# CAMERON GREAT LAKES, INC.
## MOLECULAR FILTRATION SPECIALISTS

# Molecular Filtration: Principles and Design Parameters

The two principal methods of molecular filtration used in the commercial and industrial sectors are adsorption and chemisorption. While there are other methods available to remove contaminants from air streams they are generally more specialized and are not incorporated into an HVAC system; therefore they will not be addressed in this paper.

Adsorption is the process by which one substance is attracted and held onto the surface of another. It is a surface phenomenon. **Capacity is independent of particle size and the adsorption rate is inversely proportional to particle size.** Adsorption is generally associated with activated carbon, however there are other media, for example zeolites, used as well. There are numerous types of activated carbon, generally designated by its source, i.e. coal, coconut, wood, and several others. These various carbons come with different properties, including pore structure, pore distribution, and hardness to mention a few. The choice of a carbon in a given application is dependent upon a number of factors, which will be reviewed later.

Chemisorption is a chemical reaction on and in the surface of the adsorbent; it is fairly specific and depends upon the nature of the media and the contaminant. It is irreversible and essentially instantaneous. Chemisorption is associated with chemically treated activated carbons and potassium permanganate impregnated media. Chemically treated activated carbons are fairly specific for a compound or a chemical family. They also offer the added benefit of maintaining the adsorptive properties of an untreated activated carbon, thus making it a very versatile product, in an air stream where only one contaminant family requires the use of a chemically treated carbon. Potassium permanganate media is a much broader based oxidant. For example you would be capable of cleaning and air stream containing both formaldehyde and acid gases with a potassium permanganate media, whereas it would require two different chemically treated carbons.

In order to understand some of the design criteria it is important to review some of the terminology used in association with molecular filtration.

**CONTACT EFICIENCY (E):**
- The percentage of total contaminant molecules which have come into contact with the media.
- For (E) to approach 100 % the residence time must be around 0.07 seconds.

**RESIDENCE TIME:**
- The time it takes air to cross a distance equal to the thickness of the filter (or media bed depth) without accounting for the resistance of the media through which it travels.

**REMOVAL EFFICIENCY:**
- The fraction of the contaminant that, once in contact with the media, is removed by either physical or chemical means.

**REMOVAL CAPACITY:**
- The amount of the contaminant removed over the useful life of the media.

2335 NW 29TH AVENUE, PORTLAND, OR 97210 WWW.CAMERONGREATLAKES.COM
PHONE: (800) 777-4044 FAX: (503) 225-0137 EMAIL: SALES@CGLCARBON.COM

## DESIGN CONSIDERATIONS

**Contaminant(s) & Concentration:** This is necessary for the proper selection of media. The more specific the information the easier the selection. In many industrial applications this information is often readily available, however in commercial air quality situations it is much more arbitrary. In these instances one generally knows the source and from that can determine the contaminants that are most likely present.

**Temperature & Humidity:** Activated carbons and potassium permanganate media are not recommended for use in air streams with temperatures greater than 120°F. At relative humidities greater than 60% activated carbon will begin to adsorb water, somewhat decreasing its capacity for contaminants. This generally doesn't pose major problems, unless the humidity is very high and you have 100 % outside air.

**Air Volume:** When designing a system it is noted from above that we need a minimum amount of time (residence time) to effectively remove a contaminant. The volume of air being treated is critical to the design of the system.

**Pressure Drop:** The pressure at the given velocity must be within the capacity of the blower. This is often a problem when retrofitting an existing air handling unit that was not designed to accommodate the additional filter bank. The pressure drop of a carbon/permanganate filter bed does not increase with time. The exception to this are the disposable impregnated media filters using a non woven polyester or similar material that will remove particulate in addition to gases. In this instance in addition to the initial resistance one would need to know the filters rated final resistance. Note that carbon and permanganate filter beds should be protected with a particulate filter to protect the media from particulate contamination.

**Removal Efficiency:** We know that the removal efficiency required is different depending upon the application. In some critical application such as semiconductor or computer control rooms, high efficiency is required. Designing high efficient filters requires more detailed information on the exact contaminants and concentrations, whereas when designing for a commercial light odor complaint, one need only to drop the contaminant below it's odor threshold which may not require the same level of efficiency on a one pass. It is also important to remember that the efficiency of the filters will decrease with time.

**Removal Capacity:** Capacity will determine life of the filters and thus also affects filter selection. The type and concentration of contaminants in the air stream determine the capacity of the filter. One would not want to design a system with too short a life thus increasing maintenance/service costs.

Having the above information allows one to design a system that meets the requirements in a given application. There are a few other items to consider when designing and selecting a filter system and that involves maintenance and service. Access and location of the system may cause one to select a filter of a different size or weight to accommodate service personnel.

As with most filtration applications the more information you have, the more knowledgeable you are as to your customer's goals, the better you can design a system to meet all his needs. In many applications, some of the above information will be limited, thus it becomes critical to rely on similar installations and market knowledge of applications.

# CAMERON GREAT LAKES, INC.

**MOLECULAR FILTRATION SPECIALISTS**

## *A Guide to Airport Air Quality*

Jet fumes consists of both high and low molecular weight contaminants. Activated carbon is the product of choice for high molecular weight contaminants, whereas potassium permanganate is best used for low molecular weight contaminants. Based on this, the product of choice is a blend, however the decision as to the best product to use is based upon many factors including contaminants present, levels of contaminants and economics. The goal is to reduce contaminants below their respective odor and health thresholds so as to protect the occupants and create a good working environment.

Activated carbon is often times used alone in several airport applications and has been found to be sufficient. For example O'Hare Airport uses only activated carbon. The benefits to using just carbon is that it can be reactivated and saves disposal costs, therefore large installations using refillable panels tend to strictly use carbon. While the blend might remove more of the lower molecular weight contaminants it has been found that the straight carbon removes enough to sufficiently achieve the desired goal.

A system with potassium permanganate alone is not recommended for both economics and performance.

The choice therefore lies between activated carbon and a blend of carbon and permanganate. In disposable filter applications where reactivation is not an option a blend selection of choice. It will effectively remove more of the contaminants present at an airport location than will a straight activated carbon filter.

2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.

*MOLECULAR FILTRATION SPECIALISTS*

# *AIR QUALITY IN COMMERCIAL BUILDINGS*

Air quality in a commercial building is affected, not only by the activities in the building, it is highly affected by those activities surrounding the building. If your building is located near an airport, a busy highway, or an industrial complex, the chances are very good that your indoor air quality is adversely affected. The number of unhealthy contaminants that are released into the air from these sources is well documented. Many of the contaminants present from these sources have a very low odor threshold, meaning that one can detect them at very low levels.

Unpleasant odors can have a negative effect on building occupants. Poor air quality for a business can result in low productivity and absenteeism. For the building owner it can mean loss of unsatisfied tenants.

Your surroundings need not dictate the air quality in your building. You can improve your building air quality with the use of both good particulate filters and filters designed to remove airborne molecular contaminants. A carbon or carbon/ permanganate disposable filter is ideal in this situation.

The goal is to reduce contaminants below their respective odor and health thresholds so as to protect the occupants and create a good working environment.

A proactive building owner can prevent problems before they cause a loss of revenue.

We recommend contacting a N.A.F.A. Certified Air Filter Specialist. They can provide a cost effective and quality solution for all your filtration needs.

2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.

## MOLECULAR FILTRATION SPECIALISTS

# Cleanroom Solutions

Don't let airborne molecular contaminants affect production at your facility. At Cameron Great Lakes, Inc. we design solutions to fit your specific needs. Whether your requirement be for disposable filters or refillable cells we have the most economical solution for your need. Our versatile Vapor Trap Disposable V-Bank can be retrofitted into units offering as little as 4" in depth, without compromising life or performance.

Whether your contaminants be internally generated or introduced from outside air we can provide the specialty media necessary to remove them.

Depending upon your circumstances we can provide a downstream dusting/polishing filter consisting of a non woven fiber impregnated with activated carbon. Other particulate media filters are also available.

### INSTALLATIONS

- Intel , Santa Clara, CA
- Western Digital, CA
- Lockheed Martin - Sunnyvale, CA
- Cypress Semiconductor, MN
- Advanced Micro Devices, Austin, TX
- Freescale (Motorola), Chandler, AZ
- Freescale (Motorola), Austin, TX
- Micron, Boise, ID
- Samsung, Austin , TX
- UMC, Taiwan

### TARGET GASES

- Acetone
- Amines
- Ammonia
- Arsine
- Boron trifluoride
- Chlorine
- Hydrogen Chloride
- Hydrogen Sulfide
- Hydrofluoric acid
- Isopropyl Alcohol
- Phosphine
- Sulfur Dioxide



2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.
## MOLECULAR FILTRATION SPECIALISTS

# *A Guide to Hospital Air Quality*

## The Challenge

Maintaining a high quality of air is difficult for all building operators, however when operating in a critical environment such as a hospital, maintaining air quality is a necessity.

Knowing how to provide a proper environment means understanding what problems and potential pollution sources you are up against. One must not only watch for internally generated pollutant sources but must be careful of external pollutant sources. These internal pollutants are often generated by the process and require removal as the effect on the end product may be detrimental. Often times to control internal pollutants, more outside air is introduced to the space. While this might be an acceptable control measure for some buildings, for a critical process it could introduce more potentially harmful contaminants that will ultimately damage your end products or affect test results. In urban areas, outdoor peak levels of ozone, sulfur dioxide, nitrogen dioxide, and hydrocarbons are often 40% to 100% above allowable limits. Hospital with helipads present an even further challenge in that the pad is often on the rooftop near air inlets which then draw in the contaminants of the burning fuel.

## The Solutions

To ensure that air quality is acceptable for both occupants and employees, molecular filtration is your best option. When selecting a molecular filtration system there are numerous options available in both types of adsorbent/chemisorbent media along with the hardware that holds the media. The best selection for your particular application will depend upon a a variety of factors.

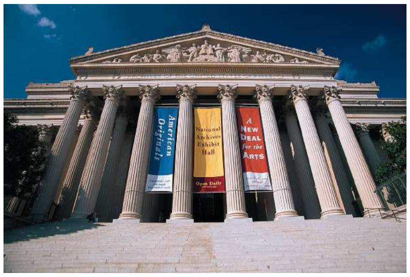
When looking into a molecular filtrations system, items to be taken into consideration include physical space, ease of maintenance, types of contaminants present and concentration, temperature and humidity and the amount of air to be treated. You generally have two choices of media, a standard activated carbon or a blend of carbon and potassium permanganate. The standard activated carbon system will remove ozone, nitrogen dioxide and your higher molecular weight volatile organic compounds. These systems have been successfully used over the years and give you the benefit of regeneration. However, often times there are also many other low molecular weight contaminants present. In this case it is often necessary to combine the carbon with potassium permanganate. The potassium permanganate readily reacts with the low molecular weight contaminants removing them from the air stream giving you an adsorption/chemisorption system that can effectively provide the proper protection you require.

Your molecular filtration specialist at Cameron Great Lakes can assist you in the proper selection of both hardware and media that will be most efficient both in performance and economics. (Please note that this guide offers information on removal of chemical contaminants only.)

2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.

**MOLECULAR FILTRATION SPECIALISTS**



# A Guide to Museum Air Quality

## The Challenge

Maintaining a high quality of air is difficult for all building operators, however museums pose an even more challenging situation.

Museum operators are faced with the dual challenge of a healthy environment for employees and patrons, and a quality environment for the protection of valuable, irreplaceable collections.

Knowing how to provide a proper environment means understanding what problems and potential pollution sources you are up against. One must not only watch for internally generated pollutant sources, including the patrons, but must be careful of external pollutant sources. These internal pollutants include biofluents, volatile organic compounds and formaldehyde contaminants from building materials and furnishings. In new construction, the levels of contaminants generated from new furnishing or construction materials often are at elevated levels and care must be taken to keep them at a minimal level. Often times to control internal pollutants, more outside air is introduced to the space. While this might be an acceptable control measure for some buildings, for your museum it could introduce more potentially harmful contaminants that will ultimately damage your collections. In urban areas, outdoor peak levels of ozone, sulfur dioxide, nitrogen dioxide, and hydrocarbons are often 40% to 100% above allowable limits. These contaminants are often responsible for the slow degradation of valuable artifacts.

## The Solution

To ensure that the indoor environment in museums is acceptable for both occupants and collections, molecular filtration is your best option. When selecting a molecular filtration system there are numerous options available in both types of adsorbent/ chemisorbent media along with the hardware that holds the media. The best selection for your particular application will depend upon a a variety of factors.

When looking into a molecular filtration system, items to be taken into consideration include physical space, ease of maintenance, types of contaminants present and concentration, temperature and humidity and the amount of air to be treated. You generally have two choices of media, a standard activated carbon or a blend of carbon and potassium permanganate. The standard activated carbon system will remove ozone, nitrogen dioxide and your higher molecular weight volatile organic compounds. These systems have been successfully used over the years and give you the benefit of regeneration. However, in instances where higher levels of formaldehyde and sulfur dioxide are suspected, your choice would be the blend of carbon and potassium permanganate. The potassium permanganate product readily reacts with the formaldehyde, sulfur dioxide, and other lower molecular weight contaminants to remove them from the air stream giving you added measure of protection. The ideal option is one pass of carbon and a pass of permanganate, this allows full use of both media beds, and eliminates changing a filter when only one media may be spent.

Your molecular filtration specialist at Cameron Great Lakes can assist you in the proper selection of both hardware and media that will be most efficient both in performance and economics.

2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# NOTES ON THE PAPER AND PULP INDUSTRY

The pulp and paper industry is a major user of gas phase filtration media. The driving force is the failure of electronic process control equipment and motor control centers due to corrosion.

The corrosion occurs on the electrical equipment, such as the contacts and electrical leads. It is caused by the presence of airborne contaminants. The most common of these contaminants are hydrogen sulfide, oxides of sulfur, chlorine, and oxides of nitrogen. Temperature and relative humidity also play a roll in the corrosiveness of the environment.

The Pulp and Paper Industry suggests that safe environments for electrical equipment are contaminant levels that range from 0 to 5 ppb total. This is somewhat dependent upon the temperature and relative humidity of the environment and the types of contaminants present. Uncontrolled environments may have levels that are 10 times greater than “safe levels”.

Contaminants can enter the space via a number of different means: diffusion through cracks, porous walls and ceilings, diffusion through open doors, contaminants that offgas from clothing of personnel entering the space, internally generated contaminants, and displacement during opening and closing of doors.

When designing a new room these should be taken into consideration. The room should be pressurized with air free from contaminants to 0.05 - 0.09 in. WG and have a capacity for about 4-6 air changes per hour. The room should be equipped with a vapor adsorption system to provide purified air at “safe levels” as listed above. Temperature and humidity control is also required in environments where the temperature is greater than 75° F and the RH is above 60%.

## VAPOR ADSORPTION SYSTEM:

Selection of an adsorber system depends upon a number of parameters, including performance and service life. Performance is affected by a number of factors, including media selection and physical integrity of the system. The adsorber must be capable of providing a zero- bypass seal.

Service life is dependent upon the following: types and concentration of contaminants, flow rate, media amount, and bed configuration.

## MEDIA SELECTION:

The media of choice is either our CGL/CI OR CGL/ZK6. The CGL/CI is an impregnated carbon that is specifically designed to remove the lighter molecular weight compounds in the air stream, while still maintaining activated carbon’s ability to adsorb the higher molecular weight contaminants. The CGL/ZK6 is a potassium permanganate impregnated zeolite. This product also has the ability to remove the lighter molecular weight compounds. The ZK6 media is often used in conjunction with standard activated carbon to provide an efficient media bed.

A combination of good room design and properly specified vapor adsorption system has been proven to be an effective means of corrosion control problems. The end user benefits from decreased down time, reduction in expensive electrical equipment replacement, and increased production.

# CAMERON GREAT LAKES, INC.

## MOLECULAR FILTRATION SPECIALISTS

# DEALING WITH SMOKE

Although smoking is on the decline, one should not overlook those places where smoking is permissible and must still be filtered. For example, the number of cigar bars is on the rise, bingo halls, casinos, and bars still have the need to provide cleaner air for their patrons and their employees. There are different approaches to these applications but ultimately what is required is the same. Removal of smoke requires both high efficiency particulate filtration and molecular filtration. One without the other is not effective.

Our recommendation on particulate filtration is to use a filter with a minimum 65% ASHRAE Efficiency. Our preference is to have a filter with a 90% Efficiency ASHRAE Rating. Anything less will compromise the overall effectiveness of the system.

As far as a choice of molecular filtration media, the best choice is always blend of carbon and permanganate. The number and types of contaminants that are generated as so vast and varied that only a blend will be able to address the majority of them.

When deciding the best method to remove smoke, it is important to first look at layout of the room or building. Answering the following questions will help to determine the filtration approach:

Does the AHU servicing the smoking area service non smoking area as well?

How much room does the AHU have for additional filtration?

Can the blower handle additional pressure drop?

Is the smoking area itself well isolated from the non-smoking area?

Once you have these answers we can begin to look at filtration alternatives. There are basically 2 filtration options.

If the AHU services both smoking and non-smoking areas, then use of stand alone air cleaners in the smoking area may not completely resolve the odor problem in non smoking areas unless air cleaners are also placed in these areas. This is probably a more expensive alternative to providing filtration in the AHU itself which will insure that the supply air to the non-smoking area has been cleaned. Deciding filter type can also depend upon the size of the unit. In larger units you may wish to use refillable carbon panels. While up front costs are more expensive than disposable filters, future cost of service easily justifies the up front expense. Smaller units or those without much room can be well serviced with a filter such as the Vapor Trap disposable V-Bank which can be made in depths from 4” to 12” so room constraints become less of an issue.

If the AHU services only the smoking area than either option is acceptable. The use of stand alone air cleaners, such as the Cascade®, has proven very successful. It allows one to capture the contaminants closer to the source. The units can provide both the particulate filtration and molecular filtration required for removal of the harmful contaminants associated with smoke. A variety of unit sizes and mounting options makes them ideal in these applications.

As far as a choice of molecular filtration media, the best choice is always blend of carbon and permanganate. The number and types of contaminnats that are generated as so vast and varied that only a blend will be able to address these contaminants.

For more information on the above products please contact us at: sales@cglcarbon.com or visit our website, www.camerongreatlakes.com.

2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.

## MOLECULAR FILTRATION SPECIALISTS

## MEDIA SELECTION GUIDE BY APPLICATION

| MEDIA→ APPLICATION ↓ | MR, CP, CCR, CCS | ZK6 | CI | AC/ZK6 | PA |
|---|---|---|---|---|---|
| AIRPORTS | X | | | X | |
| HOSPITALS | X | | | X | |
| MORGUES | | X | | | |
| NAIL SALONS | X | | | | |
| WASTEWATER TREATMENT FACILITIES | | | X | | |
| PULP & PAPER MILLS | | | X | | |
| HAIR SALONS | X | | | | X |
| MUSEUMS | | | | X | |
| RESTAURANTS/ COOKING ODORS | X | | | X | |
| CLEANING COMPOUNDS | X | | | | |
| PRISONS | X | | | | X |
| OFFICE BUILDINGS | X | | | X | |
| PET ODORS | | | | | X |
| TOBACCO ODORS | | | | X | |

The above information is to be used as a general guideline. It is based upon contaminants normally found in these applications. Some individual applications may have unique contaminants introduced that would require a different media selection to adequately provide removal. If you feel that is the case, please contact CGL for additional technical assistance. Filter selection is dependant upon individual application requirements, including space available and pressure drop.

2335 NW 29TH AVENUE, PORTLAND, OR 97210 WWW.CAMERONGREATLAKES.COM
PHONE: (800) 777-4044 FAX: (503) 225-0137 EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.

**MOLECULAR FILTRATION SPECIALISTS**

## *Benefits of a Carbon/Permanganate Blend*

### WHY A BLEND?

For odor control/molecular filtration applications, end users are often faced with the question of which filter media will perform best for the application. Unfortunately, there are many applications where we are unable to identify all of the existing contaminants in the airstream….or, we are faced with a myriad of known contaminants which require more than one type of media to remove or destroy the contaminants.

Standard activated carbon is recommended for the removal of the heavier volatile organics, while potassium permanganate is recommended for the removal of low molecular weight contaminants. A blend of these two media, offers the end user a product that is capable of addressing the vast majority of contaminants without expensive testing to identify individual contaminants.

In some applications such as diesel fume odors, kitchen cooking odors, and smoke odors, we are not aware of all contaminants present and generally recommend the use of a carbon & potassium permanganate media blend which is the best possible solution to odors where all contaminants may not be identified. Additionally this blend when used in refillable filters can be classified as UL Class 1.

It is safe to say that using a blend of media in commercial IAQ applications is a smart and safe choice.

See CGL C/ZK6 Specification sheet for technical information
on potassium permanganate/activated carbon blended media.

2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.
**MOLECULAR FILTRATION SPECIALISTS**


## Vapor Trap –DF Dusting Filter

- **Negates downstream dust**
- **Lower pressure drop than bonded panels**
- **Performance uncompromised by binders**

Don't compromise performance for fear of generating dust. The Vapor Trap DF filter allows the end user to have the best of both worlds; a bulk fill carbon filter whose efficiency is not comprised by adhesives, long life with high carbon weight, and a dusting filter that prevents small particulate matter from traveling downstream of the filter.

The Vapor trap DF is ideal for the semiconductor industry and any other applications where dusting is a concern.

Dusting with bulk carbon filters most often occurs upon initial start up. Transportation of the filters causes dusting which upon installation in the airstream may travel downstream a short distance. If dusting is an issue upon receipt of the filter shake out any loose material caused from transport and then install into the airstream. The downstream dusting filter will then provide the added protection for the life of the filter.



2335 NW 29TH AVENUE, PORTLAND, OR 97210 WWW.CAMERONGREATLAKES.COM
PHONE: (800) 777-4044 FAX: (503) 225-0137 EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.
## MOLECULAR FILTRATION SPECIALISTS

# DESIGN QUESTIONAIRE

In order to provide you the best possible system for your application, please answer as many questions below as possible and we will provide you with a quote on the housing or filter we feel is best suited for your needs.

| | | | |
|---|---|---|---|
| **Give us a brief description of the application.** | | | |
| **Air Volume being treated in CFM** | | | |
| **Space Available (housings)** | Height, in | Width, in. | Depth, in. |
| **Temperature, F** | | | |
| **Contaminants present and levels if known/ application** | | | |
| **Desired first past removal efficiency** | | | |
| **Location, indoors or out of doors** | | | |



2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# DESIGN QUESTIONAIRE

| | |
|---|---|
| **Maximum Allowable Pressure drop** | |
| **Refillable or Disposable** | |
| **Downstream Dusting Filter required** | |
| **Filter or housing Weight restrictions** | |
| **Filter Size restrictions** | |
| **Other pertinent data or requirements** | |



2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM

# CAMERON GREAT LAKES, INC.

## MOLECULAR FILTRATION SPECIALISTS

## CONTAMINANT OVERVIEW FOR VEHICLE EXHAUST

Table one will review the contaminant classes found in automobile exhaust and diesel exhaust. It is important to note that those with the highest concentration levels below may not necessarily be the cause of IAQ complaints and/or health concerns.

**TABLE 1**

| Contaminant | Automobile | Diesel Engines |
|---|---|---|
| | In pounds per 1000 | gallons of fuel |
| Aldehydes | 4 | 10 |
| Carbon Monoxide | 2300 | 60 |
| Hydrocarbons | 200 | 136 |
| Oxides of Nitrogen | 113 | 222 |
| Oxides of Sulfur | 9 | 40 |
| Organic Acids | 4 | 31 |
| Particulates | 12 | 110 |

Table two will review the threshold Limit Value and the Odor Threshold for the specific compounds below. The TLV below is the level at which health concerns may be expected. However even when the contaminants are present below the TLV it is possible that the source of an IAQ complaint may be contaminant present in concentrations meeting or exceeding its odor threshold.

**TABLE 2**

| Contaminant Class | Compound | TLV, PPM | Odor Threshold, PPM |
|---|---|---|---|
| Aldehydes | Formaldehyde | 1.0 | 1.0 |
| | Acrolein | .01 | 0.2-15 |
| Carbon Monoxide | Carbon Monoxide | 50 | n.a. |
| Hydrocarbons | Toluene | 200 | 2.14-15 |
| | Cyclohexane | 300 | 0.41 |
| | Xylene | 100 | 0.47-200 |
| Oxides of Nitrogen | Nitrogen Dioxide | 5.0 | 5.0 |
| | Nitric Oxide | 25.0 | 0.3-1.0 |
| Oxides of Sulfur | Sulfur Dioxide | 5.0 | 0.47-5.0 |
| Organic Acids | Acetic Acid | 10.0 | 0.2-2.4 |
| Other | Hydrogen Sulfide | 20.0 | 0.00047-4.6 |
| | Ozone | .01 | 0.1 |

Several hundred compounds have been detected from vehicular exhaust. These are just a few of the major known components.

2335 NW 29TH AVENUE, PORTLAND, OR 97210
PHONE: (800) 777-4044 FAX: (503) 225-0137
WWW.CAMERONGREATLAKES.COM
EMAIL: SALES@CGLCARBON.COM