Subject: Current green coatings do little to protect the environment

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Every day within the United States new green initiatives are being proposed by politians, celebrities and businesses. California governor, Arnold Schwarzenegger, is supporting hybrid cars. Musician, Sheryl Crow, is supporting green bathroom accessories. The Home Depot recently rolled out its *Eco Options* program in stores throughout the country. The company also signed an agreement with *The Conversion Fund* to reduce CO2 emissions. With just about everyone and every sector of the business world supporting some green cause, what is the US paint industry doing to protect the environment, reduce energy consumption and global warming? Not much at all. In fact, during the late 1990's many paint manufacturers unsuccessfully sued the South Coast Air Quality Management District (SCAQMD) over new volatile organic compounds (VOC) laws which were designed to protect public health. Paint manufacturers claimed that low VOC coatings would have poor durability and inferior handling. They also claimed prices would significantly increase and existing product lines would be regulated out of existence. The reality is that new compliant coatings did not have a reduction in performance, prices did not dramatically rise although some products were summarily removed from sale for not complying with new air quality guidelines. According to the *2005 ARB Architectural Coatings Survey,* the VOC emissions from architectural coatings dropped from 113 million tons per day in 1975 to 95.1 million tons in 2004, a 16% drop in emissions *(note: does not include associated emissions from thinning or solvent cleanup*). Since 1975, the amount of architectural coatings that were sold within California has more than doubled so the actual reduction in VOC emissions is significantly higher. The end result is that air quality has improved and in some cases so has paint durability. So why the lawsuits?

Energy-efficient paints can reduce Urban Heat Islands, smog and greenhouse gases

According to a 2007, *ABC/Washington Post* environmental poll, 94% of American consumers say they are willing to protect the environment by buying green products, while 73% say they will specifically purchase energy-efficient items. With three-quarters of American consumers willing to buy energy-efficient products then why aren't retail paint manufacturers producing heat-reflective coatings to meet both this commercial and environment demand?

Heat reflective coatings work on walls and roofs by lowering the surface temperature which reduces radiant heat transfer. Solar radiation is reflected away from the substrate. Less energy transfer means a lower electrical demand for air-conditioning systems which mean less polluting fossil fuels are being burned by utility companies to run these cooling systems.

Heat reflective wall coatings can also reduce stress on a home by minimizing the expansion and contraction of the home's exterior walls which occurs during intense fluctuations in temperature.

It is a well documented fact that heat-reflective coatings on flat roofs can substantially reduce utility bills depending on insulation, geography, sun orientation and other variables. This is why commercial cool roof coatings are part of the California Energy Commission's (CEC) *Title 24* energy code. In 2008, the CEC is expected to include heat-reflective residential cool roofs as part of the state energy code. The next step in thermal envelope legislation could be energy-efficient wall coatings.

Promoting the energy-saving benefits of heat-reflective wall coatings is Ferro Corporation Development Manager for Pigment Systems, Ken Loye, and Ferro Corporation, West Coast District Manager, Jim Dunn. "In many instances we see more heat penetrating through walls then through roofs especially in the downtown areas of big cities," said Dunn. "We think reflective walls would benefit many industry segments."

Former Rohm and Haas chemist and Cool Roof Rating Council (CRRC) Technical Chairman, Bill Kirn, wrote a report called, *Cool Roof Coatings to Reduce Energy Demand and Temperature in an Urban Environment*. In that report, Kirn concluded that once a roof had been coated with a white, reflective membrane then it was no longer the principle source of solar heat gain. Exterior walls was now the leading contributor of heat ingress.

Oakridge National Laboratories, a US Department of Energy (DOE) research facility located in Tennessee, reportedly did a study for the Florida based coatings manufacturer, Texcote, and found that a cool wall coating could reduce a home's cooling cost by as much as 21.9%.

Current green coating standards need to go further

Most of the current green coatings sold at the retail level promote low VOC and low odor as their principle environmental features. However, in the grand scheme of things, low VOC coatings only account for a small portion of the overall air pollution problem. According to the *ARB Almanac 2006-Chapter 2: Current Emissions and Air Quality- Criteria Pollutants*, VOCs from architectural coatings in California account for approximately 3.96% of the total statewide VOC gases and 0.40% of total statewide emissions Reducing VOCs has been a positive step forward in reducing ground level ozone depletion, however, much more needs to be done to address other serious atmospheric problems.

2005 Statewide Emission Inventory Summary (Emissions tons/day, annual average)

Category	ROG (VOC)	CO	NOx	SOx	PM10	PM 2.5	NH3
Total Statewide	2430	13,766	3219	302	2213	860	670

Architectural Coatings VOC	95.1 tons/day
Total Statewide emissions	23,460 tons/day
Total%	0.4%

Green Seal: Weak and diluted standards.

Some coating companies have products certified through independent, non-profit organizations such as Green Seal. Green Seal's coating standard, Green Seal 11 (GS-11) was written in good faith but is easy to meet and does not go far enough to protect the environment especially with respect to global warming. Green Seal's VOC standards for interior coatings are 150 g/l for non-flat and 50 g/l for flat paints. Exterior coatings are 200 g/l for non-flat and 100 g/l for flat paints. With the latest polymer technology, it is not difficult to manufacture low VOC coatings to meet these two standards. BASF, manufacturers a number of polymers that can be formulated into paint that has VOCs of 50 g/l or less such as Acronal Optive 110,130, 230 and 330. Rohm and Haas manufacturers Rhoplex**,** HG-706. Many elastomeric coatings have VOCs less than 50 g/l. If Green Seal wants to establish a rigorous VOC standard it should set a target of 50 g/l for all coatings not just for interior flat paints.

Removing toxic additives such as heavy metals is another GS-11 standard which is not difficult to accomplish and in many states is mandated.

Green Seal-11 requires a variety of physical property tests such as scrubbability to prove long-term durability. However, most exterior coatings are specified at 350-400 square feet per gallon at a DFT of 1.4-1.8 mils in two coats which is too low to prevent electromagnetic radiation being absorbed through the paint film. An easy way to prove this is to film a wall on a hot day with an infrared thermal camera. This will show radiant heat penetrating through the siding, wooden studs and wall cavities. GS-11's physical property testing means little if the DFT is too low to protect the substrate from heat ingress.

Some paint manufacturers pay a considerable amount of money to be Green Seal certified but in reality their products are no greener then many regular coatings sold throughout the US. In fact, some companies such as Bay Systems, North America (BSNA) a division of Bayer Material Sciences is expected to launch a new exterior wall and roof tile coating that has 50 g/l of VOCs in the base system and zero VOCs in the colorants. This new system is also highly energy-efficient.

The US Green Building Council (USGBC) has adopted GS-11 for *Low Emitting Materials*, under *LEED For New Construction Version 2.2*. One point is allocated for compliance.

Cool Roof Rating Council

One of the current most stringent environmental coating standards in the US was established by the CEC in the form of the CRRC. The CRRC heat-reflective standard for low pitched roofs is a solar reflectance of 0.70 and a thermal emittance of 0.75. Coatings are tested by third party laboratories and undergo a 36-month weathering test in three designated areas within the US. To ensure that coatings meet long-term durability standards, a physical property prerequisite is required under ASTM D6083 which is referenced in Table 118-C of the state energy code.

Products registered with the CRRC are energy-efficient, durable, sustainable and have low VOCs

(*Many are lower then GS-11 certified coatings).* Compliant coatings also help combat global warming, rolling blackouts and Urban Heat Islands. They contribute to energy conservation, better indoor and outdoor air quality and can save considerable amounts of money for property owners. Rigid coating standards such as those used by the CRRC should be adopted by the USGBC and the US, Environmental Protection Agency (EPA) for any potential exterior wall standards they may be considering. And since cool walls transfer less energy into buildings and utility companies are burning fewer polluting fossil fuels to operate air conditioning systems, the EPA can better meet its obligations to regulate CO2 emissions under the *Clean Air Act* which they have been required to do so by the US, Supreme Court.

The USGBC currently offers a one point credit for cool roofs that meet a solar reflective index (SRI) of 78% for *Urban Heat Island Effect* which is referenced under *LEED For New Construction Version 2.2*.

Defining a green coating

A green coating needs to satisfy three criteria: manufacturing and application, impact on the consumer and impact on the environment.

1) Manufacturing and application. Some companies belong to voluntary organizations such as *Responsible Care* and *Coatings Care* which set environmental guild lines for socially responsible manufacturing. Many companies meet these standards without even knowing it. *Rohm and Haas* and *Bayer* are two examples of *Responsible Care* manufacturers.

2) Impact on the consumer. Most paint companies which sell green coatings promote low VOCs which is a good green feature but does virtually nothing to impact the consumer in a monetary or environmental manner. Low VOC coatings sold at the retail level are not energy-efficient, do not lower radiant heat transfer or monthly utility bills. At a recommended DFT of 1.4-1.8 mils in two coats, there are more repaint cycles and therefore more VOCs in the atmosphere. Every time a home is repainted there is additional energy consumption, resources and labor costs. Left over paint ends up contaminating landfills and water streams. Extra gas and electricity is used to drive trucks, operate pressure cleaners, run spray rigs and blend coatings. By repeatedly coating walls, there is a negative effect on the environment. It makes little sense specifying low VOC coatings with low film builds if walls have to be frequently recoated.

3) Impact on the environment. VOCs in coatings lead to an increase in ground level ozone which is a principle component of urban smog. Ground level ozone is harmful to the public's health and can be damaging to crops and other vegetation. VOCs in coatings do little to nothing to protect against Urban Heat Islands, rolling blackouts or global warming. They also do not contribute to energy conservation whereas energy-efficient coatings do.

Solutions

One solution is to make low VOC coatings energy-efficient. Energy-efficient coatings generally have higher volume solids, greater film build, better dirt pick up resistance and may incorporate infrared pigment technology with specialty reflective primers. Energy-efficient exterior wall coatings will reduce radiant heat transfer through wood framed walls by lowering the exterior surface temperature. Many wood framed homes have air infiltration problems which reduces the insulation R-value. In some instances, the wall insulation will compress and leave voids which allow air to penetrate causing cavity convection. Insulation works on static air flow so any amount of air will reduce the insulation's ability to function properly. Thermal bridging through the wood framing can also reportedly reduce the insulation R-values by 20%. If using a heat reflective coating on roofs and walls, the consumer can receive a payback on energy savings, reduced air conditioning maintenance, better indoor air quality and less repaint cycles. When the savings are capitalized it can add real value to any property investment.

Conclusion

Paint manufactures need to see the huge benefits of producing energy-efficient coatings from both an environmental and financial standpoint. Consumers benefit from lower utility bills and fewer paint cycles and the environment benefits by lower greenhouse emissions. Three-quarters of Americans say they will buy energy-efficient products, but they currently can not purchase energy-efficient paint because no one is willing to manufacture it for them. According to the head of the *Heat Islands Research Project* at LBNL, Ph.D. scientist, Hashem Akbari estimates that for every 1 kWh of electricity saved, approximately 663 g of CO2 is also saved. Just imagine the enormous saving in CO2 emissions if millions of US homes were coated with heat-reflective paint?