

Cab air quality: It's more important than you think.

Operator health and safety and machine productivity are two big reasons to consider advanced air quality systems for off-highway equipment. But there are more.



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Clean air inside an operator cab can positively impact machine users and owners in many ways. A few examples include increased employee comfort and retention, reduced HVAC maintenance and compliance with new regulatory limits for worker exposure to airborne particulates.

Whether you're purchasing new equipment or upfitting an existing fleet, specifying systems that ensure operator enclosure air quality can return your investment by multiples during the life of your off-highway assets.

Let's look at some of the major benefits of clean cabin air:

1. Protect workers on the job

People who work in physically demanding jobs like construction or mining take many precautions to protect themselves and their safety. They wear personal protective equipment. They go through extensive training to learn how to handle heavy

machinery properly. They learn how to protect themselves from falls, unsafe materials and more.¹

But there are other dangers to these workers they can't even see — because they're in the very air they breathe.

Every day, 2.3 million workers are exposed to toxic dust on the job², particularly in industries including, but not limited to, construction, mining, waste and oil and gas extraction. And it's not just workers who are outside and exposed to the elements; those who operate heavy machinery from an enclosed cab are at risk too.

That's because common worksite tasks like abrasive blasting, grinding, cutting and other such work can release crystalline silica dust into the air. Crystalline silica is a material commonly found in the earth's crust and in materials such as sand, stone, concrete and mortar³. But when these tiny particles are breathed in, they become incredibly dangerous, and even fatal. And not only can exposure to silica increase the risk of developing lung cancer⁴, it can also lead to a serious, incurable condition called silicosis that reduces the lungs' ability to function. The Centers for Disease Control and Prevention (CDC) estimates silicosis contributed to 2,065 deaths between 1999 and 2013⁵.

The negative health impacts of poor-quality air in the operator enclosures of heavy machinery are preventable by upfitting operator cabs of existing equipment with an air quality system or

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purchasing new equipment with a built-in cab air quality system. Cab air quality systems preclean the fresh air entering the HVAC system of an enclosed cab, deliver positive airflow to pressurize the cabin, continuously filter dust from the air inside an operator enclosure and monitor cab pressure alerting operators when cab air pressure drops below a user-set minimum.

Overall, operator enclosure air quality systems provide a more healthful working environment for operators by creating cleaner and safer cab air and reducing the risk of occupational illness.

2. Cut HVAC maintenance needs

Reducing the amount of dust and airborne particulate from a machine’s cab doesn’t only help protect the health of the operators — it also helps protect the machines themselves. Even though they’re built for tough, rugged work, construction, mining and other heavy equipment contain deli-

cate components in the cab, like electronics, that are negatively impacted by continuous exposure to dirty air.

A machine’s HVAC system is especially susceptible to damage when dusty, particle-filled air constantly passes through it, increasing the need for filter changes and other repairs, often between regularly scheduled maintenance. This can lead to costly unplanned equipment downtime and a hefty price tag for parts, labor and reduced productivity — which can also mean missed deadlines and an increased burden on other operators⁶ and machines.

Malfunctioning or ineffective HVAC systems can further reduce productivity by creating a harsh work environment for the machine operator. Instead of a comfortable, cool cab filled with clean air, their work space becomes hot and dusty, leading to more frequent work breaks.

3. Reduce employee turnover

Providing a comfortable work environment for equipment operators is of no small importance in today’s employment landscape. In 2010, after the recession had officially ended, the construction industry was seeing 26 percent unemployment⁷, causing many workers to leave the industry out of necessity. Now that the economy has rebounded, there’s a gap in the workforce where those workers used to be.

In August 2018, the Associated General Contractors of America reported the construction industry had added 303,000 jobs over the past year, with employment reaching its highest point in 10 years⁸. And yet, the same month they reported that 80 percent of construction firms are having a hard time filling hourly craft positions, which constitute the bulk of the construction workforce⁹.



A. Before the installation of a cab air quality system, the fins in the HVAC evaporator coils are clogged with debris and a layer of dust covers the compartment.



B. One year after the installation of a cab air quality system, the fins in the HVAC evaporator coils are clean and the compartment is not dusty.

OSHA Standard 29 CFR 1926.1153

On March 25, 2016, the Occupational Safety and Health Administration (OSHA) issued a final rule on respirable crystalline silica dust. The new rule updated regulations established more than 40 years ago and introduced requirements for reducing an employee's exposure to silica dust. The final rule is written as two standards: one for construction and one for general industry and maritime.

Under the existing silica rule established in 1971, employers were responsible for testing exposure and finding ways to limit exposure below approximately 250 micrograms per cubic meter of air (250 µg/m³) averaged over an 8-hour workday. The new standard aligned the permissible exposure limit (PEL) for the construction industry and general industry to a current limit of 50 µg/m³ averaged over an 8-hour workday. According to OSHA, the new PEL is expected to prevent hundreds of silica-related deaths and illnesses each year — including 900 new cases of silicosis¹³.

To whom does this apply?

The standard states, "For each employee engaged in a task identified on Table 1, the employer shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task on Table 1."

What equipment qualifies?

Table 1 entries include the use of the following equipment:

- Vehicle-mounted drilling rigs for rock and concrete
- Heavy equipment and utility vehicles used to abrade or fracture silica-containing materials (e.g., hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials
- Heavy equipment and utility vehicles for tasks such as grading and excavating

Enclosed cab specifications

The standard further requires that enclosed cabs or booths:

- Are maintained as free as practicable from settled dust
- Have door seals and closing mechanisms that work properly
- Have gaskets and seals that are in good condition and working properly
- Are under positive pressure maintained through continuous delivery of fresh air
- Have intake air that is filtered through a filter that is 95 percent efficient in the 0.3–10 micron range (e.g., MERV 16 or better)
- Have heating and cooling capabilities¹⁴



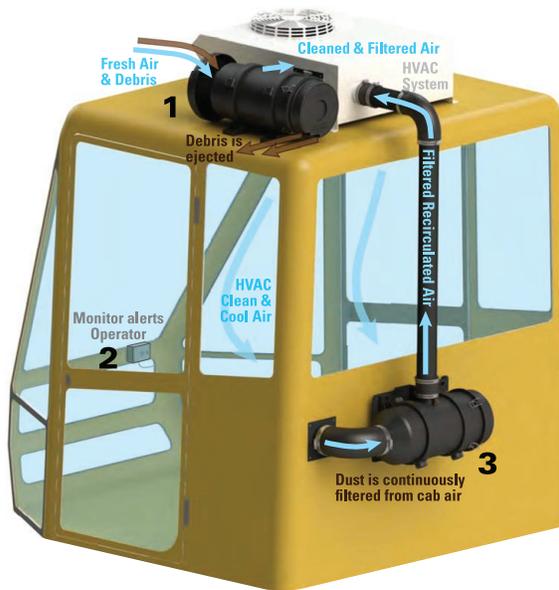
With a shortage of workers, it's more important than ever for companies to be able to attract and retain workers. Not only can this help ensure projects are properly staffed and deadlines are being met, but it limits the cost of having to replace employees, which the Center for American Progress estimates at between 16 percent of an employee's base pay all the way up to 213 percent of an annual salary¹⁰. And that's to say nothing of the time and paperwork needed to exit the employee, arrange for coverage, and recruit, hire and train a full-time replacement.

4. Manage health care costs

Providing clean air can also reduce health care costs for employers. Interstitial lung diseases (including silicosis) put a \$1.8 billion burden on the U.S. health care system according to an estimate from a 2018 study by the European Respiratory Review. These costs include diagnostic processes and evaluation, care of comorbidities, care for the interstitial lung disease itself (including end-of-life care), and acute exacerbations requiring trips to the ER and/or hospitalization¹¹. A double lung transplant, the only treatment for advanced silicosis, costs more than \$540,000¹².

A 2015 study by the National Institutes of Health estimated the U.S. spends \$13.4 billion on lung cancer care, with \$36.1 billion lost in productivity due to early death from lung cancer.

How the Sy-Klone RESPA® cab air quality system works



1 Fresh air precleaning, pressurization and filtration

- Powered precleaner removes 90 plus percent of airborne particles before it reaches the filter and delivers positive airflow to pressurize the cab enclosure
- MERV 16* filter
 - Filter media drops debris, which is ejected from the filter housing
 - Minimum average efficiency of ≥ 95 percent on particle sizes 0.3 to 10 microns or micrometers (a micrometer is one millionth of a meter)
- HEPA filter options also available

2 Cab pressure monitor (positive air pressure inside an operator enclosure helps prevent dust and harmful particles from entering a sealed cab)

- Continuous pressure readings
- Alerts operator when cab air pressure drops below user-set minimum

3 Recirculated air filtration

- Continuous air purification ensures cab air quality
- MERV 16* filter sheds debris, providing a minimum average efficiency of ≥ 95 percent on particle sizes 0.3 to 1.0 microns or micrometers
- HEPA/H13, Gas + HEPA/H13, and Odor + HEPA/H13 filter options are also available

*MERV 16 rated media

How to achieve clean air

Air quality systems are an effective way to reduce the number of harmful airborne respirable particles inside enclosed operator cabs. Major original equipment manufacturers (OEMs) have begun to design cab air quality systems into their next-generation cab enclosures. New off-road machines with an installed cab air quality system are available for direct purchase from a factory.

Existing equipment needs to be assessed and tested in real-world working conditions to determine its baseline performance. If machines don't meet requirements, they can be retrofitted with readily available cab air quality systems.

Final thoughts

Exposure to crystalline silica and toxic dust can have harmful and far-reaching effects for construction workers, off-highway vehicles, companies and even the U.S. health care system. But having advanced operator enclosure air quality systems in place can greatly reduce the risks by both removing dangerous particulate from the fresh air before it reaches the cab and continuously filtering the recirculated air inside the cab. The result is a healthful and safer working environment for equipment operators.

Resources

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About Sy-Klone

Sy-Klone is a worldwide leader in the design and production of advanced air filtration systems for equipment operator cabs, HVAC units and engine compartments. Considered pioneers in the industry of air precleaning and adaptive filtration, Sy-Klone International owns more than 60 patents and is a Tier-1 supplier to many of the largest equipment OEMs in the world.

Sy-Klone's RESPA® Cab Air Quality System is a proven solution for bringing operator exposure levels below required thresholds for both the OSHA silica rule and Mine Safety and Health Administration (MSHA) standards. The system is also endorsed as a Best Practice by the International Society of Environmental Enclosure Engineers (ISEEE).

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