Artificial or Engineered Stone: Composition, Usage, and Occupational Safety and Health

Artificial or engineered stone, also referred to as manmade stone, is a manufactured composite material characterised by a high concentration of silica. It is created by binding finely crushed crystalline silica with polymer resins, along with metals, inorganic fillers and pigments, to form a hardened composite structure.

The crystalline silica content in artificial stone is significantly higher than that found in natural stones. While natural stones, like marble and granite, typically contain 3% to 40% silica, artificial stone can contain up to 95%.

The production and installation of artificial stone involve processes such as machining, crushing, cutting, drilling, abrading, abrasive blasting, grinding, chiselling, carving, polishing, fracturing, intentional breaking, or chipping of slabs. These activities pose potential occupational hazards due to the release of, among others, silica dust.

Artificial stone has become a popular replacement for natural stone, especially in the manufacturing and installation of kitchen and bathroom countertops. These tasks are frequently carried out in small workshops that lack proper industrial conditions and in residential settings during in-home installations, adding to the challenges of maintaining adequate safety standards.

The majority of these workers are represented by other federations, if at all. IndustriAll Europe does not represent workers in these sectors. However, due to industriAll Europe's long-standing work on respirable crystalline silica (RCS) and our leading role in NEPSI[i], we are a natural participant in the discussion around adequate policy responses to the health risks.

The aim of this document is to raise awareness of the topic, the challenges that have to be addressed, and potential measures. It can serve as a basis for further discussions.

The "Re-emergence" of Silicosis

Exposure to the substances contained in artificial stone has led to a "re-emergence" of silicosis. Workers exposed to silica dust are at risk of developing silicosis, a debilitating lung disease, as well as other severe health conditions, such as kidney damage and autoimmune diseases. Exposure to respirable crystalline silica can cause symptoms including shortness of breath, persistent cough, and fatigue. While traditional forms of silicosis typically take 10 to 30 years to develop, workers exposed to high concentrations of silica dust are at risk of developing the disease much more rapidly.

The type of silicosis linked to artificial stone dust differs significantly from its traditional forms. It is characterised by a short latency period and rapid progression to progressive massive fibrosis (PMF), the most severe form of dust-related lung diseases. Many affected individuals are young workers.

Limited Data but Rising Incidence

Although extensive studies on silicosis in engineered stone industries remain scarce, smaller case studies and reports highlight the gravity of the issue. For example:

- A study conducted in Spain revealed that around 50% of workers in certain factories were affected.[1]
- In Australia, radiological evidence of silicosis has been observed in 20%–30% of workers, with one-third of these cases progressing to PMF.[2]
- Similar trends have been documented in other countries, including Israel, Italy, China, and the United States, where disease incidence and mortality rates are climbing.[3]

To date, the lack of reliable, cross-country comparative data prevents a comprehensive view. Suspected under-reporting suggests the problem may be even more widespread than current statistics indicate.

International Policy Responses to the Risks of Artificial Stone

The rising health risks associated with engineered stone have prompted various international policy responses to protect workers from exposure to respirable crystalline silica (RCS) and mitigate its long-term impacts:

Australia's Ban on Engineered Stone

On 13 December, 2023, Australia announced the decision to ban the importation and installation of engineered stone on its territory. This decision followed a four-year scientific inquiry conducted by the National Dust Disease Taskforce (NDDT) in collaboration with Safe Work Australia (SWA) and with the involvement of trade unions.

California's Proposed Legislation

California envisages a different legislative approach, focussing on the management of the risks of artificial stone. A proposed bill would:

- Prohibit the use of dry methods in stone processing.
- Require specialised training for workers, including the adaptation of training curricula within apprenticeship programmes.
- Mandate that employers be certified to ensure compliance with safety protocols.

[1] Antonio Leon-Jimenez et al.: Compositional and structural analysis of engineered stones and inorganic part, 2021
[2] Safe Work Australia: Decision Regulation Impact Statement: Prohibition on the use of engineered stone, 2023
[3] Antonio León-Jiménez et al.: Artificial Stone Silicosis Rapid Progression Following Exposure Cessation, 2020

The Discussion in Europe

In Europe, there is growing debate over whether to follow Australia's example and ban artificial stone altogether. But some of the other policy options under consideration include:

- **Limiting RCS Content**: Introducing a cap on the amount of respirable crystalline silica allowed in artificial stone products.
- **General Dust Value Limits**: Establishing permissible dust exposure thresholds for all forms of dust.
- **Employer and Worker Training**: Providing clear instructions on protective measures, defining which tasks can be safely performed on-site at a customer's home versus those that require controlled conditions in a workshop.
- **Safer Production Methods**: Encouraging practices like:
    - Using continuous streams of water on work surfaces to suppress dust.
    - Employing low-dust cleaning techniques, such as construction vacuum cleaners, air cleaners, and dust barriers.

The Challenge of Disposal and Recycling

An often-overlooked issue in policy discussions is the safe removal and recycling of artificial stone once a consumer decides to dispose of it. Questions remain about who will be responsible for its safe handling and whether adequate safety measures will be in place to prevent further health risks during disposal and recycling processes.

Is it RCS or Something More?

Respirable crystalline silica (RCS) from artificial stone differs significantly from that contained in natural stone. One key distinction is its physical properties: artificial stone generates a much higher proportion of very fine RCS particles, which are capable of penetrating deeper into the lungs.

In addition to RCS, other components of engineered stone—such as resins, metals, amorphous silica, and pigments—may play a role in the toxic effects of artificial stone dust.

Consequently, biomedical literature has begun to explore whether the diseases linked to artificial stone are caused by an interaction, or "cocktail effect," between RCS and other components of engineered stone. For example, could the presence of metals, such as aluminium or cobalt, enhance the toxic potential of silica dust?

Further research is needed to better understand the mechanisms and to inform the development of more targeted safety measures and regulations.

Occupational Exposure Limit for Respirable Crystalline Silica (RCS)

The current limit for RCS dates from 2017. The Carcinogens, Mutagens, and Reprotoxic Agents Directive introduced a binding occupational exposure limit (BOEL) for RCS at 0.1 mg/m³. A re-evaluation is in progress. Recognising the high residual risks posed by this limit, the Directive mandated a reassessment of the current OEL. The tripartite Advisory Committee for Safety and Health (ACSH) has been tasked with reviewing the RCS limit value. It has recommended that the European Commission conduct an impact study to assess the feasibility of lowering the BOEL to 0.05 mg/m³.

[i] NEPSI is the acronym for the European Network for Silica formed by the Employee and Employer European sectoral associations that signed the Social Dialogue 'Agreement on Workers' Health Protection Through the Good Handling and Use of Crystalline Silica and Products Containing it' on 25 April 2006.