

Creating structures that require
fewer natural resources to build,
operate and maintain



Sustainable Design



As an industry leader with a proud heritage spanning more than 100 years, USG understands the need to safeguard the world around us and protect the vital natural resources we all share. Long before conservation became a mainstream concern, USG was finding innovative ways to reduce waste, operate efficiently and transform manufacturing byproducts into valuable new resources.



Working with the Environment

Conserving Natural Resources

Today and Tomorrow

Today, the building industry is integrating efforts to conserve, recycle and boost efficiency into a comprehensive strategy known as sustainable design. This practice involves the careful selection of building materials, design details and construction methods to create structures that require fewer natural resources to build and maintain today and that will require minimal renovation and modernization to remain viable in the future.

As populations grow and natural resources are depleted ever more rapidly, consumers have become increasingly aware of the need to conserve energy, manage the use of raw materials, reduce waste and safeguard against pollutants. In response, many developers and owners now demand buildings with materials and technologies that will help save energy, preserve the integrity of the surrounding land and assure a clean, healthy indoor environment.

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Industry Leadership

United States Green Building Council (USGBC)

The most widely accepted national guidelines for environmentally conscious building is the LEED (Leadership in Energy and Environmental Design) GREEN BUILDING RATING SYSTEM® developed by the United States Green Building Council. The USGBC is a coalition of leaders from across the construction industry working to promote buildings that are healthy and environmentally responsible as well as profitable.

Founded in 1993 by several corporate partners including USG, the council has more than 3,000 members. Working together, members develop product resources, policy guidance, and education, marketing and research tools that encourage sustainable building.

LEED® provides design guidelines and a third-party certification tool for verifying that a project has met the technical requirements of sustainable building through various aspects of its design and construction. A project may be awarded one of four levels of certification by earning up to 69 points in six categories:

LEED Categories

Sustainable Site Selection

Channeling development to an urban area or a previously developed site; reducing the building footprint; protecting a wetland on the site; providing alternatives for exterior and landscape design or transportation and parking.

Water Efficiency

Employing innovative wastewater technologies; landscaping with plantings that can be irrigated solely with captured rain or gray water; reducing use of city water for sewage by 50 percent.

Energy and Atmosphere

Reducing energy consumption by supplying 5 percent to 20 percent of energy needs with renewable systems onsite.

Materials and Resources

Using materials reclaimed from previous applications; reducing construction waste and pressures on landfills; specifying materials with high recycled content, made from rapidly renewable resources or manufactured within a 500-mile radius.

Indoor Environmental Quality

Specifying low-VOC adhesives and sealants, paints, carpet, composite wood, and furnishings; developing an indoor-air-quality management plan; installing a permanent CO2 monitoring system.

Innovation and Design

Achieving performance above the requirements of LEED; demonstrating innovative performance in a green building category not addressed by LEED; appointing a LEED-accredited professional as a principal participant.

As a founding member of the USGBC, USG is committed to helping architects and builders create buildings that efficiently meet the needs of occupants while also protecting the surrounding environment. Here's a closer look at critical considerations that can make buildings greener, healthier and even more profitable.

Environmentally Friendly Materials

Product selection is a key to sustainable design. Ideal materials are those that reduce, recycle and renew—the three R's of sustainability. Specifically, sustainable products:

Reduce the amount of raw materials and energy needed for manufacturing. Lighter or smaller products generally require less energy to transport, store and construct.

Recycle discarded material into new products or choose new materials that could be used in other ways later. These often reduce raw material consumption and energy use as well as landfill waste in the future.

Renew the environment by using materials that can be regenerated easily or that offer other environmentally friendly benefits.

These qualities are important in their own right. But in the context of sustainability, materials are chosen not only for what they are made of, but also for their embodied energy. Embodied energy is the amount of non-renewable energy required to extract, manufacture and transport a building product. This consideration must be factored into all green product specifications, as it can have a significant—and sometimes surprising—impact on sustainable design.

While products with low embodied energy usually are good choices for enhancing sustainability, products with high embodied energy are not automatically poor choices. For example, the greater embodied energy of a product with high thermal mass may be more than offset by its ability to reduce a building's long-term energy demand for heating and cooling.

Another important consideration is material transportation, which consumes non-renewable fossil fuels. Having to transport a material long distances can negate the value of its other sustainable qualities.

Building Sustainably with USG

USG emphasizes innovation in our products, from the ingredients we choose to the processes we employ. The use of recycled and renewable raw materials reduces consumption of energy and resources without diminishing long-term performance. Take a closer look at products you can choose with confidence.

SHEETROCK® Gypsum Panels

Gypsum board meets nearly all criteria for sustainable design. Gypsum forms naturally like salt or limestone, and it is one of the most abundant minerals. The remaining materials in drywall are mostly paper (which USG recycles from newspapers, phone books, corrugated cartons and cardboard cuttings), and binders derived from renewable agricultural resources instead of petroleum-based polymers. SHEETROCK Gypsum Panels contain no volatile organic compounds (VOCs).

The embodied energy of gypsum board is extremely low, below that of many building materials including brickwork, concrete, particleboard, insulation, glass, vinyl flooring, plastics, steel, and aluminum. Manufacturing waste is also low: Approximately 95 percent of raw materials entering a manufacturing plant leave as finished product, and most of the remainder is used to protect finished panels in transit.

In addition to natural, mined gypsum, USG uses many tons of synthetic gypsum, a byproduct of emission control processes at coal-fired utility plants. Products made with synthetic gypsum perform at least as well as those made with natural gypsum, sometimes even better due to more consistent purity levels. Panels made with synthetic gypsum are identical in appearance to panels made with natural gypsum.

FIBEROCK® AQUA-TOUGH™ Panels

Made of gypsum and post-consumer recycled cellulose fibers, these high-performance panels are in multiple applications including interior walls, floor underlayments and exterior sheathings. Engineered for strength and resistance to water and mold, these panels offer an excellent sustainable alternative to wood-based products, most notably lauan, which is harvested from endangered, old-growth forests. FIBEROCK AQUA-TOUGH Panels contain no VOCs.

DUROCK® Cement Board

Cement board, a water-durable panel commonly used as a backer for ceramic tile, stone, marble and other premium finishes is made from approximately 20 percent recycled materials. These include fly ash, a byproduct of emission control processes at coal-fired utility plants.

USG Ceiling Systems

Many USG acoustical ceiling panels contain mineral wool derived from slag, a byproduct of steel-making, which reduces the need to mine and process raw materials and minimizes landfill waste. Many panels also contain recycled paper. Binders are derived from corn and wheat starch, renewable agricultural resources. USG acoustical ceiling panels contain low VOCs. Non-directional ceiling panels such as RADAR™ allow more efficient use of material, reducing waste during installation. The steel in several of our metal ceiling and drywall suspension systems includes recycled content. Steel offers additional benefits in that it can be fully re-purposed by re-melting and salvaging the metal.

Providing a high-quality indoor environment is another key aim of sustainability. A building designed to deliver maximum comfort, efficiency and productivity is likely to meet occupant needs long into the future without requiring extensive upgrades or renovations.



Designing for the Long Term

Sound Control

Making Sound Choices

Open-plan offices are great for collaboration, but noise from meetings, speakerphones and conversation can be overwhelming for those trying to work independently. Those in enclosed offices can shut out distractions, but their conversations may still be overheard by those outside.

Encouraging teamwork while allowing autonomy and providing areas with speech privacy requires careful planning and the use of materials that can help manage noise.

To help determine which materials may provide the greatest acoustical efficiency for your project, consider the performance attributes that support the ABCs of sound control:

Absorbing

Noise Reduction Coefficient (NRC) measures the percentage of sound reaching a wall or ceiling panel that will be absorbed. Panels with significant sound absorbing properties (NRC of .70 or higher) are especially effective for open-plan areas. Acoustics are further improved by partitions with high Sound Transmission Class (STC) values because they help to block sound.

Articulation Class (AC) measures how well a ceiling panel or other material prevents sound from reflecting to adjacent workspaces in an open-plan environment.

Blocking

Ceiling Attenuation Class (CAC) indicates the ability of a ceiling panel to block sound transmission (reduction of decibels–dB). Ceiling panels with a CAC of 35 or higher can significantly improve speech privacy in enclosed offices by blocking sound from transmitting up into the plenum and down to adjacent spaces.

Impact Isolation Class (IIC) measures how well the floor-ceiling structure prevents impact sound transmission from reaching a room below.

Sound Transmission Class (STC) measures how well a wall or partition prevents sound from transmitting from one side to the other.

Covering

Articulation Index (AI) represents how well speech can be understood in a space. AI is expressed as a decimal value between 0 (speech is unintelligible) and 1.00 (speech is easily heard and understood). AI can be measured using ASTM E-1130. Sound masking is an effective way to reduce AI, thereby increasing speech privacy in open areas and enclosed offices.

Privacy Index (PI) is the inverse of articulation index. The PI represents how well the elements in and the properties of a space help to render outside conversations unintelligible.

USG Offers



An extensive selection of acoustically rated ceiling systems, partition assemblies and floor/ceiling assemblies.

Many USG acoustical ceiling panels provide enhanced NRC and CAC performance including those featured below. For a complete list, see the Acoustical Ratings selector in the spiral-bound USG Ceiling Systems catalog (SC2000).

Acoustical Ceilings

	NRC	CAC
ECLIPSE™ CLIMAPLUS™	.70	35
FROST™	.70	38/40
HALCYON™ CLIMAPLUS	1.00	25
MARS™ CLIMAPLUS	.70	35
SUMMIT™ CLIMAPLUS	.70	38/40

Panels with this level of performance absorb and block significant amounts of sound. However, some noise will still transmit and reflect to adjacent areas. To further enhance sound control, an additional step is to add sound masking, which can cover noise and conversation in open areas and improve speech privacy in enclosed offices. USG has teamed up with LENCORE® Acoustics, an industry leader in sound masking, to make this effective sound control technology available to you.

LENCORE Sound Masking

This innovative system produces a unique electronic sound spectrum similar to that of softly blowing air. This carefully engineered sound is amplified through individual speakers set above the suspended ceiling. The sound masking fills the plenum area and gently filters down through the ceiling panels into the space below, uniformly raising the background sound level to cover distracting office noise.

In open-plan offices, sound masking can help those working independently to concentrate without distraction. In enclosed offices, sound masking improves speech privacy by complementing high-CAC ceiling panels to prevent intelligible conversation from being overheard by those outside (sound masking can increase CAC by as much as 10 points¹).

Assemblies

USG offers many partition systems that provide high STC ratings to reduce sound transmission between rooms. We also offer many floor/ceiling systems that have been evaluated for strong IIC ratings to minimize impact sound.

Note

(1) LENCORE sound masking adds the equivalent of 10 points of CAC by increasing ambient background sound by 10 dB.

Clean Indoor Air

Controlling Moisture, Mold and Indoor Pollution

As construction methods and materials advance, new buildings are built more tightly than ever. While such precision is vital for keeping the elements out, it can have a downside. In an enclosed environment, particulates, moisture and chemicals can build up in the air, causing a range of potential problems such as unpleasant odors, mold growth, allergy symptoms and even illness.

To prevent these problems, architects and designers must consider what the materials they select contain and how these materials will be installed and maintained. In addition, they must ensure that a building will have sufficient ventilation and air circulation to keep the air fresh and maintain a comfortable temperature. Here is a closer look at common types of indoor pollutants and ways to keep them out of your building.

Mold has become a significant issue due to today's tighter fabrication and fast-track scheduling, which can allow high levels of moisture to become trapped in the structure during construction. Moisture is so critical because mold cannot grow without it. Architects, designers, contractors and maintenance engineers must work together to prevent moisture accumulation both during construction and throughout a building's life cycle.

Volatile organic compounds (VOCs) include a range of chemicals such as carbon monoxide, carbon dioxide, formaldehyde, pesticides, and even perfumes and air fresheners. These compounds are released through an off-gassing process and may result from chemicals contained in or used with a product. Architects must consider what materials are made of as well as how these materials are processed and what chemicals may be required for their installation and maintenance.

Particulates include many substances such as dust, fibers, paper and lead. The best strategy for eliminating particulates is to ensure that openings for pipes and other wall penetrations are properly sealed, change ventilation system filters regularly and periodically clean HVAC ducts.

USG Offers



A comprehensive line of moisture-resistant products for walls, floors and ceilings that can stand up to intermittent moisture without fostering microbe growth.

Mold-resistant gypsum panels

USG offers several panels that feature a moisture- and mold-resistant gypsum core encased in moisture-resistant, 100 percent recycled face and back papers.

DUROCK Cement Board

This high-performance backer is a great choice for use with premium materials like thin stone, ceramic and quarry tile and mosaics. This noncombustible, high-strength board is mold-resistant and will not swell, soften, delaminate or disintegrate when exposed to moisture.

FIBEROCK Aqua-Tough Sheathing

These fiber-reinforced gypsum panels provide integral resistance to mold and moisture; they require no paper or glass facings that could delaminate over time. A unique water-drainage design on the back allows the sheathing to be installed up to 12 months before covering with exterior finish. Rigid fiber reinforcement throughout makes this panel ideal for use with studs spaced 24" on-center.

Acoustical ceiling panels with anti-microbial treatment

Because some applications require ceiling panels that demonstrate mold resistance when tested according to ASTM D3273, USG offers two ceiling panels featuring an anti-microbial treatment. USG ECLIPSE *CLIMAPLUS* and ASTRO™ *CLIMAPLUS* are the only ceiling panels on the market with a limited lifetime warranty against mold growth.

A broad range of products with no VOCs.

Many USG products emit no VOCs including SHEETROCK gypsum panels, paper joint tape, corner bead and setting-type joint compound; plasters; FIBEROCK sheathing, underlayment and abuse-resistant panels. USG acoustical ceiling panels qualify as low emitters of VOCs by the State of Washington and Collaborative for High-Performance Schools (CHPS).

Proper Lighting

Brightening a Space

While general lighting and task lighting are major requirements in commercial design, natural and indirect lighting play an important role, too. By preventing dark, shadowy areas and too-bright hot spots, these secondary light sources will not only give your spaces a great look and feel, but also reduce glare and eyestrain, a significant cause of occupant fatigue. A plan that includes natural and indirect lighting can also help conserve energy and cut operating costs by achieving proper light levels with fewer fixtures and lower-wattage bulbs. Fewer fixtures also mean less repairs and lower maintenance costs.

USG Offers

Many acoustical ceiling panels have been designed to efficiently reflect light within a space, which enhances indirect lighting, reduces energy consumption and creates a warm, luminous aesthetic.

LR value represents the percentage of light reflected from the surface of a material.

MARS CLIMAPLUS

USG offers numerous panels with LR values above .85, including MARS CLIMAPLUS with LR .90. Many USG panels with high LR values also feature high NRC and CAC ratings so you don't have to compromise on aesthetics for good acoustics.

Durability

Standing Up to Wear and Abuse

Durability is one of the most basic—and important—design considerations. Specifying high-performance materials often requires less money and consumes fewer resources overall than using standard materials that will require ongoing maintenance and repair. Today’s abuse-resistant systems also allow faster occupancy, weigh less and provide mechanical access.

USG Offers



Aesthetics and resistance to everyday wear are key requirements for high-traffic areas. USG meets this need with products designed to build walls and ceilings that are as strong as they are beautiful.

Walls

SHEETROCK Brand Abuse-Resistant Gypsum Panels. These panels are designed and tested to offer greater resistance to surface indentation and through-penetration than standard gypsum panels. They provide a low-cost alternative for building partitions offering enhanced impact resistance.

FIBEROCK Brand AR (Abuse-Resistant) Interior Panels. These panels are engineered to resist denting, breaking, and puncturing—even in high-traffic areas—reducing maintenance and life-cycle costs. These panels can be finished just like standard drywall without special skim coating.

FIBEROCK Brand VHI Abuse-Resistant Interior Panels. These panels enhance the strength of abuse-resistant interior panels with reinforcing fiber mesh for exceptional durability and resistance to damage. These panels can be finished just like standard drywall without special skim coating.

SHEETROCK Brand TUFF-HIDE™ Primer-Surfacer. This coating is applied in lieu of skim coat and primer coat in Level 5 gypsum board finishing to effectively hide minor surface defects.

Plaster systems. Conventional and one- and two-coat veneer plaster systems enhance finished appearance and provide added strength at a cost close to that of conventional drywall. Conventional plaster systems provide superior resistance to surface, impact, and penetration damage in the most demanding applications.

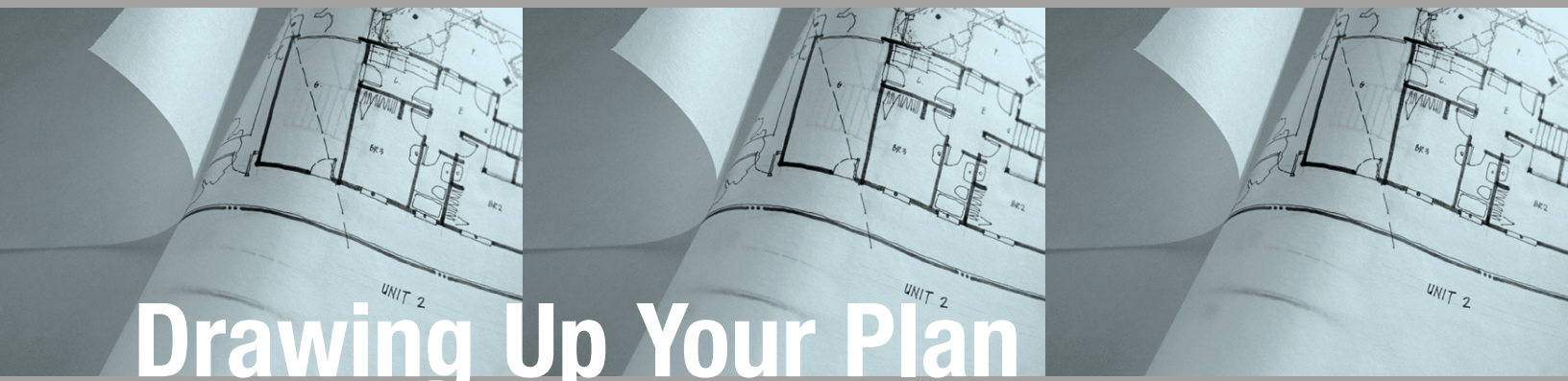
Ceilings

Cast acoustical ceiling panels. Formed and cured in molds, these extremely durable panels are up to three times stronger than standard acoustical panels and feature an integrally colored substrate to mask nicks or scrapes.

Acoustical ceiling panels with CLIMAPlus performance. These panels are specially formulated to resist sag in demanding environments with up to 100% relative humidity and up to 104 °F. These products carry a limited warranty of up to 30 years when installed in a DONN® Brand Suspension System.

Certified suspension systems. All DONN Brand Suspension Systems, when used with USG acoustical ceiling panels or tiles, carry a lifetime (30-year) warranty. USG is the only manufacturer to provide UL certification to ensure that all suspension main tees meet required performance standards for their class.

Ensuring that a structure will maintain a clean, comfortable environment inside while keeping the elements out is a process that begins with a building's first design sketches and continues throughout its useful life.



Drawing Up Your Plan

Sustainable Systems

Performance is in the Details

In addition to specifying sustainable materials, providing smart design detailing is vital to ensure that the many individual components will come together as a cohesive system that will last for decades to come. To help ensure that everyone who will be involved in the project understands your commitment to sustainability, be sure to include environmental goals such as LEED guidelines in your instructions to bidders.

When considering which suppliers you will be working with, review their responses to ASTM E2129, Standard Practice for Sustainability Assessment of Building Products. This extensive questionnaire provides a useful tool for gauging a manufacturer's interest and involvement in sustainability efforts.

The criteria of this standard and information about USG's extensive experience producing sustainable products and implementing environmentally sound manufacturing practices is included on page 18 of this booklet.

Critical locations that require special detailing include:

Roofs

Large Overhangs. By providing significant shade during summer months, wide overhangs help to keep sun out and cool the air around a building, reducing the amount of energy needed for air conditioning. Overhangs can also help to channel water away from a structure.

Rubber Membranes. Sheets of rubber, neoprene and other materials impervious to water and water vapor help to keep water out, preventing mold, wood rot, rust, and the eventual breakdown of drywall and gypsum plaster that can develop from unchecked leaks. Keep in mind that because many membranes function as water barriers, proper locations and installation methods must be carefully evaluated for each application.

Flashing. Barriers at the peaks of roofs and around skylights, exhaust vents and other penetrations divert water away from possible routes into the structure, preventing leaks, water accumulation, mold growth and damage to building materials.

Walls

Air Barriers. Structures that are not airtight due to cracks or openings in the building envelope allow moisture, pollutants, allergens and bacteria to enter, reduce the efficiency of HVAC systems and waste energy. One defense is to design an air barrier system, a combination of interconnected materials, flexible sealed joints and building envelope components that effectively separate conditioned and unconditioned spaces.

Air Retarders. Although vapor barriers are typically required by building codes, a more critical component may be an air retarder, which can repel water, reduce air entering from outside, and also allow moist air to escape the structure. A product such as spun-bonded olefin (e.g. DuPont TYVEK®) wrapped under the building's exterior can provide significant protection against the infiltration of outside air while allowing moisture vapor to escape to the outside.

Sustainable Systems

Flashing. The force of rain and wind, the presence of cracks, or gaps caused by building movement can allow water to penetrate a structure's exterior finish material. By providing a seal around windows, doors and other openings, flashing allows water to flow back out instead of collecting or seeping deeper into the structure. Weepholes provide an additional mechanism for helping water escape a wall system.

Openings

Drip caps. This specialized type of flashing typically overhangs the top of a window, door or other opening so water flowing down will be directed away from the structure. By providing an additional mechanism for keeping water away from openings, drip caps help to stop water intrusion, protect building materials from water and freeze damage, and prevent mold growth.

Shiplap. Diverse materials from metal to wood can be applied to the exterior of a structure in this stepped, overlapping pattern, which can provide significant protection against water intrusion. The linear style complements both traditional and modern designs.

USG Offers



USG leads the industry in developing high-performance systems to meet specialized requirements for modern building design and construction. A key objective of these components is to help architects integrate form and function into sustainable design as well as streamline the building process.

Building Enclosures

The SHEETROCK Brand Cavity Shaft Wall System

This non-load-bearing gypsum panel partition assembly is designed to enclose elevator and mechanical shafts, air ducts, stairwells, and areas where wall construction is only available from one side. The system can also be used to provide horizontal protection for corridor ceilings, the underside of stairwells, and other applications. The system provides up to four-hour fire resistance, and panels offering added resistance to water and mold are available for use in new construction.

FIBEROCK Brand Aqua-Tough Sheathing

USG offers exceptional strength, durability and superior water resistance for most exterior systems. Panels feature a uniform composition with no face layer to separate from the core, and they retain full strength even when cut. The distinctive pattern embossed into the back of each panel helps to drain intruding water.

DUROCK Brand Cement Board

This high-strength sheathing is not only invulnerable to water, but also promotes rapid water drainage. Panels may be used with wood or steel framing spaced 16" o.c. in new construction and in remodeling.

Best Practices

Ensure Sustainability at Every Step of the Building Process

Today, the construction industry implements safeguards throughout the building cycle to ensure that materials not only perform well on their own but also together to keep a structure strong, tight and comfortable. For a building to operate efficiently long into the future, careful planning and follow-through is critical at each step of the process:

Design	Building exteriors—roof, cladding, doors and windows—must be designed with multiple barriers to keep conditioned air in and the elements out.
Manufacturing	Materials manufacturers take care to ship products dry and undamaged so they fit right and prevent water from getting in.
Distribution	Dealers protect inventory from water and damage, ensuring that materials are delivered dry and ready to install.
Enclosure	While structures were traditionally left open to the elements during construction, contractors today cover open areas to shut out weather.
Drying	When moisture is introduced, such as through wet cement and painting, ample ventilation is maintained and special drying equipment is used to speed evaporation.
Ventilation	Owners and maintenance personnel pay close attention to HVAC system start-up, operation and performance.
Maintenance	Any breach of the building envelope is treated with the same urgency as fire. Architects, contractors, building owners and maintenance personnel understand that any damage must be repaired as soon as it is discovered.

Your Great Design Never Has to Show Its Age

Many people must work together for months—even years—to erect a building, but the completed project will offer the greatest satisfaction and inspiration to the architects, designers, specification writers and property owners, those who transformed an abstract vision into reality. With good design, careful planning and use of sustainable materials, you can ensure that your creation will look and function like new long into the future, all while minimizing its impact on the surrounding environment.

By working together to protect the resources we all share, we can build a better world.

Sustainability Assessment of USG Building Products

ASTM E2129

Standard Practice for Data Collection

Criterion No. 1

1.1

Materials (Product Feedstock)

Have efforts such as mining management, site restoration, use of 100% recycled content, etc. been made to minimize and/or avoid negative environmental impacts (such as affecting rare or endangered resources or species, releases of toxic chemicals or hazardous air pollutants, etc.) in obtaining raw materials for this product?

In 1974, USG began working with recaptured (synthetic) gypsum from flue-gas desulfurization (FGD) of coal-fired utility plants. In 1987, we became one of the first producers to use it in the manufacturing of wallboard. All gypsum cores in panels produced at seven of the 21 USG drywall plants are made exclusively of this material. We have used synthetic gypsum in ceiling products since 1996. Today, USG uses more recaptured FGD gypsum from North American coal-fired utility plants than any other manufacturer. If all recaptured gypsum produced in the U. S. were used to manufacture drywall, it would meet about 30 percent of the nation's drywall needs.

All USG gypsum panels have featured 100% recycled face and back papers since the early 1960s. Further, no bleach is used in the production of our products. USG uses 650,000 tons of secondary fiber (waste paper) annually to manufacture wallboard and ceiling products, making us one of the nation's top 10 consumers of secondary fiber. Fiberock panels, a family of high-performance wall and underlayment panels, have a recycled content of more than 97 percent.

USG manufactures several types of acoustical ceiling panels and metal suspension (grid) systems. Many of our mineral fiber ceiling panels include slag, a by-product of steel production. Every year, USG uses nearly 150,000 tons of slag in the manufacture of acoustical ceiling panels.

For information on the recycled content of metal grid systems and other USG products, please refer to the "Sustainability Table" on pages 24-26. In addition, USG has a long history of land reclamation including in mining operations, efforts that go well beyond any State or Federal requirement (for additional information, see <http://www.usg.com/news/virginiareclamationaward.asp>).

1.2

Does the product meet the requirements of EPA regulations for content of volatile organic compounds (VOCs)?

(The EPA National VOC Rule can be found in the Federal Register, Sept. 11, 1998—Volume 63, Number 176, pages 48847.)

VOC emissions for all USG products are below EPA limits. Please refer to the "Sustainability Table" for a complete listing of VOC information for USG products, or refer to the MSDS for each product (available for download at www.usg.com).

1.3

Does the VOC content of product coatings, adhesives, etc. meet South Coast Air Quality Management District Regulations?

Please refer to the "Sustainability Table" on pages 24-26 for a complete listing of VOC information for USG products, or refer to the MSDS for each product (available for download at www.usg.com). We have received low-VOC certification for four USG ceiling tiles and SHEETROCK Gypsum Panels per section 01350 of Collaborative for High-Performance Schools (CHPS).

<p>1.4</p>	<p>Does the product meet federal regulations concerning substances listed as carcinogenic by the National Toxicology Program?</p> <p>No substance in any USG product exceeds exposure limits that appear on the National Toxicology Program carcinogenic list. Please refer to the MSDS for each product for complete ingredients including trace amounts.</p>
<p>Criterion No. 2</p> <p>2.1</p>	<p>Manufacturing</p> <p>Has the manufacturer taken steps to minimize the use of nonrenewable energy from the point at which raw materials are gathered to the point at which the final product is transported to the building site?</p> <p>Two USG plants (Sweetwater, Texas, and Oakfield, New York) have natural gas cogeneration units that produce power to run the plants and heat to operate drying kilns. Cogeneration produces power and heat with 30 percent less fuel.</p>
<p>2.2</p>	<p>Is any waste produced in the manufacturing process reclaimed on-site?</p> <p>USG plants recycle waste back into the manufacturing process whenever possible. We have a 95 percent recovery rate in drywall manufacturing, and much of the remaining 5 percent is used to protect gypsum panels during shipment, raising overall plant efficiency above 98 percent. Acoustical ceiling panels that become chipped or broken are returned to the manufacturing process; USG Interiors plant efficiency exceeds 85 percent.</p>
<p>2.3</p>	<p>Does the process for manufacturing this product avoid the release of substances listed on the U.S. EPA's Toxics Release Inventory at or above the levels that require reporting to the EPA?</p> <p>The manufacturing process for USG drywall and acoustical ceiling panels does not involve toxic materials.</p>
<p>2.4</p>	<p>Have any recent improvements been made to limit negative environmental impacts relating to the manufacturing process?</p> <p>One-third of the gypsum USG uses to manufacture drywall, plaster and acoustical ceiling panels is derived from synthetic gypsum from North American coal-fired utility plants. We use more of this resource than any other manufacturer. Because synthetic gypsum is a powder, it requires no mining or grinding; raw material extraction and processing accounts for about 10 percent of the embodied energy in drywall made of natural gypsum.</p>
<p>2.5</p>	<p>If water is used during the production process, have water conservation and/or recycling measures been initiated?</p> <p>USG's seven paper mills recycle 90 percent to 98 percent of the water used in their manufacturing processes, saving 4 million to 6 million gallons at each location every day.</p>

Sustainability Assessment of USG Building Products

2.6

Has the manufacturer undertaken any of the following actions?

A. Redesigned a production process to decrease greenhouse gas emissions?

Two USG plants have natural gas cogeneration units that produce power to run the plants and heat to operate drying kilns. Cogeneration produces power and heat with 30 percent less fuel.

In the production of our conventional drywall and plaster products, we did not modify our manufacturing process, but we do take advantage of a modification to the Clean Air Act that allows the use of synthetic gypsum. Since the 1970s, increased regulation of sulfur dioxide emissions from fossil-fuel-burning power plants has required a number of power plants to install flue gas desulfurization equipment. This equipment helps reduce acid rain by removing sulfur dioxide from flue gases. Some of this equipment uses limestone to remove sulfur dioxide and produces calcium sulfate, or synthetic gypsum, as a byproduct.

In 1987, USG became one of the first wallboard companies in North America to include synthetic gypsum in its products. We began using this raw material at our plant in Galena Park, Texas. In 1989, the Galena Park plant became the first plant to make gypsum wallboard from 100 percent synthetic gypsum.

B. Redesigned a production process to decrease liquid effluents?

We continue to improve manufacturing efficiencies. Our three newest gypsum drywall plants are the most efficient in the industry.

C. Redesigned a production process to utilize less toxic materials?

N/A.

D. Substituted safer solvents in a production process?

Water is only the solvent used in the production of drywall and acoustical ceiling panels. Wastewater is reclaimed and reused in the manufacturing process.

E. Instituted more stringent dust controls?

Yes. Dust is closely monitored in our plants; gypsum rocks are misted during the grinding process to prevent dust from developing.

F. Install smoke-stack particulate collectors or gas scrubbers?

N/A.

G. Installed or improved plant solid and toxic waste reduction programs?

United States Gypsum plants are 95 percent efficient and USG Interiors plants are 85 percent efficient. This means that 95 percent and 85 percent of everything that enters these respective plants emerges as finished product.

2.7

Does the manufacturing facility comply with OSHA requirements?

USG facilities exceed OSHA requirements. In fact, U.S. Gypsum joined 67 other firms in 1914 to establish the National Safety Council. In addition, USG's safety record is five times better than that of other gypsum companies and eighteen times better than that of the industry overall. USG has won more MSHA Sentinel of Safety awards (15) than any other company in the United States. Our Hagersville, Ontario, Canada facility holds the record for the fewest "lost time" injuries world wide. Information on the U.S. Department of Labor Mine Safety and Health Administration safety records is available at www.nsha.org.

Criterion No. 3

Operational Performance of Installed Product

3.1

If applicable, does the product qualify for an EPA EnergyStar?

N/A.

3.2

Describe routine maintenance procedures for the product.

Instructions for cleaning and maintenance can be obtained from many USG sources including product literature, packaging labels and the United States Gypsum Company "Gypsum Construction Handbook." Product maintenance information is also available at www.usg.com or by contacting 888 874.2450 or samplit@usg.com.

3.3

How long will the product last in the building if maintained properly with routine maintenance procedures?

The life of the building, when installed properly and maintained.

3.4

Does the manufacturer provide detailed instructions with the product upon delivery to the job site for the proper use and maintenance required in order to insure that this product will last this long?

Instructions on shipping, handling, installation and maintenance can be obtained from many USG sources including product literature, packaging labels and the United States Gypsum Company "Gypsum Construction Handbook." Product maintenance information is also available at www.usg.com or by contacting 888 874.2450 or samplit@usg.com.

Criterion No. 4

Indoor Environmental Quality

4.1

Is there any other information about how this product contributes to indoor environmental quality (positively or negatively, e.g. acoustical properties, lighting, potential risks to workers during application, etc.) that has not already been reported, but that sender of this questionnaire should know?

IEQ values for ceiling tiles can be found in the USG Ceilings Systems catalog (SC2000) including light reflectance, acoustical ratings and fire ratings. The best source of fire and sound performance for USG gypsum systems is the USG Construction Selector (SA100). The complete USG Gypsum Systems reference (SA99) can be ordered by contacting 888 874-2450 or samplit@usg.com. Information on VOCs for most USG products can be found on individual product MSDS forms, which are available at www.usg.com.

Sustainability Assessment of USG Building Products

Criterion No. 5

Corporate Environmental Policy

5.1	Does the manufacturer have a written environmental policy? USG environmental policy is presented in our publication "Committed to the Environment" (X2985), which is available at www.usg.com or by contacting 888 874.2450 or samplit@usg.com .
5.2	Does the manufacturer have a reclamation program or any other program in place for the recycling or reuse of its product by accepting return of the product at the end of its useful life? Most USG plants have grinding equipment to recycle scraps from material made at the facility. In 2000, we recycled more than 430,000 tons of damaged drywall or drywall scraps returned from construction sites. This waste was reused to meet 3.5 percent of our raw material needs. We have worked with several waste management firms on the requirements of returned C&D materials and continue to investigate new methods for taking back scrap material where local conditions allow. Since the 1960s, USG has recycled drywall for specific jobs. However, many factors, including shipping distance and contamination, affect the feasibility of reusing waste drywall from outside sources. We are currently developing a specification on requirements of C&D waste for return. For additional information on re-grind uses, visit www.drywallrecycling.com USG has a long history of land reclamation, including in our mining operations, which exceed all state and federal requirements. For additional information, visit www.usg.com/news/virginiareclamationaward.asp
5.3	Does the manufacturer have a program in place to reduce the amount of the product's packaging? U.S. Gypsum has reduced product packaging to simple paper strips that wrap around the edge of a bundle of two drywall panels; during shipping, drywall stacks are protected with reusable tarps. We continue to look for methods that will enable us to further reduce packaging.
5.4	Does the manufacturer have a program in place to facilitate the return, reuse, recycling, or composting of the product's packaging? U.S. Gypsum has reduced product packaging to simple paper strips that wrap around the edge of a bundle of two drywall panels; during shipping, the drywall is protected with reusable tarps.
5.5	Can the environmental claims on this questionnaire be substantiated with invoices, data sheets, or other documentation? Many USG publications include portions of this information but no one piece contains all of this information. Environmental information is provided in this publication, individual product MSDS sheets, and the USG Sustainability Table on pages 24-26.

5.6

Does the manufacturer provide information on the service life of the product or encourage the use of professional guidelines to determine the service life of the product?

With proper upkeep and maintenance, the useful life of most of USG products is the service life of the building. The best source for this type of information is the United States Gypsum Company “Gypsum Construction Handbook”. Product use and maintenance information is also available at www.usg.com or by contacting 888 874.2450 or samplit@usg.com.

5.7

Does the manufacturer provide information regarding natural disaster mitigation, such as performance of the product during a natural disaster or appropriate response after a natural disaster?

Plaster products have performed extremely well through natural disasters. Drywall and ceiling panels likewise have performed well through natural disasters. Specially designed compression components are used in ceiling assemblies in areas that experience seismic activity. Repair and re-assembly of systems after natural disasters is covered in the USG “Gypsum Construction Handbook” and literature for individual products or product assemblies.

5.8

Is there other objective information about the environmental quality of the building products you offer that you would like taken into consideration?

USG has several programs available for the continuing education of architects, contractors and code officials. Information on these programs is available at www.usg.com or by contacting us at ces@usg.com.

Product Selection

Acoustical Ceiling Panels

USGBC LEED Credits	MR 4.1 & 4.2				EQ 8					MR 5.1 & 5.2	
	Post-Cons.		Post-Ind.		LR	NRC	CAC	Dens. Lb/m ³	VOCs (ug m ³)		Manu Eff.
	Class A	FC	Class A	FC							
ECLIPSE CLIMAPLUS	0%	0%	78%	62%	.84	.70	35	17	<10	85+%	'X'-technology Manufactured at Cloquet, MN Slag Wool (within 500 miles), Perlite (within 500 miles), Cellulose (local), Starch (local) & Clay (over 500 miles) Embodied Energy 14.6 MJ/kg
MILLENNIA® CLIMAPLUS	0%	0%	76%	62%	.85	.70	35	17	<10		
ORION™ 210 CLIMAPLUS	0%	NA	72%	NA	.76	.65	25	14-17	<10		
ORION 270 CLIMAPLUS	0%	NA	72%	NA	.84	.80/.85	25	14-17	2		
MARS CLIMAPLUS	0%	NA	72%	NA	.92	.70	35	15	<10		
ASTRO CLIMAPLUS	0%	0%	62%	67%	.85	.55	35	18-21	<10		
BRIO™ CLIMAPLUS	0%	0%	67%	67%	.81	.70	35	20	26	85+%	Cast Products Manufactured at Wallworth, WI Slag Wool (made on site, slag within 100 miles), Plaster of Paris (within 100 miles), Starch (local) & Clay (over 500 miles) Embodied Energy 14.6 MJ/kg
"F" FISSURED™	0%	0%	67%	67%	.79	.70	35	24	26		
Fresco CLIMAPLUS	0%	0%	67%	67%	.81	.70	35	20	26		
FROST	0%	0%	67%	67%	.82	.70	40	24	26		
GLACIER™	0%	0%	67%	67%	.69	.70	35	22-24	26		
SANDRIFT™ CLIMAPLUS	0%	0%	67%	67%	.83	.70	40	20	26		
Olympia Micro CLIMAPLUS	3%	NA	49%	NA	.88	.50	35	18	21	85+%	WetFelt Products Manufactured at Greenville, MS Slag Wool (over 500 miles), Perlite (within 500 miles), Cellulose (within 300 miles), Starch (within 150 miles) & Clay (within 100 miles) Embodied Energy 14.6 MJ/kg
Aspen	3%	1%	35%	44%	.87	.55	35	18-22	21		
Pebbled	4%	1%	26%	45%	.87	.55	35	14	21		
ROCK FACE® CLIMAPLUS	NA	1%	NA	44%	.84	.55	35	24	21		
Touchstone CLIMAPLUS	3%	1%	35%	44%	.86	.55	35	26	21		
RADAR CLIMAPLUS	4%	1%	31%	45%	.84	.55	35	13-14	21		
Fissured	4%	1%	26%	45%	.82	.50/.55	35	12-20	21		
RADAR	4%	1%	26%	45%	.84	.55/.60	35	13-14	68		
RADAR CLIMAPLUS	7%	1%	34%	52%	.84	.55	35	13-14	21	85+%	WetFelt Products Manufactured at Cloquet, MN Slag Wool (within 500 miles), Perlite (within 500 miles), Cellulose (local), Starch (local) & Clay (over 500 miles) Embodied Energy 14.6 MJ/kg
Fissured	12%	5%	11%	41%	.82	.50/.55	35	12-20			
RADAR	13%	4%	10%	42%	.84	.55/.60	35	13-14			
RADAR CLIMAPLUS	1%	1%	51%	51%	.84	.55/.70	35/40	18			
High CAC/NRC											
CLEAN ROOM™ CLIMAPLUS	NA	0%	NA	0%		-.60	35	21			
RADAR Ceramic CLIMAPLUS	NA	0%	NA	43%	.82	.50	40	26			

Specialty Ceiling Panels

USGBC LEED Credits	MR 4.1 & 4.2				EQ					MR 5.1 & 5.2	
	Post-Cons.		Post-Ind.		LR	NRC	CAC	Dens. Lb/Ft ³	VOCs (ug m ³)	Manu. Eff.	Raw Materials/Comments (% by weight)
	Class A	FC	Class A	FC							
PREMIER HI-LITE™ CLIMAPLUS	0%	NA	29%	NA		.60/.75	20	28		85+%	Glass Fiber Products Manufactured at Greenville, MS
HALCYON CLIMAPLUS	0%	NA	27%	NA		.90/1.0	20/30	6			
PREMIER NUBBY™ CLIMAPLUS	0%	NA	29%	NA		.85/.90	20/25	6			Embodied Energy 30.3 MJ/kg
Sheetrock Panel CLIMAPLUS	NA	5%	NA	23%		—	35/40	48		95+%	Gypsum & Glass Fiber Product Manufactured at Shoals, IN; Sweetwater, TX; Stony Point, NY; & Plaster City, CA
SHEETROCK Lay-in/ CLEAN ROOM	NA	5%	NA	23%	.77	—	40	48		95+%	Gypsum & Glass Fiber Product Manufactured at Sweetwater, TX

Partition Components

USGBC LEED Credits ¹	MR 4.1 and 4.2			EQ4			MR 5.2
Product Family	Post-Cons.	Post Ind.	Embodied Energy	Dens. lb/ft ³	VOC	Manu. Eff.	Raw Materials (% by weight)
SHEETROCK Panels—Percent varies across 23 plants nationwide.	~5%	0% -95% 36.5% avg.	3.6MJ/kg	43-50	None ¹	95+%	95% Gypsum, 5% Paper, 1% Starch; special panel with wax and glass fiber
Steel Framing	0	25%	34.8 MJ/kg		None		Steel
Paper Tape	0	0	.6 MJ/kg		None	95+%	Paper
Glass Fiber Tape	0	0					Fibrous Glass (Continuous Filament)
Paper-Faced Bead	0	25%	40.8 MJ/kg		None		Steel, Paper, & Non-Solvent Organic Adhesive
Metal Bead	0	25%	34.8 MJ/kg		None		Steel
DUROCK Cement Panels	0	20%	10 MJ/kg	72			Portland Cement & Fly Ash
FIBEROCK Sheathing, AR Panels & Underlayment	10%	85%	5 MJ/kg	55	None	95%	85% FGD Gypsum (barged 250 miles), 10% Cellulose (local), & 1% Starch (local).
Veneer Plasters	0	0	3 MJ/kg	105	None	98%	Plaster of Paris & Lime (Diamond [®]), Plaster of Paris & Sand (IMPERIAL [™])
RED Top [®] Plaster, Regular	0	100%	3 MJ/kg	105	None	98%	Plaster of Paris, Lime & Sand
Joint Compound—Drying Type	0	0	3 MJ/kg	100	< 2 g/L	98%	Limestone and Latex
Joint Compound—Setting Type	0	0	3 MJ/kg	100	None	98%	Plaster of Paris, Limestone & Mica
Acoustical Sealant	0	0			<65 g/L		Limestone, Water, Acrylic Polymer
MICORE™ 160 panels	18%	30%	14.6 MJ/kg	3			Perlite, 1% Starch (local), Clay, 37% Mineral Wool (local), 19% Paper (local) Manufactured at Cloquet, MN
MICORE 300 panels	18%	30%					
AX Aluminum Lay-in Ceiling Grid	0	95	17.3 MJ/kg ²		None	90%	Aluminum
Steel Lay-in & Drywall Ceiling Grid	0	25	34.8 MJ/kg		None	90%	Steel (from US and foreign markets; can specify US material), Paint

See footnotes on the following page.

Notes

USG uses more recaptured (FGD or flue gas desulfurization) gypsum than any other wallboard supplier, over 3 million tons in 2003. However, this content changes from plant to plant and even day to day at any one plant due to availability. The recycled contents above are approximates based on the plants' averages for 2002. Most of the power plants that produce this recaptured or byproduct gypsum are east of the Mississippi River. While this byproduct gypsum is not available everywhere in North America, we do have plants strategically located to meet your needs. Evaluation should be made per job on the benefits of using this material over natural gypsum in the production of drywall used in your project. Using locally produced drywall may be more environmentally friendly than shipping drywall across country for high recycled content. LEED is a guideline for building solutions established by the USGBC—Products are NOT LEED certified, however they assist on obtaining points for the project.

For example:

EA Credit 1—Optimize Energy Performance

High Light Reflectance (LR) of ceiling materials can reduce required luminaries of design space as required per ASHRAE (1 Point)

MR Credit 2—Construction Waste Management

2.1—Divert 50% of project waste (by weight) from landfill (1 Point)

2.2—Divert another 25% of project waste (by weight) from landfill (1 Point)

MR Credit 4—Recycled Content

4.1—5% of project materials' value (Post-Consumer + 1/2 Post-Industrial) (1 Point)

4.2—10% of project materials' value (Post-Consumer + 1/2 Post-Industrial) (1 Point)

MR Credit 5—Local/Regional Materials

5.1—If 20% of project materials are manufactured within 500 miles (1 Point)

5.2—If raw materials for above products are obtained within 500 miles (1 Point)

MR Credit 6—Rapidly Renewable Materials

EQ Credit 4—Low-Emitting Materials

4.1—Architectural Sealants have VOC less than 250g/L per Reg. 8, Rule 51 (1 Point)

4.2—Drywall Installation less than 200g/L and Ceiling Tile installation less than 250g/L per Green Seal, Table 5 (1 Point)

VOC Emissions and USG Ceiling Panels:

USG Acoustical Ceiling Panels are low VOC emitters by the State of Washington requirements and professional standards.

State Of WA Standard VOC maximum allowed = 500 ug m3

USG Ceiling Panels and Tiles of similar composition would be expected to contain similar VOC emissions.

USG Ceiling Panels that have been tested following ASTM 5116 protocol show TVOC and formaldehyde levels below the State of Washington product emission standard. Table 1 shows the emissions of USG Ceiling Panels tested to date.

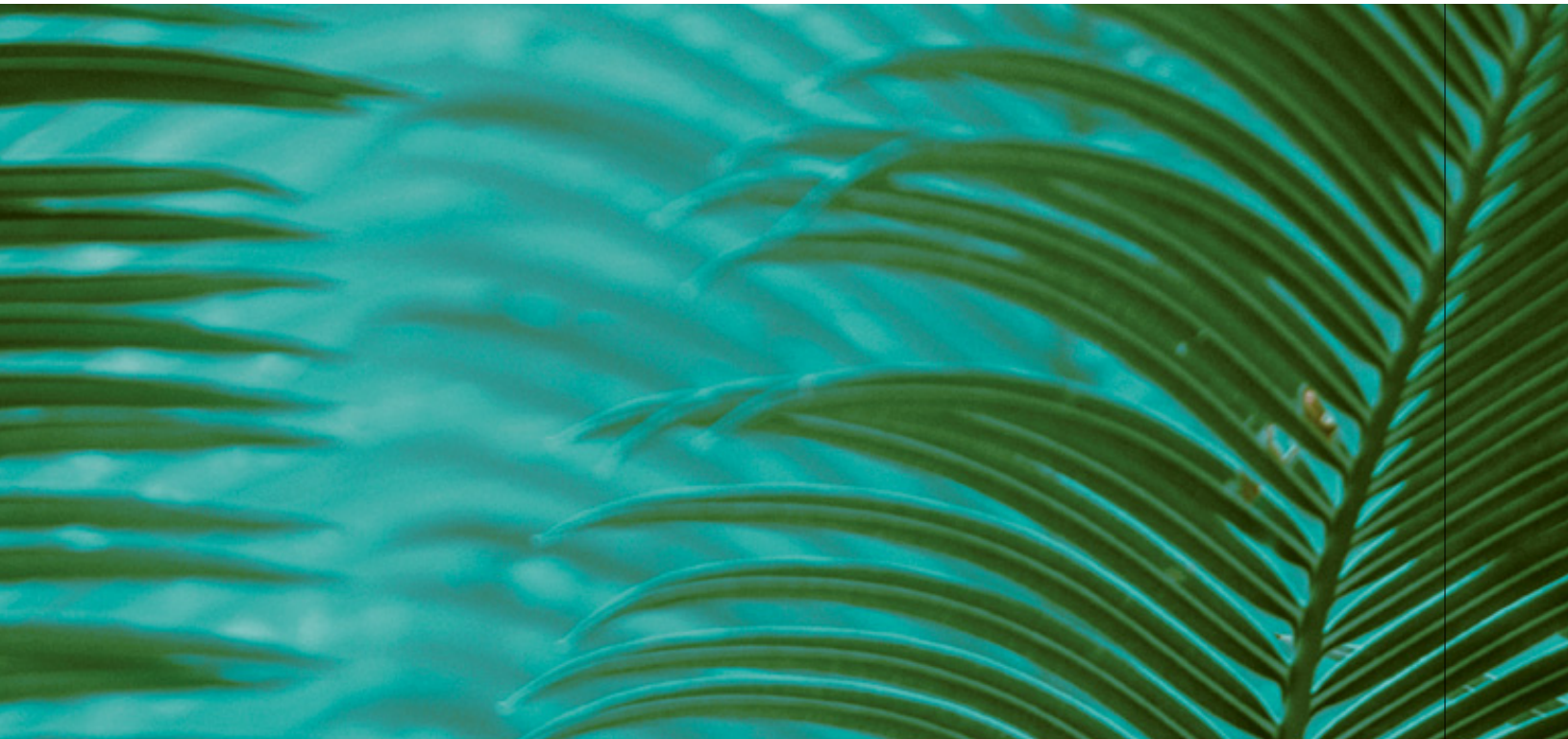
Total Volatile Organic Compound (TVOC) emission from USG Ceiling tile following ASTM D 5116.

General Note

(1) This product passed the Section 01350 of the Material Specifications adopted by the Collaborative for High Performance Schools (CHPS) for VOC emissions.

Embodied Energy calculations are based on 'Cradle to Market' and averages for all plants within North America. For the most complete list of building material Embodied Energy values visit www.strategicdata.co.nz/mukhtar/sam2.htm. Values published above may vary due to differences in shipping distances and efficiencies. Visit <http://hem.dis.anl.gov/eehem/95/950109.html> for information on how Embodied Energy impacts design solutions and material selection.

(2) Embodied Energy values for recycled Aluminum do not include transportation from job to manufacturing or energy to separate from waste.



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Note

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Safety First!

Follow good safety and industrial hygiene practices during handling and installation of all products and systems. Take necessary precautions and wear the appropriate personal protective equipment as needed. Read material safety data sheets and related literature on products before specification and/or installation.

