



PERMA•CRETE®

Green Surface Products



Memorandum

DATE: October 12, 2007
TO: PERMA•CRETE® Dealers
FROM: George A. Henderson
RE: PERMA•CRETE® Green Products

A recent phenomenon has occurred in this country as well as many other countries around the world from a new awareness and acute concern over the environmental standards in which we live; the air that we breathe; the water we drink; and, the buildings in which we work and live. It's been labeled as the new green society, and it's responsible for rapidly-increasing changes in our building codes and many public standards of living that are affecting virtually everyone.

In fact, it's all happened so fast that most, if not all, citizens are unclear about what it all means, how it works, what the definitions are, and how specific applications apply for the target buzzwords that are now regularly referenced in almost every publication, TV news events, the Internet, public advertisements, and even everyday conversations. The word most commonly misunderstood that denotes every facet and phase of this new phenomenon is the word, "*Green*".

This Memo will attempt to clarify the misconceptions and surrounding confusion in the current environmental standards change, and put a discernable face on these issues by simply and clearly defining the new environmental goals, and explaining how each facet fits together in society's plan to achieve cleaner energy and create a better and healthier world to live in.

PERMA•CRETE® products, which are sold to over 1,200 installing Dealers located in all 50 states as well as 24 foreign countries, are the result of years of research and successful applications worldwide in all types of climates. A PERMA•CRETE® surface provides a new architectural, load-bearing surface of unusual strength and flexibility, and the exclusive product line includes high-strength, cementitious bag mixes, sealers, epoxies, urethanes, cleaners and crack repair products. Perhaps, more importantly, in today's green society which demands eco-friendly products in all types of construction, PERMA•CRETE® leads the way with its low VOC, environmentally-safe products that greatly contribute to the world around us.

Quality Systems, Inc. (QSI) is the manufacturer of **PERMA•CRETE®** products, and is an active member of the **U.S. Green Building Council (USGBC)**, a nonprofit organization established in 1993 that awards highly-coveted Leadership in Energy and Environmental Design (LEED) ratings as buildings have become a focus of efforts to cut energy use. Buildings that have earned LEED certification achieved an average 25% to 30% reduction in energy use, and save 40% in water use, 39% in carbon dioxide emissions, 50-75% of construction and demolition waste going to landfills, \$58 billion of sick time from work annually, and add, \$180 billion in increased worker productivity annually.

The **LEED Green Building Rating System** is the national benchmark for high-performance green buildings. Developed through consensus by green building experts from every sector of USGBC's members, LEED evaluates the environmental performance of a building and provides independent, third-party certification to validate to the local community that a project is green. This is important because, according to the U.S. Energy Information Administration, buildings are responsible for 48 percent of annual greenhouse gas emissions, and 76 percent of all electricity generated by U.S. power plants goes towards supplying the building sector. As a result, the National Association of Home Builders (NAHB), the International Code Council (ICC) and the NAHB Research Center have initiated a process for the development of an American National Standards Institute (ANSI) standard for green home building construction practices.

LEED was launched in an effort to develop a “consensus-based, market-driven rating system to accelerate the development and implementation of green building practices.” The program is not rigidly structured; not every project must meet identical requirements to qualify. LEED outlines the intent, requirements, technologies, and strategies for meeting each credit, and credits are broken down into individual points. A building requires at least 26 points to be certified; higher levels of silver, gold and platinum are also available.

LEED Certification Levels

Certified:	26 – 32 Points
Silver:	33 – 38 Points
Gold:	39 – 51 Points
Platinum:	52 – 69 Points

Using LEED green building practices result in energy and cost savings over the life of the structure with better indoor air quality and plenty of daylight. Studies have shown that workers in these environments have increased labor productivity, job retention, and days worked. Students in these environments have higher test scores and lower absenteeism. Retail sales are also higher in these buildings.

The U.S. government is adopting LEED or similar green building standards for the General Services Administration (which owns or leases over 8,300 buildings), the U.S. Army, the Department of State, the Department of Energy (DOE), and the Environmental Protection Agency (EPA). Eight states, including California, New York, Oregon, and Washington, have adopted LEED for public buildings. Many agencies are requiring LEED silver certification as a minimum, and thirteen countries have expressed interest in LEED, including China and India.

Why Build Green?

In the United States, buildings account for:

- 36% of total energy use / 76% of electricity consumption
- 48% of greenhouse gas emissions
- 30% of raw materials use
- 30% of waste output / 136 millions tons annually
- 12% of potable water consumption

It may be interesting to note that, despite a lack of publicity, information technology, including the Web, consumes fourteen (14%) percent of all electricity produced. That's everything from Internet server farms, to what corporations run for IT, to the home desktop. Server farms are like small towns in the way they use power; they sit and run all the time with none of the down time of a home, which, generally, goes to sleep at night. Most computer efficiency standards so far have applied to desktop computers, especially their sleep mode functions. But, the opposite is true for servers, since they are on all the time. Servers today run in the range of 30% to 40% efficiency, but are expected to eventually be pushed into 70% to 80% efficiency, cutting the waste in half. So, surfing the Web may not be as eco-friendly as some assume.

Facts & Figures on Green Building

- Green building construction starts will exceed \$12 billion in 2007
- The construction market accounts for 14.2% of the \$10 trillion U.S. GDP
- USGBC has 11,267 member organizations
- USGBC has 91,000 actively-engaged individuals
- LEED for new construction began in 2000
- LEED for existing buildings, commercial interiors, operation & maintenance, and tenant improvements began in 2004
- LEED for core & shell began in July 2006
- LEED for homes & neighborhood development are currently in pilot testing
- There are LEED projects in all 50 states and 41 countries
- Number of LEED **Registered** Projects Worldwide
 - * New Construction: 5,294
 - * Commercial Interiors: 716
 - * Existing Buildings: 505
 - * Core & Shell: 981
 - * Neighborhood Development: 238
 - * Schools: 63
 - * Retail: 46
 - * Total Commercial: 7,843
 - * Homes: 8,204
- Number of LEED **Certified** Projects Worldwide
 - * New Construction: 787
 - * Commercial Interiors: 166
 - * Existing Buildings: 58
 - * Core & Shell: 47
 - * Total Commercial: 1,004
 - * Homes: 267

What Makes a Product Green?

A green product is a building component that has minimal or no negative environmental impacts, or allows for the elimination or substitution of potentially hazardous materials. However, even in the greenest of projects it is likely that many products will be used that are not green in themselves, but they are used in a manner that helps reduce the overall environmental impacts of the building. A particular window may not be green, but the way it is used maximizes collection of low winter sunlight and blocks the summer sun. Creating a green building means matching the products and materials to the specific design and site to minimize the overall environmental impact.

In defining some products as green, there are easily verifiable standards that can be identified, such as with energy-consuming appliances and VOC-emitting paints. But, for many others, the lines are blurred and judgment calls are required. It's also important to note that multiple criteria often apply. In other words, a product may be considered green for more than one reason. Recycled plastic lumber, for example, is made from recycled waste, it's highly durable, and it can eliminate the need for pesticide treatments. Straw particleboard products are made from agricultural waste materials, and they are free from formaldehyde offgassing.

Conversely, a product with one or more green attributes might not qualify if it also carries significant environmental risks. For example, wood treated with toxic preservatives has advantages in terms of durability, but it wouldn't be considered green due to the health and environmental hazards it represents.

Defining Standards of Green

The materials used to produce a building product, and where those materials came from, is also a key factor in determining green.

- **Salvaged Products:** If a product can be reused instead of producing a new one from raw materials, resource use and energy are saved. Many salvaged materials, such as bricks, millwork, framing lumber, plumbing fixtures, and dated hardware, are sold regionally or locally by salvage yards.
- **Post-Consumer Recycled Materials:** Materials that have finished their initial purpose and value to consumers and industrial users, but which can be recycled into other products of new value and use, is an important feature of many green products. Rubber flooring made from recycled auto tires is a good example. Environmentally, post-consumer is preferable to pre-consumer materials because post-consumer recycled materials are more likely to be diverted from landfills.
- **Pre-Consumer Recycled Products:** Products that are industrial by-products as opposed to products that have been in consumer use. Fly ash used to make concrete and PVC pipe scrap used to make shingles are examples of pre-consumer or "post-industrial" recycled materials.
- **Agricultural Waste Products:** Many of these are made from straw; the stems left after harvesting cereal grains. Citrus oil, a waste product from orange and lemon juice extraction, is also used in some green products, but is usually included in a renewable products category.
- **Reduced Material Use Products:** These are products that create resource efficiency benefits. Examples are drywall clips that eliminate corner studs, foundation systems that minimize concrete use, and concrete pigments that turn plain concrete slabs into attractive finished floors thereby eliminating the need for conventional finish flooring.

- **High Durability or Low Maintenance Products:** These products need to be replaced less frequently, or their maintenance has very low environmental impact. Examples are fiber-cement siding, fiberglass windows, and slate shingles.
- **Certified Wood Products:** Wood products with third-party certification, based on standards developed by the Forest Stewardship Council (FSC), are considered green. Wood products must go through a chain-of-custody certification process to carry an FSC stamp. Manufactured wood products can meet FSC certification requirements with less than 100% certified wood content through percentage-based claims.
- **Rapidly Renewable Products:** Rapidly renewable products are distinguished from wood by the shorter harvest cycle, typically 10 years or less. They are biodegradable, low VOC, and usually produced from agricultural crops. Because sunlight is generally the primary energy source (via photosynthesis), these products use less energy to produce, although processing and transportation energy use must also be considered. Examples are linoleum, natural paints, cork, and organic cotton and wool textiles (non-organic cotton is highly pesticide intensive).
- **Low Manufacturing Impact Products:** Examples are minimally processed products such as wood products, agricultural or non-agricultural plant products, and mineral products such as natural stone or slate.
- **Products That Save Energy or Water:** Examples include structural insulated panels (SIPs), insulated concrete forms (ICFs), and high performance windows.
- **Equipment That Saves Energy:** Examples are energy-efficient refrigerators, dishwashers and washing machines with an Energy Star or higher designation. Compact fluorescent lamps and occupancy/lighting controls as well as ice or chilled-water thermal energy storage equipment is also included.
- **Equipment That Renews Energy:** Equipment and products that use renewable energy instead of fossil fuels and conventional electricity are environmentally desirable and considered green. Examples include solar water heaters, photovoltaic systems, and wind turbines. Additionally, although fuel cells use natural gas or other fossil fuels as the hydrogen source, they're considered green because emissions are lower than combustion-based equipment.
- **Equipment That Conserves Energy:** All toilets and showerheads that meet the federal water efficiency standards are considered green. Other products such as rainwater catch systems are also included.
- **Products That Contribute To Safe a Environment:** Included are zero and low VOC interior paints, caulks, adhesives, and non-formaldehyde manufactured wood products. However, the EPA is presently working on establishing data for the resultant VOC concentrations in a space after a given period of time that could minimize a product's initial green status. Other examples are products that block the spread of indoor contaminants; products that improve indoor light quality by bringing daylight into a building; and, products that reduce or control noise from indoor and outside sources.
- **Other Products:** Other products that are considered green are those that eliminate the need for pesticide treatments; reduce stormwater pollution; eliminate the need for excavation; exterior stains and paints with low VOC emissions; masonry fireplaces that burn wood more completely with fewer emissions than conventional fireplaces and wood stoves

PERMA●CRETE® Green Products

Against this background, and especially from a **PERMA●CRETE®** Dealer's perspective, the question arises: Are **PERMA●CRETE®** products green, and, if so, what makes them green? Product ingredients, uses, and finished applications of **PERMA●CRETE®** all contribute to

the green characteristics of **PERMA●CRETE**[®] products, and will now be individually analyzed.

One of the most critical standards in determining whether **PERMA●CRETE**[®] products are green, is the Volatile Organic Compounds (VOCs) “toxic off-gassing” emitted by the products as they’re installed, as well as the amount of time needed for the installed products to finish any continued off-gassing. Simply meeting the maximum U.S. standard for VOC emissions is no longer sufficient for products to gain green status, despite many companies’ claims otherwise.

VOCs in paints and coatings have been regulated variously in different parts of the U.S. for more than 20 years. In 1998, the EPA established a national VOC limit of 450 g/l (grams per liter) for architectural and industrial maintenance coatings; this limit will soon be lowered. However, the national limit can be, and has been, superseded by stricter rules within the states, a trend expected to continue. For example, the California Air Resources Board (CARB) provides model rules and suggested control measures (SCM) as guidance for California’s air quality districts. CARB’s current SCM is 250 g/l and, this year, CARB is reconsidering its SCM at 100 g/l. Other groups around the nation are considering, or have already adopted, CARB’s model rule.

Because of the rapidly changing national and individual state VOC standards, **PERMA●CRETE**[®] reformulated its primer, epoxy and urethane products in 2007, that previously had higher but allowable VOCs, with recently developed and much stronger ingredients that provide better performance while emitting near zero VOCs. **PERMA●CRETE**[®] products are all waterbase products, and over 90% of them now have VOC ratings well under 100 g/l which, as a result, qualify them as green simply because of their extremely low, environmentally-safe VOC content. Importantly, one hundred percent of all out-gassing in **PERMA●CRETE**[®] products occurs in less than seven days, regardless of the type of application.

Product VOCs

Matrix Mixes	0 g/l
Bonding Additive	0 g/l
Orange Power Degreaser.....	0 g/l
Blue Nitro Cleaner.....	4 g/l
PermaThane CRU-750	7 g/l
PermaPoxy Enamel	8 g/l
PermaCaulk Sealant	11 g/l
PermaPrime E-Coat.....	12 g/l
PermaBond Crack Repair.....	22 g/l
PermaSeal Clear	66 g/l*
PermaSeal Stain.....	78 g/l*
Matrix Colorant	276 g/l*

* NOTE: The primary contributor of the VOC contents in Matrix Colorant, PermaSeal Clear and PermaSeal Stain is propylene glycol (relatively benign from a health perspective), a VOC only by a technicality. Propylene glycol is widely used in a number of food items such as salad dressing (Miracle Whip), and a number of sauces and drinks (Root Beer & Ginger Ale).

Product Uses

Other characteristics of **PERMA•CRETE**[®] products and finished applications also contribute to making **PERMA•CRETE**[®] green and, when used in conjunction with new building construction or refurbishing projects, can contribute LEED points to the overall building/project plan.

- Reducing urban heat island on parking lots and roofs. For instance, light colors will reflect heat on roofs, reducing a home's air-conditioning needs, as well as provide fewer roof repairs or replacements. This is because heat absorbed by dark roofs makes shingles expand and contract, and ultimately break.
- Using materials made from within the region additionally qualifies for LEED points, depending upon the proximity of the manufacturing facility to the active LEED project, thereby reducing transportation costs and fuel energy consumed.
- Achieving sustainability. Sustainability is often defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. **PERMA•CRETE**[®]'s inherent properties make it a natural choice for achieving sustainability with today's new buildings.
- Refurbishing old or damaged floors, or adding dimension to new ones. Also, low maintenance and treatment to protect floors, as well as providing color concrete surfaces to add a further decorative element, qualify and contribute to making a product(s) green.
- The **PERMA•CRETE**[®] vertical surface system will improve indoor air quality because the products used significantly reduce air infiltration and therefore minimize the amount of moist air entering through walls. With the implementation of new energy codes, such as the new Massachusetts Energy Code, code bodies are recognizing the importance of addressing the issue of air and vapor movement through wall assemblies.
- **PERMA•CRETE**[®]'s vertical surface system with its seamless surface also contributes to the energy efficiency of a building by minimizing thermal breaks and improving the efficiency of the wall cavity insulation.
- Longevity, cost, low maintenance without harsh chemicals, and easy repair that does not require extensive demolition all qualify as green under the Projected Life Cycle Costs classification.

Product Types

- **Matrix Mix/Bonding Additive:** There are seven (7) different types of **PERMA•CRETE**[®] Matrix Mixes, all available in white or thirty (30) different pre-colored bag mixes. All Matrix types have essentially the same cement/aggregate formulation, but each are distinguished by certain chemical additives that produce different set times or different application finishes, e.g., PolarSet Matrix sets rapidly in sub-freezing temperatures, TropicSet Matrix sets slowly in tropical temperatures, PermaGrit Matrix contains a much larger aggregate and provides a different-type surface finish, and so on.

Widely used as a protective or decorative coating over installed concrete in all types of horizontal and vertical surfaces, including highway bridges and airport runways, **PERMA•CRETE**[®] facilitates and extends the life of concrete and continues to promulgate the continued use of concrete installations and structures everywhere. This is important because concrete contains fly ash, a by product of coal-fired power plants that is difficult to use because of inconsistencies in grind and weight, and

because it contains some radioactivity; massive stockpiles of fly ash are unused and go to landfills for disposal. However, when added to concrete as a substitute for sand, fly ash makes concrete easier to work, stronger and more durable.

Fly ash also enhances the environmental performance of concrete. Mining and manufacturing of natural raw materials can be reduced along with decreasing greenhouse gas emissions. In fact, using a ton of fly ash can save almost a ton of carbon-dioxide (CO₂) emissions from being introduced into the atmosphere and, therefore, to global warming.

Matrix Mixes have zero VOCs and, when mixed with the acrylic polymer Bonding Additive, which also has zero VOCs, the applied mixture (without liquid Colorant) still has zero VOCs. Score green for Matrix Mix for zero VOCs as well as many other classifications.

Pre-colored Matrix Mixes were introduced in January 2007, and have become a runaway hit as more and more Dealers switched from white Matrix, that requires the use of liquid Matrix Colorant, to pre-colored Matrix that requires no Colorant. Over 26% of pre-colored Matrixes (8 out of 30 colors) use dry pigments recovered from iron oxide run-off from coal mines, the largest single source of water pollution in the United States. The iron oxide pigment products used by **PERMA•CRETE**[®] in its pre-colored Matrix Mixes were selected as one of the top 10 Green Building Products at the second annual Greenbuild conference in Pittsburgh last fall. Score green for pre-colored Matrix Mixes that use iron oxide removed from abandoned mine drainage, resulting in clean water for streams, rivers, and lakes.

- **PermaSeal Sealers:** Over 1,000 colors are available in the acrylic PermaSeal Sealers which complete the third and final part of **PERMA•CRETE**[®]'s three-part surface system for both vertical and horizontal installations, and which provide a non-porous surface finish that protects and enhances the finished application. All PermaSeal Sealers have low VOCs, well under 100 g/l (see NOTE earlier), and, when used solely as a one-coat sealer application over existing floors and walls, provide a restorative application that contributes to less maintenance and less repair. All of these characteristics qualify PermaSeal Sealers as green.
- **PermaPrime/PermaPoxy/PermaThane Coatings:** PermaPrime E-Coat is a waterbase, two-component epoxy primer with just 12 VOCs qualifying it as a green product, and it's used as a premium primer over concrete, steel, masonry or wood surfaces before an epoxy or urethane application. The 100% solids PermaPoxy Enamel waterborne epoxy, and the chemical resistant PermaThane CRU-750 waterbase urethane, products are available in twelve standard colors, as well as most custom colors. Used as architectural surface coatings over many different types of surfaces, even including underwater applications, both high performance products are frequently applied as the final sealer application over a Matrix Mix installation. PermaPoxy and PermaThane products each have less than 10 VOCs; both are easily applied; both have virtually no maintenance requirements; and, both easily qualify as green products.
- **Orange Power Degreaser:** This biodegradable, highly effective degreaser has 0 VOCs, and its primary ingredient is d-limonene, a terpene extracted from citrus peel

oils which is an Agricultural Waste Product, and which also is a Rapidly Renewable Product, both categories being clear qualifications for status as a green product.

- **Blue Nitro Cleaner:** This biodegradable, industrial cleaner contains only 4 VOCs making it environmentally safe and green, and is additionally qualified by providing easy maintenance without the use of harsh chemicals. It delivers effective removal of all commonly encountered oils, greases and other contaminants found on concrete, wood, asphalt and metallic surfaces, and is used exclusively by **PERMA•CRETE®** Dealers to clean virtually any surface prior to an installation.
- **PermaCaulk Sealant:** A one-part, elastomeric acrylic caulk composed primarily of natural ingredients such as calcium carbonate, potassium and sand, with only 11 VOCs, making it also environmentally safe and green. In addition to its use in concrete slab expansion joints and masonry perimeters, it's extremely effective for sealing around doors and windows in all types of buildings making them more energy efficient for heating and cooling therefore requiring less electricity or fossil fuel.
- **PermaBond Crack Repair:** A 100% solids, two-component epoxy resin containing no solvents, and used to fill surface cracks in structural concrete and masonry; five times stronger than concrete. PermaBond has just 22 VOCs and is an environmentally-safe, green product.

Research Sources:

U.S. Green Building Council (USGBC)
LEED Reference Guide (LEED)
Portland Cement Association (PCA)
Contract Magazine
Environmental Building News
BuildingGreen, Inc.
DeVit Consulting, Inc.
Building Safety Journal
Construction Specifier Magazine
Precast Solutions Magazine
Wall Street Journal
Internet Search Engines
QSI Quality Control Research
Rohm & Haas Corporation
Iron Oxide Recovery, Inc.
AllBusiness Website
UNIVAR USA Inc.
Peninsula Polymers, LLC
J. Smythe Consulting

