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## Fogging Danger Zones that Can Make Safety Eyewear Unsafe



Workplace and environmental conditions that cause anti fog treatments to fail and put your workers at risk

# Safety eyewear promotes workplace safety.

## Anti fog promotes safety eyewear compliance.

It's an established fact that 90% of the 2000 daily workplace eye injuries could be prevented if the victim had been wearing protective eyewear, such as safety glasses or safety goggles. By one estimate, the annual cost of eye injuries to employers is over \$300 million in lost production time, medical expenses and worker compensation.

The relationship between anti fog and the wearing of protective eyewear is well documented. In a 2009 study published in Accident Analysis & Prevention Magazine, research with focus groups made up of construction, manufacturing, service and retail workers showed that 100% of the groups named fogging as a factor for not wearing safety eyewear, number one among vision-related reasons. Over 55% of research respondents suggested an anti fog solution to increase usage of personal protective eyewear. It was named by more focus groups than incentives, warning signs, eyewear cleaning stations and as a condition of employment.

Nanofilm, the maker of Clarity Defog It™ anti fog, conducted a research study among attendees at the 2009 National Safety Council Congress and Expo. Over 70% of the professionals who took part in the survey stated they either manage or specify products for people who have a problem with fogged protective eyewear or have a personal workplace fogging problem themselves.

This article is intended to review some of the most challenging scenarios that can cause fogging problems and the very real hazards they create in workplace safety. If a high-performance anti fog isn't part of your organization's planning for safety in the workplace, you could be putting workers in significant danger.

### ***Danger Zone 1: The space between eyewear and face***

Anti fog treatments work by creating an invisible absorbent film on the lenses of eyeglasses, safety glasses and safety goggles. The film absorbs moisture as micro-droplets too small to see and spreads them across the film surface. As a person works, the build-up of body heat and the extra humidity created by perspiration put more moisture in the air and increase the likelihood of fogging. While eyewear styles let some of that heat and moisture escape, close-fitting safety glasses, side guards or wrap-around styles trap them. Closed safety goggles or faceshields can have an even greater problem. For maximum safety, an antifog must be able to perform in the hot, moist mini-climates created by closed safety eyewear.



### ***Danger Zone 2: High heat combined with high humidity***

This can be double-trouble for work safety. Whether these environmental factors are outdoor weather (construction, mining, utilities) or indoor conditions (pulp & paper, chemical processing, metal refining) the danger is real. The humidity creates more moisture, which an antifog must absorb and spread across the surface if it's to prevent fogging. The high heat increases the chance of condensation of that moisture on protective eyewear. In addition, the heat increases worker perspiration, further adding to the moisture problem.

Many commercial anti fog treatments are not well bonded to the surface, and, with continued exposure to moisture, literally are washed away. An anti fog that's formulated to chemically bond more tightly to the lens will provide longer lasting protection under the most challenging conditions.

### ***Danger Zone 3: Unknown lens surfaces***

Perhaps you've changed the type of safety glasses or other protective eyewear you provide and suddenly noticed an increased fogging problem. Or, your anti fog seems to work well for one employee, but fails for another. The lens material may be the culprit. Safety eyewear is made from several materials, such as acrylic, polycarbonate, other plastics, and even tempered glass. Many – especially prescription lenses – may have an anti-reflective, non-scratch or easy-clean coating on them. An anti fog that chemically bonds well to the surface of one may only bond loosely to another, which means it will be washed off more easily by humidity and perspiration.

The chemistry of formulating a broad-spectrum anti fog that bonds well to many surfaces is complex. Each type of lens material or coating has a specific “surface energy” based on its molecular and chemical structure. To adhere well to the material, an antifog must match that lens' specific surface energy. To perform effectively across a variety of materials, the formulation must contain a balance of surface-active agents to bridge the full range of surface energies found on today's lens materials.

### ***Danger Zone 4: Full-body gear***

As mentioned earlier, perspiration is the enemy of anti fog. Workers in full-body protective gear, including tactical officers, HAZMAT workers, firefighters, and nuclear utility workers, put extra stress on the antifog used on safety eyewear. Exertion in full-body gear creates more heat, and workers perspire. Moreover, the full body gear is also likely to include full-face protection as well. This creates a closed system that doesn't allow fog-causing heat and moisture to escape. In this situation, an anti fog must be performance-formulated, capable of absorbing high amounts of moisture and staying bonded to the lens of the safety glasses or safety goggles.

### ***Danger Zone 5: Environmental changes***

When pulp and paper workers experience the rush of steam from the paper drying process, they can be virtually blinded in an instant from the fogged safety eyewear. But the conditions don't have to be so extreme. A kitchen worker going from the walk-in cooler to the cooking area can have the same problem. A construction worker, mail carrier or warehouse materials handler who's moving between indoor and outdoor tasks is also at risk.

The anti fog must be fast acting, which requires a high concentration of moisture absorbing ingredients in the formulation, if workplace safety is to be maintained.

#### **• How can you test anti fogs?**

Before you put an anti fog into the field, consider testing its effectiveness in the Danger Zones. The Research chemists at Nanofilm, maker of Defog It, have developed a number of tests to measure performance under different conditions. However, you can approximate this work in these 20-min. experiments in your own company kitchen.

#### **• Heat and humidity test**

Measures the effect of heat and humidity on the coating.

1. Select samples of the safety eyewear you use in your workplace. If you have multiple types of lenses, test them all.
2. Apply anti fog to one lens and leave the other one bare.
3. Hold the protective eyewear over a pot of boiling water for 30 seconds.

If fog forms on the coated lens, you could have workplace safety problems in the real world.

#### **• Heat and cold cycle testing**

This simulates moving from hot to cold environments, such as working in commercial kitchens or the work pattern of people who move frequently from indoors to outdoors.

1. Select samples of the safety eyewear you use in your workplace. If you have multiple types of lenses, test them all.
2. Apply anti fog to one lens and leave the other one bare.
3. Place them in the freezer for 5 min.
4. Take them out of the freezer and breathe on the lenses to see if fog forms.
5. Repeat 2 or 3 times.

If fog forms on the coated lens of your eye protection, you could have problems in the real world.



# About Clarity Defog It Anti fog

Defog It anti fog multi-use cloths and liquid can keep optics fog-free up to all day with a single application. The formula is used by militaries around the world to prevent fogged protective eyewear in vision-critical situations. It's tested safe and effective on safety glasses, safety goggles, faceshields and eyeglasses.

Defog It has been field tested and proven by organizations with identified fogging issues, including global pulp and paper producers, utility companies, the National Tactical Officers Association Members, the U.S. Coast Guard, the National Ski Patrol and major U.S. mining organizations. In each case, users reported the improved vision clarity that promotes usage of protective eyewear and safety in the workplace.

The product has been rigorously performance tested. In one test, a lens treated with Defog It was held over constant hot steam for 60 minutes without fog forming. Similar anti fog products failed in as little as 5 minutes. In another test, lenses coated with Defog It were moved between cold and hot environments 100 times without fog forming.



## **Additional Resources**

**National Institute of Occupational Health and Safety:** *Toolbox Talk*  
<http://www.cdc.gov/niosh/topics/eye/toolbox-eye.html>

**Liberty Mutual Research Institute for Safety:** *Eyewear in the Workplace, Examining Barriers to Use*  
[http://www.libertymutualgroup.com/omapps/ContentServer?c=cms\\_document&pagename=LMGRsearchInstitute%2Fcms\\_document%2FShowDoc&cid=1239990441146](http://www.libertymutualgroup.com/omapps/ContentServer?c=cms_document&pagename=LMGRsearchInstitute%2Fcms_document%2FShowDoc&cid=1239990441146)

**Centers for Disease Control and Prevention:** *Eye Safety for Emergency Response and Disaster Recovery*  
<http://www.cdc.gov/niosh/topics/eye/eyesafe.html>

**Centers for Disease Control and Prevention:** *Eye Protection for Infection Control*  
<http://www.cdc.gov/niosh/topics/eye/eye-infectious.html>

**Centers for Disease Control and Prevention:** *Eye Safety Checklist*  
<http://www.cdc.gov/niosh/topics/eye/eyechecklist.html>

**Centers for Disease Control and Prevention:** *Eye Safety*  
<http://www.cdc.gov/niosh/topics/eye/>

**Reducing Eye Injuries in the Workplace:** *A Study of Personal Protective Eyewear and Antifog*  
[http://defogitworks.com/syncshow/uploaded\\_media/glmod\\_Modules\\_Knowledge-Center/Reducing\\_Workplacircbrvbares\\_research-1307655297.pdf](http://defogitworks.com/syncshow/uploaded_media/glmod_Modules_Knowledge-Center/Reducing_Workplacircbrvbares_research-1307655297.pdf)

**How to Improve Workplace Safety:** *Seven Simple Best Practice Tips*  
[http://defogitworks.com/syncshow/uploaded\\_media/glmod\\_Modules\\_Knowledge-Center/Seven\\_Tips\\_on\\_Workplace\\_Eye\\_Safety-1307631132.pdf](http://defogitworks.com/syncshow/uploaded_media/glmod_Modules_Knowledge-Center/Seven_Tips_on_Workplace_Eye_Safety-1307631132.pdf)