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SMOG-Eating Tile:

A Real-World Product for Reducing the Harmful Health Effects of Contaminated Air

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Smog-Eating Tile

A Real-World Product for Reducing the Harmful Health Effects of Contaminated Air

The following article was originally published in the January 2012 issue of RCI Incorporated's technical journal **Interface**. *RCI is a professional association of building envelope consultants whose members specialize in the design, investigation, repair and management of roofing, exterior wall and waterproofing systems. For more information, visit www.rci-online.org or call (800) 828-1902.*

By **JOHN RENOWDEN**, CEng, FIMechE

Shelter is one of our basic human needs, and the roof is the most important element of any shelter. Throughout time, there have been many different materials used for roofing, and tile has been the most enduring. Tile has provided the unique combination of form and function, being both aesthetically pleasing and highly durable. Rarely, however, has it been associated with preventive health measures and increasing human lifespan.

Currently, a key topic in the roofing industry is sustainability, and it has taken centre stage with both builders and consumers, as well as with the architects and contractors who support them. While the use of eco-sound materials in roofing technology can be seen as nothing less than good for the planet, it is hard to see a direct correlation between the use of these earth-friendly materials and the potential for improving health.

In 2010, Boral Roofing sought to make that correlation when it introduced the Boral Pure roof technology to the United States builder and consumer markets. Often referred to as "smog-eating tile," this revolutionary concrete tile roofing system employs a photocatalytic technology that helps to clean the air.

HOW IT WORKS

The first and only product of its kind in the U.S. roofing industry, smog-eating tile integrates titanium dioxide (TiO_2) into a micromortar coating over the upper tile body. Safely embedded in the coating, titanium dioxide is found in many consumer and industrial products; and when exposed to sunlight, it speeds up the oxidation process of nitrogen oxide (NOx), a major component of smog that is found in high levels in major metropolitan regions where cars and freeways are prolific.

Smog-Eating tile oxidizes harmful NOx, molecules released from vehicles, helping to make air safer to breathe. The roof coating contains a photocatalyst, activated by day-light, which helps convert harmful nitrous oxides into calcium nitrates. When it rains, the calcium nitrates are then washed off the roof.

Some major health problems are directly attributable to the NOx formed during any burning process. Over one year, 2000 sq. feet (185.8 m^2) of the tile can oxidize as much NOx as a car produces from being driven up to 10,800 miles (17,381 km).[1] Thus, the tile's air-cleansing process represents one real way that builders and homeowners alike can reduce smog and the occurrence of the health problems it causes.

WHY DOES IT MATTER?

Smog taints the skylines of many of the world's great cities, covering blue skies with a brown haze. While unattractive to view, the harm in smog runs much deeper. The World Health Organization (WHO) recently estimated that 2.4 million people worldwide die annually from causes directly

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attributed to air pollution. Weighing in closer to home, the American Lung Association, in its prominent 2011 "State of the Air" study, found that more than 154 million people (over half the nation) still suffer pollution levels that are often dangerous to breathe.[2]

The American Lung Association cites numerous health concerns and conditions caused by smog. They include premature births, infant deaths, chronic obstructive pulmonary disease, allergies, asthma, reduced lung function, premature death, lung cancer, heart disease and heart attacks. These diseases and conditions can often be fatal. The bottom line is that when you reduce the levels of smog in the air, you raise the life expectancy of people breathing that air.

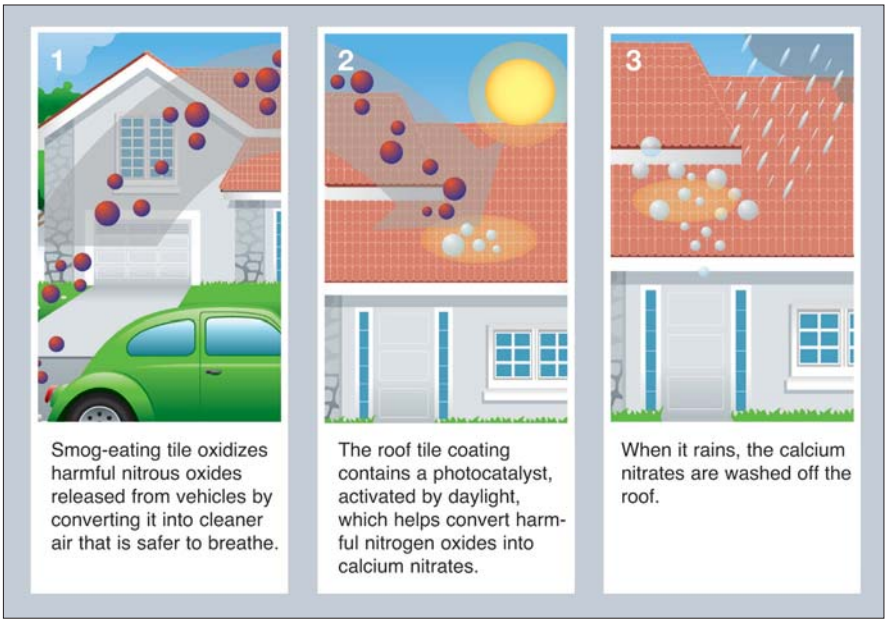

Figure One. How it works

TITANIUM DIOXIDE – IS IT SAFE?

Titanium dioxide, the photocatalyst that instigates the smog-eating tile's air-cleaning process, is a proven de-pollutant that is both naturally occurring and safe for humans. The compound is commonly found in a number of items that we interact with daily such as paints, cosmetics, aspirin, toothpaste and white roof membranes. It is now also being used in hospitals on operating room walls for sterilization purposes.

Titanium dioxide's depolluting and desoiling capabilities are proven. The notable European PICADA Project[3] studies demonstrate the capabilities of TiO_2 as a key ingredient in coatings. Conducted by a consortium of leading European contractors, manufacturers and research centres, the PICADA Project fully demonstrates titanium dioxide's depolluting properties against nitrogen oxide and volatile organic compounds (VOCs), the key ingredients of smog.

"In the studies conducted in Europe where they actually applied (titanium dioxide) to roadways, the air was measurably cleaner," said President Michael Chusid of Chusid Associates, a marketing and technical consultancy on building products. "It works."

ADDITIONAL BENEFITS OF TITANIUM DIOXIDE

In addition to its ability to reduce the formation of smog molecules, the titanium dioxide coating on the smog-eating tile adds another benefit to home-owners with this concrete roof solution. It is a stay-clean technology that can break down organic substances that commonly accumulate on roof surfaces. Substances such as mold and algae are destroyed when UV light hits the roof surface. The visible organic materials on the roof then become transparent, maintaining the appearance of the structure.

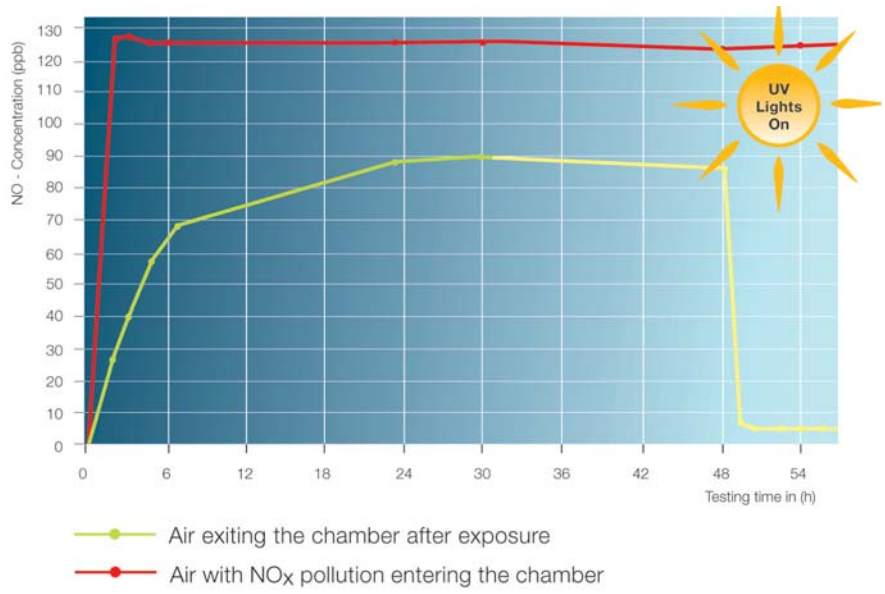

Figure Two. The Franhofer Institute set up a test cell that shows how smog-eating tile causes a significant decrease in air pollution when exposed to UV lighting. The UV rays actually encourage smog reduction with a photocatalytic action.

CONCRETE TILE – A SUSTAINABLE, LIFETIME PRODUCT

While smog-eating tile provides health benefits with its coating, the base material of the tile also offers many efficiency and earth-saving benefits. Concrete tiles are made of locally sourced raw mineral materials – a mixture of sand, water and cement. It is an energy-efficient solution that helps homeowners achieve up to 22 per cent in energy savings.[4] Concrete roof tile helps to keep a home cooler in summer months and warmer in winter months. These temperature-regulating qualities reduce a homeowner's need for heat and air conditioning, providing valuable energy cost savings.

Concrete tile is also a lifetime product requiring little maintenance.[5] Concrete roofing protects against inclement weather and fire. And, when a homeowner decides to replace the roof for whatever reason, concrete tile can be recycled to create new structures and roads, and reduce landfill

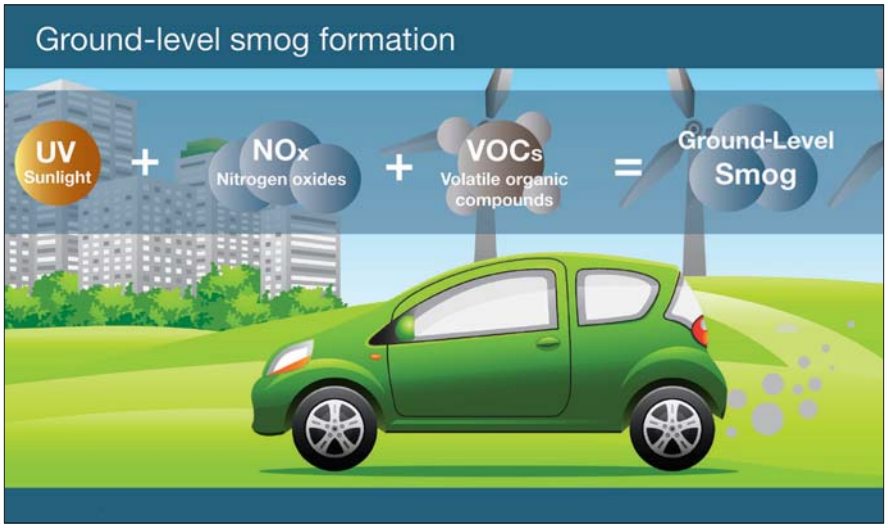

Figure Three.

waste. In an added commitment to the planet, Boral produces its concrete roof solutions in eco-conscious manufacturing plants.

With installation processes in line with other tile roof solutions and the sustainability, energy-efficiency, cost-savings, lifetime solution and air-cleaning qualities, why wouldn't builders and homeowners turn to smog-eating tile? The benefits are too great to be ignored.

REFERENCES

(1) U.S. Environmental Protection Agency Vehicle Program, Tier 2 Standard. Daylight hours based on Los Angeles, CA. Laboratory air-purification performance testing per ISO 22197-1./ Results may vary, depending on geographic location, weather and other factors, including but not limited to NOx concentration in the air.

(2) American Lung Association, 2011 "State of the Air Report." www.lungusa.org.

(3) PICADA: Photocatalytic Innovative Coverings Applications for Depollution Assessment, Europe, 2004.

(4) "Steep-Slope Assembly Testing of Clay and Concrete Tile," Oak Ridge National Laboratory, 2005. Results vary based on profile of tile installed.

(5) Boral Roofing concrete tiles are covered by a limited lifetime, fully transferable, non-prorated product warranty. See www.boralna.com for full coverage details.

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John Renowden is vice president of product development for Boral Roofing, with more than 25 years in technology-based manufacturing. He serves as senior product manager, responsible for Boral's product portfolio, including new product development, installation practices and building standards throughout the U.S. Renowden has also served as principal systems engineer, analysing and providing recommendations for the company's manufacturing and production operations. He hails from the United Kingdom, where he held management and engineering positions at Redland Technologies, an international building materials company. With degrees in mechanical and electrical engineering from Bath University of Technology in Bath, England, he also holds two professional qualifications of chartered engineer (CEng) and Fellow of the Institution of Mechanical Engineers (FIMechE). Renowden's webinar is available on demand in the GreenExpo365.com auditorium.

Figure Four. (Above) Boral Pure Barcelona, kern canyon blend, high profile.

Figure Five. (Below) Boral Pure country slate, Whitney grey, low profile.

Figure Six. (Above) Boral Pure villa, goldenrod flash, medium profile.