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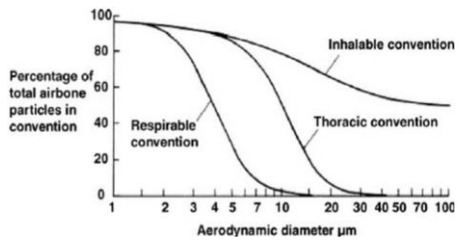
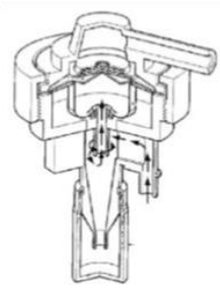
Application Notes – Respirable dust containing free crystalline silica, metals, asbestos or other hazardous particles in occupational health and safety

The respirable fraction of the dust, particles generally considered to be smaller than 5µm (millionth of a meter), can penetrate to the innermost reaches of the respiratory tract in the lungs. These are the alveoli or air sacs where exchange of oxygen and carbon dioxide occurs. Dust particles, which land on these surfaces, are removed by white blood cells known as macrophages. The convention for these size fractions is described in ISO 7708 or EN 481.

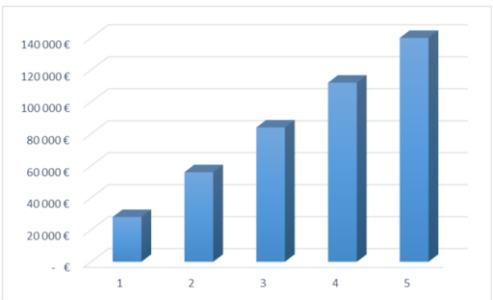


In this case particles of free crystalline silica cause the macrophages to break open. The result is the formation of a scar like patch on the surface of the alveolus. A formation of large numbers of “scars” following prolonged exposure causes the alveolar surface to become less elastic. This reduces the transfer of gases. This is noticed as shortness of breath following exertion. Symptoms seldom develop in less than five years and in many cases may take more than 20 years to become disabling.

For example, according to DIRECTIVE NUMBER: CPL-02-00-160 in US, the Permissible Exposure Limit (PEL) for crystalline was recently reduced to 50µg/m3 (micrograms per cubic meter of air).Employers will be required to monitor crystalline silica exposure if there is a risk that workplace levels exceed 25µg/m3 for at least 30 days in a year and provide medical monitoring to employees in those workplaces. In Europe the required number of samplings are in a range between 4 times per year to once per 24 months.



Worldwide numerous national guidelines and laws on hazardous Permissible Exposure Limits and how they need to be followed are written. What they all have in common is that they are based on periodic measurement with gravimetric samplers and an exact laboratory evaluation. The performance criteria of the sampler are outlined e.g.in EN 13205-1: 2014. Air monitoring should be representative of the working periods of the individuals exposed. General guidance on workplace monitoring is given in monitoring strategies for toxic substances (HSG173 or ISO 15767). A longer sampling time ensures a heavier deposit and reduces potential weighing inaccuracies. So, sampling times should be as long as is reasonably practicable.



What all these norms and regulations are not answering is the question:

“What is the situation before and after the sampling period?”

The affected companies are facing some challenges:

How to make sure that the next sampling is within the limit?

One goal is also to reduce the number of samplings (they are very expensive and disturb the work routine). It is fair to say that the total cost of one gravimetric sampling is about 300 to 400 USD/Euro includ ing the analyzation. This would mean for a 20-person production at 4 samples per year a negative cash flow of 140.000€ in a course of 5 years.

This calculation does not take into account any medical costs, sickness leaves or disturbances in the workflow. And finally; how to avoid the harsh fines and consequences? Next to extremely high financial penalties, severe cases or willful violations could be deemed as and followed up as a criminal act.

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QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

Est 2003

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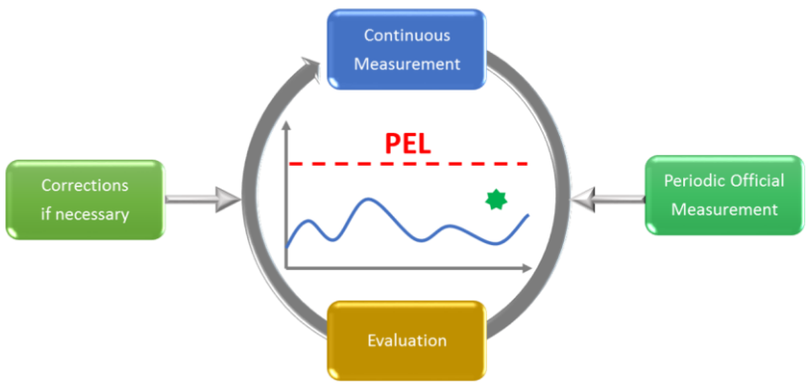
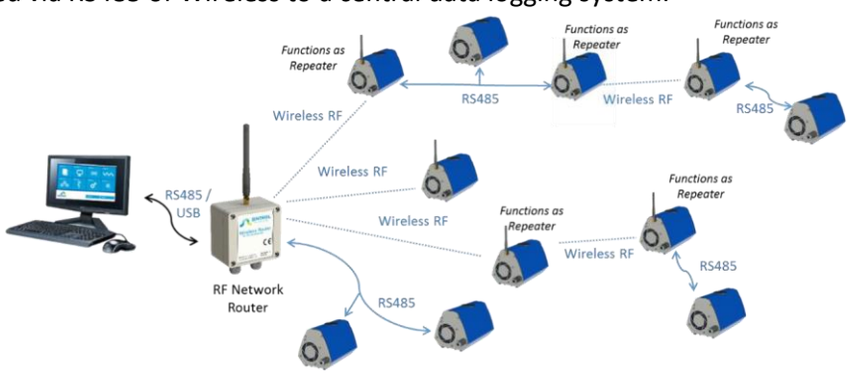
The answer is constant measuring to assure always being below the limit.



The basic principle is to perform the periodic official measurement and calibrate with the measurement results the constant measurement device. Usually analyzers which give an ongoing reading of certain respirable particles are extremely expensive and therefore if at all only applicable for one-point measurements.
Our idea is to implement an affordable and flexible multipoint measurement of total suspended dust24/7. All monitors are connected via RS485 of Wireless to a central data logging system.



We are aware that respirable dust of a certain material is only a portion of the total dust and cannot actually be seen.

However, if the total airborne dust is rising, a problem is likely to exist.

It is fair to state that the same raw material will have a similar content of hazardous material. Therefore, it is possible to correlate the official measurement to total suspended dust.

Examples of the types of dust found in the work environment include:

- Mineral dusts, such as those containing free crystalline silica (e.g., as quartz), coal and cement dusts;
- Metallic dusts, such as lead, cadmium, nickel, and beryllium dusts;
- Other chemical dusts, e.g., many bulk chemicals and pesticides:
- Organic and vegetable dusts, such as flour, wood, cotton and tea dusts, pollens;
- Biohazards, such as viable particles, molds and spores

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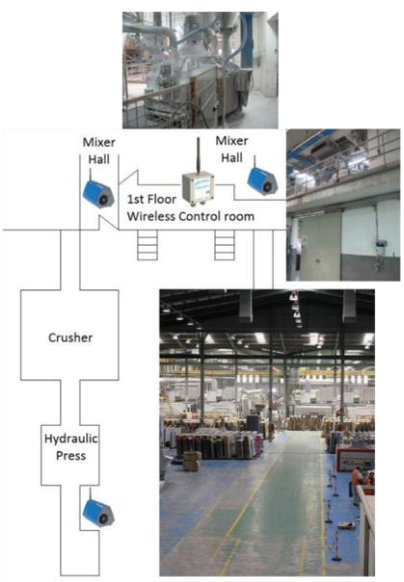
Application Cosentino Stone Processing

Cosentino Group is a global, Spanish, family-owned company that produces and distributes high value innovative surfaces for the world of design and architecture. Cosentino has 7 production factories, 12 natural stone quarries and 13 processing centers around the world. The minimization of dust emissions to the atmosphere during operations for delivering materials, storage, transportation, the measuring and mixing of crushed and micronized materials is anchored in Cosentino's Policies for sustainability.



The initial need for a flexible dust measurement system was born with the establishment of a new production line which needed to be optimized. The goal was to diminish the exposure of dust and free silica to the workers by enhancing the ventilation system. In order to capture in depth background information of how the dust is spreading within the production hall a system of five wireless dust monitors (Dumo) has been installed. With the results of the measurements as a base, two additional automatic doors and modifications to the ventilation system has been executed.

After these implementations, the system is today used to continuously follow up the dust concentrations in the production on neuralgic positions. Cosentino's aim is to be notified of abnormal conditions immediately in order to assure that their workers are never exposed to extensive dust or silica levels. They are using the Dust Log software as a reporting system and working on reducing the number of officially requested gravimetric samplings. The biggest challenge of this application is the enormous amount of different stones and raw materials which all contain different amounts of free silica. So, the correlation with the total dust, measured by the Dumo required in depth analyzes and experience.

As a next step Cosentino plans to equip the second production line with five more Dumos. As the relevant positions are now known, Cosentino decided to go for a fixed solution and wire the instruments to their distributed control systemin order to have the possibility to adjust right away the production process if necessary.

Principle of Operation

Sintrol dust monitors are based on a unique Inductive Electrification technology. The measurement is based on particles interacting with an isolated probe mounted into the duct or stack. When moving particles pass nearby or hit the probe a signal is induced. This signal is then processed through a series of Sintrol's advanced algorithms to filter out the noise and provide the most accurate dust measurement output.

Classic triboelectric technology is based on the DC signal, which is caused by particles making contact with the sensor to transfer charges. Compared to DC based measurements, the Inductive Electrification technology is more sensitive and minimizes the influence of sensor contamination, temperature drift and velocity changes. By using the Inductive Electrification technology, it is possible to reach dust concentration measurement thresholds as low as 0.01 mg/m3.

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