or drink them or if they are absorbed through your skin. This booklet explains some links between chemicals and other harmful substances and their possible health effects.

People respond to chemical exposures in different ways. Some people may come into contact with a chemical and never be harmed. Others may be more sensitive and get sick. Sometimes illness happens only if you are exposed to a harmful substance for a long time.

Many factors play a part in whether you get sick from contact with chemicals, including

Health Effects of Some Chemicals on Your Body Systems

The RESPIRATORY SYSTEM's function is to supply oxygen to the body and remove carbon dioxide. It includes the nasal passages, pharynx, trachea, bronchi, and lungs. Possible health effects of the respiratory system include asbestosis, emphysema, chronic bronchitis, fibrosis, emphysema, and decreased oxygen supply in blood.

Possible Contaminants	Where do you find these?
Asbestos	Old insulation
Radon	The ground
Cadmium	Old batteries
Benzene	Degreasers
Carbon monoxide	Car exhaust, unvented or faulty furnaces
Soot	Furnaces, wood burning stoves

The RENAL SYSTEM's function is to rid the body of waste, to regulate the amount of body fluids, and to regulate the amount of salts in the body. It includes the kidneys, the urethra, the bladder, and the ureter. Possible health effects of the renal system include decreased formation of urine, decreased blood flow to kidney, decreased ability to filter the blood, prevented urine flow, kidney tissue damage, and kidney cancer.

Possible Contaminants	Where do you find these?
Cadmium	Old batteries, cigarette smoke
Lead	Old paint, outdated plumbing
Mercury	Thermostats, thermometers, some fish
Uranium	Food & water, proximity to nuclear testing sites
Chlorinated hydrocarbon solvents (TCE, PCE, PCT)	Degreasers, paint removers, dry cleaning solutions

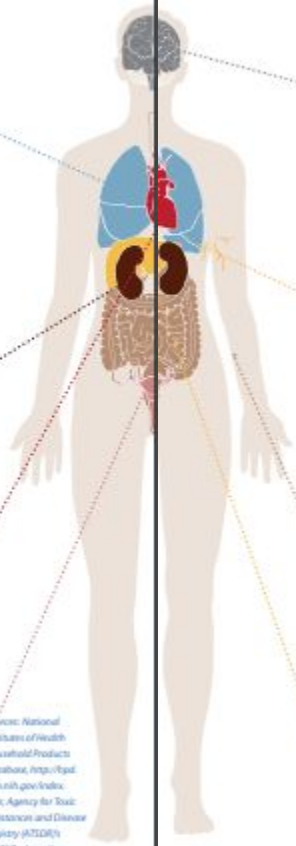
The CARDIOVASCULAR SYSTEM's function is to move nutrients, gases, and wastes to and from the body, to help stabilize body temperature, and to fight diseases and infections by transporting white blood cells to important areas. It includes the heart, blood, arteries, veins, and capillaries. Possible health effects include heart failure and the inability of blood to carry the necessary oxygen to the body.

Possible Contaminants	Where do you find these?
Carbon monoxide	Car exhaust, unvented or faulty furnaces
Carbon disulfide	Industrial production
Nitrates	Fertilizers
Methylene chloride	Auto part cleaners, paint removers

The REPRODUCTIVE SYSTEM's function is to produce egg and sperm cells, to nurture a developing fetus, and to produce hormones. For males it includes the testicles, seminal vesicles, prostate gland, and the penis. For females it includes the uterus, bladder, vagina, fallopian tubes, ovaries, and the cervix. Possible health effects of the reproductive system include decreased ability to have a baby, increased baby deaths, increased birth defects, and infertility (the inability to have children).

Possible Contaminants	Where do you find these?
Methyl mercury	Some fish, coal-burning power
Carbon monoxide	Car exhaust, unvented or faulty furnaces
Lead	Old paint, outdated plumbing

Sources: National Institutes of Health Household Products Database, http://hpd.nlm.nih.gov/index.htm; Agency for Toxic Substances and Disease Registry (ATSDR)'s ToxFAQs, http://www.atsdr.cdc.gov/toxfaq.html



Health Effects of Some Chemicals on Your Body Systems

The NERVOUS SYSTEM's function is to transmit messages from one part of the body to another. It includes the central nervous system (the brain and spinal cord) and the peripheral nervous system. Possible health effects of the nervous system include inability to move, loss of feeling, confusion, and decreased speech, sight, memory, muscle strength, or coordination.

Possible Contaminants	Where do you find these?
Arsenic	Pressure treated wood
Cadmium	Discarded batteries
Carbon monoxide	Car exhaust, unvented or faulty furnaces
Cyanide	Rat poison

The IMMUNE SYSTEM's function is to protect the body from tumor cells, environmental substances, and invading viruses and bacteria. It includes the lymph system, bone marrow, white blood cells, and the spleen. Possible health effects of the immune system include overreaction to environmental substances (allergy), immune system slow down or failure, and autoimmunity (autoimmunity causes the body to attack itself – which makes it more likely to have an over-reaction or infection).

Possible Contaminants	Where do you find these?
Mercury	Thermostats, thermometers, some fish
Lead	Old paint, outdated plumbing
Pesticides	Unwashed fruits and vegetables
Polychlorinated biphenyls (PCBs)	Industrial waste, fish from contaminated water
Polycyclic aromatic hydrocarbons (PAHs)	Cigarette smoke, vehicle exhaust, asphalt roads

The SKIN serves as a barrier to germs and other substances, prevents dehydration, and regulates body temperature. Possible health effects of the skin include irritation, rash, redness or discoloration, dermatitis, and health effect related to other systems and organs due to contamination through the skin.

Possible Contaminants	Where do you find these?
Nickel	Cement
Mercury	Thermostats, thermometers, some fish
Arsenic	Pressure treated wood
Chromium	Paints, industrial production
Polychlorinated biphenyls (PCBs)	Industrial waste, fish from contaminated water
VOC (volatile organic compounds)	Fumes from gasoline, paint, adhesives, building supplies

The HEPATIC SYSTEM's function is to break down food and store nutrients, to make proteins which are essential for blood to clot, and to purify the body of drugs, contaminants, or chemicals. It includes the liver and its veins. Possible health effects of the hepatic system include liver damage, tumors, accumulation of fat (steatosis), and death of liver cells.

Possible Contaminants	Where do you find these?
Carbon tetrachloride	Adhesives
Methylene chloride	Auto part cleaners, paint removers
Vinyl chloride	Pipe sealer

Reduce Exposure

Health Effects of Chemical Exposure

Wash fruits and vegetables

Keep home ventilated

You come into contact with chemicals every day, but that does not necessarily mean that you will get sick. The human body has a good defense system. It usually tries to get rid of harmful substances.

Some diseases get worse when you come into contact with a harmful substance, and some diseases are caused by exposure to chemicals. A few examples of diseases caused by an exposure include smog and asthma caused by exposure to smog, mesothelioma caused by exposure to asbestos, and learning disabilities caused by exposure to lead.

You can reduce your contact with harmful chemicals by

- Being aware of chemicals in everyday products;
- Being aware of any contamination, pollution, or hot spots (areas known to have harmful amounts of contamination) around your home or work;
- Washing your hands;
- Washing fruits and vegetables;
- Reading labels that warn you about chemical exposure;
- Not burning treated wood;
- Keeping your home ventilated;
- Following proper disposal guidelines for electronics, batteries, paint, and other harmful chemical-containing products;
- Limiting intake of fish high in mercury and following local fish advisories (But remember: Consuming low-mercury fish is part of a healthy diet!); and
- Avoiding cigarette smoke.

For more information about the health effects of chemical exposure or other environmental health topics, please call the ATSDR Information Center, toll-free, at 1-800-232-4636; or visit our Web site at http://www.atsdr.cdc.gov.

The Agency for Toxic Substances and Disease Registry (ATSDR), based in Atlanta, Georgia, is a federal public health agency of the U.S. Department of Health and Human Services. ATSDR partners with communities across the nation to increase knowledge about toxic substances, reduce the health effects of toxic exposures, and protect the public health.

Some diseases get worse when you come into contact with a harmful substance, and some diseases are caused by exposure to chemicals. A few examples of diseases caused by an exposure include smog and asthma caused by exposure to smog, mesothelioma caused by exposure to asbestos, and learning disabilities caused by exposure to lead.

You can reduce your contact with harmful chemicals by

- Being aware of chemicals in everyday products;
- Being aware of any contamination, pollution, or hot spots (areas known to have harmful amounts of contamination) around your home or work;
- Washing your hands;
- Washing fruits and vegetables;
- Reading labels that warn you about chemical exposure;
- Not burning treated wood;
- Keeping your home ventilated;
- Following proper disposal guidelines for electronics, batteries, paint, and other harmful chemical-containing products;
- Limiting intake of fish high in mercury and following local fish advisories (But remember: Consuming low-mercury fish is part of a healthy diet!); and
- Avoiding cigarette smoke.

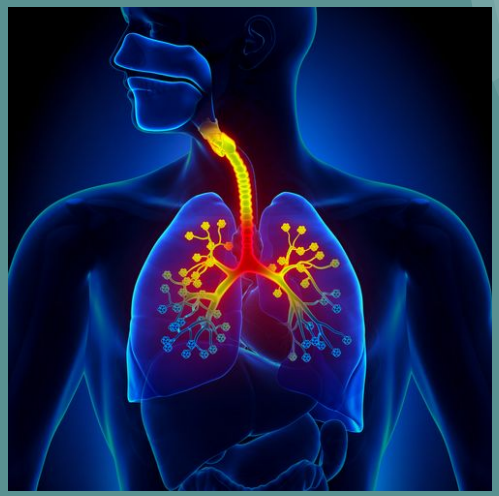
Covid 19… Need I say more?

Air also transports
disease
bacteria
viruses

- TB
- SARS
- Mumps
- Diphtheria
- Measles
- Smallpox
- Influenza
- Anthrax

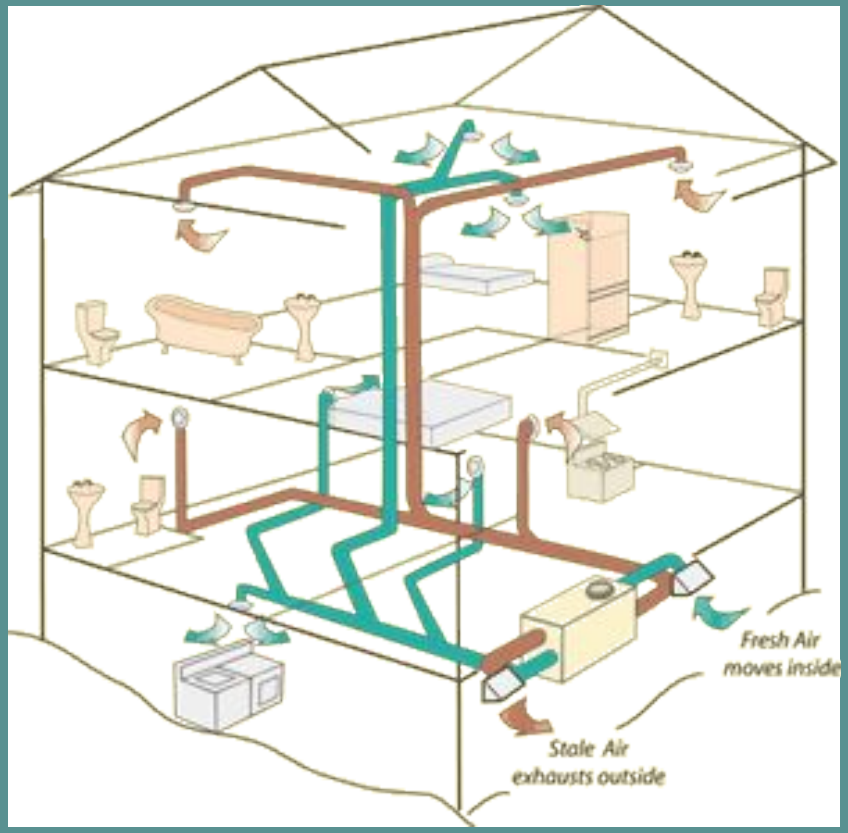
Humans come equipped with a Ventilator

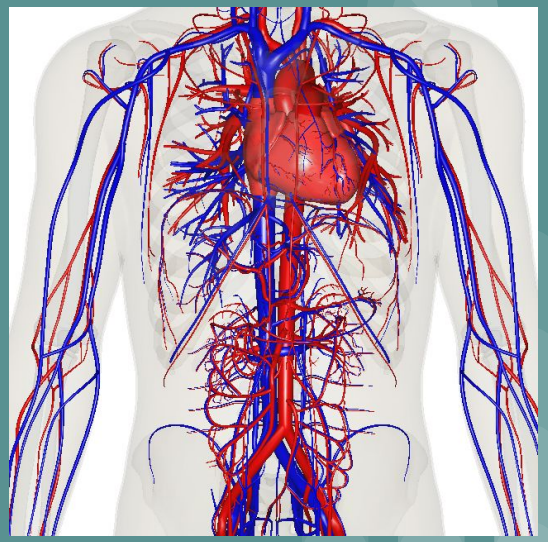
All of us breath constantly
- over 20,000 breaths each day
- 35 pounds of air.



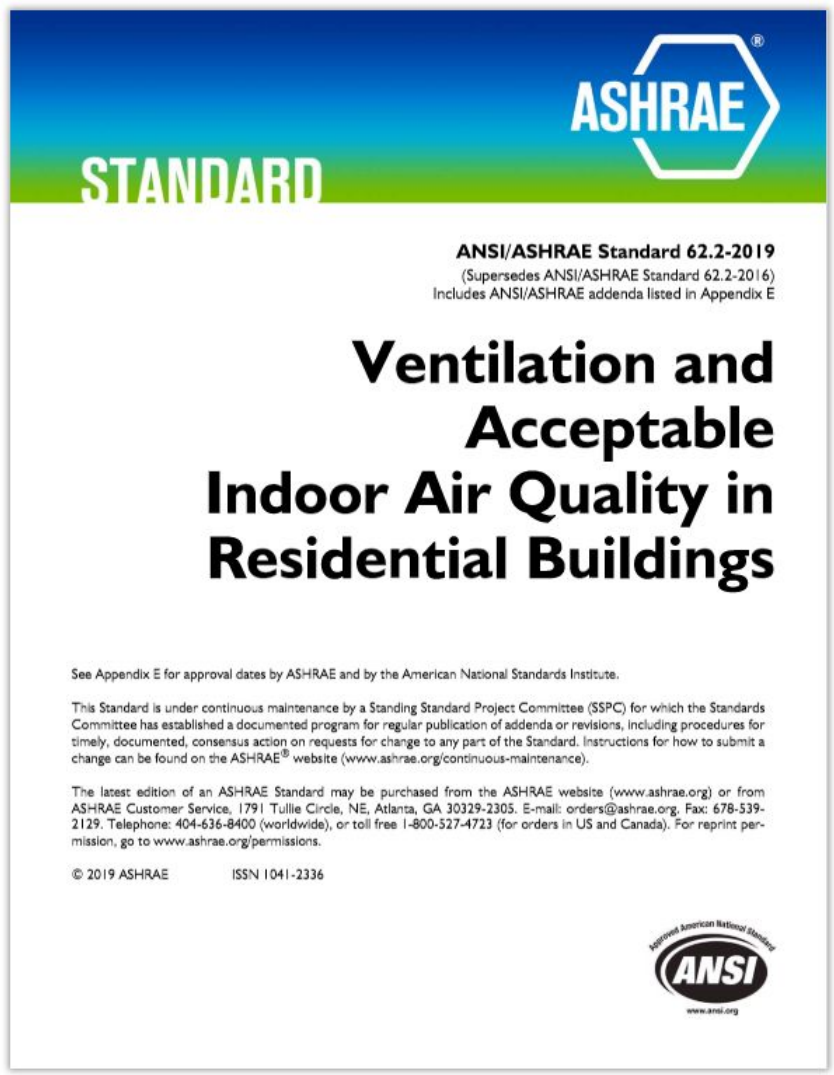
Normal metabolism creates CO_2
and other
pollutants we need to get rid of

A system needs to consider the whole area





Residential Ventilation



STANDARD

ASHRAE

ANSI/ASHRAE Standard 62.2-2019
(Supersedes ANSI/ASHRAE Standard 62.2-2016)
Includes ANSI/ASHRAE addenda listed in Appendix E

Ventilation and Acceptable Indoor Air Quality in Residential Buildings

See Appendix E for approval dates by ASHRAE and by the American National Standards Institute.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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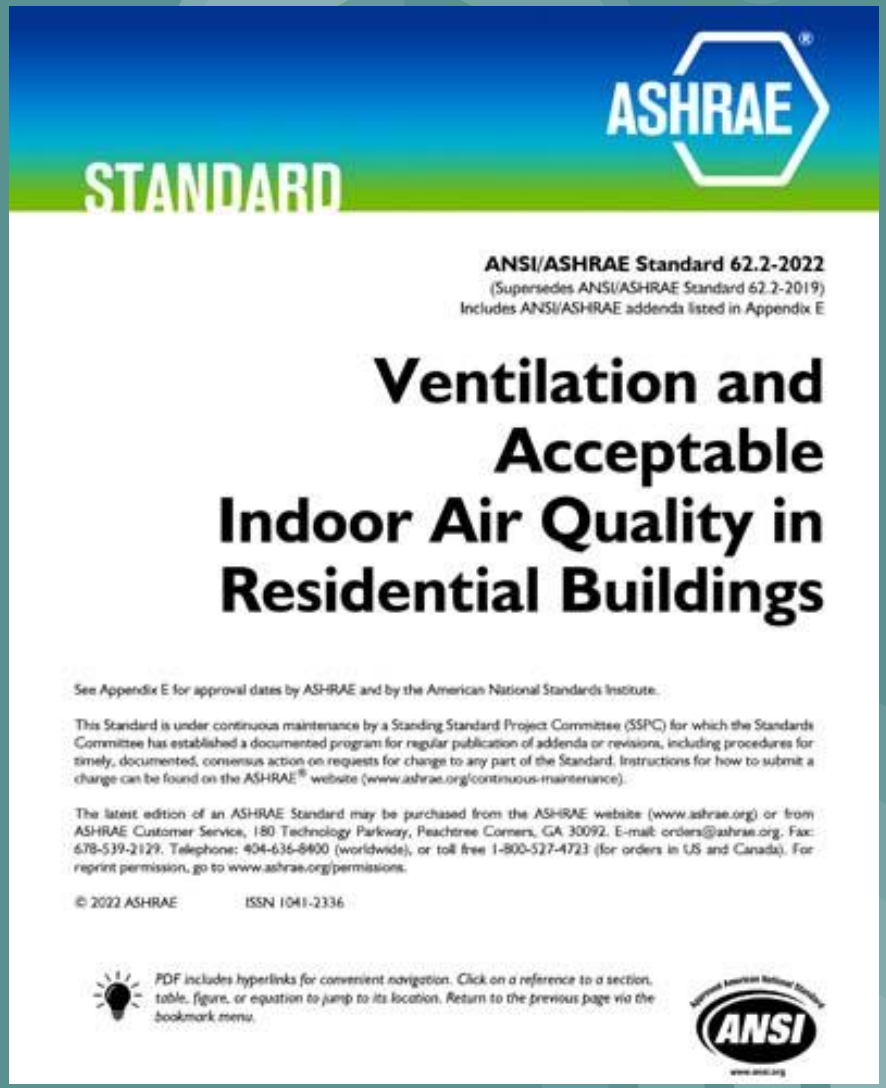

STANDARD

ASHRAE

ANSI/ASHRAE Standard 62.2-2022
(Supersedes ANSI/ASHRAE Standard 62.2-2019)
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 ISSN 1041-2336

PDF includes hyperlinks for convenient navigation. Click on a reference to a section, table, figure, or equation to jump to its location. Return to the previous page via the bookmark menu.

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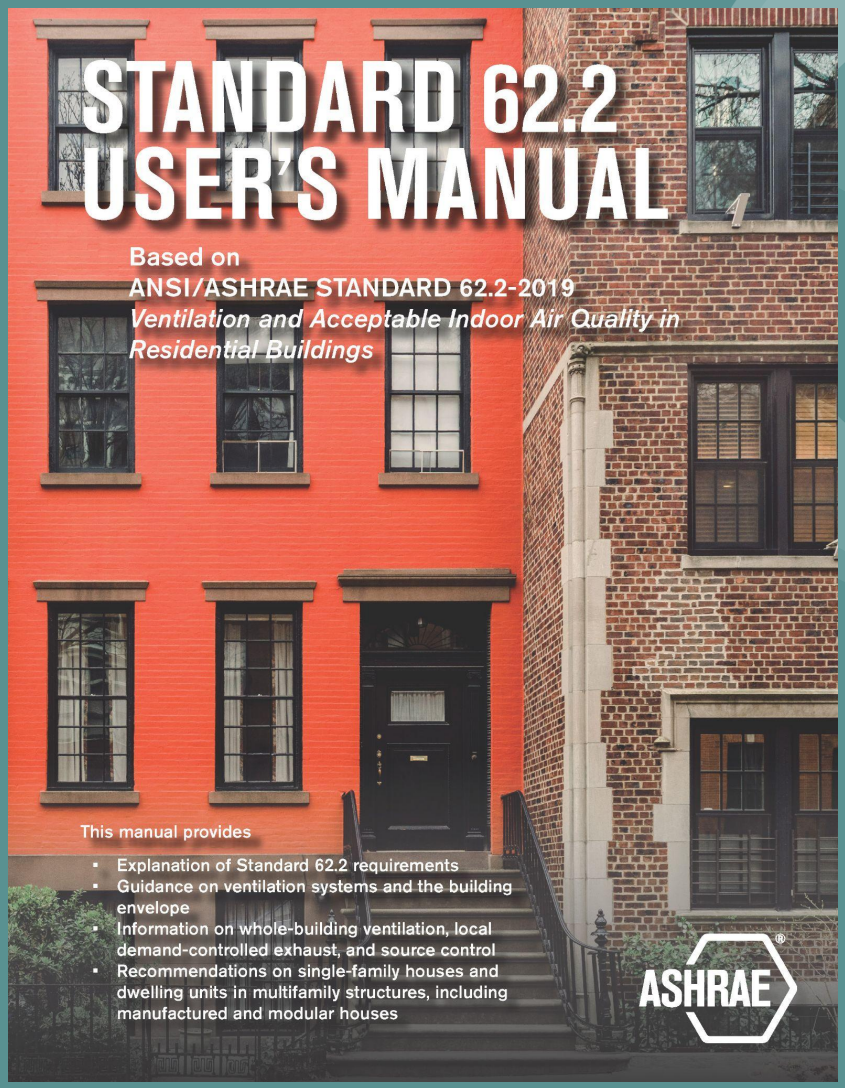
Helpful Handbook $60



ASHRAE 62.2 - 2019 and addendums

- sets **minimum outdoor** air ventilation rates and **requires other measures intended to provide indoor air quality** that is both acceptable to human occupants and minimizes negative effects on health.
- Both occupant perception and health issues affect the acceptability of indoor air quality. Therefore, both are relevant to this Standard.

- Furthermore, the purpose of Standard is broader than minimum ventilation rates, encompassing such subjects as moisture control, control of certain contaminant sources, maintenance, and air cleaning.

- Indeed, the impact of indoor air quality on health, stated broadly in the Purpose of Standard is addressed in a number of ASHRAE documents. It remains an important factor in the development and implementation of standards and guidelines that benefit the general public.

It is a **ventilation minimum** Standard
NOT a
Healthy Air Quality Standard

16 from 16

2019 incorporates the contents of 16 addenda to the 2016 version

Major changes include:

- adding a compliance path that gives credit for particle filtration
- distinguishing between balanced and unbalance ventilation system interactions with natural infiltration
- requiring compartmentalization limits for new multifamily dwellings
- allowing for single point envelope leakage test results to be used when calculating infiltration credit.

2. Scope Expansion

- ASHRAE 62.2 - 2019 has widened its scope to encompass multiple dwelling units (MDUs) and multifamily buildings, addressing the need for ventilation standards in these settings.
- This expansion reflects the evolving landscape of residential construction and the importance of maintaining indoor air quality in various housing types.

B. Ventilation Rate Determination

- The 2019 edition provides updated methods for determining ventilation rates based on factors such as building size, occupancy, and climate zone.
- It includes specific requirements for both intermittent and continuous ventilation systems, ensuring adequate fresh air supply while considering energy efficiency.

C. Compliance Options

- ASHRAE 62.2 - 2019 offers multiple compliance options to accommodate different building configurations and ventilation strategies.
- These options include prescriptive requirements, performance-based approaches, and simplified compliance paths, allowing flexibility in meeting the standards objectives.

D. Indoor Air Quality (IAQ) Control Measures

- The standard emphasizes the importance of controlling indoor air pollutants through measures such as source control, filtration, and proper ventilation.
- It provides guidance on mitigating contaminants like volatile organic compounds (VOCs), radon, and moisture, promoting a healthier indoor environment for occupants.

E. Integration with Energy Efficiency

- ASHRAE 62.2 - 2019 seeks to strike a balance between indoor air quality and energy efficiency goals.
- It encourages the use of energy-efficient ventilation systems and strategies to minimize energy consumption while meeting ventilation requirements, aligning with broader sustainability objectives.

F. Adaptation to Changing Technologies

- The standard acknowledges advancements in building technologies and ventilation systems, offering provisions for their integration and compatibility.
- It addresses emerging trends such as smart ventilation controls, decentralized ventilation solutions, and enhanced filtration techniques, ensuring relevance in modern building practices.

G. Continuous Improvement and Research

- ASHRAE 62.2 - 2019 reflects ongoing research and industry feedback, incorporating updates and revisions to enhance effectiveness.
- It encourages collaboration among stakeholders, including researchers, engineers, architects, and building owners, to drive continuous improvement in indoor air quality standards.

4. Dwelling-Unit Ventilation

Ventilation Rate
Mechanical exhaust system, supply system or combination

Total Ventilation Rate Calculation
Q_{tot} = 0.03 x floor area + 7.5 times (# of bedrooms +1)

Ex. 28 x 56 ranch on full basement with 3 bedrooms
28 x 56 x 2 x .03 + 7.5 x 4 = 124.08 cfm

or

Required Airflow (cfm)					
Floor area (square feet)	Number of bedrooms				
	1	2	3	4	5
<500	30	38	45	53	60
501-1,000	45	53	60	68	75
1,001-1,500	60	68	75	83	90
1,501-2,000	75	83	90	98	105
2,001-2,500	90	98	105	113	120
2,501-3,000	105	113	120	128	135
3,001-3,500	120	128	135	143	150
3,501-4,000	135	143	150	158	165
4,001-4,500	150	158	165	173	180
4,501-5,000	165	173	180	188	195

Addendum M : Feb 21, 2018

Do we include: Basements/ Crawl Spaces/ Warm Attics?

Old Standard defined floor area to include only finished spaces

This addendum includes such below-grade unfinished spaces in the calculation of floor area if they are within the pressure boundary of the home.

4.1.2 Infiltration Credit

If a blower door test has been performed,

Then

a credit for “assumed” infiltration rate can reduce cfm requirement

Qfan = Qtot - (credit amount)

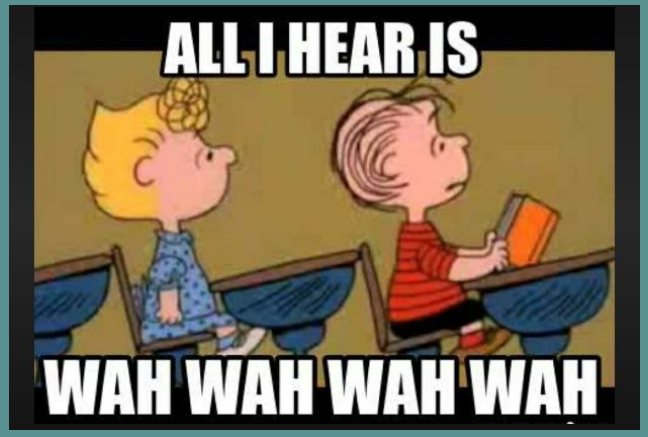
**Exception - if total is 15 cfm or less, not ventilation required*

4.1.2.1 Effective Annual Ave. Infiltration Rate

$$Qinf = 0.052 \times Q50 \times wsf \times (H/Hr)z$$

Qinf = Estimated infiltration rate, cfm
Q50 = leakage rate @50 Pa depressurization or pressurization, cfm
wsf = weather and shielding factor from Normative Appendix B
H = vertical distance between the lowest and highest above-grade points within the pressure boundary, ft
Hr = reference height, 8.2 ft
z = 0.4 for the purpose of calculating the Effective Annual Average Infiltration Rate

EASY = Engineers, Auditors, Scientists, and You



Other Methods

4.1.2

- ASTM Procedure
- CGSB Procedure
- Normalized Leakage
- Effective Annual Average Infiltration Rate

4.1.3 - Different Occupant Density

4.1.4 - Ventilation-Rate Reduction for Particle filtration

4.1.4.1 - Air Distribution System - The filtered air shall be supplied to or returned from all rooms in the habitable space through an air-handling system that supplies air from (or returns air to) the filter from every bedroom and living area, comply with this requirement but are not required.

4.1.4.2 - Particle Filtration -
recirculation = Merv 11 or higher

4.1.4.3 - Airflow Rate

4.1.4.4 - Installation & Maintenance of filters

- readily accessible
- instruction and labeling
  - filter designation prominently displayed on or near access door

Section 4 cont.

4.2 - System Type
- Supply & Exhaust - Balanced system
- Supply only - inlet to HVAC system
- Exhaust - consisting of local and whole house fans

4.3 - Airflow Measurement - Multiple methods

4.4 Control and Operation - Readily accessible on-off (showing function)
Exception- Multifamily not required to be readily accessible.
- *are we mixing air between units?*

4.5 Variable Mechanical Ventilation (tracking occupancy)
- 4.5.1 - Short Term Average Ventilation
- 4.5.2 - Scheduled Ventilation
  - 4.5.1 - Annual Average Schedule
  - 4.5.2 - Block Scheduling
- 4.5.3 - Real time Control - (Measuring air, i.e, CO2, VOCs, etc)

4.6 - Equivalent Ventilation - a design that meets keeping exposure levels at or below annual exposure levels

Exhausted Yet?

Local Exhaust

5.1 - Local Mechanical Exhaust - each kitchen and bathroom

Enclosed Kitchen - 100 cfm min. or 300 cfm downdraft

- Vented range hood incl. combination (micro) :100 cfm
- Other kit. fans, including downdraft : 300 cfm or 5 ACH

Non Enclosed Kitchen

- same but no 5 ACH (hard to calculate)

Bathroom - 50 cfm

Continuous Local Ventilation
Enclosed Kitchen = 5 ACH
Bathroom - 20 cfm

Prescriptive Duct Sizing

Table 5-2 Continuous Local Ventilation Exhaust Airflow Rates

Application	Airflow
Enclosed kitchen	5 ach, based on kitchen volume
Bathroom	20 cfm (10 L/s)

Table 5-3 Prescriptive Duct Sizing

Fan Airflow Rating, CFM at minimum static pressure of 0.25 in. of water (L/s at minimum 62.5 Pa)	≤50 (25)	≤80 (40)	≤100 (50)	≤125 (60)	≤150 (70)	≤175 (85)	≤200 (95)	≤250 (120)	≤350 (165)	≤400 (190)	≤450 (210)	≤700 (330)	≤800 (380)
Duct Type	**Minimum Duct Diameter, in. (mm) [a,b]**												
Rigid duct	4 [e] (100)	5 (125)	5 (125)	6 (150)	6 (150)	7 (180)	7 (180)	8 (205)	9 (230)	10 (255)	10 (255)	12 (305)	12 [d] (305)
Flex duct [c]	4 (100)	5 (125)	6 (150)	6 (150)	7 (150)	7 (180)	8 (205)	8 (205)	9 (230)	10 (255)	NP	NP	NP

Use of Table 5-3 is limited to duct systems not exceeding 25 ft (8 m) in length, duct systems with no more than three (3) elbows, and duct systems with exterior termination fittings having a hydraulic diameter greater than or equal to the minimum duct diameter and not less than the hydraulic diameter of the fan outlet.

a. For noncircular ducts, calculate the diameter as four times the cross-sectional area divided by the perimeter.
b. NP = application of the prescriptive table is not permitted for this scenario.
c. Use of this table for verification of flex duct systems requires flex duct to be fully extended and any flex duct elbows to have a minimum bend radius to duct diameter ratio of 1.0.
d. For this scenario, use of elbows is not permitted.
e. For this scenario, 4 in. (100 mm) oval duct shall be permitted, provided the minor axis of the oval is greater than or equal to 3 in. (75 mm).

5.4 - Exception - Design criteria or prescriptive requirements shall be permitted in place of a measurement (if it's designed by professional, assume it works)

Other Requirements

Attached Garages

Crawlspace

Attics

6.1 Adjacent Spaces and Transfer Air

Measures shall be taken to minimize air from adjacent spaces

- garages
- unconditioned crawl spaces
- unconditioned attics
- other dwelling units

Pressure boundary wall, ceiling and floor penetrations shall be sealed as shall any Vertical chases adjacent to dwelling.

Doors between dwelling units and common hallways shall be gasketed or made substantially air tight.

Supply and Balanced mechanical ventilation systems shall be designed and constructed to provide air directly from outdoors.

Balanced systems airflow shall be the average of the supply fan and the exhaust fan.

6.1.1 Compliance for attached Dwelling unit

Attached dwelling units, except existing per Appendix A, shall demonstrate compliance with Sec. 6.1 by verifying a leakage rate less than or equal to .3 cfm of the dwelling unit envelope area by means of a blower door test @ 50 Pa.
Leakage from the other dwelling unit is of concern

6.2 - Instruction and Labeling

- Information on system and owners manuals required
- must detail maintenance
- Controls shall be labeled

6.3 - Clothes Dryers - exhausted directly to the outdoors
- exception. condensing dryers plumbed to a drain

6.4 - Combustion and Solid Fuel Burning Appliances

6.4.1 - must be provided with adequate combustion and ventilation air

6.4.2 - Where atmospherically vented appliances are located inside the pressure boundary, the total net exhaust flow of the 2 largest exhaust fans shall not exceed 15 cfm per 100 sq/ft (ex. 3000 sq ft area = 450 cfm)

Problems:

- Range hoods over 400 cfm
-

- Gravity or barometric dampers in non powered exhaust makeup air systems shall NOT be used to provide compensation outdoor air.

6.5 Air Tightness Requirements

6.5.1 - Garages

- When adjoining an occupiable space, must prevent migration of contaminants to the occupiable space.
- air seal walls, ceilings, and floors that separate the spaces
- to be considered sealed, all joints, seams, penetrations, opening between door assemblies and jambs and framing and other sources of air leakage …. shall be caulked, gasketed, weather stripped, wrapped or otherwise sealed to limit air movement.
- Doors shall be gasketed or made substantially air tight

6.5.2 - Space-Conditioning System Ducts

- outside conditioned space all joints shall be sealed
- not connected to garage
- ducts outside of pressure boundary leakage rate less than 6%

6.6 Ventilation Opening Area

Spaces shall have ventilation openings as listed

6.6.1 - Habitable Spaces - not less than 4% of floor area

6.7 Minimum Filtration - intake air Merv 6 or greater (soon to be Merv 11)

6.7.1 Filter Pressure Drop - Labeled with design airflow and visible

6.8 - Air Inlets - Min 10 feet from known contaminant source

- stack
- vent
- exhaust hood
- vehicle exhaust
- not obstructed by snow, plantings or other obstructions
- screen not larger than ½

Exceptions

- as close as stretched string 3 ft from through roof or dryer exhaust
- no minimum distance from windows and local exhaust, kitchen or bath
- Vent terminations covered by NFPA 54
- Combined exhaust/intake with 10% or less contamination by design

6.8.1 Ventilation Openings shall be readily accessible.

6.9 - Carbon Monoxide Alarms - installed in each dwelling per NFPA 720

7. Air Moving Equipment

7.1 Selection and Installation - Ventilation equipment HVI certified. Installation according to manufacturer instructions.

7.2 Sound Ratings for Fans - rated per HVI

7.2.1 Dwelling Unit Ventilation or Continuous Exhaust fans = 1 sone or less

7.2.2 Demand Controlled Local Exhaust fans = 3 sones or less

7.3 Exhaust Ducts

7.3.1 Multiple fans using one duct - need backdraft. Multiple units, NO.

7.3.2 Single Exhaust Fan w/Multiple inlets across multiple dwelling units. Must run continuous and have backdraft to isolate each unit.

7.4 Supply Ducts - Commonly ducted across multiple units, one or more fans located upstream must run continuously, or backdraft dampers to isolate units.

Appendix A: Existing Buildings

A1. Summary - to provide an alternative compliance path for existing buildings and associated ventilation equipment. Already occupied and not meeting the provisions of the standard. Jurisdiction to decide what to apply.

A2. Dwelling Unit Mechanical Ventilation Rate - Section A3 applied before 4.1.2

A3. Local Exhaust - When replacing, must meet std. When existing does not meet, use this section to compensate.

A.3.1 Initial room Airflow Deficit - bath 50 cfm, kitchen 100 cfm

- if it doesn't work or can not be measured, assume zero.

A.3.2 Window Opening Credit - CEO determines if permissible. If there is an operable window, deficit may be reduced by 20 cfm (expect this to go away)

A.3.3 Required additional Airflow - Total airflow deficit from all fans / 75%

A4 Air-Moving Equipment - all equipment to meet Section 6 and 7 requirements.

A5 - Dwelling unit Air Sealing

Units undergoing alterations between 15% and 80% of the envelope wall area shall comply with Section 6.1.1 or A5.1. At least 80% shall comply 6.1.1

A5.1 Seal readily accessible penetrations

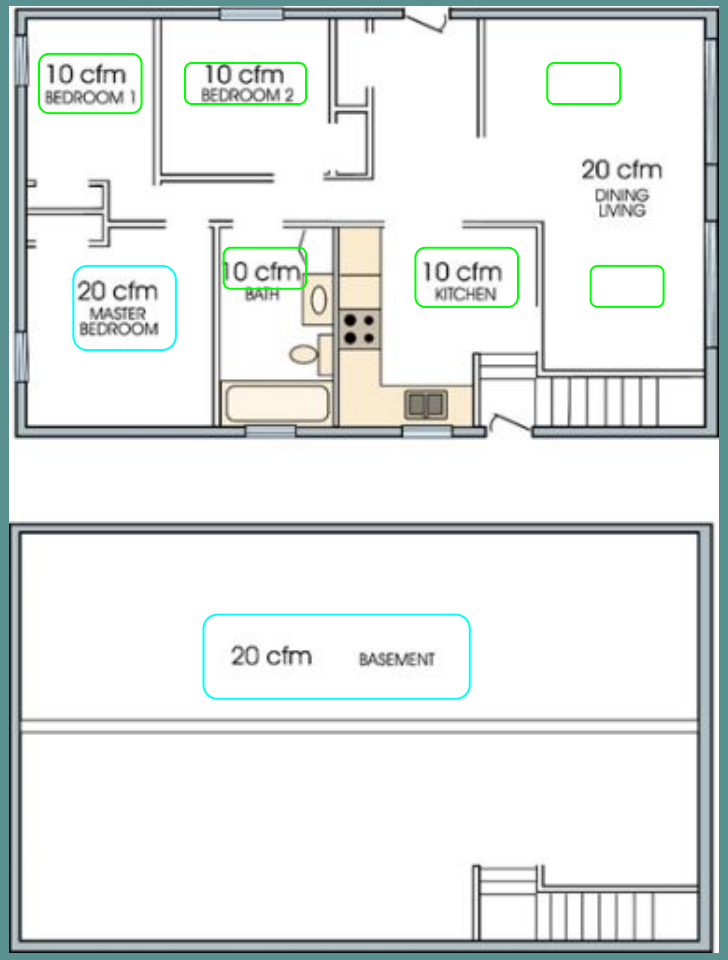
A5.2 Seal accessible leaks and gaps in air barrier

A5.3 Where previously inaccessible become accessible, seal them

A 5.4 Use appropriate sealants and materials

CSA F326

Ventilation Air Requirements



- The capacity of a ventilation system is based on the “Total Ventilation Capacity,” (TVC) which represents the minimum amount of outdoor air the ventilation system shall be capable of providing.
- The “Total Ventilation Capacity” (TVC) is determined using a room count method where each room of the house is assigned an airflow in cfm.

Ventilation Air Requirements

- The system which provides the TVC shall have the following characteristics:
  - Shall be capable of continuous operation at the TVC,
  - Shall have the ability to operate at 40% to 60 % of the TVC.

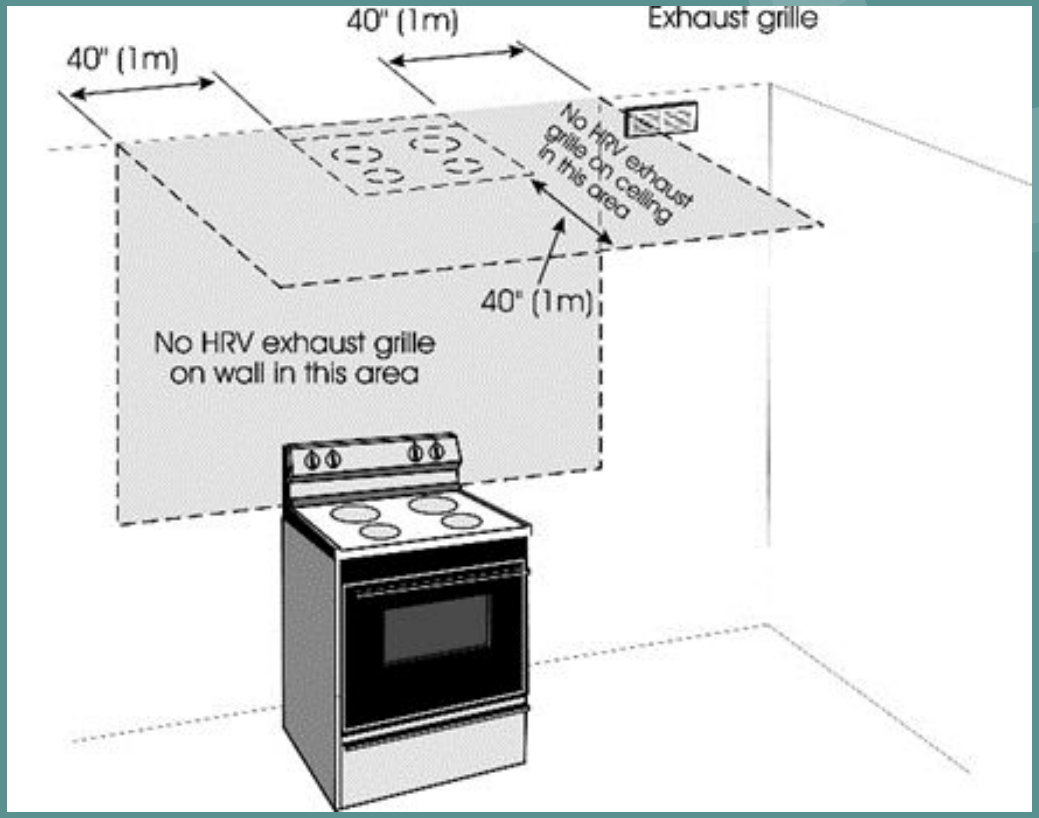
The 40-60% requirement of CSA F326 is roughly equivalent to the Principal Ventilation Capacity in many building codes.

Exhaust Air Requirements

Basically the same as 62.2

Bathrooms
Intermittent = 50 cfm
Continuous = 20 cfm

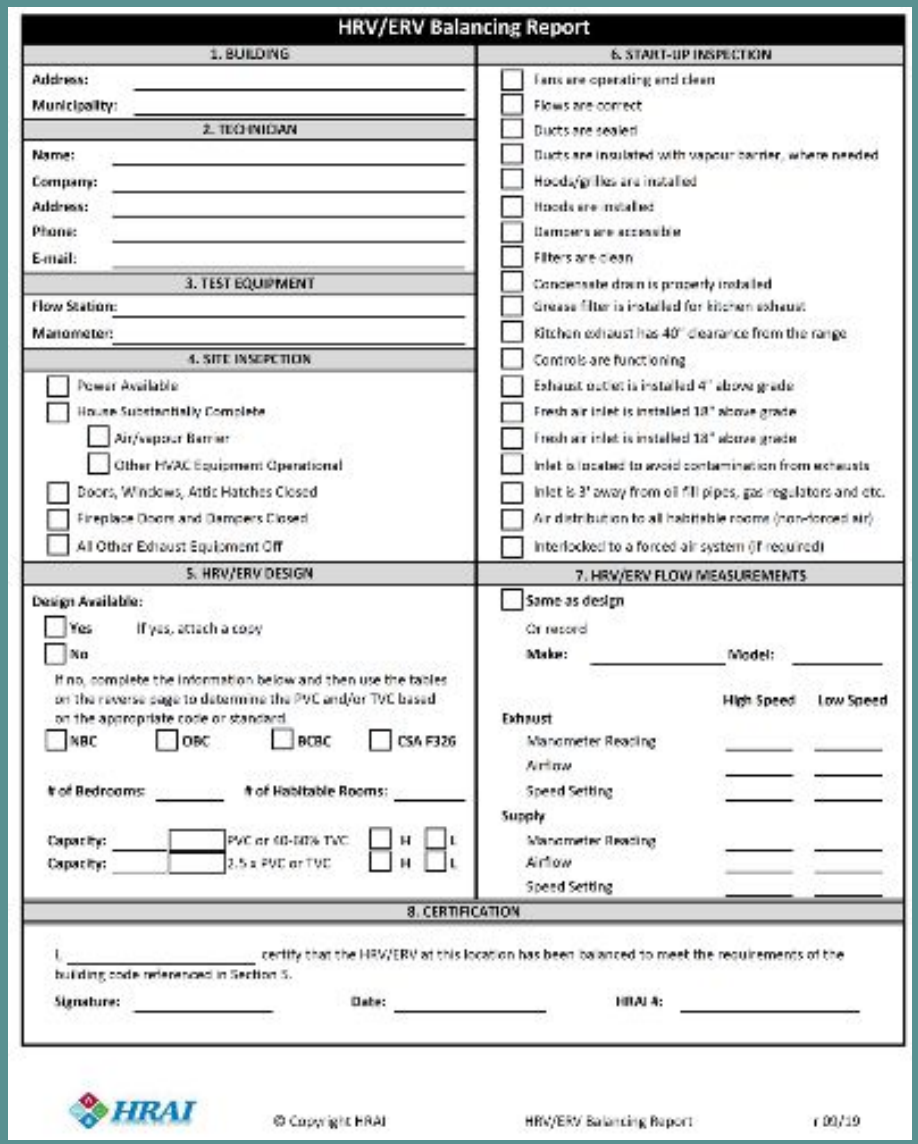
Kitchen = 100 cfm
Ventilation air = 60 cfm



Distribution

- Ventilation air shall be distributed to all habitable rooms.
- There are four ways for a system to meet this requirement.
    - Ventilation air supplied directly from outside to a room (e.g. HRV/ERV with dedicated duct system).
    - Ventilation air supplied to a room mixed with air recirculated from other areas of a house (e.g. ventilation air connected to the return air of a forced-air heating/cooling system).
    - Recirculated air only (e.g. ventilation air provided by infiltration from an exhaust-only system).
    - Air removed from a room to either be exhausted outside or re-circulated (e.g. the return air to a furnace or an inline fan removing air from some areas and supplying air to others.

Installation



HRV/ERV Balancing Report

1. BUILDING

Address: _____

Municipality: _____

2. TECHNICIAN

Name: _____

Company: _____

Address: _____

Phone: _____

E-mail: _____

3. TEST EQUIPMENT

Flow Station: _____

Manometer: _____

4. SITE INSPECTION

- ☐ Power Available
- ☐ House Substantially Complete
  - ☐ Air/vapour Barrier
  - ☐ Other HVAC Equipment Operational
- ☐ Doors, Windows, Attic Hatches Closed
- ☐ Fireplace Doors and Dampers Closed
- ☐ All Other Exhaust Equipment Off

5. HRV/ERV DESIGN

Design Available:

☐ Yes If yes, attach a copy

☐ No

If no, complete the information below and then use the tables on the reverse page to determine the PVC and/or TVC based on the appropriate code or standard.

☐ NBC ☐ OBC ☐ BCBC ☐ CSA F326

# of Bedrooms: _____ # of Habitable Rooms: _____

Capacity: _____ ☐ PVC or 60-80% TVC ☐ H ☐ L

Capacity: _____ ☐ 2.5 x PVC or TVC ☐ H ☐ L

6. START-UP INSPECTION

- ☐ Fans are operating and clean
- ☐ Flows are correct
- ☐ Ducts are sealed
- ☐ Ducts are insulated with vapour barrier, where needed
- ☐ Hoods/grilles are installed
- ☐ Hoods are installed
- ☐ Dampers are accessible
- ☐ Filters are clean
- ☐ Condensate drain is properly installed
- ☐ Grease filter is installed for kitchen exhaust
- ☐ Kitchen exhaust has 40" clearance from the range
- ☐ Controls are functioning
- ☐ Exhaust outlet is installed 4' above grade
- ☐ Fresh air inlet is installed 10' above grade
- ☐ Fresh air inlet is installed 10' above grade
- ☐ Inlet is located to avoid contamination from exhausts
- ☐ Inlet is 3' away from oil fill pipes, gas regulators and etc.
- ☐ Air distribution to all habitable rooms (non-forced air)
- ☐ Interlocked to a forced air system (if required)

7. HRV/ERV FLOW MEASUREMENTS

☐ Same as design

Or record

Make: _____ Model: _____

	High Speed	Low Speed
Exhaust		
Manometer Reading		
Airflow		
Speed Setting		
Supply		
Manometer Reading		
Airflow		
Speed Setting		

8. CERTIFICATION

I _____ certify that the HRV/ERV at this location has been balanced to meet the requirements of the building code references in Section 5.

Signature: _____ Date: _____ HRAI #: _____

HRAI © Copyright HRAI HRV/ERV Balancing Report r 09/19

- All equipment shall be commissioned in accordance with the manufacturers' start-up instructions for airflow and balancing,
- A balancing report similar to HRAI's HRV/ERV Balancing Report shall be completed, signed by the technician and left with the equipment.

Training

Maine Indoor Air Quality Council currently training on the CSA F326

- 3 trainings already offered in 2023
- 3 more this year with one in Bangor already completed
- Certificate from HRAI is give upon meeting exam requirements

- Training with an overview specifically for CEOs to be offered soon

Questions?

Kurt T. Johnson, Owner
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HRAI Certified Design and Installation of
Residential Mechanical Ventilation Systems
Board Member of The Maine Indoor Air Quality Council
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