# SmartStack™

## Using Active Sensing to Safely Improve Lab Exhaust Efficiency

Rev 1.03

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## About This Document

This document describes many aspects of exhaust fan performance, especially as it relates to an exhaust system's ability to perform safely when handling a wide range of chemical compounds that may and sometimes will be released in lab spaces. Measured Air Performance (MAP) makes no representations or warranties of any kind with respect to the information in this publication. The information in the publication is provided "as is" and we do not guarantee the accuracy of this content. Although MAP believes the information in this publication is accurate as of its publishing date, the information is subject to change without notice. As applications of use will vary, the information provided is given without legal responsibility.

## Introduction:

In most labs, there are typically only a few active fume hoods in the system emitting limited levels of contaminants.  These contaminants are significantly diluted by the relatively clean air that is manifolded from other locations. Although, the laboratories operate in these relatively clean states for extended periods of time, the exhaust fan systems run at high exit velocities (e.g., 3,000 ft/min or higher). As a result, these systems frequently operate at much higher total flow rates than required using significantly more energy than necessary. Many assume that exhaust fans are required to operate at 3,000 ft/min (minimum). However, this setting is only a recommendation from ANSI Z9.5. The standard also states lower velocities can be used, provided there is sufficient dilution, as indicated below.

*"The exhaust stack velocity shall be at least 3,000 ft/min (15.2 m/s) is required unless it can be demonstrated that a specific design meets the dilution criteria necessary to reduce the concentration of hazardous materials in the exhaust to safe levels at all potential receptors."*

SmartStack™ ensures dilution criteria are met and concentrations of hazardous materials are at safe levels, while maximizing energy savings. SmartStack™ is an active sensing system that monitors the cleanliness of lab exhaust air and provides a signal to the fan controls or building automation system to index the exit velocity of the fans accordingly. The purpose of this system is to reduce excess exhaust fan energy use when it is safe to do so, either by way of bypass air reductions or, in some applications, by enabling lab air change rate reductions. This results in fan exit velocities that are less than 3,000 ft/min, when it's safe to operate in this mode. Such lower exit velocities are enabled when SmartStack™ determines that the exhaust air is clean. Also, in many applications fan exit velocities may have initially been set to values much higher than 3000 ft/min. Sometimes this is the result of an undersized fan nozzle; in which case it may not be possible to reduce much below 3000 ft/min as bypass air is reduced. However, that's not viewed as a constraint to energy savings. The important thing is, by applying fan setback when the exhaust is clean, it provides a way to reduce excess bypass air.

## The Inefficiency of Excess Fan Dilution:

Figure 1 helps to illustrate the common characteristics of high plume fan systems in terms of their tendency to provide dispersive dilution of contaminants with exit velocity. The actual dilution performance will vary considerably based on the vertical height of the fan and its surroundings. However, notice that the curve relating dilution levels to exit velocity is concave down. This means that, with an increase in CFM and exit velocity through the fan, you do not get a proportionally similar increase in dilution from the fan's exit plume.  What this also means is that small reductions in fan exit velocity (when the exhaust is clean) will result in even smaller reductions in the overall dilution provided by the system. Further, fan affinity laws suggest a cubic relationship between flow and power. In most cases, because of system efficiency issues the power relationship is not quite cubic but is often still exponential nonetheless. Table 1 illustrates this further. In this example, a reduction in fan exit velocity by 31% (from 4400 fpm to 3000 fpm) results in an 8.4% reduction in dispersive dilution (from 483 to 442). However, the power savings in this example (assuming slightly less than cubic law performance) is approximately 62% (from 88 kW to 32.7kW).

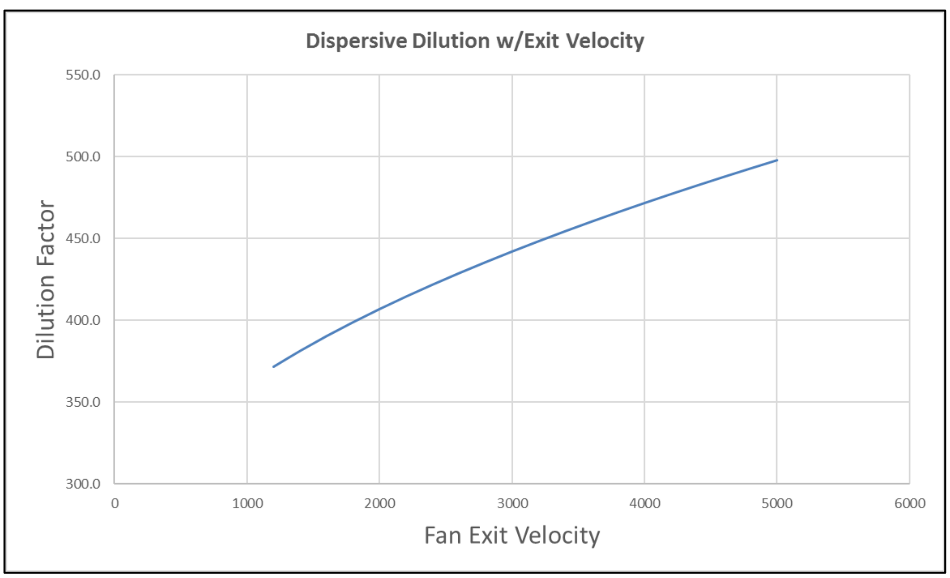


***Figure 1*: Example Relationship of Dilution with Exit Velocity**

| Fan Power (KW) | Fan (CFM) | Exit Velocity (Ft/min) | Dispersive Dilution |
|---|---|---|---|
| 88 | 55,000 | 4400 | 483 |
| 32.7 | 37,000 | 3000 | 442 |
| 19.4 | 30,000 | 2400 | 421 |

Table 1: Illustration of power savings with exit velocity

## How it Works – SmartStack™ Applied to an Exhaust Fan System

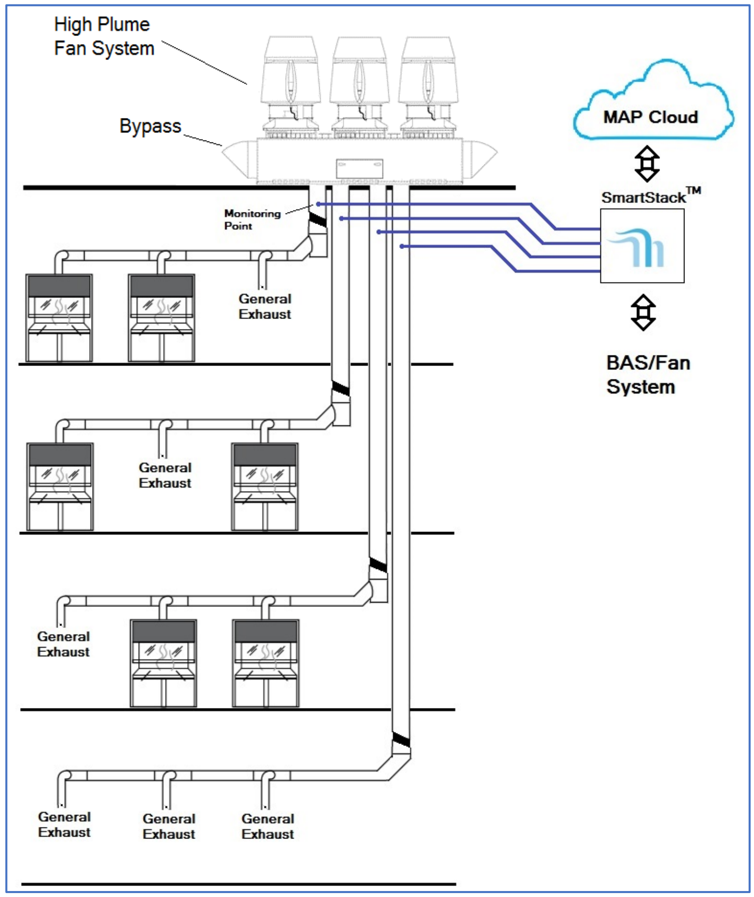


*Figure 2: Multi-Riser Exhaust System*

The SmartStack™ system incorporates a multi-point air sampling approach that monitors a location on each riser that is manifolded to the fan set. One SmartStack™ system is applied to each fan set and air samples are continuously drawn from each riser in a sequential fashion and analyzed by the system using a photoionization detector (PID) sensor technology that is integrated within the system. The PID is capable of detecting hundreds of compounds commonly found in laboratory facilities and is a technology that is recognized by health and safety professionals worldwide. Once all of the monitoring points have been verified to be free of contaminants, SmartStack™ then issues a "setback" command to the specific exhaust fan controls. In doing so, the fan system will reduce its exit velocity by way of a reduction in bypass air. Only the amount of bypass air is affected during this setback condition. As soon as contaminants are detected at any of the risers, the system will switch out of setback and into a mode that protects the PID ("sensor protective mode") that is intrinsic to the system. Approximately 20 minutes after the detection of contaminants, the system will resume taking air samples to see if the sampled locations still have high contaminant levels. If so, the system will go back into sensor protective mode with setback disabled. The process continues until the system is able to verify that all monitored locations are free of contaminants, before once again issuing a setback command.

In other applications where bypass air is not present, SmartStack™ can be used to not only save on exhaust fan energy but supply fan energy and heating and cooling energy. This is accomplished by lowering lab minimum air change rates when the fan exhaust is free of contaminants. This method provides a way to reduce lab air changes in scenarios where lower air changes result in fan exit velocities of less than 3000 feet per minute. With this approach, reduced air change rates are implemented via the lab controls based on the SmartStack™ setback signal.

## SmartStack™ Photoionization Detector:

At the heart of SmartStack™ is our photoionization detector technology. A photoionization detector (PID) is a gas sensing technology capable of sensing hundreds of different compounds commonly found in lab environments. PID's have been in use (particularly as handheld instruments) for many decades and are especially recognized by Environmental Health and Safety (EH&S) professionals, due to their sensitivity. Such technology is also used in trace level sensing equipment, including gas chromatography-mass spectrometry due to their excellent sensing resolution. SmartStack™ incorporates a specialized PID design that provides low power performance, excellent stability, and the best sensitivity found in industry. This instrument provides detection capabilities of concentrations down to a few parts per billion (ppb). This is incorporated along with a patent pending mechanism that is used to protect the sensor from prolonged over-exposure, when high contaminant concentrations are detected and is an important enabling capability to this application. Without this capability, a PID would tend to foul and drift with prolonged exposure, thus affecting the detection reliability important to properly controlling the fan.

Figure 3 is a simplified illustration of the PID design. It incorporates an ultraviolet (UV) lamp as an ionization source and a collector electrode which serves as the detector. The air being analyzed flows through the sensor chamber and is exposed to the lamp. The sensor detects compounds based on the affinity for the gas to be ionized by the UV source. Ionization takes place when the compound's ionization potential is less than the energy level of the photons emitted from the lamp. Currently, our PID incorporates a lamp design which outputs an energy level of 10.7 electron volts (eV). This tends to be the most popular eV level used in industry because lamps at this energy level (made from a krypton filament) tend to be highly reliable and a vast number of compounds will ionize at this level. The way that this works is that if the compound's ionization potential is lower than 10.7 eV, then it can be ionized and thus detected. For example, from the appendix below benzene has an ionization potential of 9.25 eV; therefore, it can be detected. Further, Chloroform has an ionization potential of 11.37 eV and therefore will not be detected. (See the section below explaining why some compounds such as Chloroform may not need to be detected in this application.) When a gas molecule becomes ionized, it becomes positively charged. This causes its charge to be drawn to the negative electrode causing an electrical current to flow. The level of molecular ionization and the current that is produced is proportional to the gas concentration that is present.

Another aspect of the PID's operation to be aware of is that different gases will generate different responses, even though their ionization potential may be less than 10.7 eV. This characteristic is known as a response factor or "RF". With the tables in the Appendix, a column is provided which lists the RF values for each compound. The RF value is an indication of the ratio of the sensor's sensitivity to a specific gas (isobutylene) to that of the given compound. For example, ammonia has a response factor of 9.4, which means that the sensor's response to ammonia is

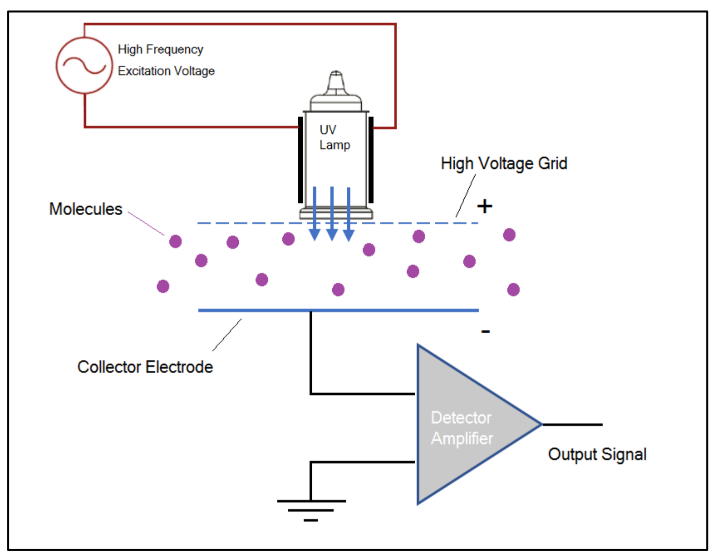

*Figure 3: Simplified PID Schematic*

9.4 times lower than its response to isobutylene. On the other hand, the sensor's RF for benzene is .5, which means that the PID is twice as sensitive to benzene as it is to isobutylene.

## Exhaust System Dilution with Chemical Inventory:

Usually, when a lab exhaust system is designed, much attention is given to the types of compounds that may be used in the lab spaces. Properties of the chemical inventory including not only exposure limits and odor thresholds but also the ease with which a compound may become airborne is factored into this analysis. The performance that's needed from the system is then assessed by considering a spill condition (usually at a fume hood) for each compound in question. When evaluating exposure potentials from compounds that are liquids or solids, a fixed spill area is often applied. This usually will correlate to the area of a popular fume hood size (such as a 5-foot hood for example). Because of the fixed spill area, quantities of 1 liter are often assumed. Some compounds are too potent to be used in 1-liter quantities and will usually require a quantity limitation protocol that is independent of whether or not SmartStack™ is applied. For gas phase compounds, the analysis will usually assume a certain leakage or fugitive emissions rate from a canister.

Especially for liquids and certain solids, the vapor pressure of the compound will significantly influence the dispersion characteristics of the material in question, as well as the concentration of that material that might be seen at the exhaust fan inlet in the event of a spill. Even though SmartStack™ is capable of sensing hundreds of different compounds that may be found in a lab, it's important to realize that the dilution requirements of the exhaust fan system vary greatly due to the vapor pressure variations of the compounds. In the event of a spill, many compounds may not appear in high concentrations at the fan inlet. For example, sulfuric acid, a compound which is quite toxic to the touch, has a very low vapor pressure; so low that even a large spill in a fume hood would hardly influence airborne concentrations seen at the fan inlet.

Another factor which can significantly influence fan dilution requirements is the "internal dilution" provided by the manifolded exhaust from each lab space. The airflow from a single fume hood where a spill takes place will often be diluted by a factor of 40 or more by the clean air from other spaces.

The appendix includes a detailed list of over 350 compounds which are found in chemical inventories. This includes many compounds which are often used in labs along with a number of materials which have more specialized use, including some potent compounds which often require quantity limitation protocols. The list in the appendix not only demonstrates which compounds are detected by SmartStack™ but also models the result of a spill by each compound. For liquids and solids, the spill condition assumes a fume hood spill area of about 9ft2 and an air flow rate of 900 CFM. It also assumes a very conservative figure for the internal dilution rate of the exhaust system by a factor of 15. For gas phase compounds, the spill condition assumes a fugitive emission at a rate of 4 liters per minute.

Although the majority of the compounds in this list are detected by the SmartStack™ system, some of these compounds need not be detected because of their relatively low impact on the dilution requirements to be provided by the fan system. This is measured in the "Fan Inlet Spill Concentration" column, which provides a measure of the dilution required of the fan. For example, a spill of Acetic Acid would result in concentrations that are only a factor of .3 of that compound's health limit and only a factor of 23.7 of that compound's odor threshold. So, in this case although the odor threshold at the fan's inlet will be exceeded by a factor of 23, the fan itself should be able to provide more than enough dilution to address those levels. It should be clear however that, in the application of SmartStack™ the fan would not be held in a setback condition as concentrations of this compound are detected.

There are also a few compounds in this list which are not detected by SmartStack™, most of which are compounds which would normally not need to be detected because of their low vapor pressures (sulfuric acid for example). However, there are also a smaller number of compounds which are not detected that would normally require a quantity limitation protocol (Boron Trifluoride, for example), due to their abnormally high toxicity, low odor threshold, and high vapor pressure.

Lastly, many EH&S personnel require that extremely toxic compounds be used only in designated fume hoods, with strict protocols. Irrespective of SmartStack$^{TM}$'s ability to detect these compounds, the system is able to interface with an occupancy sensor signal from these fume hoods and disable the fan setback when anyone is working at or near these fume hoods. This feature can also apply to an occupancy signal detecting presence of anyone in the entire lab.

## Noise Reduction

Fan noise can be an issue that requires mitigation, particularly when the fans are located near non-industrial locations such as neighborhoods, schools, or other locations where occupants may be less tolerant to noisy conditions. Noise levels are also of concern in many vivariums or animal holding facilities, for example. Mitigation may also be necessary to meet local code requirements.

Reducing fan exit velocity can drive not only dramatic energy savings, but can also result in reductions in noise levels that can often be significant. Figure 4 shows a typical scenario where there is approximately a 3:1 ratio of fan operating speed reduction to net sound pressure level reduction. Actual results will vary based on the fan geometry, its suroundings, and fan operating conditions, such as fan total static pressure.

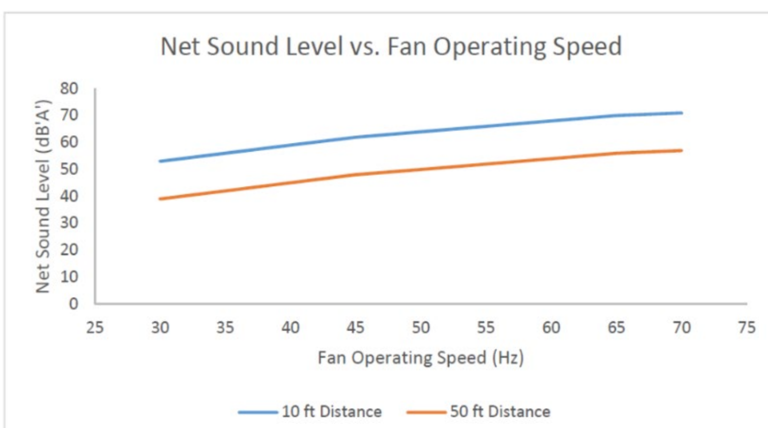


*Figure 4: Net Sound Level vs. Fan Operating Speed. Chart Courtesy of Strobic Air Corporation*

In certain cases, SmartStack™ may be the most effective noise abatement solution as compared to mechanical isolation, silencers, blade rebalancing, or the addition of expensive barriers or sound absorbing materials.

# APPENDIX: Exhaust System Performance and Spill Detection:

This appendix tabulates the performance of an exhaust fan system equipped with SmartStack™ and subjected to spill conditions for over 350 of the most frequently used liquid or gas phase compounds in labs. The spill condition assumptions and operational characteristics of the exhaust system are stated below. Generally, the compounds which have higher vapor pressures and lower toxic limit values or odor threshold values will require more dilution from the exhaust fan system. Along with tabulating whether a compound is detected by SmartStack™'s PID sensor, concentrations at the fan inlet are estimated for each compound based both on health limits and odor thresholds. Note that in many cases, concentrations may be well above exposure limits at the fan, it is then the dispersive dilution provided by the fan system which prevents over exposure at receptor points around the lab facility. For this analysis, we assume the plume will provide at least 400:1 dilution to any contaminants at the fan inlet. In practice, dilution levels will usually be higher than this, when on accounts for the dilution provided at the fan's windband and, when present, the dilution provided by bypass air.

**Assumptions:**

| | |
|---|---|
| Hood Flow at Spill: | 900 CFM |
| Hood Surface Area: | 9 $ft^2$ |
| Fugitive Emission Rate when gas: | 4 Liters per minute |
| Liquid Spill Quantity: | 1 Liter |
| Building Internal Dilution: | 15:1 |
| Fan Dilution: | 400:1 |

# APPENDIX: **Exhaust System Performance and Spill Detection**

| # | Compound | CAS Number | Liquid or Gas | RF | IP(eV) | Health Limits (PPM) | Odor Threshold (PPM) | OEL Type | OEL Agency | Detect? | Fan Inlet Spill Concentrations | | Adequate Detection? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Factor Above Health Limit | Factor Above Odor Threshold | |
| 1 | Acetaldehyde | 75-07-0 | Liquid | 10.80 | 10.21 | 25.01 | 0.050 | Ceil | ACGIH | YES | 8.8 | 4419.5 | QLP* |
| 2 | Acetic Acid | 64-19-7 | Liquid | 11.00 | 10.69 | 15.05 | 0.160 | STEL | ACGIH | YES | 0.3 | 23.7 | YES |
| 3 | Acetic Anhydride | 108-24-7 | Liquid | 4.00 | 10 | 4.79 | | Ceil | NIOSH | YES | 0.2 | 0.0 | YES |
| 4 | Acetone | 67-64-1 | Liquid | 1.20 | 9.69 | 749.91 | | STEL | ACGIH | YES | 0.1 | 0.0 | YES |
| 5 | Acetonitrile | 75-05-8 | Liquid | - | NA | 60.68 | | TWA | ACGIH | NO | 0.4 | 0.0 | YES |
| 6 | Acetophenone | 98-86-2 | Liquid | 0.59 | 9.27 | 29.95 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 7 | Acetylene | 74-86-2 | Gas | - | - | None | | | | NO | 0.0 | 0.0 | YES |
| 8 | Acrolein | 107-02-8 | Liquid | 3.90 | 10.1 | 0.10 | 0.174 | Ceil | ACGIH | YES | 679.0 | 391.2 | QLP* |
| 9 | Acrylic Acid | 79-10-7 | Liquid | 2.70 | 10.6 | 6.01 | | TWA | ACGIH | YES | 0.1 | 0.0 | YES |
| 10 | Acrylonitrile | 107-13-1 | Liquid | - | - | 2.00 | | TWA | ACGIH | NO | 12.4 | 0.0 | YES |
| 11 | Allyl Alcohol | 107-18-6 | Liquid | 2.50 | 9.67 | 4.21 | | STEL | ACGIH | YES | 1.2 | 0.0 | YES |
| 12 | Allyl Chloride | 107-05-1 | Liquid | 4.50 | 9.9 | 1.92 | 0.489 | STEL | ACGIH | YES | 0.1 | 0.4 | YES |
| 13 | Ammonia | 7664-41-7 | Gas | 9.40 | 10.2 | 35.00 | 5.000 | STEL | ACGIH | YES | 0.3 | 1.9 | YES |
| 14 | Amyl Acetate (n-) | 628-63-7 | Liquid | 3.50 | | 99.90 | 0.100 | STEL | ACGIH | YES | 0.1 | 89.6 | YES |
| 15 | Amyl Acetate (sec-) | 626-38-0 | Liquid | 3.50 | | 125.00 | 0.100 | STEL | ACGIH | YES | 0.0 | 20.9 | YES |
| 16 | Amyl Alcohol | 71-41-0 | Liquid | 3.20 | 10 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 17 | Aniline | 62-53-3 | Liquid | 0.50 | 7.7 | 5.99 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 18 | Anisole | 100-66-3 | Liquid | 0.50 | 8.2 | 1000.000 | | | | YES | 0.0 | 0.0 | YES |
| 19 | Arsine | 7784-42-1 | Gas | 2.60 | 9.89 | 0.01 | 0.500 | Ceil | NIOSH | YES | 1927.0 | 19.3 | QLP* |
| 20 | Benzaldehyde | 100-52-7 | Liquid | 0.90 | 9.5 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 21 | Benzene | 71-43-2 | Liquid | 0.53 | 9.25 | 1.00 | 1.250 | STEL | NIOSH | YES | 28.4 | 22.8 | YES |
| 22 | Benzenethiol | 108-98-5 | Liquid | 0.70 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 23 | Benzonitrile | 100-47-0 | Liquid | 0.70 | 9.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 24 | Benzyl Alcohol | 100-51-6 | Liquid | 1.30 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 25 | Benzyl Chloride | 100-44-7 | Liquid | 0.60 | 10.2 | 0.97 | | Ceil | NIOSH | YES | 0.3 | 0.0 | YES |
| 26 | Benzyl Formate | 104-57-4 | Liquid | 0.80 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 27 | Biphenyl | 92-52-4 | Solid | 0.40 | | 0.60 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 28 | Bis(2,3-epoxypropyl) ether | 2238-07-5 | Liquid | 3.00 | | 0.53 | | Ceil | OSHA | YES | 0.1 | 0.0 | YES |
| 29 | Boron Tribromide | 10294-33-4 | Liquid | 1.30 | 9.7 | 1.00 | | REL | NIOSH | YES | 12.0 | 0.0 | YES |
| 30 | Boron Trifluoride | 7637-07-2 | Gas | - | 15.56 | 0.10 | | TWA | ACGIH | NO | 96.3 | 0.0 | YES |
| 31 | Bromine | 7726-95-6 | Liquid | 10.54 | 10.51 | 0.20 | 0.066 | STEL | ACGIH | YES | 265.9 | 801.4 | QLP* |
| 32 | Bromine Pentafluoride | 7789-30-2 | Liquid | - | | 0.10 | | TWA | ACGIH | NO | 979.4 | 0.0 | QLP* |
| 33 | Bromobenzene | 108-86-1 | Liquid | 0.70 | 9 | 1000.00 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 34 | Bromoethane | 74-96-4 | Liquid | 5.00 | | 14.80 | | TWA | ACGIH | YES | 7.6 | 0.0 | YES |
| 35 | Bromoethyl methyl ether, 2- | 6482-24-2 | Liquid | 2.50 | | 1000.00 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 36 | Bromoform | 75-25-2 | Liquid | 2.30 | 10.48 | 1.45 | | TWA | ACGIH | YES | 1.0 | 0.0 | YES |
| 37 | Bromomethane | 74-83-9 | Gas | 1.80 | 10.54 | 20.59 | | Ceil | ACGIH | YES | 0.5 | 0.0 | YES |
| 38 | Bromopropane, 1- | 106-94-5 | Liquid | 1.30 | | 29.82 | | TWA | ACGIH | YES | 1.1 | 0.0 | YES |
| 39 | Butadiene diepoxide, 1,3- | 1464-53-5 | Liquid | 4.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 40 | Butadiene, 1,3- | 106-99-0 | Gas | 0.69 | 9.07 | 4.97 | 0.455 | STEL | OSHA | YES | 1.9 | 21.2 | YES |
| 41 | Butane, n- | 106-97-8 | Gas | 46.30 | 10.5 | 2402.02 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 42 | Butanol, 1- | 71-36-3 | Liquid | 3.40 | 10.04 | 49.49 | | Ceil | NIOSH | YES | 0.0 | 0.0 | YES |
| 43 | Buten-3-ol, 1- | 598-32-3 | Liquid | 1.20 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 44 | Butene,1- | 106-98-9 | Gas | 1.30 | 9.5 | 750.50 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 45 | Butoxyethanol, 2- | 111-76-2 | Liquid | 1.30 | 10 | 14.90 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 46 | Butyl Acetate | 123-86-4 | Liquid | 2.40 | 10 | 199.89 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 47 | Butyl Acrylate, n- | 141-32-2 | Liquid | 1.50 | | 6.94 | | TWA | ACGIH | YES | 0.2 | 0.0 | YES |
| 48 | Butyl Alcohol (n-) | 71-36-3 | Liquid | 4.70 | 10.04 | 100.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 49 | Butyl Alcohol (sec-) | 78-92-2 | Liquid | 3.00 | 10.04 | 100.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 50 | Butyl alcohol, tert- | 75-65-0 | Liquid | 3.44 | 10.04 | 148.48 | | STEL | NIOSH | YES | 0.1 | 0.0 | YES |
| 51 | Butyl Lactate | 138-22-7 | Liquid | 2.50 | | 12.54 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 52 | Butyl mercaptan, tert- | 109-79-5 | Liquid | 0.55 | 9.15 | 0.49 | 0.010 | Ceil | NIOSH | YES | 189.7 | 9255.9 | QLP* |

* "QLP" means Quantity Limitation Protocol Recommended

| | | | | | | | | | | | Fan Inlet Spill Concentrations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Compound** | **CAS Number** | **Liquid or Gas** | **RF** | **IP(eV)** | **Health Limits (PPM)** | **Odor Threshold (PPM)** | **OEL Type** | **OEL Agency** | **Detect?** | **Factor Above Health Limit** | **Factor Above Odor Threshold** | **Adequate Detection?** |
| 53 | Butylamine, n- | 109-73-9 | Liquid | 1.00 | 8.71 | 5.01 | 0.053 | Ceil | OSHA | YES | 4.9 | 462.3 | QLP* |
| 54 | Butylamine, tert- | 75-64-9 | Liquid | 0.71 | 8.7 | 1000.00 | | | | YES | 0.1 | 0.0 | YES |
| 55 | Carbon Disulfide | 75-15-0 | Liquid | 1.20 | 10.07 | 9.64 | 0.096 | STEL | NIOSH | YES | 9.5 | 952.5 | QLP* |
| 56 | Carbon tetrabromide | 558-13-4 | Solid | 3.00 | | 0.30 | | STEL | NIOSH | YES | 39.8 | 0.0 | YES |
| 57 | Carbon Tetrachloride | 56-23-5 | Liquid | - | | 10.00 | | STEL | ACGIH | NO | 2.7 | 0.0 | YES |
| 58 | Carvone, R- | 6485-40-1 | Liquid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 59 | Chlorine | 7782-50-5 | Gas | - | 11.48 | 0.50 | | Ceil | ACGIH | NO | 19.3 | 0.0 | YES |
| 60 | Chlorine Dioxide | 10049-04-4 | Gas | 1.00 | 10.36 | 0.30 | | STEL | ACGIH | YES | 32.0 | 0.0 | YES |
| 61 | Chloro-1,3-butadiene, 2- | 126-99-8 | Liquid | 3.20 | 8.8 | 0.99 | | Ceil | NIOSH | YES | 52.3 | 0.0 | YES |
| 62 | Chlorobenzene | 108-90-7 | Liquid | 0.40 | 9.07 | 29.97 | | TWA | ACGIH | YES | 0.1 | 0.0 | YES |
| 63 | Chloroethanol, 2- | 107-07-3 | Liquid | 10.00 | 10.5 | 0.91 | | Ceil | NIOSH | YES | 1.6 | 0.0 | YES |
| 64 | Chloroform | 67-66-3 | Liquid | - | 11.37 | 10.00 | | TWA | ACGIH | NO | 5.8 | 0.0 | YES |
| 65 | Chloromethyl Ether (bis-) | 542-88-1 | Liquid | - | | 0.001 | | TWA | ACGIH | NO | 8964.6 | 0.0 | QLP* |
| 66 | Chloropicrin | 76-06-2 | Liquid | 400.00 | | 0.10 | | TWA | ACGIH | YES | 53.8 | 0.0 | YES |
| 67 | Chloroprene (Beta-) | 126-99-8 | Liquid | 1.30 | 8.79 | 10.00 | | TWA | ACGIH | YES | 5.6 | 0.0 | YES |
| 68 | Chlorotoluene, o- | 95-49-8 | Liquid | 0.50 | 8.8 | 72.19 | | STEL | OSHA | YES | 0.0 | 0.0 | YES |
| 69 | Chlorotoluene, p- | 108-41-8 | Liquid | 0.50 | 8.7 | 1000.00 | | STEL | OSHA | YES | 0.0 | 0.0 | YES |
| 70 | Chlorotrifluoroethylene | 79-38-9 | Gas | 1.00 | 9.81 | 29.00 | | AEG | EPA | YES | 0.3 | 0.0 | YES |
| 71 | Citral | 5392-40-5 | Liquid | 1.70 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 72 | Citronellol | 26489-01-0 | Liquid | 1.00 | 8.5 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 73 | Cresol, m- | 108-39-4 | Solid | 1.10 | 8.14 | 2.30 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 74 | Cresol, o- | 95-48-7 | Solid | 1.10 | 8.14 | 2.30 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 75 | Cresol, p- | 106-44-5 | Solid | 1.10 | 8.14 | 2.30 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 76 | Crotonaldehyde | 4170-30-3 | Liquid | 1.00 | 9.7 | 2.00 | | Ceil | ACGIH | YES | 2.8 | 0.0 | YES |
| 77 | Cumene (Isopropyl Benzene) | 98-82-8 | Liquid | 0.54 | 8.75 | 149.51 | 0.100 | TWA | OSHA | YES | 0.0 | 23.9 | YES |
| 78 | Cyanogen | 460-19-5 | Gas | - | | 10.00 | | | | NO | 1.0 | 0.0 | YES |
| 79 | Cyclohexane | 110-82-7 | Liquid | 1.50 | 9.8 | 300.00 | | TWA | ACGIH | YES | 0.1 | 0.0 | YES |
| 80 | Cyclohexanol | 108-93-0 | Liquid | 1.60 | 10 | 50.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 81 | Cyclohexanone | 108-94-1 | Liquid | 0.82 | 9.14 | 25.00 | | TWA | ACGIH | YES | 0.1 | 0.0 | YES |
| 82 | Cyclohexene | 110-83-8 | Liquid | 0.80 | 8.9 | 300.00 | | TWA | ACGIH | YES | 0.1 | 0.0 | YES |
| 83 | Cyclohexylamine | 108-91-8 | Liquid | 1.00 | 8.6 | 10.00 | | TWA | NIOSH | YES | 0.3 | 0.0 | YES |
| 84 | Cyclopentane | 287-92-3 | Liquid | 4.00 | 10.5 | 600.00 | | TWA | ACGIH | YES | 0.2 | 0.0 | YES |
| 85 | Decane | 124-18-5 | Liquid | 1.60 | 9.6 | 500.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 86 | Dibenzoyl peroxide | 94-36-0 | Solid | 0.80 | | 1.50 | | TWA | NIOSH | YES | 0.1 | 0.0 | YES |
| 87 | Dibromochloromethane | 124-48-1 | Liquid | 10.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 88 | Dibromoethane, 1,2- | 106-93-4 | Liquid | 2.00 | 9.45 | 0.13 | | Ceil | NIOSH | YES | 27.5 | 0.0 | YES |
| 89 | Dibutyl hydrogen phosphate | 107-66-4 | Liquid | 4.00 | | 1.16 | | STEL | ACGIH | YES | 0.3 | 0.0 | YES |
| 90 | Dichloro-1-propene, 2,3- | 78-88-6 | Liquid | 1.40 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 91 | Dichloroacetylene | 7572-29-4 | Liquid | 5.00 | | 0.10 | | Ceil | ACGIH | YES | 362.8 | 0.0 | YES |
| 92 | Dichlorobenzene, 1,2- | 95-50-1 | Liquid | 0.50 | 9.06 | 49.90 | | Ceil | OSHA | YES | 0.0 | 0.0 | YES |
| 93 | Dichloroethene, cis-1,2- | 156-59-2 | Liquid | 0.80 | 9.7 | 597.39 | | TWA | OSHA | YES | 0.0 | 0.0 | YES |
| 94 | Dichloroethylene, trans-1,2- | 156-60-5 | Liquid | 0.45 | 9.7 | 597.39 | | TWA | OSHA | YES | 0.0 | 0.0 | YES |
| 95 | Dichloroethylene, 1,2- | 540-59-0 | Liquid | 0.70 | 9.7 | 597.39 | | TWA | OSHA | YES | 0.1 | 0.0 | YES |
| 96 | Dicyclopentadiene | 77-73-6 | Solid | 0.90 | | 5.00 | | TWA | NIOSH | YES | 0.1 | 0.0 | YES |
| 97 | Diesel fuel #1 | 68334-30-5 | Liquid | 0.90 | <10.6 | 45.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 98 | Diesel fuel #2 | 68334-30-5 | Liquid | 0.75 | <10.6 | 45.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 99 | Diethyl maleate | 141-05-9 | Liquid | 2.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 100 | Diethyl phthalate | 84-66-2 | Liquid | 1.00 | | 1.65 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 101 | Diethyl sulphate | 64-67-5 | Liquid | 3.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |

*** "QLP" means Quantity Limitation Protocol Recommended**

| | | | | | | | | | | | Fan Inlet Spill Concentrations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Compound** | **CAS Number** | **Liquid or Gas** | **RF** | **IP(eV)** | **Health Limits (PPM)** | **Odor Threshold (PPM)** | **OEL Type** | **OEL Agency** | **Detect?** | **Factor Above Health Limit** | **Factor Above Odor Threshold** | **Adequate Detection?** |
| 102 | Diethyl sulphide | 352-93-2 | Liquid | 0.60 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 103 | Diethylamine | 109-89-7 | Liquid | 1.00 | 8.01 | 10.00 | 0.140 | STEL | ACGIH | YES | 5.7 | 409.8 | YES |
| 104 | Diethylaminoethanol, 2- | 100-37-8 | Liquid | 2.70 | | 10.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 105 | Diethylaminopropylamine, 3- | 104-78-9 | Liquid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 106 | Dihydrogen Selenide | 7783-07-5 | Gas | 1.00 | | 0.14 | 0.300 | TWA | ACGIH | YES | 66.5 | 32.1 | YES |
| 107 | Dihydroxybenzene, 1,2- | 120-80-9 | Solid | 1.00 | | 5.00 | | TWA | NIOSH | YES | 0.6 | 0.0 | YES |
| 108 | Dihydroxybenzene, 1,3- | 108-46-3 | Solid | 1.00 | | 10.00 | | STEL | NIOSH | YES | 0.0 | 0.0 | YES |
| 109 | Diisobutylene | 107-39-1 | Liquid | 0.60 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 110 | Diisopropylamine | 108-18-9 | Liquid | 0.70 | | 5.00 | 0.398 | TWA | OSHA | YES | 4.2 | 52.5 | YES |
| 111 | Diketene | 674-82-8 | Liquid | 2.20 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 112 | Dimethoxymethane | 109-87-5 | Liquid | 11.30 | 10 | 1000.00 | | TWA | OSHA | YES | 0.1 | 0.0 | YES |
| 113 | Dimethyl cyclohexane, 1,2- | 583-57-3 | Liquid | 1.10 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 114 | Dimethyl ether | 115-10-6 | Gas | 1.30 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 115 | Dimethyl phthalate | 131-11-3 | Liquid | 1.00 | 9.64 | 1.89 | | TWA | OSHA | YES | 0.0 | 0.0 | YES |
| 116 | Dimethylacetamide, N,N- | 127-19-5 | Liquid | 0.73 | 8.81 | 10.00 | | TWA | OSHA | YES | 0.1 | 0.0 | YES |
| 117 | Dimethylamine | 124-40-3 | Gas | 1.40 | 8.23 | 10.00 | 0.081 | STEL | ACGIH | YES | 1.0 | 118.9 | YES |
| 118 | Dimethylaminoethanol | 108-01-0 | Liquid | 1.50 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 119 | Dimethylaniline, N,N- | 121-69-7 | Liquid | 0.60 | 7.13 | 10.09 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 120 | Dimethylbutyl acetate | 108-84-9 | Liquid | 1.60 | | 50.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 121 | Dimethyldisulfide | 624-92-0 | Liquid | 0.30 | 8.69 | 1.56 | | TWA | ACGIH | YES | 5.5 | 0.0 | YES |
| 122 | Dimethylethylamine, N,N- | 598-56-1 | Liquid | 0.80 | | 1000.00 | | | | YES | 0.1 | 0.0 | YES |
| 123 | Dimethylformamide, N,N- | 68-12-2 | Liquid | 0.80 | 9.12 | 10.00 | | TWA | OSHA | YES | 0.1 | 0.0 | YES |
| 124 | Dimethylheptan-4-one, 2,6- | 108-83-8 | Liquid | 0.80 | | 25.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 125 | Dimethylhydrazine, 1,1- | 57-14-7 | Liquid | 1.00 | 7.3 | 0.06 | 8.800 | Ceil | NIOSH | YES | 503.1 | 3.5 | QLP* |
| 126 | Dinitrobenzene, m- | 99-65-0 | Solid | 3.00 | 10.43 | 0.45 | | TWA | NIOSH | YES | 0.5 | 0.0 | YES |
| 127 | Dinitrobenzene, o- | 100-25-4 | Solid | 5.00 | | 0.45 | | TWA | NIOSH | YES | 0.5 | 0.0 | YES |
| 128 | Dinonyl phthalate | 84-76-4 | Liquid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 129 | Dioxane, 1,4- | 123-91-1 | Liquid | 1.40 | 9.19 | 1.00 | | Ceil | ACGIH | YES | 8.7 | 0.0 | YES |
| 130 | Dipentene | 138-86-3 | Liquid | 0.90 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 131 | Diphenyl ether | 101-84-8 | Liquid | 0.80 | 8.09 | 1.00 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 132 | Disulphur dichloride | 10025-67-9 | Liquid | 3.00 | | 1.00 | | Ceil | ACGIH | YES | 2.1 | 0.0 | YES |
| 133 | Di-tert-butyl-p-cresol | 2409-55-4 | Solid | 1.00 | | 1.00 | | | | YES | 0.0 | 0.0 | YES |
| 134 | Divinylbenzene | 1321-74-0 | Liquid | 0.40 | | 10.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 135 | Dodecanol | 112-53-8 | Solid | 0.90 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 136 | Enflurane | 13838-16-9 | Liquid | - | | 2.00 | | | | NO | 26.1 | 0.0 | YES |
| 137 | Epichlorohydrin | 106-89-8 | Liquid | 7.60 | 10.2 | 1.51 | | TWA | ACGIH | YES | 2.6 | 0.0 | YES |
| 138 | Epoxypropyl isopropyl ether, 2,3- | 4016-14-2 | Liquid | 1.10 | | 50.50 | | Ceil | NIOSH | YES | 0.1 | 0.0 | YES |
| 139 | Ethanol | 64-17-5 | Liquid | 10.02 | 10.5 | 997.09 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 140 | Ethanolamine | 141-43-5 | Liquid | 3.00 | 8.9 | 3.00 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 141 | Ethoxy-2-propanol, 1- | 1569-02-4 | Liquid | 2.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 142 | Ethoxyethanol, 2- | 110-80-5 | Liquid | 29.80 | 9.6 | 1.47 | | TWA | NIOSH | YES | 0.8 | 0.0 | YES |
| 143 | Ethoxyethyl acetate, 2- | 111-15-9 | Liquid | 3.00 | | 1.50 | | TWA | NIOSH | YES | 0.4 | 0.0 | YES |
| 144 | Ethyl (S)-(-)-lactate | 97-64-3 | Liquid | 3.00 | 10 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 145 | Ethyl Acetate | 141-78-6 | Liquid | 4.20 | 10.11 | 1165.61 | | TWA | OSHA | YES | 0.0 | 0.0 | YES |
| 146 | Ethyl Acetoacetate | 141-97-9 | Liquid | 0.90 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 147 | Ethyl Acrylate | 140-88-5 | Liquid | 2.30 | 10.3 | 25.00 | | TWA | OSHA | YES | 0.3 | 0.0 | YES |
| 148 | Ethyl amine | 75-04-7 | Gas | 1.00 | 8.9 | 10.00 | 0.324 | STEL | NIOSH | YES | 1.0 | 29.7 | YES |
| 149 | Ethyl butyrate | 105-54-4 | Liquid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 150 | Ethyl chloroformate | 541-41-3 | Liquid | 80.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 151 | Ethyl cyanoacrylate | 7085-85-0 | Liquid | 1.50 | | 0.59 | | TWA | ACGIH | YES | 0.2 | 0.0 | YES |
| 152 | Ethyl decanoate | 110-38-3 | Liquid | 1.80 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 153 | Ethyl Ether | 60-29-7 | Liquid | 1.20 | 9.51 | 501.54 | 2.290 | STEL | ACGIH | YES | 0.3 | 57.4 | YES |
| 154 | Ethyl formate | 109-94-4 | Liquid | 30.00 | 10.6 | 296.96 | | TWA | OSHA | YES | 0.2 | 0.0 | YES |

*** "QLP" means Quantity Limitation Protocol Recommended**

| | | | | | | | | | | | Fan Inlet Spill Concentrations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Compound** | CAS Number | Liquid or Gas | RF | IP(eV) | Health Limits (PPM) | Odor Threshold (PPM) | OEL Type | OEL Agency | Detect? | Factor Above Health Limit | Factor Above Odor Threshold | Adequate Detection? |
| 155 | Ethyl hexanoate | 123-66-0 | Liquid | 2.60 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 156 | Ethyl hexanol, 2- | 105-76-7 | Liquid | 1.50 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 157 | Ethyl hexyl acrylate, 2- | 103-11-7 | Liquid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 158 | Ethyl Mercaptan | 75-08-1 | Liquid | 0.60 | 9.29 | 0.51 | 0.001 | Ceil | NIOSH | YES | 258.0 | 132066.1 | QLP* |
| 159 | Ethyl octanoate | 106-32-1 | Liquid | 2.30 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 160 | Ethylbenzene | 100-41-4 | Liquid | 0.51 | 8.76 | 100.00 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 161 | Ethylene | 74-85-1 | Gas | 10.10 | 10.52 | 200.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 162 | Ethylene Glycol | 107-21-1 | Liquid | 15.70 | 10.2 | 40.00 | | Ceil | ACGIH | YES | 0.0 | 0.0 | YES |
| 163 | Ethylene Oxide | 75-21-8 | Gas | 19.50 | 10.57 | 4.99 | 851.000 | STEL | NIOSH | YES | 1.9 | 0.0 | YES |
| 164 | Ferrocene | 102-54-5 | Solid | 0.80 | 6.88 | 3.93 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 165 | Formamide | 75-12-7 | Liquid | 2.00 | 10.2 | 10.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 166 | Formic Acid | 64-18-6 | Liquid | - | 11.05 | 5.00 | | | | NO | 0.5 | 0.0 | YES |
| 167 | Furfural | 98-01-1 | Liquid | 1.40 | 9.2 | 6.03 | | TWA | ACGIH | YES | 0.1 | 0.0 | YES |
| 168 | Furfuryl alcohol | 98-00-0 | Liquid | 2.00 | | 14.95 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 169 | Gasoline | 8006-61-9 | Liquid | 1.10 | <10.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 170 | Germane Tetrahydride | 7782-65-2 | Gas | - | 11.34 | 0.20 | | TWA | NIOSH | NO | 48.2 | 0.0 | YES |
| 171 | Glutaraldehyde | 111-30-8 | Liquid | 0.90 | | 0.20 | | Ceil | ACGIH | YES | 25.3 | 0.0 | YES |
| 172 | Glycolonitrile | 107-16-4 | Liquid | - | | 2.00 | | Ceil | ACGIH | NO | 0.1 | 0.0 | YES |
| 173 | Halothane | 151-67-7 | Liquid | - | 11 | 2.00 | | Ceil | ACGIH | NO | 36.3 | 0.0 | YES |
| 174 | Heptan-2-one | 110-43-0 | Liquid | 0.70 | 9.3 | 149.65 | 0.141 | TWA | ACGIH | YES | 0.0 | 6.4 | YES |
| 175 | Heptan-3-one | 106-35-4 | Liquid | 0.80 | 9.02 | 74.93 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 176 | Heptane | 142-82-5 | Liquid | 2.50 | 10.08 | 439.22 | | Ceil | NIOSH | YES | 0.0 | 0.0 | YES |
| 177 | Hexamethyldisilazane, 1,1,1,3,3,3- | 999-97-3 | Liquid | 1.00 | <10.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 178 | Hexamethyldisiloxane | 107-46-0 | Liquid | 0.30 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 179 | Hexan-2-one | 591-78-6 | Liquid | 0.80 | 9.34 | 9.76 | | STEL | ACGIH | YES | 0.3 | 0.0 | YES |
| 180 | Hexane, n- | 110-54-3 | Liquid | 4.50 | 10.18 | 149.76 | | TWA | ACGIH | YES | 0.2 | 0.0 | YES |
| 181 | Hexene, 1- | 592-41-6 | Liquid | 0.90 | 9.4 | 149.91 | | TWA | ACGIH | YES | 0.4 | 0.0 | YES |
| 182 | Hexyl Acetate (sec-) | 108-84-9 | Liquid | - | | 50.00 | | TWA | NIOSH | NO | 0.0 | 0.0 | YES |
| 183 | Hydrazine | 302-01-2 | Liquid | 2.60 | 8.1 | 0.03 | 3.600 | Ceil | NIOSH | YES | 97.7 | 0.8 | YES |
| 184 | Hydrogen Bromide | 10035-10-6 | Gas | - | 11.62 | 3.00 | | TWA | OSHA | NO | 3.2 | 0.0 | YES |
| 185 | Hydrogen Chloride | 7647-01-0 | Gas | - | 12.74 | 5.00 | | REL | NIOSH | NO | 1.9 | 0.0 | YES |
| 186 | Hydrogen Cyanide | 74-90-8 | Liquid | - | 13.6 | 4.70 | | REL | NIOSH | NO | 40.1 | 0.0 | YES |
| 187 | Hydrogen Fluoride | 7664-39-3 | Liquid | - | 15.98 | 3.00 | | TWA | NIOSH | NO | 78.0 | 0.0 | YES |
| 188 | Hydrogen Peroxide | 7722-84-1 | Liquid | 4.00 | 10.5 | 1.00 | | TWA | NIOSH | YES | 1.5 | 0.0 | YES |
| 189 | Hydrogen Selenide | 7783-07-5 | Gas | 2.00 | 9.8 | 0.05 | | TWA | NIOSH | YES | 192.7 | 0.0 | YES |
| 190 | Hydrogen Sulfide | 7783-06-4 | Gas | 3.20 | 10.46 | 10.76 | 0.130 | Ceil | NIOSH | YES | 0.9 | 74.1 | YES |
| 191 | Hydroquinone | 123-31-9 | Solid | 0.80 | 7.95 | 0.44 | | Ceil | NIOSH | YES | 0.0 | 0.0 | YES |
| 192 | Hydroxy-4-methyl-2-pentanone, 4- | 123-42-2 | Liquid | 0.55 | | 150.23 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 193 | Hydroxypropyl acrylate, 2- | 999-61-1 | Liquid | 1.50 | | 1.58 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 194 | Iminodi(ethylamine), 2,2- | 111-40-0 | Liquid | 0.90 | | 1.00 | | TWA | NIOSH | YES | 0.1 | 0.0 | YES |
| 195 | Iminodiethanol, 2,2'- | 111-42-2 | Solid | 1.60 | | 3.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 196 | Indene | 95-13-6 | Liquid | 0.50 | | 10.00 | | TWA | OSHA | YES | 0.0 | 0.0 | YES |
| 197 | Iodine | 7553-56-2 | Solid | 0.20 | 9.4 | 0.10 | | Ceil | NIOSH | YES | 0.9 | 0.0 | YES |
| 198 | Iodoform | 75-47-8 | Solid | 1.50 | | 1.80 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 199 | Iodomethane | 74-88-4 | Liquid | 0.40 | | 5.00 | | PEL | OSHA | YES | 23.9 | 0.0 | YES |
| 200 | Iron Carbonyl | 13463-40-6 | Liquid | - | | 0.10 | | TWA | NIOSH | NO | 119.5 | 0.0 | YES |
| 201 | Isoamyl Acetate | 123-92-2 | Liquid | 1.80 | | 99.90 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 202 | Isobutane | 75-28-5 | Gas | 8.00 | 10.6 | 800.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 203 | Isobutanol | 78-83-1 | Liquid | 4.70 | 10.12 | 100.00 | | PEL | OSHA | YES | 0.0 | 0.0 | YES |
| 204 | Isobutyl Acetate | 110-19-0 | Liquid | 2.60 | 9.97 | 150.00 | | TWA | OSHA | YES | 0.0 | 0.0 | YES |
| 205 | Isobutyl Acrylate | 106-63-8 | Liquid | 1.30 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 206 | Isobutylene | 115-11-7 | Gas | 1.00 | 9.4 | 750.50 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 207 | Isobutyraldehyde | 78-84-2 | Liquid | 1.20 | | 1000.00 | | | | YES | 0.1 | 0.0 | YES |
| 208 | Isodecanol | 25339-17-7 | Liquid | 0.90 | | 1000.00 | | | | YES | 0.000 | 0.000 | YES |

*** "QLP" means Quantity Limitation Protocol Recommended**

| | | | | | | | | | | | Fan Inlet Spill Concentrations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Compound** | **CAS Number** | **Liquid or Gas** | **RF** | **IP(eV)** | **Health Limits (PPM)** | **Odor Threshold (PPM)** | **OEL Type** | **OEL Agency** | **Detect?** | **Factor Above Health Limit** | **Factor Above Odor Threshold** | **Adequate Detection?** |
| 209 | Isooctane | 540-84-1 | Liquid | 1.30 | | 385.38 | | Ceil | NIOSH | YES | 0.0 | 0.0 | YES |
| 210 | Isooctanol | 26952-21-6 | Liquid | 1.70 | | 50.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 211 | Isopentane | 78-78-4 | Liquid | 8.00 | 10.32 | 609.98 | | Ceil | NIOSH | YES | 0.3 | 0.0 | YES |
| 212 | Isophorone | 78-59-1 | Liquid | 0.74 | 9.07 | 4.95 | | Ceil | ACGIH | YES | 0.0 | 0.0 | YES |
| 213 | Isoprene | 78-79-5 | Liquid | 0.60 | 8.85 | 1000.00 | | | | YES | 0.2 | 0.0 | YES |
| 214 | Isopropanol | 67-63-0 | Liquid | 5.55 | 10.12 | 400.31 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 215 | Isopropyl Acetate | 108-21-4 | Liquid | 2.60 | 9.99 | 250.00 | | PEL | OSHA | YES | 0.1 | 0.0 | YES |
| 216 | Isopropyl chloroformate | 108-23-6 | Liquid | 1.60 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 217 | Isopropyl Ether | 108-20-3 | Liquid | 0.80 | 9.2 | 311.01 | 0.017 | STEL | ACGIH | YES | 0.1 | 2091.5 | QLP* |
| 218 | Isopropylamine | 75-31-0 | Liquid | 0.90 | 8.72 | 5.00 | 0.210 | TWA | OSHA | YES | 27.5 | 654.5 | QLP* |
| 219 | Jet A fuel | 8008-20-6 | Liquid | 0.40 | <10.6 | 36.68 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 220 | JP-5 fuel | 8008-20-6 | Liquid | 0.48 | <10.6 | 36.68 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 221 | JP-8 fuel | 8008-20-6 | Liquid | 0.48 | <10.6 | 36.68 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 222 | Ketene | 463-51-4 | Gas | 3.00 | 9.61 | 0.50 | | REL | ACGIH | YES | 19.3 | 0.0 | YES |
| 223 | Maleic anhydride | 108-31-6 | Solid | 2.00 | 10.8 | 0.25 | | TWA | NIOSH | YES | 0.2 | 0.0 | YES |
| 224 | Mercaptoacetic acid | 68-11-1 | Liquid | 1.00 | | 1.00 | | TWA | ACGIH | YES | 3.0 | 0.0 | YES |
| 225 | Mesityl Oxide | 141-79-7 | Liquid | 0.47 | 9.08 | 24.90 | 0.056 | STEL | ACGIH | YES | 0.1 | 48.0 | YES |
| 226 | Methacrylic acid | 79-41-4 | Liquid | 2.30 | | 59.70 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 227 | Methacrylonitrile | 126-98-7 | Liquid | 5.00 | | 1.00 | | REL | NIOSH | YES | 21.2 | 0.0 | YES |
| 228 | Methane | 74-82-8 | Gas | - | NA | 1000.00 | | TWA | ACGIH | NO | 0.0 | 0.0 | YES |
| 229 | Methanol | 67-56-1 | Liquid | - | NA | 200.00 | | TWA | NIOSH | NO | 0.1 | 0.0 | YES |
| 230 | Methoxy-2-Propanol, 1- | 107-98-2 | Liquid | 1.40 | 9.54 | 100.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 231 | Methoxyethoxyethanol, 2- | 111-77-3 | Liquid | 1.40 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 232 | Methoxymethylethoxy-2-propanol | 34590-94-8 | Liquid | 1.30 | | 100.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 233 | Methoxypropyl acetate | 108-65-6 | Liquid | 1.20 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 234 | Methyl Acetate | 79-20-9 | Liquid | 7.00 | 10.27 | 200.00 | | TWA | NIOSH | YES | 0.3 | 0.0 | YES |
| 235 | Methyl Acetoacetate | 105-45-3 | Liquid | 1.09 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 236 | Methyl Acrylate | 96-33-3 | Liquid | 3.40 | 9.9 | 10.00 | | TWA | NIOSH | YES | 1.9 | 0.0 | YES |
| 237 | Methyl Benzoate | 93-58-3 | Liquid | 0.93 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 238 | Methyl cyanoacrylate | 137-05-3 | Liquid | 5.00 | | 3.52 | | STEL | NIOSH | YES | 0.0 | 0.0 | YES |
| 239 | Methyl Ethyl Ketone | 78-93-3 | Liquid | 0.90 | 9.54 | 200.00 | | TWA | NIOSH | YES | 0.1 | 0.0 | YES |
| 240 | Methyl Ethyl Ketone peroxides | 1338-23-4 | Liquid | 0.80 | | 0.21 | | Ceil | ACGIH | YES | 0.0 | 0.0 | YES |
| 241 | Methyl Isobutyl Ketone | 108-10-1 | Liquid | 1.10 | 9.3 | 73.20 | | STEL | NIOSH | YES | 0.1 | 0.0 | YES |
| 242 | Methyl isothiocyanate | 556-61-6 | Liquid | 0.60 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 243 | Methyl Mercaptan | 74-93-1 | Gas | 0.60 | 9.44 | 0.51 | 0.001 | Ceil | NIOSH | YES | 19.0 | 9634.8 | QLP* |
| 244 | Methyl Methacrylate | 80-62-6 | Liquid | 1.50 | 9.7 | 100.14 | 0.085 | STEL | NIOSH | YES | 0.1 | 101.9 | YES |
| 245 | Methyl salicylate | 119-36-8 | Liquid | 1.20 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 246 | Methyl sulphide | 75-18-3 | Liquid | 0.50 | | 29.53 | | TWA | ACGIH | YES | 4.0 | 0.0 | YES |
| 247 | Methyl tert-Butyl Ether | 1634-04-4 | Liquid | 0.86 | | 150.03 | | TWA | ACGIH | YES | 0.5 | 0.0 | YES |
| 248 | Methyl-2-propen-1-ol, 2- | 51-42-8 | Liquid | 1.10 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 249 | Methyl-2-pyrrolidinone, N- | 872-50-4 | Liquid | 0.90 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 250 | Methyl-4,6-dinitrophenol, 2- | 534-52-1 | Solid | 3.00 | | 0.20 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 251 | Methyl-5-hepten-2-one, 6- | 110-93-0 | Liquid | 0.80 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 252 | Methylamine | 74-89-5 | Gas | 1.15 | 8.97 | 14.94 | 0.019 | STEL | ACGIH | YES | 0.6 | 507.1 | QLP* |
| 253 | Methylbenzyl alcohol | 89-95-2 | Solid | 0.80 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 254 | Methylbutan-1-ol, 3- | 123-51-3 | Liquid | 3.40 | | 124.74 | | STEL | NIOSH | YES | 0.1 | 0.0 | YES |
| 255 | Methylcyclohexane | 108-87-2 | Liquid | 1.10 | | 400.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 256 | Methylcyclohexanol, 4- | 589-91-3 | Liquid | 2.40 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 257 | Methylcyclohexanone, 2- | 583-60-8 | Liquid | 1.00 | | 74.96 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 258 | Methylene Chloride | 75-09-2 | Liquid | - | NA | 125.00 | | STEL | OSHA | NO | 0.8 | 0.0 | YES |
| 259 | Methylheptan-3-one, 5- | 541-85-5 | Liquid | 0.80 | | 74.50 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 260 | Methylhexan-2-one, 5- | 110-12-3 | Liquid | 0.80 | | 100.00 | | PEL | OSHA | YES | 0.0 | 0.0 | YES |

*** "QLP" means Quantity Limitation Protocol Recommended**

| | Compound | CAS Number | Liquid or Gas | RF | IP(eV) | Health Limits (PPM) | Odor Threshold (PPM) | OEL Type | OEL Agency | Detect? | Fan Inlet Spill Concentrations | | Adequate Detection? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Factor Above Health Limit | Factor Above Odor Threshold | |
| 261 | Methyl-N-2,4 6-tetranitroaniline, N- | 479-45-8 | Solid | 3.00 | | 0.38 | | TWA | NIOSH | YES | 0.8 | 0.0 | YES |
| 262 | Methylpentan-2-ol, 4- | 108-11-2 | Liquid | 2.80 | | 39.47 | | STEL | NIOSH | YES | 0.0 | 0.0 | YES |
| 263 | Methylpentane-2,4-diol, 2- | 107-41-5 | Liquid | 4.00 | | 25.07 | | Ceil | ACGIH | YES | 0.0 | 0.0 | YES |
| 264 | Methylstyrene | 25013-15-4 | Liquid | 0.50 | 8.2 | 99.91 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 265 | Methyoxyethanol, 2- | 109-86-4 | Liquid | 2.50 | 9.6 | 0.29 | | TWA | ACGIH | YES | 6.2 | 0.0 | YES |
| 266 | Mineral Oil | 8042-47-5 | Liquid | 0.80 | <10.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 267 | Mineral spirits | 64475-85-0 | Liquid | 0.80 | <10.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 268 | Naphthalene | 91-20-3 | Solid | 0.37 | 8.12 | 10.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 269 | Nitric Acid | 7697-37-2 | Liquid | - | 11.95 | 2.00 | | TWA | NIOSH | NO | 7.2 | 0.0 | YES |
| 270 | Nitric Oxide | 10102-43-9 | Gas | 7.20 | 9.25 | 25.00 | 1.000 | TWA | NIOSH | YES | 0.4 | 9.6 | YES |
| 271 | Nitroaniline, 4- | 100-01-6 | Solid | 0.80 | | 1.59 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 272 | Nitrobenzene | 98-95-3 | Liquid | 1.70 | 9.8 | 1.00 | | TWA | OSHA | YES | 0.1 | 0.0 | YES |
| 273 | Nitrogen dioxide | 10102-44-0 | Liquid | 10.00 | 9.8 | 0.96 | 0.190 | STEL | NIOSH | YES | 224.9 | 1132.3 | QLP* |
| 274 | Nitrogen trichloride | 10025-85-1 | Liquid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 275 | Nitromethane | 75-52-5 | Liquid | - | 11.08 | 100.00 | | TWA | OSHA | NO | 0.1 | 0.0 | YES |
| 276 | Nonane, n- | 111-84-2 | Liquid | 1.60 | 10.6 | 200.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 277 | Norbornadiene, 2,5- | 121-46-0 | Liquid | 0.60 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 278 | Octachloronaphthalene | 2234-13-1 | Solid | 1.00 | | 0.02 | | STEL | NIOSH | YES | 14.9 | 0.0 | YES |
| 279 | Octane | 111-65-9 | Liquid | 2.20 | 9.82 | 385.38 | | Ceil | NIOSH | YES | 0.0 | 0.0 | YES |
| 280 | Octene, 1- | 111-66-0 | Liquid | 0.70 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 281 | Oxydiethanol, 2,2- | 111-46-6 | Liquid | 4.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 282 | Parraffin wax, fume | 8002-74-2 | Solid | 1.00 | <10.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 283 | Parraffin wax, normal | 64771-72-8 | Solid | 1.00 | <10.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 284 | Pentacarbonyl iron | 13463-40-6 | Liquid | 1.00 | | 0.06 | | STEL | ACGIH | YES | 212.9 | 0.0 | YES |
| 285 | Pentadione, 2,4- | 123-54-6 | Liquid | 0.80 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 286 | Pentan-3-one | 96-22-0 | Liquid | 0.80 | | 300.16 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 287 | Pentane, n- | 109-66-0 | Gas | 9.73 | 10.3 | 10.00 | | Ceil | ACGIH | YES | 1.0 | 0.0 | YES |
| 288 | Pentanone, 2- | 107-87-9 | Liquid | 0.78 | 9.38 | 150.22 | | STEL | ACGIH | YES | 0.1 | 0.0 | YES |
| 289 | Peracetic acid | 79-21-0 | Liquid | 2.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 290 | Phenol | 108-95-2 | Solid | 1.00 | 8.5 | 15.59 | | Ceil | NIOSH | YES | 0.0 | 0.0 | YES |
| 291 | Phenyenediamine, p- | 106-50-3 | Solid | 0.60 | 6.89 | 0.07 | | TWA | NIOSH | YES | 4.4 | 0.0 | YES |
| 292 | Phenyl propene, 2- | 98-83-9 | Liquid | 0.40 | | 99.29 | | Ceil | OSHA | YES | 0.0 | 0.0 | YES |
| 293 | Phenyl-2,3-epoxypropyl ether | 122-60-1 | Liquid | 0.80 | | 0.98 | | Ceil | NIOSH | YES | 0.0 | 0.0 | YES |
| 294 | Phosphine | 7803-51-2 | Gas | 2.80 | 9.87 | 0.72 | 0.140 | STEL | NIOSH | YES | 13.4 | 68.8 | YES |
| 295 | Phosgene | 75-44-5 | Gas | - | 11.55 | 0.10 | | REL | NIOSH | NO | 96.3 | 0.0 | QLP* |
| 296 | Picoline, 2- | 109-06-8 | Liquid | 0.57 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 297 | Picoline, 3- | 108-99-6 | Liquid | 0.90 | 9 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 298 | Pinene, alpha- | 80-56-8 | Liquid | 0.40 | 8.1 | 60.30 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 299 | Pinene, beta- | 127-91-3 | Liquid | 0.40 | 8.1 | 60.36 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 300 | Piperidine | 110-89-4 | Liquid | 0.90 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 301 | Piperylene | 504-60-9 | Liquid | 0.70 | | 1000.00 | | | | YES | 0.1 | 0.0 | YES |

*** "QLP" means Quantity Limitation Protocol Recommended**

| | | | | | | | | | | | Fan Inlet Spill Concentrations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Compound** | **CAS Number** | **Liquid or Gas** | **RF** | **IP(eV)** | **Health Limits (PPM)** | **Odor Threshold (PPM)** | **OEL Type** | **OEL Agency** | **Detect?** | **Factor Above Health Limit** | **Factor Above Odor Threshold** | **Adequate Detection?** |
| 302 | Prop-2-yn-1-ol | 107-19-7 | Liquid | 1.30 | | 2.62 | | TWA | NIOSH | YES | 1.4 | 0.0 | YES |
| 303 | Propane-1,2-diol, total | 57-55-6 | Liquid | 10.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 304 | Propanol, 1- | 71-23-8 | Liquid | 5.70 | 10.2 | 200.00 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 305 | Propionaldehyde (propanal) | 123-38-6 | Liquid | 14.80 | 9.98 | 60.60 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 306 | Propionic acid | 79-09-4 | Liquid | 8.00 | | 15.72 | | STEL | NIOSH | YES | 0.1 | 0.0 | YES |
| 307 | Propyl acetate, n- | 109-60-4 | Liquid | 3.10 | 10.04 | 248.81 | 0.575 | STEL | ACGIH | YES | 0.0 | 13.0 | YES |
| 308 | Propylene | 115-07-1 | Gas | 1.30 | 9.73 | 1498.36 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 309 | Propylene Oxide | 75-56-9 | Liquid | 6.50 | 10.22 | 100.00 | | TWA | OSHA | YES | 1.3 | 0.0 | YES |
| 310 | Propyleneimine | 75-55-8 | Liquid | 1.30 | 9 | 2.00 | | TWA | NIOSH | YES | 16.7 | 0.0 | YES |
| 311 | Pyridine | 110-86-1 | Liquid | 0.79 | 9.32 | 5.00 | | TWA | NIOSH | YES | 1.0 | 0.0 | YES |
| 312 | Pyridylamine, 2- | 504-29-0 | Solid | 0.80 | | 0.50 | | TWA | NIOSH | YES | 0.5 | 0.0 | YES |
| 313 | Quinoline | 91-22-5 | Liquid | 0.72 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 314 | Styrene | 100-42-5 | Liquid | 0.40 | 8.47 | 40.00 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 315 | Sulfuric Acid | 7664-93-9 | Liquid | - | | 0.25 | | TWA | NIOSH | NO | 0.0 | 0.0 | YES |
| 316 | Terpinolene | 586-62-9 | Liquid | 0.50 | | 1000.000 | | | | YES | 0.0 | 0.0 | YES |
| 317 | Tetrabromoethane, 1,1,2,2- | 79-27-6 | Liquid | 2.00 | | 0.30 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 318 | Tetracarbonylnickel | 13463-39-3 | Liquid | 1.00 | 8.28 | 0.001 | 1.000 | TWA | OSHA | YES | 94119.1 | 94.1 | QLP* |
| 319 | Tetrachloroethylene | 127-18-4 | Liquid | 0.56 | 9.32 | 101.01 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 320 | Tetrachloronaphthalenes, all isomers | 20020-02-4 | Solid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 321 | Tetraethyl orthosilicate | 78-10-4 | Liquid | 2.00 | 9.8 | 10.00 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 322 | Tetrafluoroethylene | 116-14-3 | Gas | 1.00 | | 6.01 | | TWA | ACGIH | YES | 1.6 | 0.0 | YES |
| 323 | Tetrahydrofuran | 109-99-9 | Liquid | 1.60 | 9.54 | 200.00 | | TWA | NIOSH | YES | 0.2 | 0.0 | YES |
| 324 | Tetramethyl succinonitrile | 3333-52-6 | Solid | 1.00 | | 1.50 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 325 | Thiophene | 110-02-1 | Liquid | 0.47 | 8.86 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 326 | Toluene | 108-88-3 | Liquid | 0.53 | 8.82 | 148.66 | | STEL | NIOSH | YES | 0.0 | 0.0 | YES |
| 327 | Toluene-2,4-diisocyanate | 584-84-9 | Solid | 1.60 | | 0.02 | | STEL | ACGIH | YES | 0.1 | 0.0 | YES |
| 328 | Toluenesulphonylchloride, p- | 98-59-9 | Solid | 3.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 329 | Toluidine, o- | 95-53-4 | Liquid | 0.50 | 7.44 | 6.02 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 330 | Tributyl phosphate | 126-73-8 | Liquid | 5.00 | | 0.61 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 331 | Tributylamine | 102-82-9 | Liquid | 1.00 | | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 332 | Trichlorobenzene, 1,2,4- | 120-82-1 | Liquid | 0.60 | | 5.00 | | Ceil | ACGIH | YES | 0.1 | 0.0 | YES |
| 333 | Trichloroethylene | 79-01-06 | Liquid | 0.50 | 9.47 | 2.00 | | Ceil | NIOSH | YES | 8.7 | 0.0 | YES |
| 334 | Trichlorophenoxyacetic acid, 2,4,5- | 93-76-5 | Solid | 1.00 | | 2.87 | | TWA | NIOSH | YES | 0.0 | 0.0 | YES |
| 335 | Triethylamine | 121-44-8 | Liquid | 0.90 | 7.5 | 3.00 | 0.001 | STEL | ACGIH | YES | 5.4 | 16134.0 | QLP* |
| 336 | Trimethylamine | 75-50-3 | Gas | 0.83 | 7.82 | 14.89 | | STEL | NIOSH | YES | 0.6 | 0.0 | YES |
| 337 | Trimethylbenzene, 1,2,3- | 526-73-8 | Liquid | 0.49 | 8.48 | 75.06 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 338 | Trimethylbenzene, 1,2,4- | 95-63-6 | Liquid | 0.43 | 8.27 | 75.06 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 339 | Trimethylbenzene, 1,3,5- | 108-67-8 | Liquid | 0.34 | 8.39 | 75.06 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 340 | Turpentine -crude sulfite | 8006-64-2 | Liquid | 1.00 | <10.6 | 60.36 | | TWA | ACGIH | YES | 0.0 | 0.0 | YES |
| 341 | Turpentine -pure gum | 8006-64-2 | Liquid | 0.45 | <10.6 | 302.03 | | TWA | OSHA | YES | 0.0 | 0.0 | YES |
| 342 | Undecane, n- | 1120-21-4 | Liquid | 0.90 | 9.6 | 1000.00 | | | | YES | 0.0 | 0.0 | YES |
| 343 | Vinyl Acetate | 108-05-04 | Liquid | 1.30 | 9.19 | 4.26 | | Ceil | NIOSH | YES | 5.8 | 0.0 | YES |
| 344 | Vinyl Bromide | 593-60-2 | Gas | 0.40 | 9.8 | 1.51 | | TWA | ACGIH | YES | 6.4 | 0.0 | YES |
| 345 | Vinyl Chloride | 75-01-4 | Gas | 1.80 | 10 | 5.00 | | STEL | OSHA | YES | 1.9 | 0.0 | YES |
| 346 | Vinyl-2-pyrrolidinone, 1- | 88-12-0 | Solid | 0.90 | | 0.15 | | TWA | ACGIH | YES | 0.2 | 0.0 | YES |
| 347 | Vinylidene Chloride (1,1-DCE) | 75-35-4 | Liquid | 0.80 | 10 | 15.12 | | TWA | ACGIH | YES | 9.9 | 0.0 | YES |
| 348 | Xylene, m- | 108-38-3 | Liquid | 0.53 | 8.56 | 149.88 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 349 | Xylene, o- | 95-47-6 | Liquid | 0.54 | 8.56 | 149.88 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 350 | Xylene, p- | 106-42-3 | Liquid | 0.50 | 8.44 | 149.88 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 351 | Xylenes, mixed isomers | 1330-20-7 | Liquid | 0.40 | 8.6 | 149.88 | | STEL | ACGIH | YES | 0.0 | 0.0 | YES |
| 352 | Xylidine, all | 1300-73-8 | Liquid | 0.70 | 7.65 | 1.51 | 0.010 | TWA | ACGIH | YES | 0.2 | 29.8 | YES |

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