## What Can the CERV™ Smell?

**Build Equinox CERV VOC Library** 

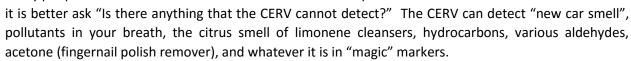
We are continuously bombarded in our homes by a dizzying array of pollutants. Many of these substances are modern creations in which humans have never before been immersed. Our homes are deteriorating because of substances such as "Chinese drywall" that emits sulfurous fumes, and formaldehyde released by many of today's building materials and furnishings. Formaldehyde turns into formic acid that corrodes the copper tubing in air conditioners (web search "formicary corrosion"). If these substances can destroy our homes, what are they doing to our lungs, body, and mind? It is essential that we flush these substances from our homes in an energy efficient manner in order to minimize their impact on us.

We breathe 40 pounds of air into our lungs each day. In order to keep air inside a building fresh enough for our lungs, at least 2000 pounds of outdoor air per person must flow into a building daily! Have you ever moved a ton of anything? It takes a lot of work to effectively move a volume of 28,000 cubic feet of fresh air per person throughout a home's nook-n-crannies each day. This is why ventilation ductwork should become foremost in importance in home design rather than as an afterthought left to the whims of installers.

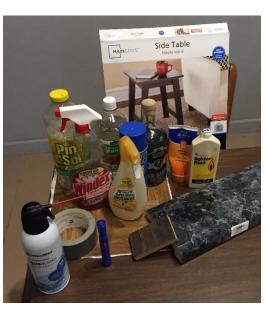
The CERV™ fresh air ventilation system, by Build Equinox, incorporates air pollution sensors (carbon dioxide and VOCs) that detect pollutants our noses cannot. Various hydrocarbon gases (methane, propane, butane) are odorless, and we will not smell them at any concentration, but the CERV can. Like our best friends, our dogs, your CERV is continually on guard and extends our sense of smell to keep us protected.

Our CERV's VOC (Volatile Organic Compound) sensor is a total VOC sensor that can detect minute amounts reactive compounds. Not all VOCs are bad, such as the wonderful odors of Grandma's chicken soup. Such beneficial odors release good feelings, love and accelerated healing. But, even good odors should not be allowed to stay so long that they become infused and absorbed in our furnishings and building surfaces.

Many people ask us which VOCs the CERV can detect. Perhaps



Build Equinox, the inventor and manufacturer of the CERV, has started a library that lists the CERV's sensitivity to VOCs emitted by various substances. A "high" or "low" rating is not an indication of toxicity or danger, but rather an indication of how strongly the CERV's total VOC sensor is able to detect something. For example, two brands of duct tape are listed. One brand was found to emit very little VOCs while the other emits a moderate levels of VOCs. We do not know whether the VOCs emitted by the



"smelly" duct tape are harmful or not. That is a question for others to answer. But we do know that a typical mixture of VOCs in the modern home, office and school environment do impact our cognitive performance [1] as well as having the potential over time to produce health problems [2].

Table 1 is a listing of the substances Build Equinox has tested to date, ordered in terms of "High", "Medium", "Low", and "No" VOC detection by our CERV VOC sensor. The ranking of a substance as high, medium, low or no is based on our judgement. You should know our judgment is very good because we have measured VOCs in more homes for a longer time than almost anyone else.

We use a 41 quart size, covered polypropylene container to test substances. The container is intentionally not well-sealed in order to create a space with some level of infiltration and dilution during the test period. A CERV VOC sensor is placed in the container and connected to a data recorder. We tested the empty container, too. The polypropylene test box did not emit a VOC level detectable by the CERV, which is nice to know because polypropylene is a polymer commonly used for food containers (eg, plastic milk jug bottle caps) and toys (hula hoops).

A "High" rating occurs due to either a high peak VOC sensor reading, or a steep increase of the VOC sensor output after a sample is added to the test container. A sample of isobutane, for example, does not elevate the VOC sensor output to its highest level because we use a small sample (butane is highly flammable and can be explosive!). The steep rise of the VOC sensor output, however, indicates that the sensor is very sensitive to isobutane. What is isobutane? It is a common aerosol can propellant used to spray other chemicals (paints, cleansers, etc). Some test materials, such as liquids, have a very high VOC content that builds more slowly to a very high VOC sensor reading. A "Medium" level is less than a "High" level, while a "Low" level indicates there is some VOC detection, but either the pollutant emission rate from the sample is low, or the amount of pollutants in the sample that can be volatilized is low.

We hope this information is useful to you. Check back often to see new listings added to our list. We welcome suggestions from you, too. Are there some substances that you would like to know about? If so, we'll add it to our list and do our best to test it.

<sup>[1]</sup> Joseph G. Allen, Piers MacNaughton, Usha Satish, Suresh Santanam, Jose Vallarino, and John D. Spengler; "Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments"; Env Health Perspectives; Oct 2015

<sup>[2]</sup> Formaldehyde Chemical Summary, US Environmental Protection Agency, Toxicity and Exposure for Children's Health; www.usepa.gov/teach/

Table 1 "High" to "No" listing of VOC substances that the CERV can detect.

Substance	Form	VOC (N/L/M/H)	Comments
Acetone	liquid	Н	4g in ceramic bowl
Ajax "triple action" dish detergent	liquid	Н	4g in ceramic bowl
Bourbon 80 Proof	liquid	Н	4g in ceramic bowl
Easy-Off No Fume Oven Cleaner	liquid	Н	4g in ceramic bowl
Human Breath	gas	Н	2 breaths exhaled into test box
Isobutane	gas	Н	6" diameter balloon released into box; common aerosol propellant
Isopropyl Alcohol (50%)	liquid	Н	4g in ceramic bowl
Murphy Oil Soap	liquid	Н	4g in bowl, "Tall" Oil Fatty Acid and potasium hydroxide
Office Max "Gasduster"	gas	Н	6" diameter balloon released into box; aersol for cleaning computer keyboards; also called 1,1-difluoro-ethane and refrigerant R152a
Pine-Sol	liquid	Н	~ 4g of cleanser in a ceramic bowl
Renuzit Super Odor Neutralizer	liquid	Н	~4g in ceramic bowl
Staples Blue Marker	liquid	Н	cap removed from permanent marker
Walgreens Lighter Fluid	liquid	Н	4g of lighter fluid (naptha; petroleum distillates) in ceramic bowl
Windex	liquid	Н	~8g in ceramic bowl
Zep Heavy Duty Foam Degreaser	liquid	Н	4g of foam in ceramic bowl
Chlorox (6% sodium hypochlorite)	liquid	M	4g in ceramic bowl
ipg Duct Tape	solid	M	30ft of 2" wide tape; noticeable odor
Sun "oxy" gen dish detergent	liquid	M	4g in ceramic bowl
White Vinegar	liquid	М	~4g in ceramic bowl
Dirty teeshirt and socks	solid	L	worn for one day
Laminate Countertop	solid	L	52g laminate covered particleboard
Max Block 30SPF Sunscreen	liquid	L	4g of sunscreen in ceramic bowl
Sauder Bookshelf "B"	solid	L	36g of low density particleboard from bookshelf
Sauder Bookshelf "C"	solid	L	50g of high density particle board; low reading but higher than part
Shaw Laminate Floor	solid	L	16g of glueless (floating) laminate floor materials
Vinyl Floor Tile	solid	L	12" x 12" Peel-n-stick vinyl tile with adhesive back exposed
Hydrogen Peroxide (3%)	liquid	N	4g in ceramic bowl
Polypropylene	solid	N	Empty plastic tub used for VOC measurements. No measurable TVOCs with CERV sensor.
Scotch 395 Duct Tape	solid	N	80 sq in of duct tape
Scotch Packaging Tape	solid	N	80 sq in of heavy duct packaging tape
Water	liquid	N	no noticeable reading, but humidity increase due to water can mobilize other VOCs