CAB AIR QUALITY CASE STUDY

Aggregate site reduces occupational exposure and improves machine operator alertness with ISO 23875-compliant RESPA® cab filtration system

Problem:

Daily operations at aggregates sites and quarries produce a significant amount of dust during the extraction, processing, and transportation of aggregates and natural resources. Byproducts of operations may produce harmful respirable particulate, such as silica. Long-term exposure to harmful respirable dust may cause chronic lower lung diseases, including silicosis and lung cancer. In addition, dust impacts machine performance, resulting in downtime, higher maintenance costs, and increased Total Cost of Ownership (TCO) for a company's heavy machinery.

Solution:

To support occupational exposure reduction programs, a global aggregates company implemented a field test of ISO 23875-compliant cab air quality systems on two pieces of heavy equipment. ISO 23875 is a cab air quality standard that identifies engineering requirements including filter efficiency, safe CO_2 levels, and pressurization levels to improve air quality inside of operator cabs.

Implementation of ISO 23875 with compliant cab air quality systems provided the site with both health and safety and operational benefits.

Benefits:

- Reduced operator fatigue by maintaining CO_2 at a low level
- Reduced exposure to harmful respirable dust to levels below permissible limits
- Ensuring CO_2 and dust are managed through continuous cab pressurization, fresh air exchange, and real-time monitoring
- Cleaner machine cabs, resulting in less dust and debris impacting sensitive controls and components, potentially extending service intervals and the life of air conditioning components, such as the evaporator core

System Installation and Integration:

Sy-Klone RESPA cab air quality fresh and recirculation systems with HEPA filters and the RESPA Advisor+ (CO_2 and pressure monitor) were specified and installed on a haul truck and wheel loader. The process, followed from pre-installation through long-term performance measurement, included:

- Machine cab inspection and measurement prior to installing cab air quality systems to establish a comparative baseline
- Inspection, identification, and sealing of air leaks inside the cabs
- Short-term performance measurement and testing immediately following the installation of the cab air quality systems
- Long-term performance measurement and re-testing of the machines eight months after the cab air quality system installations

The Basics of ISO 23875

ISO 23875 is a cab air quality standard that outlines engineering controls and performance requirements to improve air quality in operator cabs, including:

- Defined CO_2 levels
- Recirculation system efficiency
- Increased filter efficiency requirements
- Defined pressurization requirements
- Real-time cab monitoring

THE BENEFITS OF CLEAN AIR:

"Equipment stays cleaner inside. Machine operator states 'air seems to be more fresh'. He has noticed his energy level throughout his 10 to 11 hour day seems more consistent not the peaks and valleys throughout the day."

Site Manager, Aggregate Quarry

HAUL TRUCK

FRESH AIR UNIT:
RESPA CF2

Engineering Controls Installed

- **RESPA® CF2** Powered Fresh Air Precleaner/Filter/Pressurizer with HEPA filtration
- **RESPA FFX2** Non-Powered Recirculation Air System with HEPA filtration (2 Units)
- **RESPA Advisor®+** CO_2 and Pressure Monitoring System

INSIDE CAB

RECIRCULATION UNITS:
RESPA FFX2
DUAL UNITS INSTALLED

MONITOR:
RESPA ADVISOR+

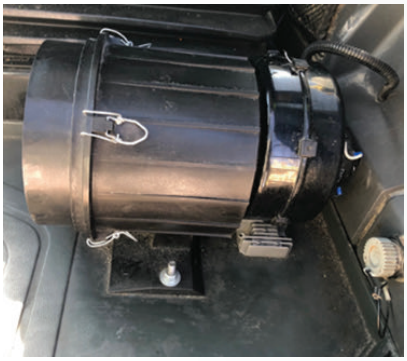
WHEEL LOADER

FRESH AIR UNIT:
RESPA CF

Engineering Controls Installed

- **RESPA CF** Powered Precleaner/Filter/Pressurizer Fresh Air System with HEPA filtration
- **RESPA PFX** Powered Recirculation System with HEPA filtration
- **RESPA Advisor+** CO_2 and Pressure Monitoring System

RECIRCULATION UNIT: RESPA PFX IN CAB



"I really feel from my ongoing conversations with the operators that this has been an asset to the machines' operators in their alertness and ability to stay focused."

Site Manager,
Aggregate Quarry

Test Results

Following the ISO 23875-compliant installation, both the haul truck and wheel loader showed significant improvements and passed all ISO 23875 engineering control tests, including CO_2, dust decay, external system leakage, and cab pressure tests. Approximately eight months after the installation, both machines were tested again. The air quality improvements were sustained and the haul truck and wheel loader again passed all ISO 23875 engineering control tests.

Equipment	CO_2 Test	Dust Decay Test	External System Leakage Test	Cab Pressure Test
ISO 23875 Requirement	CO_2 concentration must be less than the ambient CO_2 concentration plus 400 PPM. Test site ambient CO_2 455 PPM plus 400 = 955 PPM	Decay must be under two minutes	Dust concentration not to exceed 100 ug/m^3	Minimum cab pressure 20 Pa, Maximum cab pressure 200 Pa
Haul Truck	Status: PASSED ✓	Status: PASSED ✓	Status: PASSED ✓	Status: PASSED ✓
Wheel Loader	Status: PASSED ✓	Status: PASSED ✓	Status: PASSED ✓	PASSED at low fan speed *

*Pressure below threshold at low fan speed, however, exceeded 200 Pa at medium and high fan speeds

Conclusion

Cab air quality in the haul truck and wheel loader has been significantly improved with operators experiencing increased productivity, alertness, improved comfort, and much cleaner cabs. **Read the complete report at Sy-Klone.com/blog**