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Adequate Ventilation: How is it defined and does it adequately warn consumers?

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ADEQUATE VENTILATION: HOW IS IT DEFINED AND DOES IT ADEQUATELY WARN CONSUMERS?

A thesis submitted to the Graduate College of Marshall University

In partial fulfillment of the requirements for the degree of Master of Science Safety

by

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Marshall University
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ABSTRACT

The purpose of this research was to clarify and define the term “adequate ventilation.” Upon looking at regulations, court cases, and other elements, it is clear that the term is inadequate to inform consumers and does not instruct consumers on how to achieve proper ventilation. To find out if consumers understand this, random persons were asked to define it. The answers were given a numerical value to show the knowledge trend. The outcome showed that most people do not understand how to achieve proper ventilation. Conclusion: Diagrams showing how to set up a room with ventilation and new instructions are needed for consumers.
Introduction

Stores all across America sale products in super markets and hardware stores to meet the demands of customers, ranging from air-freshener’s to paint stripping. On these products, labels are in place to inform the consumer about safe handling procedures and what dangers might be possible. Placing labels on products is regulated, but how well are warning labels interpreted by the general public? Is the wording understandable and is the language defined well enough for the public? The purpose of this research is to answer questions about “adequate ventilation” such as how to define it, do people understand this warning, and is there a need for better instructions? Many products, such as cleaning and paint products, have this warning on the product, but there is no clear or concrete definition. In order to answer these questions, a few things need to be examined: regulatory processes for labels, legal cases involving commercial products, general warning label effectiveness, certain chemicals related to consumer injury and death, and consumer knowledge trends. By examining this information, extrapolations can be made on giving a definition to adequate ventilation, determining whether or not the public understands, and what can be made to improve the warning.
Defining Adequate Ventilation

The term “adequate ventilation” is meant to inform and communicate to customers in a simplistic and brief manner that a product contains a hazardous chemical.\(^1\) Since the 1940s, it has been commonly used and recommended for products to help keep the public safe.\(^2\) But what does this term really mean? Does this general statement mean to crack a window, open the window all the way, turn on a fan, or is there information missing from this statement that would make it clearer? It is obvious that if researchers are unclear of the meaning, then the general public is unclear, and that leads to misinterpretation and accidental exposures. According to the label reading guide, it is a term “used to describe a continuous exchange of fresh air with contaminated air. Although many labels indicate the need for adequate ventilation, there is no regulated standard for the term ‘adequate’”.\(^3\)

Taken from ANSI Z129.1 (1976),\(^4\) adequate ventilation is “a condition falling within either of the following categories: (1) Ventilation to reduce levels of air contaminant below that which causes personal injury or illness, (2) Ventilation sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentration over one-fourth of the lower flammable limit.” OSHA’s standard interpretation, “Enforcement of ventilation requirements for welding operations,” says that “ventilation required (natural or mechanical) such that personal exposure to hazardous concentrations of airborne contaminants are maintained below the


allowable levels or sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentration over one-fourth of the lower flammable limit.” The definition takes the middle ground, not appropriate to the consumer nor appropriate for a professional. It explains ventilation in terms of lowering air contamination but does not fully explain how a consumer can mechanically achieve ventilation and for professionals it fails to give further information that could be useful, such as general CFM, air changes per minute, or liters of air.

“OSHA acknowledges that there may be instances in which flow rates in excess of those prescribed in a regulation may be required and other instances in which a lesser flow rate may be adequate and hence, ‘it is more protective to require that adequate ventilation be maintained than it would be to try to enforce specific flow rates...’ and that chemical manufacturers ‘cannot accurately predict the hazard presented by the chemical downstream.’”

It is essential to define “adequate ventilation” because many household products contain a wide variety of ingredients that can be harmful or fatal. According to the Injury Facts 2011 publication, the odds of deaths by accidental poisoning by and exposure to noxious substances were 23,618 persons, 27,531 persons, and 29,846 persons, in the years 2005, 2006, and 2007 respectively. Of these accidental poisonings, 703 persons, 656 persons, and 680 persons were due to gases and vapors in the same years respectively. Paint products are notorious for volatile organic compounds (VOC’s) and “The Environmental Protection Agency ranks paint on its top-five list of environmental hazards and a study conducted by the US agency found that VOC

5 ibid.

levels indoors can be 1,000 times higher than outdoor levels when an indoor paint is drying.”

Here is a list of common ingredients and health effects taken from the article:

**Acetone:** Solvent. *Can cause eye, nose and throat irritation, headache, dizziness, dermatitis.*

**Ammonia:** Preservative. *Can cause eye, skin and respiratory irritant, and trigger asthma.*

**Benzene:** Solvent. *Can cause skin, eye and upper respiratory tract irritation. Neurological symptoms from inhalation include drowsiness, dizziness, headaches, immune system damage, blood disorders; carcinogenic.*

**Ethylene glycol:** Solvent. *Can cause central nervous system depression; ingestion causes kidney damage.*

**Formaldehyde:** Preservative. *Irritates the eyes, nose and throat; allergic skin reactions; breathing difficulties; carcinogenic.*

**Methyl alcohol:** Solvent. *Eye, skin, mucous membrane irritation. Overexposure can provoke headache, drowsiness, nausea, vomiting and blurred vision.*

**Phenol:** Biocide. *Can cause mouth, eye, nose and throat irritation; dermatitis, headache, dizziness, muscle ache and pain, tremors and twitches.*

**Kerosene:** Solvent. *Can cause eye, skin and respiratory system irritation; dermatitis; anaesthetic; toxic to aquatic life*

**Ethylene acrylate:** Film former, polymer. *Can cause irritation to the eyes, respiratory system and skin; potential carcinogen*

**Propylene glycol:** Solvent. *Inhalation and skin contact can cause dermatitis with erythema, oedema, and weeping.*

**Quaternary ammonium compounds:** Biocide. *Can cause skin, eye and nose irritation.*

**Trichloroethylene:** Solvent. *Central nervous system effects including sleepiness, fatigue, headache, confusion, and feelings of euphoria. Damage to the liver, kidneys, immune and endocrine systems.*

**Vinyl Acetate – Acrylic Copolymer:** Film former. *Can cause eye, nose and throat irritation, lung damage; convulsions have been observed in rodents inhaling high levels.*

Additional compounds not on this list are:

**Toluene:** Solvent. *Can cause CNS depression, visual impairment, pregnancy loss, and problems with female reproduction.*

**Xylene:** Solvent. *Can cause upper respiratory and eye irritation and CNS depression.*

**Ethylbenzene:** Solvent. *Can cause upper respiratory irritation, kidney damage (nephropathy), and cochlear impairment.*

---

**Methylene Chloride:** Pesticide. Used as a solvent. Can cause cardiovascular, liver, and neurological damage. Reasonably anticipated to be a human carcinogen. Can cause death.

Here is a list of household products and possible VOC ingredients:

<table>
<thead>
<tr>
<th>Examples of Household Products</th>
<th>Possible VOC Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel containers or devices using gasoline, kerosene, fuel oil and products with petroleum distillates: paint thinner, oil-based stains and paint, aerosol or liquid insect pest products, mineral spirits, furniture polishes</td>
<td>BTEX (benzene, toluene, ethylbenzene, xylene), hexane, cyclohexane, 1,2,4-trimethylbenzene</td>
</tr>
<tr>
<td>Personal care products: nail polish, nail polish remover, colognes, perfumes, rubbing alcohol, hair spray</td>
<td>Acetone, ethyl alcohol, isopropyl alcohol, methacrylates (methyl or ethyl), ethyl acetate</td>
</tr>
<tr>
<td>Dry cleaned clothes, spot removers, fabric/leather cleaners</td>
<td>Tetrachloroethene (perchloroethene (PERC), trichloroethene (TCE))</td>
</tr>
<tr>
<td>Citrus (orange) oil or pine oil cleaners, solvents and some odor masking products</td>
<td>d-limonene (citrus odor), a-pinene (pine odor), isoprene</td>
</tr>
<tr>
<td>PVC cement and primer, various adhesives, contact cement, model cement</td>
<td>Tetrahydrofuran, cyclohexane, methyl ethyl ketone (MEK), toluene, acetone, hexane, 1,1,1-trichloroethane, methyl-isobutyl ketone (MIBK)</td>
</tr>
<tr>
<td>Paint stripper, adhesive (glue) removers</td>
<td>Methylene chloride, toluene, older products may contain carbon tetrachloride</td>
</tr>
<tr>
<td>Degreasers, aerosol penetrating oils, brake cleaner, carburetor cleaner, commercial solvents, electronics cleaners, spray lubricants</td>
<td>Methylene chloride, PERC, TCE, toluene, xylene, methyl ethyl ketone, 1,1,1-trichloroethane</td>
</tr>
<tr>
<td>Moth balls, moth flakes, deodorizers, air fresheners</td>
<td>1,4-dichlorobenzene, naphthalene</td>
</tr>
<tr>
<td>Refrigerant from air conditioners, freezers, refrigerators, dehumidifiers</td>
<td>Freons (trichlorofluoromethane, dichlorodifluoromethane)</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Examples of Household Products</th>
<th>Possible VOC Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerosol spray products for some paints, cosmetics, automotive products, leather treatments, pesticides</td>
<td>Heptane, butane, pentane</td>
</tr>
<tr>
<td>Upholstered furniture, carpets, plywood, pressed wood products</td>
<td>Formaldehyde</td>
</tr>
</tbody>
</table>

(Figure 1)

Chemicals can also invoke another health effect. A study from 2003 shows that work-related asthma is associated with exposure to cleaning products. The reports are from a wide range of jobs in industry as well as in the home. The potential to cause or aggravate asthma has been recognized, but still needs further research. The report suggests that along with improved warning labels, adequate ventilation is needed, however, the report fails to further define adequate ventilation so that future problems can be avoided.

Consumers can mitigate their exposure to these chemicals in various ways. The easiest way is to avoid products that contain VOC’s or other harmful chemicals. There are paints on the market that are organic or contain no VOC’s and will have a label on the front stating it as such. If the product will be used indoors, create a flow of air with box fans, one bringing in fresh air and one blowing out the contaminated air. If there are no windows for ventilation, use an approved NIOSH respiratory mask designed to absorb organic vapors (check the product to make sure it will filter all vapors being used, such as one with a NIOSH P95 rating.

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Methylene Chloride (Dichloromethane)

Methylene Chloride is a common ingredient in over the counter paint thinners that can easily be fatal and an ingredient that is still common in the market. Hazards for the chemical can be shown in MSDS’s of products sold in stores, such as Piranha 2.\textsuperscript{10} In section 3, hazards identification, it states the routs of entry as inhalation, skin, and ingestion. High vapor concentrations can cause various effects as well as death. In section 8, the stated precautions for this particular product is to “use only with adequate ventilation.” It further explains ventilation, recommending ventilation sufficient to prevent a build up of concentrations in the air and the use of supplied-air respiratory protection in confined or enclosed spaces as needed. However, with the previous statement of “adequate ventilation,” it could be misleading if the general public was taking a general glance over the information and still does not clearly state how to achieve ventilation.

Fatal exposures to methylene chloride among workers (bathtub finishers) have been documented over the last years and factors involving the deaths have been examined in this report.\textsuperscript{11} The findings show that not only are professional finishers at risk, but the general public who seek to do their own bathtub refinishing are also at risk due to the widespread availability of the product. After reviewing OSHA IMIS system, internet, and hardware stores, researchers found 42 stripping products, many containing 60%-90% methylene chloride. “Many internet sites promote do-it-yourself bathtub stripping, and no state or federal restrictions exist on the use

\textsuperscript{10} Piranha 2 @ Heavy-Duty Methylene Chloride Paint Remover. MSDS No. 5720 [Online]. Fiberlock Technologies: March 14, 2012.

of methylene chloride stripping agents.” 12 Thus, it is important for all parties involved (manufacturers, health agencies, etc) to make sure the hazards are clearly communicated that everyone can understand.

A worker fatality alert from the California Department of Public Health discusses the hazard concerns of methylene chloride. 13 Knowing that it can cause death in confined spaces and spaces with little to no ventilation, the alert informs consumers that an alternative is safer and that proper ventilation, supplied air respiratory protection, and air monitoring are needed. Banned from many uses in Europe, this product is still easily obtainable within the United States. Although alerts are important, they may only go so far as to bring attention to the subject, but not give the best instructions to prevent it. Alerts may also have limited visibility with the general population, thus better instructions are needed on the label.

**Warning Label Regulations**

Products, depending on how the product is used and what it contains, are regulated by Code of Federal Regulations, such as FHSA, and enforced by government agencies, such as the EPA, CPSC and OSHA. Along side these, states can also require and enforce regulations of their own. However, to keep uniformity with labeling, preemption clauses are included in regulations that normally can overrule state regulations. These regulations, both state and federal, give no definition or description for “adequate ventilation.”

12 *ibid.* 124.

The Federal Hazardous Substances Act (codified at 15 U.S.C. 1261-1278) is a compilation of other acts to help protect consumers. It defines certain terms used on products, such as “toxic” and “highly toxic,” along with other regulations to protect employers and employees (consumers) and is enforced by the Consumer Product Safety Commission. It requires precautionary measure or statements describing to users what actions are needed or actions to be avoided in order to protect oneself. The Federal Hazardous Substance Act has further requirements for the language used in those precautionary statements, requiring them to be visible, noticeable and in clear and legible English, yet still fails consumer safety and fails to define the term “adequate.”

The EPA has a published guide for label making. The manual discusses placement, font size, and cautionary keywords, along with other requirements. Normally on products that need adequate ventilation, a cautionary word precedes the phrase “adequate ventilation,” such as CAUTION or WARNING. There is no regulation for the specific language after cautionary words.

Common law plays a role when examining adequacy. The Third Restatement of the Law of Torts: Products Liability, is an examination of several court cases throughout the years that set a general standard and consensus among the court system. One of the categories for product defect is:

\[(c)\text{ is defective because of inadequate instructions or warnings when the foreseeable risks of harm posed by the product could have been reduced or}\]

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avoided by the provision of reasonable instructions or warnings by the seller or other distributor, or a predecessor in the commercial chain of distribution, and the omission of the instructions or warnings renders the product not reasonably safe.

From subsection (i) - Inadequate instructions or warnings, the Restatement gives some of the considerations used in court:

In evaluating the adequacy of product warnings and instructions, courts must be sensitive to many factors. It is impossible to identify anything approaching a perfect level of detail that should be communicated in product disclosures. For example, educated or experienced product users and consumers may benefit from inclusion of more information about the full spectrum of product risks, whereas less-educated or unskilled users may benefit from more concise warnings and instructions stressing only the most crucial risks and safe-handling practices.

The Restatement puts forth an idea and consensus that adequacy is a necessity for manufacturers and sellers to protect themselves from legal troubles and for the protection of the public. Unfortunately, there is no further discussion or consensus on how to properly evaluate “adequacy,” which leads to greater subjectivity in terms of court rulings and and requirements for manufacturers when designing labels. The example given under subsection (i), “less-educated or unskilled users may benefit from more concise warnings and instruction stressing only the most crucial risks and safe-handling practices,” is essential. Using this key phrase, it seems appropriate to further define and instruct users of consumer products by using concise graphic labels and instruction on how to achieve adequate ventilation to protect themselves.

Label Adequacy and Court Case Examinations

Product liability and warning adequacy is an evolving process, stemming from the decision of court cases through the past century and through state and federal statutes. “Under current products liability law, a determination of adequacy is a highly subjective and fact-
intensive evaluation.” Manufacturers must warn only those that it could foresee a reasonable danger although the Sophisticated Doctrine may relieve a manufacturer of warning duties. While all companies should develop a standard, in-depth procedure for evaluation of labels, a few key points to remember are: too many warnings will decrease the effectiveness, a product label may be inadequate if it can be redesigned with a better warning, and warning labels will be inadequate if the anticipated audience cannot understand. Unfortunately, in many cases such as Bituminous Casualty Corp v. Black and Decker Manufacturing Company, rulings and evaluation use the phrase “comprehensible to the average user,” however, that would be 50% of the population when the court should be thinking of the majority of the people.

Dean v. Morningstar et al. v. The Black and Decker Company was a benchmark case in the state of West Virginia. It set precedents that are still used today when interpreting the law in failure to warn cases. First, the product must be “reasonably safe” for its intended use, secondly it must adequately warn and have no defects (design, manufacture, use), and third recognizes strict liability in product liability cases. It also recognizes that the term “strict liability” does not impose absolute liability or make the manufacturer an insurer of his product. “In the absence of statutory regulation, Morningstar remains the leading product liability law in

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18 Ibid.

19 Bituminous Casualty Corp. v. Black and Decker Co. 518 S.W. 2d 868. Texas Court of Civil Appeals.

20 Dean v. Morningstart et al. v. The Black and Decker Company. No. CC905. Supreme Court of Appeals of West Virginia.
West Virginia.”21 “The issue of whether ‘a defendant’s efforts to warn of a product’s dangers are adequate is a jury question.”22

Burch and Appellants v. Amsterdam Corporation and The Syracuse Adhesives Company, in the District of Columbia Court of Appeals, decided December 1, 1976, reversed the initial ruling of summary judgement for the appellant and remanded.23 George Burch was using a floor tile adhesive when a vapor buildup occurred and ignited causing serious burns to George Burch. The warning label instructed him to use “adequate ventilation” and had no mention of extinguishing pilot lights in stoves. The court “cannot as a matter of law cannot say that this warning adequately alerted users of the dangers inherent in the product. Among other things, an ordinary user might well not have realized that ‘near fire or flame’ included nearby pilot lights or that fumes and vapors, as well as the adhesive itself, were extremely flammable. Whether more specific instructions or warnings were required is a question of fact for the jury.”24 Indeed the label was inadequate in the fact that there was no mention of extinguishing pilot lights, but the “adequate ventilation” too was inadequate. Had the label gave better instructions for the user, George Burch, on how to ventilate the room properly, the situation might have been avoided by preventing the buildup of flammable vapors. Unfortunately, not everyone was in favor of the ruling. Chief Judge Reilly dissents that the warning labels were adequate and states that “even the least sophisticated user of household appliances would be aware that pilot lights are designed to ignite gas and thus far more likely than a smoldering cigarette to set ablaze any vapors rising


22 Ibid.


24 Ibid. 10.
from an ‘extremely flammable’ mixture.”

He suggest that it was contributory negligence. The subjectivity of the judge and from the others show how the laws can be interpreted differently and the evaluations of facts can lead to different conclusions.

Lakeman v. Otis Elevator Company, United States Court of Appeals for the Eleventh Circuit, decided May 13, 1991, ruled in favor of the plaintiff on wantonness. Donald Lakeman, deceased, worked for the Otis Elevator Company and was told to clean the elevator pit with a cleaner, Solvent-Cleaner No. 4, which contained 1,1,1-trichloroethane. He was asphyxiated from the buildup of vapors in the bottom of the pit. There was evidence showing the label was inadequate because the label did not explain what adequate ventilation meant and also failed to warn that trichloroethane vapors can be fatal. The jury found part negligence from the plaintiff due to the fact that they concluded he knew about the chemical but disregarded his safety.

Oken v. Monsanto, decided June 4, 2004, wherein the ruling was in favor for the defendant. The consumer, Oken, purchased two bags of pesticides from a retailer. The product had a warning label approved by the Environmental Protection Agency. Oken claimed that his injuries were caused, at least in part, by the inadequacy of the label. Oken would not have used the product, had there been adequate warning of the dangers of the pesticide. The exposure to the pesticide produced a reaction and required extensive hospitalization and treatment. However, because of the preemption clause in the Federal Insecticide, Fungicide, and Rodenticide, the judgement was in favor for the manufacturer, stating that the plaintiff’s claims were all preempted. This particular case also mirrored that of Papas v. Upjohn Co., 985 F.2d 516, 517, 520 (11th Cir. 1993) (Papas II), which was also a FIFRA preemption case. Oken asked the court

25 Ibid. 11.
to overturn the previous decision, but the court was not “free to reconsider an issue decided by a prior panel, United States v. Steele, 147 F.3d 1316, 1317-18 (11th Cir. 1998) (en banc), we are bound by our decision in Lowe's, and must adhere to Papas II.” After reading the label for the product, it is inadequate. It does not inform the consumer of inhalation situations that might arise. For those persons that do read warning labels, this label leaves out critical information regarding wind changes that could prevent injury or death.

Jenkins v. James B. Day and Company is the last court case to examine, wherein the ruling was initially preempted, but on appeal was determined that the court erred in granting summary judgment in the manufacturers favor and sent back to the lower courts to determine a ruling. On March 8, 1990, Julette Jenkins was found on the first floor of her home; the cause of death not immediately apparent. It was later confirmed that her death was caused by inhalation of methylene chloride. A container of paint stripping product, “Marine-Strip,” was found in the attic where she was stripping furniture, and the window opened about 2 inches. The container had a warning label with the following: “WARNING! HARMFUL IF INHALED OR SWALLOWED. SKIN AND EYE IRRITANT. CAUTION -- CONTAINS METHYLENE CHLORIDE. USE ONLY WITH ADEQUATE VENTILATION.” The court found that the warning label on the “Marine-Strip” container issues of compliance with the requirements of the Federal Hazardous Substance Act, also raising questions as to whether or not identical state regulations were preempted. Within the notes of the court case, Title 15 U.S.C.S. § 1261(p), “does not specify all the language required on the products warning label. A manufacturer of a

27 Ibid.

product formulates its own warning language, guided by the Federal Hazardous Substance Act, but the language is not reviewed for adequacy by a federal agency.”

“Given that a manufacturer selects its own language to convey this information, to comply with Federal Hazardous Substances Act a manufacturer must supply a label which provides a reasonably adequate warning to inform a user of the risks involved, and the action to take to avoid those risks.”

Through the appellee’s expert witness, issues were raised regarding potential problems with the label. It did not define what a “prolonged exposure” is and also did “not explain what steps must be taken to achieve ‘adequate ventilation.’”

Labels such as these should all be deemed inadequate because it fails to instruct the user on how to achieve a situation in which there would have been enough ventilation to use this product or any other product.

The court system is what the consumer truly depends on when it comes to public protection. Although there are federal and state laws, it is up to the court to evaluate the case and interpret that law. There are questions that come into play when these court matters are decided, such as, was the interpretation of common law or federal regulations correct, to what extent was the plaintiff injured, was this a foreseeable danger, or perhaps was there some kind of bias within the court. There are instances where the judge may have a conflict of interest and not remove himself from the trial, however, that is not a common scenario. What is common is the large amount of money spent on lobbying each year. Lobbying information for each company can be
seen on the internet.\textsuperscript{32} For example, Monsanto Company, in 2012, spent $5,970,000 for lobbying firms to press their agenda in Washington, D.C..

\textit{“Adequate Ventilation” Warning Label Analysis}

Warning labels follow federal guidelines when being produced. However, depending on the danger of a product, more or less information could be placed on the product label. It is not unusual for detailed information to be placed behind the primary label (peeling back the label for more information) or in the product’s MSDS.

Here is the label for Purple Power, a common household cleaner/degreaser that can be bought at Walmart and other locations:

\begin{quote}
\textit{WARNING: MAY CAUSE BURNS OR IRRITATION. SEVERE EYE IRRITANT. HARMFUL IF SWALLOWED OR INHALED. Use with adequate ventilation. Wear rubber gloves and eye protection. Prevent contact with eyes or skin. In case of contact with eyes, remove contact lenses if present. Immediately flush eyes with large amounts of water for at least 15 minutes...}
\end{quote}

While this product does not impose an immediate danger, it fails to define how to properly ventilate this product. The MSDS for this product mentions mechanical ventilation, but for the public there is still no explanation on how to achieve mechanical ventilation. There are other products with better labels. Here is the label for AIRCRAFT Paint Remover:

\begin{quote}
\textit{DANGER! POISON. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. VAPOR HARMFUL. EYE IRRITANT. USE ONLY WITH ADEQUATE VENTILATION TO PREVENT BUILDUP OF VAPORS.}
\end{quote}

\textit{Do not use in areas where vapors can accumulate and concentrate, such as basements and small, enclosed areas. Whenever possible use outdoors in an open air area. If using indoors, open all windows and doors and maintain a strong ventilation of moving fresh air through the work area. If strong odor is noticed, or you experience slight dizziness - STOP - ventilation is inadequate. Leave area immediately. IF THE WORK AREA IS}

NOT WELL VENTILATED, DO NOT USE THIS PRODUCT. A dust mask does not provide protection against vapors.

Although this label still uses the vague “adequate ventilation” warning, it does go into detail and gives a better definition that informs the public how to ventilate. An addition to this label, such as, “place one box fan on high blowing in and one box fan on high blowing out,” would give more of a concrete meaning to consumers. The warning becomes concise and instructive for the majority of the population. A warning label such as this should be on all products that need ventilation. A technical definition, such as the amount (liters) of air movement needed, may not be necessary for the public, but concise, concrete, and easily understood information is needed. Both labels, compared to the regulations, meet the standards. The latter of the two exceeds the minimal standards.

Warning Label Effectiveness

After reviewing these cases, it is clear that there are problems with label requirements, what the general public understands, and clear, concrete information. Even though labels state how to use the product, consumer products can still cause serious harm to a person. These cases illustrate how “adequate ventilation” is too vague. Had labels been more specific, or perhaps had a graphic warning label and information on how to achieve ventilation, loss of life and injuries could have been avoided. Unfortunately, it is not known if it would have made a difference, but reviewing other literature on other warning labels might give insight into the ability of the public to understand warning labels and thus make further extrapolations into whether or not further research and clarification is needed for the term “adequate ventilation.”
Warning label effectiveness research is organized using an information processing framework: attention, comprehension, beliefs and attitudes, motivation. Each stage needs to be focused on carefully, otherwise problems can occur, for example, “a warning that is not comprehended will have little or no influence on beliefs and attitudes, motivation, and behavior. In the comprehension stage, “product and warning designers often assume incorrectly that everyone at risk understands the hazard as well as the designers themselves do.” Thus, labels should target persons who are least-skilled rather than assuming common sense. “Use adequate ventilation’ or ‘May be hazardous to health’ are vague messages; comprehension can be improved by using instead specific messages like ‘Use in a room with forced air or with at least two open windows’ or ‘Can cause lung cancer, which almost always leads to death.’"

Cigarettes are a common over-the-counter product that has serious health effects and has a well known warning label associated with them. Warning labels on this product were first required by the Federal Cigarette Labeling and Advertising Act of 1965. However, since the new requirements in 1984, the effectiveness has drastically weakened, and the current labels are virtually meaningless. New research suggests that “warning labels that contain a clear, direct, and accurate message about the dangers of tobacco use, are the most effective.” Also, warnings with pictures are more effective than text-only warning, which also increases the message to persons with lower levels of literacy. Extrapolating on this idea of clearer meanings and

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34 Ibid. 34.

35 Ibid. 35.

pictures, a picture of a fan along with a better warning than “adequate ventilation” could prevent overexposures to dangerous chemicals that can not only harm but cause death.

Even though cigarettes are a well known product, one study finds that smokers in different countries have significant gaps in their knowledge of the product. The knowledge gap is due to the fact that not all cigarette labels inform consumers of all the dangers and ingredients due to the different government requirements in each country. Although most smokers understood that smoking causes heart disease, fewer than half of the smokers believed that smoking causes impotence. Also, smokers had a low level knowledge of the toxic constituents in cigarettes. Showing that smokers do not know everything about the product they consume, it is likely that consumers of products that need “adequate ventilation” do not know their product either, which it is safe to conclude that the topic of ventilation in a hygienic sense is known only to those whom have specialized knowledge, which does little to protect the majority of consumers.

In addition to providing information, a label’s effectiveness needs to take into account the ability to influence a person’s attitude. A person needs to feel the harm, feel susceptible, be knowledgable of the actions to take, and be able to understand the cost and benefits of taking certain risks and actions. These feelings are particularly difficult to instill in young people due to the immortal perceptions to death and illness. Another study shows the same complications


with perception. In their fourth meta-analysis, they found that “warning labels were not effective in influencing consumers’ perception of hazards and risks. Further, in those cases in which consumers do perceive hazards with a product, these perceptions are more likely to be associated with products that are purchased less frequently as opposed to products purchased more often.”

Relating “adequate ventilation” to the difficulty in perceiving danger and risk, the term “adequate” is not sufficient to convey the type of risk involved with chemical inhalation.

Knowledge Trends of Consumers

An unpublished class project concerning adequate ventilation with paint products in local retail stores was conducted by students from the University of Arizona. Their goal for the project was to define the phrase, “adequate ventilation,” and to ask local retail employees or customers questions regarding their knowledge. The questions came from three general areas: knowledge of painting hazards (toxic chemicals and effects on pregnancy), knowledge of the phrase “adequate ventilation” (does the person know how to define), and knowledge of PPE (using the correct respirator for painting). Following these three categories, the answers were given a numeric designation in order to show trends and allow to analysis of the information given. Persons were placed into the “No Understanding” category if the answer was not known or was incorrect. If persons had a general understanding of the concept or had a partially correct answer, such as knowing some health effects of chemicals, open windows and doors, turn on a fan and did not mention air exchange, or suggested only a dust mask, they were placed in the “General Understanding” category. If the question at hand was answered correctly, such as full

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40 Ibid.

41 Stobbe, Terry. University of Arizona.
health effects, air exchange with a fan, or NIOSH approved mask, they were placed in the “Full Understanding” category.

(Figure 2)

When reading the responses of the people, most did not really understand the effects of chemicals in paints and paint thinners, such as the effects on pregnancy and carcinogens. The results show that 59% of the persons interviewed did not know or did not believe any of the paints or paint thinners in the stores to be toxic, 32% of the persons knew that there was some correlation between chemicals and health, such as carcinogens or birth defects, and only 9% had a full understanding, knowing VOC’s and the full dangers of chemicals in paints and thinners.
The next category was determining if people knew what the phrase adequate ventilation was. Few persons had no understanding of the term, showing only 9%. The majority of the data showed that 86% had some understanding of the phrase “adequate ventilation.” Answers that fell into this category were: open all the windows, use a fan, turn on the overhead exhaust in the bathroom. Only 5% that were interviewed gave a satisfactory answer, such as open a window, use a fan, and make sure there is an exchange of fresh air.
The last category was to determine if a proper PPE would be recommended or if there was an understanding of respirators. At 35%, there was no understanding of respirators or the students were not offered any PPE. At 43%, there was some understanding that there was a need to have a respirator, but the students were offered incorrect masks or dust masks. Only 22% were recommended the correct respirator, NIOSH approved, P or R rated.

Another survey was conducted by selecting people at random, simply asking what adequate ventilation meant. It was given a numeric value just like the previous information and has the same problems when designating the these values.
The second survey confirms the trends of the previous information. The phrase “use with adequate ventilation” is not reaching the majority of the population. 21% of the participants did not know or gave a wrong answer, 50% knew about opening a window or door, and only 29% knew about using a fan for constant air exchange.

**Conclusion and Recommendations**

By examining different elements, several factors involving “adequate ventilation” bring light to a vague term with significant deficiencies that needs further research and interpretation. Starting with our standards and regulations, FHSA, CPSC, EPA, ANSI, OSHA and other regulations and agencies fail to give meaning to the term “adequate ventilation.” Both OSHA and ANSI state that ventilation is needed to reduce levels of the air contaminant. OSHA
acknowledges that there may be instances where flow rates differ and thus feel “adequate ventilation” is a better term. Both the Federal Hazardous Substances Act and Consumer Product Safety Act give no definition, yet adequate ventilation labels are accepted current guidelines.

Plaintiffs have helped to evolve the “adequacy” of warning labels throughout the years. It shows that the court system can be highly subjective when determining product liability and adequacy of labels. Even when the law is clear, all facts must be evaluated to determine if there is an adequacy problem or perhaps negligence. In determining the outcomes of cases, the court system essentially has the duty to protect the public with its interpretations of the law. It protects the public by setting benchmarks on what is acceptable as adequate and what is not.

As for the consumer, comprehension of warning labels is one of the key factors in protecting the public. Designers of labels often assume common sense but need to reach those in the public that least-skilled and make the warning understandable to all. Studies of cigarettes, a common product, show that people still fail to understand the full hazards associated with smoking. The cigarette manufacturers spend millions on aggressive marketing campaigns to influence targeted groups to purchase the product and have understood the need to give false information to create that connection of appeal between the consumer and the product, yet continuously want to exclude information linking the product to death. Extrapolating on this, how many in the general public understand products that are not used very often and could they gain information from the term “adequate ventilation?” Not only does it not provide enough information, consumers do not feel the harm or hazards that this warning is supposed to provide. The manufacturers and sellers of consumer products fail to give critical information to consumers by not informing the consumer on how to achieve proper ventilation or ventilation
that will protect the consumer. Some labels indicate opening windows and doors or say cross ventilation, but fails to reach the majority of the population in meaning. The label should include specifically how to ventilate mechanically, presumably with box fans, considering many homes have them or are easily found in stores.

Searching through methylene chloride MSDS’s and other products that have VOC’s give better information on the term “adequate ventilation.” However, products use this term along with additional information that might get lost to the general public due to how the warning is written. Upon reviewing several different products, the most common phrase to prevent vapor buildup was opening the windows and doors to provide cross ventilation. Simply opening the windows and doors of a specific area does not ensure a consistent exchange of air. Labels also say to use mechanical ventilation. The average user could possibly conclude that the term mechanical could mean to use a fan, but the label should reach those that cannot determine the meaning of mechanical ventilation. Products, such as those containing deadly methylene chloride, are readily available in the United States, not only to professionals, but to first-timers doing it themselves, with only the help of local store personnel. It is already known that the lack of knowledge chemicals and ventilation poses a public health threat.

When looking at the graphs, the clear trend is that people have a serious lack of education regarding commercial paint products and procedures that ensure safety. Unfortunately, almost all of this information is being passed on from employee to customer, person to person, which results in continual misinformation among the public, especially those who rely on the expert employees at their local retail stores. Many of the students reported that the employees had
absolutely no training on the products they were giving advice on, nor did many of the employees have much painting experience in their personal life.

The questionnaires from the unpublished class research has some margin of error. The information gathered was an oral response that was given a numeric designation, thus presenting subjectivity to the designation. Even though there is some error, it is safe to assume that the trend still holds true and that the above data is correct.

Graphic labels should be included on the back of labels. Along with specific information on how to create ventilation, an additional graphic warning label can create a snapshot of the ventilation requirements of a product, much the same way a skull and crossbones gives a consumer immediate information on a products health hazard. Below are 3 examples that could be added that can capture the danger of a product. Following guidelines from FHSA, EPA, or others, cautionary words can be added and the correct safety colors can be added.

(Figure 6)
The problem with adding new labels for the public is that fact that they are new and will take some time for consumers to get accustomed to and may not initially understand the full meaning. It will be essential to connect the graphic warning with the information on how to
achieve ventilation described earlier. It may be beneficial to show a graphic label on how to set
the room up for ventilation rather than a description. No label will be 100% effective nor can it
reach 100% of the public, but this gives some concrete meaning that reaches more of the
population than using the term “adequate ventilation.” Further study should be conducted on the
best designs for the graphic labels and determine if the labels achieve the goal of informing
consumers. Additional studies should be conducted on ventilation knowledge of “specialists” in
retail stores to determine the lack of knowledge extent.

Example Setup of a Room

![Example Setup of a Room](Figure 9)(Source Unknown)

Ultimately, manufacturers need to take responsibility for the health and well being of its
consumers. The manufacturers continuously put the blame on the consumer and even when the
courts find them at fault, the consumer eventually ends up paying for the court costs. The
manufacturers need to accept responsibility by fixing the labels, paying the court costs with their
profits, and not putting the cost on the consumer.
REFERENCES


Bituminous Casualty Corp. v. Black and Decker Co.  518 S.W. 2d 868. Texas Court of Civil Appeals.


Dean v. Morningstart et al. v. The Black and Decker Company. No. CC905. Supreme Court of Appeals of West Virginia.


Stobbe, Terry. University of Arizona.


APPENDIX

June 14, 2013

Jim McIntosh
Safety Technology

RE: IRBNet ID# 443068-1
At: Marshall University Institutional Review Board #2 (Social/Behavioral)

Dear Dr. McIntosh:

Protocol Title: [443068-1] Adequate Ventilation
Expiration Date: June 14, 2014
Site Location: MU
Submission Type: New Project APPROVED
Review Type: Exempt Review

In accordance with 45CFR46.101(b)(2), the above study and informed consent were granted Exempted approval today by the Marshall University Institutional Review Board #2 (Social/Behavioral) Chair for the period of 12 months. The approval will expire June 14, 2014. A continuing review request for this study must be submitted no later than 30 days prior to the expiration date.

This study is for student Chris Blankenship.

If you have any questions, please contact the Marshall University Institutional Review Board #2 (Social/Behavioral) Coordinator Michelle Woomer, B.A., M.S at (304) 696-4308 or woomer3@marshall.edu. Please include your study title and reference number in all correspondence with this office.