



# **FOAMGLAS<sup>®</sup> Insulation, Sustainable Design, and LEED<sup>®</sup>**

A report to Pittsburgh Corning on the attributes on FOAMGLAS<sup>®</sup>  
Insulation relative to sustainable building design.

**Christine A. Subasic, P.E., LEED AP**  
**6/8/2010**

## **FOAMGLAS® Insulation, Sustainable Design, and LEED®**

### **Introduction**

Green building is firmly established in the commercial new construction market, and demand for green building materials continues to grow. Nearly 200 localities have some sort of green building ordinance or initiative according to the U.S. Green Building Council (USGBC®)<sup>1</sup>. Several federal government agencies and state governments have enacted green building initiatives. In many cases, these initiatives move beyond voluntary measures to actual LEED® certification requirements for public and in some cases, private, new construction. Recent development of several green building standards, written for adoption by local building code officials, will likely accelerate the *requirement* for green building in future years.

Green building is not however, necessarily the same as sustainable design. Sustainable design refers to the design and construction of buildings in a way that meets the needs of today without compromising the needs of the future. With green building the focus is often limited to environmental impacts, but true sustainable design considers the economic and social aspects of the design in addition to the environmental impacts and looks to balance this “triple bottom line.” Sustainable building design is a holistic look at the entire building process.

### **FOAMGLAS® Insulation and Accessory Adhesive & Sealant**

This report evaluates the suitability of FOAMGLAS® Insulation manufactured by Pittsburgh Corning, as well as PC® RTV 450 Silicone Adhesive and Pittseal® 444N Sealant for use in sustainable commercial building designs. Though many of these strategies may also be appropriate for residential construction, the residential market has several unique aspects that are not covered here. Insights into the suitability of FOAMGLAS® Insulation, PC® RTV 450 Silicone Adhesive, and PITTSEAL® 444N Sealant for sustainable design strategies are based on information provided by Pittsburgh Corning and information obtained online.

Evaluating the applicability to sustainable design strategies requires an understanding of the use of the product and its manufacture. Based on information received from Pittsburgh Corning and that obtained online, the following generalizations can be made.

FOAMGLAS® Insulation is currently used primarily in industrial applications, such as pipe insulation, in the United States. The insulation is also extensively used as roof, wall or slab insulation for buildings. FOAMGLAS® Insulation is characterized by high compressive strength, resistance to moisture, and resistance to fire. While some other rigid insulating materials such as polyisocyanurate or polystyrene may have a higher initial insulating value, the thermal properties of FOAMGLAS® Insulation have demonstrated a longer useful life, even when exposed to moisture. Other common building insulations can rapidly lose their insulating properties when subject to moisture or settling.

FOAMGLAS® Insulation is manufactured from sand, limestone and soda ash. The raw materials are melted and the resulting glass is crushed to a fine powder and mixed with a cellulating agent. The

---

<sup>1</sup> [www.usgbc.org](http://www.usgbc.org) accessed June 2009.

powder is dispensed into molds, and sintered and cellulated (chemical reaction at high temperature) to form large buns. The buns are annealed to eliminate stress and limit breakage. The buns are trimmed into blocks of required size (18"x24"x thickness up to 7"), and then packaged. In this block form, FOAMGLAS® Insulation can be used directly as wall or roof insulation. FOAMGLAS® Insulation can be fabricated into pipe insulation or other shapes made from blocks. This fabrication may occur at separate authorized facilities not owned by Pittsburgh Corning.

The melting furnace is fueled by natural gas and electricity. Waste heat is captured in the glass melting process and is reused to preheat combustion air for the melting oven. Cellulating furnaces and annealing ovens are fueled by natural gas. Water used in the process to cool equipment is re-circulated and recycled. A minimal amount of fresh water is used to prepare molds. At present no post consumer recycled materials are used in the manufacture of FOAMGLAS® Insulation in the U.S., though European facilities use 30% or more post-consumer recycled glass content in their manufacture of FOAMGLAS® Insulation.

PC® RTV 450 Silicone Adhesive and PITTSEAL® 444N Sealant are low-VOC products used in assembling FOAMGLAS® Insulation components into piping insulation systems.

### **Evaluating Sustainable Design**

Determining exactly what qualifies as sustainable design is difficult and subjective, but many organizations have tried. The most widely used commercial green building assessment tool in the U.S. is the LEED® for New Construction rating system. However, since 2008 several other green building standards were introduced. These include the *Green Building Assessment Protocol for Commercial Buildings*® (ANSI/GBI 01-2010), the *Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings*® (ANSI/ASHRAE/USGBC/IES Standard 189.1-2009) and the *National Green Building Standard*™ (NAHB/ICC 700-2008) for residential construction. In addition, LEED® Canada has also developed a rating system that is slightly different from the U.S. version of LEED®. A brief description of each program follows.

The *Green Building Assessment Protocol for Commercial Buildings*® (ANSI/GBI 01-2010) is a consensus standard developed by the Green Building Initiative (GBI) and based on the Green Globes online building and management environmental audit. It allows for either self-assessment or third-party verification of a building's design and construction.

The *Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings*® (ANSI/ASHRAE/USGBC/IES Standard 189.1-2009) is a consensus standard based on LEED for New Construction. This standard is intended for adoption by local jurisdictions and is written in mandatory language with both prescriptive and performance compliance paths.

The *National Green Building Standard*™ (NAHB/ICC 700-2008) was developed by the National Association of Home Builders (NAHB) and the International Code Council. This standard covers residential construction, including neighborhood development.

*LEED® for New Construction* is a tool for assessing the energy and environmental impact of buildings that was developed by the U.S. Green Building Council (USGBC®). LEED® stands for Leadership in Energy and Environmental Design, and USGBC® has developed several rating systems for the different types of construction in the building industry, including new construction, existing buildings, schools, etc. The LEED® rating systems are voluntary rating systems that provide a third-party certification to define what constitutes a “green” building.

The *LEED® Canada for New Construction* rating system is based on the U.S. version. Some of the most notable differences for building products are that LEED® Canada for New Construction includes a credit for utilizing durable materials, recognizes differences in method of transport for building products, and uses a specific recycled content calculation for products utilizing cement replacements (supplementary cementing materials).

While each of these rating systems is slightly different in content and approach, there is general agreement on the importance of evaluating

- energy efficiency
- water efficiency
- land use (sites)
- materials and resources (resource efficiency)
- pollution (global impact)
- indoor environmental quality (health and well being)
- transport
- operations and maintenance

However, sustainable design encompasses many elements not included in LEED® or other assessment tools. A better tool for evaluating sustainable design is found in the *Principles of High Performance School Buildings* developed by the Sustainable Buildings Industry Council. These principles of high performance, sustainable building design are:

- Environmentally responsive site planning
- Energy efficient building shell
- Thermal comfort
- Energy analysis
- Renewable energy
- Water efficiency
- Safety and security
- Daylighting
- Commissioning
- Environmentally preferable materials and products
- High performance HVAC
- High performance electric lighting
- Life cycle cost analysis

- Acoustic comfort
- Superior indoor air quality
- Visual comfort

This framework of principles of high performance buildings provides consideration of several elements not covered in LEED® for New Construction that are key to sustainable design and masonry products. These include durability, efficient use of materials, avoidance of waste, life cycle costs, environmental life cycle assessment, and safety and security.

### **FOAMGLAS® Insulation, PC® RTV 450 Silicone Adhesive, PITTSEAL® 444N Sealant and Sustainable Design Principles**

The applicability of a product to a sustainable building design strategy depends both on its use and on characteristics of its manufacture. This section describes the high performance sustainable design principles applicable to FOAMGLAS® Insulation, PC® RTV 450 Silicone Adhesive, and PITTSEAL® 444N Sealant.

#### **Environmentally Responsive Site Planning**

Environmentally responsive site planning includes consideration of site selection, site disturbance, storm water management, and effect of the building on its surroundings. One area of interest is the use of vegetated (“green”) roofs. Vegetated roofs are increasingly used on sustainable building designs to reduce the heat island effect and reduce storm water runoff from the roof. The heat island effect is that effect whereby dark colored surfaces retain excess heat creating a microclimate. This is why oftentimes nighttime temperatures in the countryside are much cooler than in a city. The heat island effect can be reduced by shading of horizontal surfaces and by utilizing light-colored, reflective materials, or by introducing vegetation. Vegetation absorbs moisture and provides an evaporative cooling effect on the roof. FOAMGLAS® Insulation is especially suited for use under a vegetated roof because of its high compressive strength and resistance to moisture.

#### **Energy efficient building shell, Thermal Comfort, and Energy Analysis**

An energy efficient building envelope is a key component in sustainable building design. Achieving an energy efficient building envelope includes consideration of both the insulating value of materials as well as the thermal mass of materials.

FOAMGLAS® Insulation can be used to provide the necessary insulation for the building envelope, in both vertical (wall) applications and horizontal (roof) applications. Cavity wall applications for FOAMGLAS® Insulation pose a challenge in that the required thickness to achieve the necessary R-value may exceed the allowable cavity width. Other applications, such as foundation insulation or exterior-applied wall insulation may be more suited to FOAMGLAS® Insulation. As discussed previously, the high compressive strength of FOAMGLAS® Insulation may provide an advantage in vegetated roof applications. The weight of vegetated roofs can be significant in some cases. FOAMGLAS® Insulation may be especially appropriate in these cases.

### Safety and security

Safety and security are two aspects of sustainable design that are not covered by the LEED® rating systems. Fire-resistant construction and resistance to impacts and wind-borne debris promote occupant health and safety. FOAMGLAS® Insulation is non-combustible.

### High Performance HVAC

High performance HVAC systems are designed to respond to occupancy and environmental conditions. High performance HVAC systems may incorporate cooling by flushing with night air under appropriate environmental conditions, or the use of ground-source heat pumps. High performance HVAC also includes use of equipment that does not contain HCFC's and halons. FOAMGLAS® Insulation is often used as piping or duct insulation in HVAC&R applications such as these.

### Environmentally preferable materials and products

Consideration of the environmental impact of building materials and products is an important element in a sustainable design, though it is only one of several criteria to be considered for product selection. Materials should be evaluated over their entire life cycle, from raw material extraction to end of useful life. This life cycle assessment (LCA) of a building material or product must include accurate evaluation of product service life.

There are several aspects to consider in the environmental evaluation of building materials. Life cycle assessment allows for a complete examination of all aspects of building material manufacture and use. It includes all impacts from raw material acquisition to manufacturing to building maintenance and end of building life. This is often called "cradle to grave" for building materials. However in the U.S., life cycle assessment of building materials is often lacking. Few manufacturers can provide such robust information about their products. As a result, green building rating systems such as LEED® have developed surrogate measures of environmental impact, as well as measures that reflect on-site construction practices. Thus environmentally preferred products should incorporate one or more of the following strategies:

- Abundance of raw materials
- Efficient use of raw materials
- Use of bio-based or rapidly renewable materials
- Use of recycled materials
- Sustainable measures in acquisition or manufacture
- Use of regionally available materials (near to building project site)
- Regional manufacture or fabrication (near to building project site)
- Recyclable
- Salvageable
- Durable
- Non-toxic (not made of toxic materials)
- Avoidance of construction waste

FOAMGLAS® Insulation may incorporate several of these sustainable strategies. FOAMGLAS® Insulation is made in part from sand which is considered an abundant raw material. FOAMGLAS® Insulation manufacturing has little waste. Roughly 90% of raw materials are used in the final product. Opportunity exists for obtaining raw materials close to the manufacturing plant. The Sedalia plant sources approximately 75% (by weight) of its raw materials from within 500 miles of the factory, although in the LEED® rating systems it is the distance between material extraction, as well as manufacture, and the project site that is calculated.

FOAMGLAS® Insulation is 100% glass, and as such, is recyclable. FOAMGLAS® Insulation is durable and requires little or no maintenance. FOAMGLAS® Insulation is inert, is not made from toxic materials (no HCFC's), and retains its physical properties for its entire life span.

FOAMGLAS® Insulation can be made of recycled materials, though it is not presently done in the U.S. Pittsburgh Corning's European facilities use 30% or more post-consumer recycled glass content in the production of FOAMGLAS® Insulation.

#### Life cycle cost analysis

Costs of building materials should be considered over the entire life span of the building. Durable materials like glass products generally have an advantage in that because of their long life and low maintenance, their life cycle costs are often low as compared with products that have a low initial cost but high life cycle cost.

#### Acoustic comfort

Acoustic comfort is another important element in sustainable designs. Walls with high Sound Transmission Class (STC) values provide superior acoustic insulation. FOAMGLAS® Insulation used in a building envelope can nominally contribute to achieving the minimum STC for walls of 50 required by most rating systems with acoustic criteria.

#### Superior indoor air quality

Superior indoor air quality encompasses both the reduction/elimination of pollutants in a building (i.e. tobacco smoke, chemical pollutants) as well as moisture control to help prohibit mold. FOAMGLAS® Insulation is inert, is not a food source for mold, does not produce volatile organic compounds (no VOCs) and is not made from HCFC's. PC® RTV 450 Silicone Adhesive and PITTSEAL® 444N Sealant also help to improve indoor air quality.

#### **The LEED® Rating System**

In spring 2009 U.S. Green Building Council formally launched LEED® v3 and LEED® 2009. LEED® v3 is the overarching umbrella that includes all of the LEED® rating systems, the online component of LEED®, and the actual building certification program. The suite of LEED® rating systems that make up LEED® 2009 includes new construction, schools, commercial interiors, and other specialties. Changes made in LEED® 2009 include harmonization of credits across rating systems, weighting (adjusting point values) of credits, and introduction of regional priority credits. LEED® for New Construction 2009 now includes a total of 110 points organized into five environmental categories: sustainable

sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality; an innovation and design category; and regional priority credits. Figure 1 shows the percentage of points in each of the categories in LEED® 2009. Because the overall points possible has increased, so too have the points needed for each level of certification. See Figure 2.

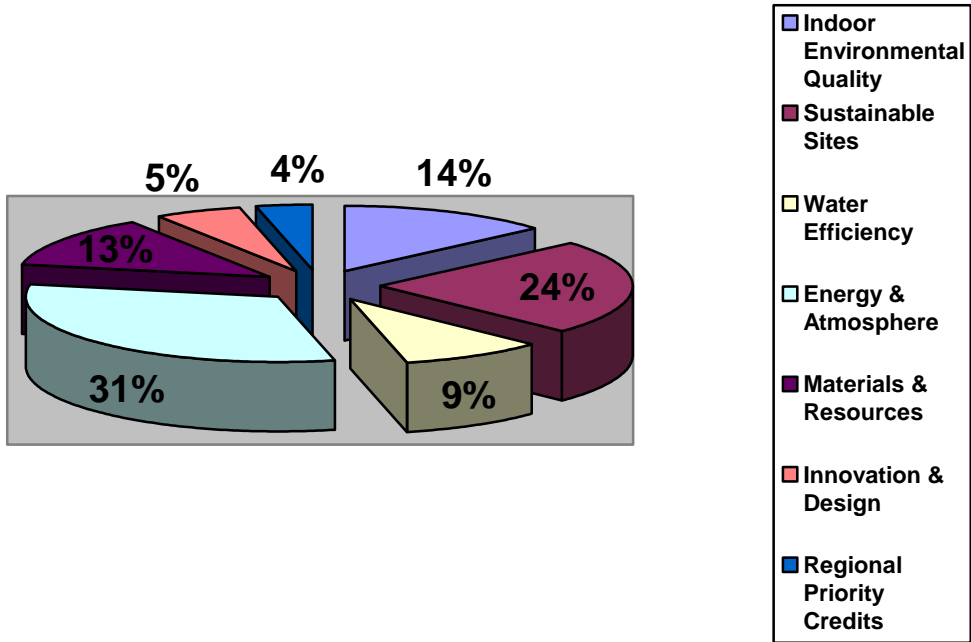


Figure 1: LEED® 2009 Categories

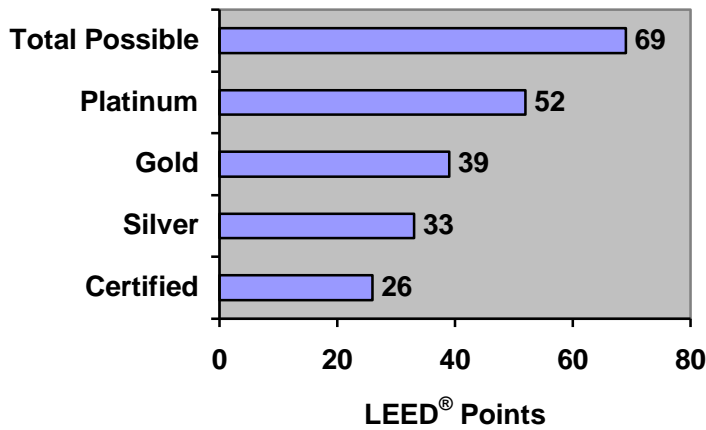


Figure 2: LEED® 2009 certification levels

**Changes in LEED® 2009**

**Harmonization.** The first major change in LEED® 2009 is harmonization of all the LEED® rating systems (except LEED® for Homes), aligning credits between rating systems so that, for example, the recycled content credit in LEED® for New Construction is the same as the recycled content credit in LEED® for Schools. This was mostly a “housekeeping” measure, ensuring that credits were consistent

in language and specification across rating systems and that language was clear. In addition, the total number of points available and points needed for certification in each rating system is now the same.

**Weighting of Credits/Changes to Points.** Another major change in LEED® 2009 was the introduction of weightings and the resulting changes to the total points available. Each credit was evaluated against a list of 13 environmental impact categories. In LEED® 2009, credits that emphasize energy efficiency and CO<sub>2</sub> reductions earn more points. Because of the points added to increase the weighting of certain credits, the total points available in the five environmental categories is now 100. LEED® 2009 also includes 10 points in Innovation & Design and Regional Priority credits for a grand total of 110 points in LEED® for New Construction.

**Regional Priority Credits.** In LEED 2009, six of the existing LEED credits that address regionally prioritized environmental issues have been assigned “bonus points.” Which credits are considered Regional Priority Credits depends on a project’s specific location (organized by zip code). A given project can earn up to four bonus points as Regional Priority Credits by earning the corresponding LEED credits. For example, a project in Pennsylvania zip code 15239 earning Sustainable Sites Credit 7.2: Heat Island Effect – Roof will also earn 1 bonus Regional Priority Credit. The complete list of Regional Priority Credits is available at <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1984>.

#### **LEED® Credits and FOAMGLAS® Insulation**

FOAMGLAS® Insulation, PC® RTV 450 Silicone Adhesive and PITTSEAL® 444N Sealant can contribute toward earning LEED® points on a project. While no one product or material alone (with the noted exception) can earn LEED credit points<sup>2</sup>, FOAMGLAS® Insulation, PC® RTV 450 Silicone Adhesive, and PITTSEAL® 444N Sealant can be used as part of a strategy to earn points in several credit categories.

#### **Sustainable Sites**

Credit 6 – storm water management

Credit 7.1 – roof heat island effect

FOAMGLAS® Insulation can be part of a vegetated roof design which is one sustainable strategy that can be used to earn both of these Sustainable Sites credits.

#### **Energy & Atmosphere**

Prerequisite 2 – minimum energy performance

Credit 1 - Optimize energy performance

FOAMGLAS® Insulation can be used as part of strategies to help achieve the required energy performance and to further reduce the amount of energy consumed by the building.

Prerequisite 3 – fundamental refrigerant management

Credit 4 – enhanced refrigerant management

FOAMGLAS® Insulation is often used as part of HVAC&R systems that do not use HCFC’s.

---

<sup>2</sup> Certified wood is the only product that can earn 1 point under Materials & Resource Credit 7.

## Materials & Resources

Credits 2.1 and 2.2 – construction waste management – FOAMGLAS® Insulation scrap construction waste can be recycled.

Credits 4.1 and 4.2 – recycled content – FOAMGLAS® Insulation that incorporates post-consumer recycled materials can be included in this calculation of the total recycled content in all building materials.

Credits 5.1 and 5.2 – regional materials – this credit recognizes that portion of materials that have both a raw material source and manufacturing facility within 500 miles of the building project site. FOAMGLAS® Insulation manufactured in a facility that is within 500 miles of a building project site can include that percent (by weight) of the raw materials that are also within 500 miles of the project site toward the calculation of the total regionally located content in all building materials.

## Indoor Environmental Quality

Credit 4 – low-emitting materials – Though insulation is not considered in this section, FOAMGLAS® Insulation would also eliminate another potential source of VOC's in a building. PC® RTV 450 Silicone Adhesive and PITTSEAL® 444N Sealant meet the requirements of this credit.

## Innovation and Design

Up to 3 points: FOAMGLAS® Insulation can help earn points for use of durable materials and good indoor environmental quality, though the indoor environmental quality credit has not yet been recognized on a LEED®-certified project. LEED® Canada does have a credit for durable buildings.

## Summary of LEED® credits for FOAMGLAS® Insulation

FOAMGLAS® Insulation as currently manufactured can be part of a strategy to earn points in the following LEED® credits.

- Sustainable Sites
  - Credit 6 – storm water management
  - Credit 7.1 – roof heat island effect
- Energy and Atmosphere
  - Prerequisite 2 – minimum energy performance
  - Credit 1 – optimize energy performance
  - Prerequisite 3 – fundamental refrigerant management
  - Credit 4 – enhanced refrigerant management
- Materials and Resources
  - Credit 2 – construction waste management
  - Credit 4 – recycled content
  - To a lesser extent, possibility for
    - Credit 5 – regional materials
- Indoor Environmental Quality
  - Credit 4 – low-emitting materials
- Innovation and Design
  - Credit 1.1 – durable materials

To a lesser extent, possibility for

- Credit 1.2 – good indoor environmental quality

PC® RTV 450 Silicone Adhesive and PITTSEAL® 444N Sealant can contribute toward LEED® 2009 Credits on IEQ Credit 4, Low-Emitting Materials: Adhesives and Sealants.

### **Summary**

FOAMGLAS® Insulation, PC® RTV 450 Silicone Adhesive and PITTSEAL® 444N Sealant can contribute to a sustainable building design. It is important to recognize the value of the holistic approach taken by the principles of high performance design to achieve a truly sustainable building that considers social and economic impacts as well as environmental ones. Issues such as durability and life cycle cost are not part of the LEED® for New Construction rating system criteria but are important issues for sustainable design.

FOAMGLAS®, PC® and PITTSEAL® are registered trademarks of Pittsburgh Corning.  
LEED® and USGBC® are registered trademarks of U.S. Green Building Council.