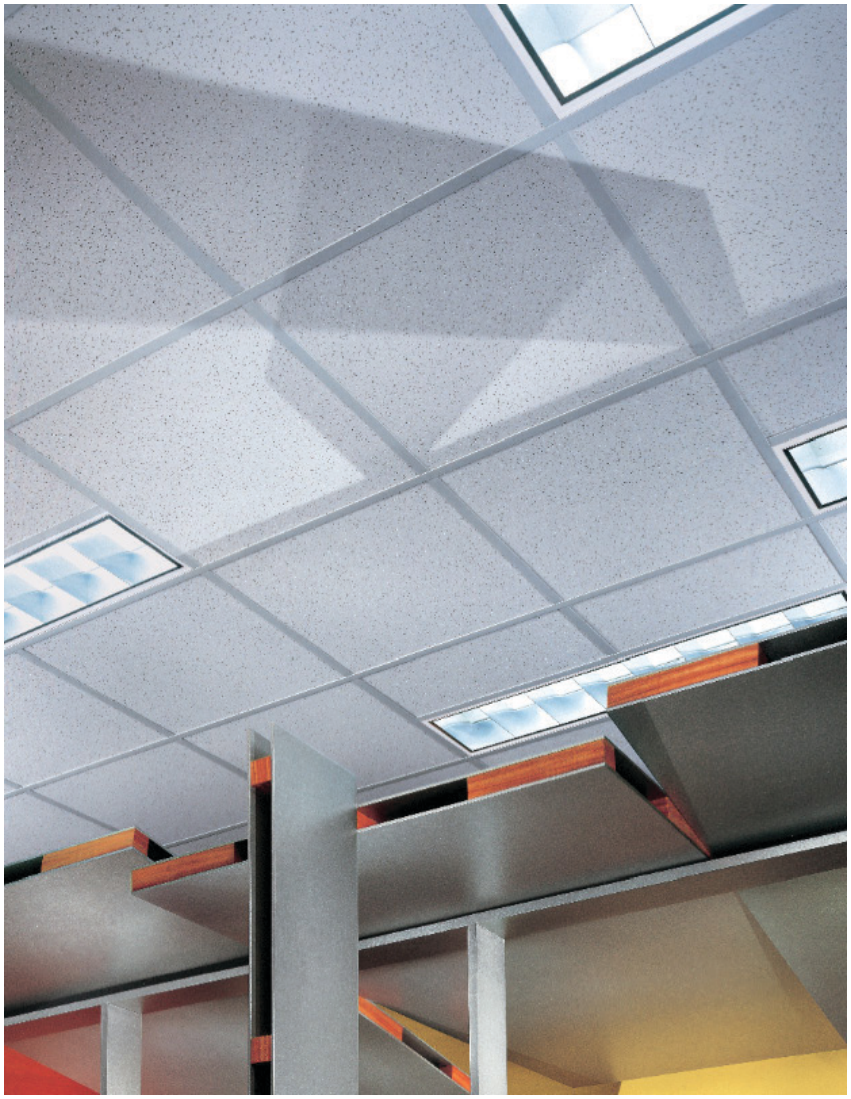
Environmental Product Declaration

USG CEILINGS™ BRAND RADAR™ FIRECODE®, RADAR™ CLIMAPLUS™ FIRECODE®, RADAR™ CLIMAPLUS™ HIGH-NRC/HIGH-CAC FIRECODE®

USG Wet Felted Mineral Fiber Ceiling Panels DX®/DXL™, Centricitee DXLT™, Fineline DXLF™ Suspension Systems



USG Ceilings™ Brand Radar™ Firecode®, Radar™ Climaplus™ Firecode®, Radar™ Climaplus™ High-NRC/High-CAC Firecode® acoustical ceiling panels are economical, wet felted mineral fiber and medium-textured panels that feature a non-directional pattern and offer Firecode and optional anti-sag performance. They install quickly and easily and are classified as low-emitting ceiling panels for offices, schools, corridors and retail stores.

USG

For over a century, sustainable practices have naturally been an inherent part of our business at USG. Today, they help shape the innovative products that become the homes where we live, the buildings where we work and the arenas where we play. From the product formulations we choose, to the processes we employ, USG is committed to designing, manufacturing, and distributing products that minimize overall environmental impacts and contribute toward a more healthy living space. We believe that transparency of product information is essential for our stakeholders and EPDs are the next step toward an even more transparent USG.

USG's ceiling panels listed in this UL Environment Certified Document provides an acoustical ceiling panel's: Life Cycle Assessment (LCA), LCA Impact Measures, Product Composition, Material Definitions, Manufacturing Process, Product Performance Attributes, and Product Application.

For additional information, visit usg.com and usgdesignstudio.com

UL CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

USG Ceilings™ Brand: Radar™ Firecode®, Radar™ ClimaPlus™ Firecode®, Radar™ ClimaPlus™ High-NRC/High-CAC Firecode®
Wet Felted Mineral Fiber Ceiling Panels

According to ISO 14025

This declaration is an environmental product declaration in accordance with ISO 14025. This EPD does not guarantee that any performance benchmarks, including environmental performance benchmarks, are met. EPDs are intended to compliment Type I environmental performance labels. EPDs provide LCA-based information and additional information on the environmental aspects of products and assist purchasers and users to make informed comparisons between products. EPDs are not comparative assertions. EPDs encourage improvement of environmental performance and provide information for assessing the environmental impacts of products over their life cycle. EPDs not based on an LCA covering all life cycle stages, or based on a different PCR, are examples of declarations that have limited comparability. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	USG
DECLARATION NUMBER	12CA30659.103.1
DECLARED PRODUCT	USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode
REFERENCE PCR	Institut Bauen und Umwelt e.V. PCR[1] for Ceiling panels for suspended ceiling systems

DATE OF ISSUE	5 September 2013
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verification

The PCR review was conducted by:	Institut Bauen und Umwelt e.V. PCR confirmed by SVA Rheinufer 108 D-53639 Königswinter Germany Tel.: +49 (0)2223 296679-0 Fax: +49 (0)2223 296679-1 Email: info@bau-umwelt.com
This declaration was independently verified by Underwriters Laboratories in accordance with ISO 14025 ☐ INTERNAL ☒ EXTERNAL	 Loretta Tam
This life cycle assessment was independently verified by in accordance with ISO 14044 and the reference PCR	 James Mellentine, Sustainable Solutions Corporation

1. PCR = Product Category Rules

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

EPD **Transparency Summary**

COMPANY NAME	**USG Interiors, LLC**
PRODUCT TYPE	**Wet Felted Mineral Fiber Ceiling Panels**
PRODUCT NAME	USG Ceilings™ Brand: Radar™ Firecode®, Radar Climaplus™ Firecode & Radar Cp h-nrc/h-cac Firecode
PRODUCT DEFINITION	Wet felted mineral fiber ceiling panel offering a non-directional pattern with a fresh, clean appearance and fast, efficient installation. This low-emitting ceiling panel is a USDA Certified Biobased Product and ClimaPlus system warranty against sag, mold and mildew.
PRODUCT CATEGORY RULE (PCR)	Ceiling Panels for Suspended Ceiling Systems Institut Bauen und Umwelt e.V.
CERTIFICATION PERIOD	**9/5/13 - 9/5/18**
DECLARATION NUMBER	**12CA30659.103.1**

LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

	ATMOSPHERE			WATER		EARTH	
	Global Warming Potential refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.	**Ozone Depletion Potential** is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	**Photochemical Ozone Creation Potential** happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.	**Acidification Potential** is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.	**Eutrophication Potential** occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	**Depletion of Abiotic Resources (Elements)** refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.	**Depletion of Abiotic Resources (Fossil Fuels)** refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI	**0.572** kg CO2-Equiv.	**4.19E-10** kg CFC 11-Equiv.	**1.20E-06** g NOx-Equiv.	**0.115** mol H+ Equiv.	**1.91E-04** kg N-Equiv.	**NOT APPLICABLE**	**NOT APPLICABLE**
CML	**0.572** kg CO2-Equiv.	**5.02E-10** kg CFC 11-Equiv.	**2.60E-04** kg Ethene-Equiv.	**2.12E-03** kg SO2-Equiv.	**2.67E-04** kg Phosphate-Equiv.	**NOT APPLICABLE**	**NOT APPLICABLE**

FUNCTIONAL UNIT: One square foot (12"x12") ceiling panel for use for 50 years.

Environment

MATERIAL CONTENT

Material content measured to 1%.

COMPONENT	MATERIAL	AVAILABILITY	MASS%	ORIGIN
Ceiling Panel Core	Mineral Wool	Recycled Mineral Resource, Nonrenewable, Abundant	<65%	US
Ceiling Panel Core	Perlite	Mineral Resource, Abundant	<25%	US
Ceiling Panel Core	Recycled Paper	Recycled Resource, Abundant	<8%	US
Ceiling Panel Core	Starch	Rapidly Renewable Resource, Abundant	<10%	US
Ceiling Panel Core	Clay	Mineral Resource, Abundant	<20%	US
Ceiling Panel Coating	Clay-based Prime and Back Coating	Mineral Resource, Abundant	<6%	US
Ceiling Panel Coating	Pigmented Finish Coatings	Fossil-based Resource, Abundant	<2%	US

ADDITIONAL ENVIRONMENTAL INFORMATION

PRE-CONSUMER RECYCLED CONTENT	42.3 %
POST-CONSUMER RECYCLED CONTENT	0-7 %
VOC EMISSIONS	Meets CDPH 01350
WATER CONSUMPTION	11.45 kg/l

RECYCLING OR REUSE

The preferred method is for the product to be recycled through USG's Ceiling Take-back program.

ENERGY

RENEWABLE ENERGY	12.8 %	1.86 MJ
NON-RENEWABLE ENERGY	87.2 %	12.7 MJ

STANDARDS

- ASTM E1264
- ASTM E84
- ASTM C367
- ASTM C423
- ASTM E1414
- ASTM C518-1

Performance Attributes:
NRC: 0.55-0.79
CAC: 35-40
LR: 0.83-0.84

CERTIFICATIONS

Acoustics

Fire

MANUFACTURER CONTACT INFO

NAME	USG Interiors, LLC
PHONE	800 USG.4YOU (800 874.4968)
EMAIL	USG4YOU-TechnicalSupport@usg.com
WEBSITE	usg.com

USG Ceilings™ Brand: Radar™ Firecode®, Radar™ ClimaPlus™ Firecode®, Radar™ ClimaPlus™ High-NRC/High-CAC Firecode®
Wet Felted Mineral Fiber Ceiling Panels

According to ISO 14025

Product Classification

Product Description

USG Interiors produces a family of wet felted acoustical ceiling panels at its Cloquet, MN and Greenville, MS facilities having various light reflectance, noise reduction, and attenuation specifications with various levels of post-consumer/industrial recycled content. These production lines employ a wet felted technology in the production of acoustical ceiling panels. Wet felted acoustical ceiling panels contain mostly perlite, mineral wool, starch, recycled paper and clay. In smaller amounts, other raw materials used in the panel forming process include flocculants, biocides and defoamer. The finishing and packaging unit processes are dominated by the use of water-based paint, which contains the following ingredients: calcium carbonate, clay, latex, titanium dioxide (TiO_2) and other chemicals. Shrink-wrap and corrugated strip are used as packing materials.

USG Interiors, LLC also produces a family of grid products at its Westlake, OH, Cartersville, GA, Oakville, ON, Canada and Stockton, CA facilities. This family of grid products coordinates with USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode panels and includes 8 grid profiles including DX/DXL, DXLT, and DXLF. Each profile is available in Intermediate Duty and Heavy Duty weight. Grid production encompasses the third-party production of the hot-dipped galvanized steel coils, transport of these coils to USG fabrication facilities where the steel coil is cleaned, coated (optional depending on intended purpose) and slit and optionally transported to additional production facilities where the coated steel is formed into finished grid components. These finished grid components are then packaged in cardboard boxes.

Product Styles

This Environmental Product Declaration (EPD) covers USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode products produced at USG's Cloquet, MN and Greenville, MS production facilities. These products are 5/8" or 3/4" thick and are produced with a smooth fissured, perforated and painted surface. This Environmental Product Declaration (EPD) also presents, as additional information, LCA cradle-to-grave data on USG's Intermediate Duty DX/DXL grid product. LCA Data for other compatible suspension systems with USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode is available upon request.

Features and Benefits

Attributes below are representative of all item numbers in the product line called USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode produced at Cloquet, MN and Greenville, MS.

- NRC .55-.70 (depending on product type)
- CAC 35-40 (depending on product type)
- Surface Burning Characteristics: Class A
- Firecode formulation: See a USG sales representative for approved fire rated assemblies
- Light Reflectance .83-.84 (depending on product type)
- Weight/sf = 1.09-1.29 (depending on product type)
- Fine Textured (Perforated and Fissured Surface)
- Thermal Resistance: R = 1.6-1.9 [hr • ft^2 • ºF/Btu] (depending on product type)
- ClimaPlus Superior Performance – Sag resistant and contains a broad-spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew.
- USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode products have total recycled content values ranging from 41 to 58%. Precise pre-consumer and post

consumer recycled content values may be found on usg.com and usgdesignstudio.com.

- Low Emissions (VOC). USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode are low emitting products that meet CA specification 01350 (CA Dept. of Health Services Standard Practice for the testing of VOC emissions) and are listed on the CHPS database for low-emitting materials. USG Certificate of Compliance for Low VOC Emissions is also available on usg.com.
- USG Ceilings: Radar Firecode, Radar ClimaPlus Firecode, Radar ClimaPlus High-NRC/High-CAC Firecode products are recyclable under the USG Ceiling Recycling program. Refer to usgdesignstudio.com for detailed product information.

Ceiling Panel Options (USG Ceilings Radar Firecode)

					UL Classified							
	Edge	Panel Size	Class	Item No. Imperial Metric	NRC	CAC Min.	LR	Color	Grid Options	VOC Emissions	Recycled Content	Panel Cost
USG Ceilings Radar Firecode Panels	SQ 	**2'x2'x5/8"**	Firecode	2115	.55	35	.83	White	A	Low	41-49%	$
		2'x4'x5/8"	Firecode	2315	.55	35	.83	White	A	Low	41-49%	$
	SLT 	**2'x2'x5/8"**	Firecode	2125	.55	35	.83	White	B	Low	49-58%	$

Grid Profile Options (USG Ceilings Radar Firecode)

DX®/DXL™ DX/DXL

A B

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Wet Felted Mineral Fiber Ceiling Panels

According to ISO 14025

Ceiling Panel Options (USG Ceilings Radar ClimaPlus Firecode)

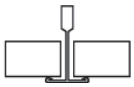
30

Year System Warranty
– No visible sag
– Mold/Mildew protection

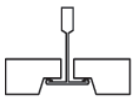
	Edge	Panel Size	Class	Item No.	UL Classified NRC	UL Classified CAC Min.	LR	Color	Grid Options	VOC Emissions	Anti-Mold & Mildew	Recycled Content	Panel Cost
USG Ceilings Radar ClimaPlus Firecode Panels	SQ 	**2'x2'x5/8"**	Firecode	2215	.55	35	.84	White	A	Low	●	41-49%	$
		2'x4'x5/8"	Firecode	2415	.55	35	.84	White Flat Black Charcoal	A	Low	●	41-49%	$
	SLT 	**2'x2'x5/8"**	Firecode	2225	.55	35	.84	White	B	Low	●	49-58%	$
		2'x4'x5/8"	Firecode	2425	.55	35	.84	White	B	Low	●	49-58%	$
	FLB 	**2'x2'x5/8"**	Firecode	2235	.55	35	.84	White	C, D	Low	●	49-58%	$

Grid Profile Options (USG Ceilings Radar ClimaPlus Firecode)

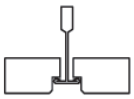
DX/DXL A



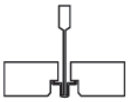
DX/DXL B



CENTRICITEE DXLT C



FINELINE DXLF D



USG Ceilings™ Brand: Radar™ Firecode®, Radar™ ClimaPlus™ Firecode®, Radar™ ClimaPlus™ High-NRC/High-CAC Firecode®
Wet Felted Mineral Fiber Ceiling Panels

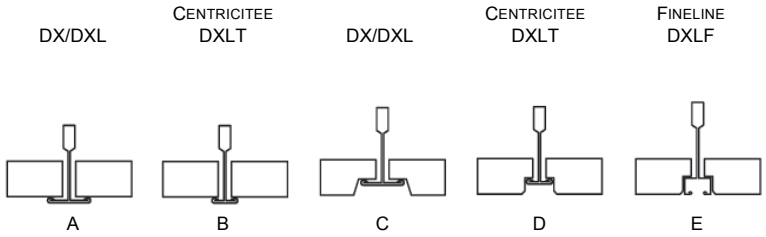
According to ISO 14025

Ceiling Panel Options (USG Ceilings Radar ClimaPlus High-NRC/High-CAC Firecode)

30 Year System Warranty
– No visible sag
– Mold/Mildew protection

	Edge	Panel Size	Class	Item No.	UL Classified NRC	UL Classified CAC Min.	LR	Color	Grid Options	VOC Emissions	Anti-Mold & Mildew	Recycled Content	Panel Cost
USG Ceilings Radar ClimaPlus High-NRC/CAC Firecode Panels	SQ 	**2'x2'x3/4"**	Firecode	22521	.70	40	.84	White	A, B	Low	●	57%	$$
		2'x4'x3/4"	Firecode	22541	.70	40	.84	White	A	Low	●	57%	$$
	SLT 	**2'x2'x3/4"**	Firecode	22523	.70	40	.84	White	C	Low	●	57%	$$
	FLB 	**2'x2'x3/4"**	Firecode	22527	.70	40	.84	White	D, E	Low	●	57%	$$

Grid Profile Options (USG Ceilings Radar ClimaPlus High-NRC/High-CAC Firecode)



Application

This product is typically installed as a suspended ceiling in the following applications: offices, schools, corridors and retail stores.

Codes of Practice

- ASTM E1264 – Classification For Acoustic Ceilings
- ASTM E84 – Surface Burning Characteristics
- ASTM C367 – Strength Properties of Prefabricated Architectural Acoustics Tile or Lay-In Ceiling Panels
- ASTM C423 – Sound Absorption
- ASTM C636 – Standard Practice for Installation of Metal Suspensions Systems for Acoustical Tile and Lay-In Panels

- ASTM E119 – Fire Tests of Building Construction and Materials
- ASTM E1414 – Sound Attenuation
- 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions for Indoor Sources Using Environmental Chambers – Version 1.1 - California
- ASTM C518-10 – Thermal Transmission Properties

Quality Assurance

- UL listed with follow-up service as required for fire, flame spread and acoustical performance.
- Certificate of Compliance for VOC Emissions: Berkeley Analytical Associates, LLC

Delivery Condition

USG Ceilings Radar Firecode panels (e.g., Item No. 2115; 2'x2'x5/8" SQ Firecode panels) and USG Ceilings Radar ClimaPlus Firecode (e.g., Item No. 2215; 2'x2'x5/8" SQ Firecode panels) arrive at the jobsite in a shrink-wrapped wrap-around carton that contain 16 panels (64 sf) each. USG Ceilings Radar ClimaPlus High-NRC/High-CAC Firecode panels (e.g., Item No. 22521; 2'x2'x3/4" SQ Firecode panels) arrive at the jobsite in a shrink-wrapped wrap-around carton that contain 12 panels (48 sf) each.

Technical Data

Fire

- ASTM – E1264 –Type III, Form 2, Pattern C, E
- ASTM E84 – Class A, Flame spread of 25 or less, smoke developed of 50 or less
- ASTM E119 – See a USG sales representative for approved fire rated assemblies

Sound

- ASTM C423 – Sound Absorption
- NRC .55 (USG Ceilings Radar Firecode and USG Ceilings Radar ClimaPlus Firecode panels)
- NRC .70 (USG Ceilings Radar ClimaPlus High-NRC/High-CAC Firecode panels)
- ASTM E1414 – Sound Attenuation
- CAC 35 (USG Ceilings Radar Firecode and USG Ceilings Radar ClimaPlus Firecode panels)
- CAC 40 (USG Celings Radar ClimaPlus High-NRC/High-CAC Firecode panels)

Light Reflectance

- ASTM C1477 – Standard Test Method for Luminous Factor of Acoustical Materials by Use of Integrating Sphere Reflectometers
  - LR .83 (USG Ceilings Radar Firecode)
  - LR .84 (Usg Ceilings Radar ClimaPlus Firecode panels and USG Ceilings Radar ClimaPlus High-NRC/High-CAC Firecode panels)

Thermal Transmission

- ASTM C518-10 – Thermal Transmission Properties
- R = 1.6-1.9 [hr • ft2 • ºF/Btu] (USG Ceilings Radar Firecode, USG Ceilings Radar ClimaPlus Firecode)
- R = 1.9 [hr • ft2 • ºF/Btu] (USG Ceilings Radar ClimaPlus High-NRC/High-CAC Firecode panels)

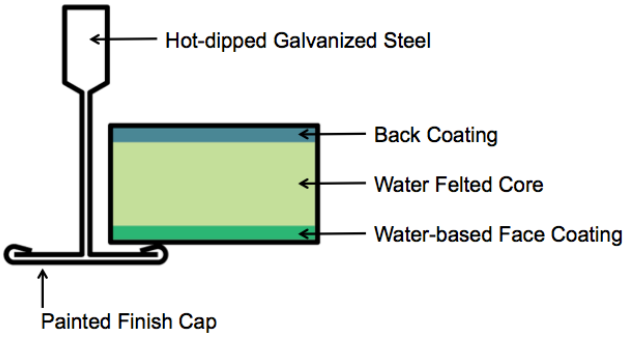
Water Damage

Moisture must not come in contact with the ceiling panel as a result of a leaking roof, a sweating pipe, a leaking radiator, a flood, condensation on windows, condensation on more subtle surfaces where dew points are reached, humidified air from the HVAC system or any other similar causes.

Mechanical Damage

The product must be installed and maintained in accordance with current USG written instructions and best industry practice, including the CISCA Handbook and ASTM C636, "Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels."

Base Materials



Product Composition

Product Properties (USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode)		
Type of Manufacture	Wet Felted Ceiling Panel	
Product Specifications	Thickness – 5/8"; Density – 21 pcf	
Core Type	Wet Felted with Recycled Content	
Product Composition	Material	Weight Percent
Wet Felted Core Composition	Mineral Wool	< 65%
	Perlite	< 25%
	Recycled Paper	< 8%
	Starch	< 10%
	Clay	< 20%
Coatings	Clay-based Back and Prime Coatings	< 6%
	Pigmented Finish Coatings	< 2%

Product Properties (Intermediate Duty DX/DXL Grid)		
Type of Manufacture	Ceiling Grid	
Product Specifications	15/16" Grid Face	
Product Composition	Material	Weight Percent
Web	Hot-dipped Galvanized Steel Coil	< 87%
Cap	Hot-dipped Galvanized Steel Coil	< 14%
Coating	Pigmented Finish Coating	< 1%

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Material Definitions

Product Properties (USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode)				
Layer	Component	Material	Availability	Origin
Wet Felted Core Composition	Ceiling Panel Core	Mineral Wool	Recycled Mineral Resource, Non-renewable, Abundant	US
		Perlite	Mineral Resource, Abundant	US
		Recycled Paper	Recycled Resource, Abundant	US
		Starch	Rapidly Renewable Resource, Abundant	US
		Clay	Mineral Resource, Abundant	US
Back and Prime Coatings	Paints	Clay-based Coating	Mineral Resource, Abundant	US
Finish Coatings	Paints	Pigmented Coatings	Fossil-based Resource, Abundant	US

Product Properties (Intermediate Duty DX/DXL Grid)			
Component	Material	Availability	Origin
Web	Hot-dipped Galvanized Steel Coil	Recycled Metal, Recyclable, Non-renewable, Abundant	US & International
Cap	Hot-dipped Galvanized Steel Coil	Recycled Metal, Recyclable, Non-renewable, Abundant	US & International
Coating	Pigmented Coatings	Fossil-based Resource, Abundant	US

Raw Material Definitions (Ceiling Panels)

Wet felted Core

Consists of 5 main raw materials including mineral wool, perlite, recycled paper, starch and clay. Recycled dust and board of the same composition is also added to the slurry. Processing additives include a flocculant.

Backcoating

Consists of an aqueous clay-based coating.

Prime and Finish Coatings

Consist of aqueous primers and pigmented finish coatings that utilize various coating filler, binders and additives.

Raw Material Definitions (Grid)

Hot-dipped Galvanized Steel Coil
Hot-dipped galvanized steel coil is the main raw material used in the production of grid products and is produced using established cold rolling techniques.

Raw Material Extraction and Origin (Ceiling Panels)

Mineral Wool (recycled resource)

USG mineral wool is produced at USG's Red Wing, MN product facility and utilizes predominantly post-industrial slag in combination with other minor minerals and rocks to achieve the desired fiber chemistry. The slag used in this process is a by-product of the steel industry generated during the production of iron. The mineral wool is produced using natural gas and coke to melt the slag and minor ingredients followed by fiber generation and collection.

Perlite (mineral non-renewable resource)

Perlite is used as a lightweight filler in the core of USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products and is a non-renewable mineral resource sourced within the United States.

Recycled Paper (recycled post-consumer resource)

Recycled paper is used as a binder and fibrous reinforcement in the core of the USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products and is a renewable resource sourced within the United States.

Gluten-free Starch (rapidly renewable resource)

Starch is used as a gluten-free binder in the core of the USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products and is a renewable resource sourced within the United States.

Clay (mineral non-renewable resource)

Clay is used as a filler in the core of USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products and is a non-renewable mineral resource sourced within the United States.

Raw Material Extraction and Origin (Grid)

Hot-dipped Galvanized Steel Coil

Hot-dipped galvanized steel coil is sourced both domestically and internationally based on its availability and price.

Production Process

In wet felted production, the panel ingredients are mixed into a slurry, which is then distributed onto a moving wire fabric, dewatered using gravity and vacuum drainage and formed into a dewatered basemat. The dewatered basemat is then pressed and dried. The dried panels are cut or trimmed into the appropriate sizes, fissured, perforated and painted. Painting may involve two or more coatings with a drying cycle between coatings. After inspection, the ceiling panels are packaged for shipment. Panel trim and panels that are chipped or broken during manufacturing (referred to as "broke") are recycled and returned to the process. The Cloquet plant produces its own paint coatings and the primary ingredients for these coatings are also included in the analysis.

In grid production, the incoming hot-dipped galvanized steel coils are cleaned, coated (optional depending on intended purpose) and slit and optionally transported to additional production facilities where the coated steel is formed into finished grid components.

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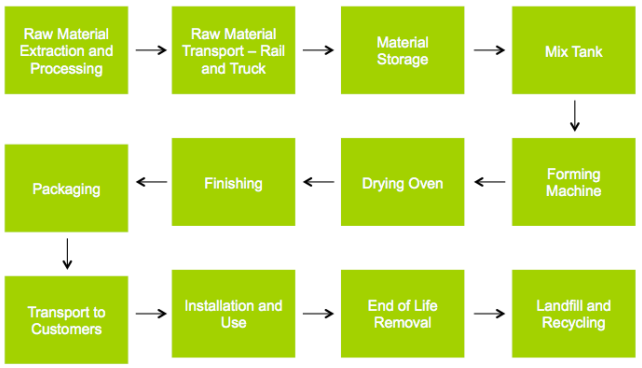
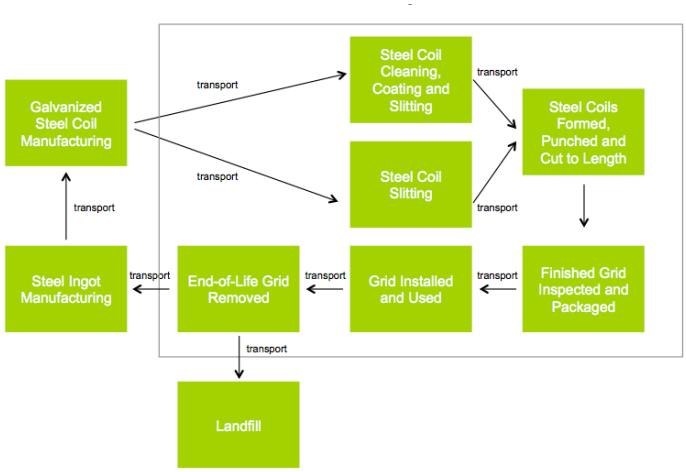
According to ISO 14025

Ceiling Panel Production Process



Grid Production Process



Health, Safety and Environmental Aspects During Production

USG Corporation has a commitment to sustainability. As part of our Product Stewardship program the environmental, health and safety evaluation of raw materials are diligently reviewed. Since the early days of our company, we have made employee safety one of our seven core values by developing and adhering to safety guidelines that exceed industry standards and regulations. We have achieved a safety performance that is 25 times better than the typical manufacturing company. USG Corporation has multiple manufacturing facilities that have achieved OSHA “Star” status. This is the most prestigious OSHA designation and recognizes work sites that have highly successful safety and health programs that result in injury and illness rates at or below the national average for their industry.

Installation of Ceiling Panels

Installation Recommendations

The ceiling panels must be installed in accordance with all applicable USG Interiors installation guidelines. Approved installation procedures are provided in the Ceiling Systems Handbook published by the Ceiling and Interior Systems Construction Association and must be followed.

Installation of USG’s ceiling and grid products is accomplished by manual labor using mostly hand tools. No material or energy inputs are required on the jobsite.

Health, Safety and Environmental Aspects during Installation

This product is not expected to produce any unusual hazards during normal use. Exposure to high dust levels during installation may irritate the skin, eyes, nose, throat, or upper respiratory tract; proper personal protective gear should be worn by installer for protection.

Residual Material

USG is helping to meet the needs of a growing world and preserve natural resources by taking back approved ceiling panels from any manufacturer and recycling them into new building products. Recycling reduces waste and relieves pressure on overburdened landfills. Incorporating renovation waste into new building products can also slow the rate at which raw materials are extracted from the land.

For the ceiling LCA study there is assumed to be a 7% waste factor during installation. All ceiling panel waste generated during installation and at end-of-life is assumed to be disposed of in an appropriate landfill. The disposal of this installation scrap was modeled in this LCA study.

Packaging

USG Interiors USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode ceiling panels are packaged using cardboard sleeves and are then wrapped in plastic shrink wrap. USG encourages the proper recycling of these packaging materials. Both the production and disposal of these packaging materials was modeled in this LCA study.

USG grid products are packaged in corrugated cardboard boxes. USG encourages the proper recycling of these packaging materials. Both the production and disposal of these packaging materials was modeled in this LCA study.

Use Stage

Use of the Ceiling Panel

Cleaning and Maintenance

The USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products can be cleaned easily with a soft brush or vacuum.

Prevention of Structural Damage

To insure the longevity of the product, make sure that panels are not exposed to high relative humidity or high temperature. Criteria can be found in the USG warranty information specific for each product.

Effects on the Environment and Health

The installed ceiling panel is static and meets the California Department of Public Health CDPH/EHLB/Standard Method Version 1.1,2010 (Emissions Testing Method for CA Specification 01350) emissions criteria for a high performance product with respect to harmful VOC emissions.

Useful Life

All USG ceiling and grid products carry a lifetime (30-year) warranty. However, the useful life of ceiling panels with grid can have a service life equal to the buildings' useful life if properly installed and maintained. For the purpose of this study the service life of the USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode ceiling panels is considered to be 50 years.

End-of-Life

Recycling or Reuse and Disposal

While USG encourages recycling of its ceiling panels through its take back program, all ceiling panel waste generated during installation and at end-of-life is assumed to be disposed of in an appropriate landfill.

Life Cycle Assessment

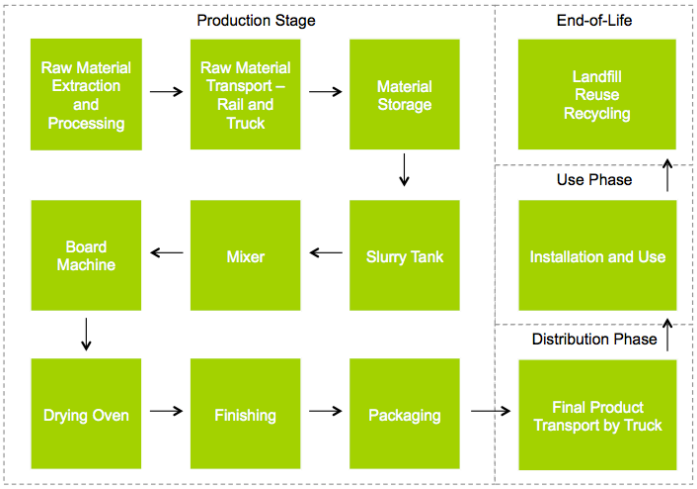
Product System and Modeling of the Life Cycle

Functional Unit

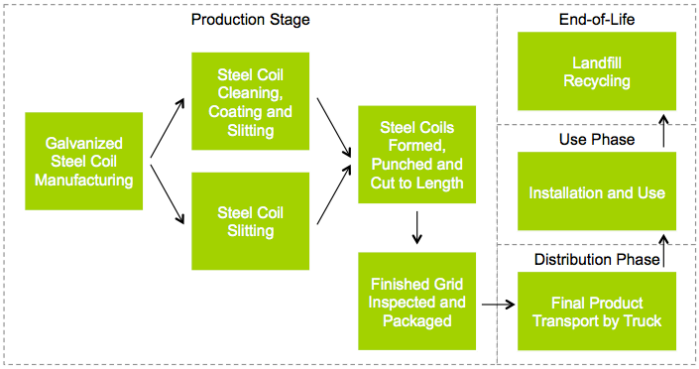
The functional unit for this cradle-to-grave LCA study on the USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products is one square foot (1 sf) of acoustical ceiling panel product over a lifetime of 50 years. The functional unit for the cradle-to-grave LCA study of the Intermediate Duty DX/DXL grid is one square foot (1 sf) of installed grid over a lifetime of 50 years.

Life Cycle Stages

Ceiling Life Cycle Stages



Grid Life Cycle Stages



System Boundaries

This study includes an intermediate “cradle-to-gate” LCA analysis for mineral wool production as part of the “cradle-to-grave” LCA analysis for wet felted ceiling panels. It covers all of the production steps from raw material extraction (i.e., the cradle) to end of life product disposal and/or recycling. This study draws on both primary plant data collected from USG’s Red Wing, MN mineral wool production facility and Cloquet, MN acoustic ceiling panel plant and their suppliers, as well as secondary Life Cycle Inventory (LCI) data.

The system boundaries include the following system processes in the production of mineral wool: raw material extraction, raw material production, raw material transportation, product manufacturing and waste management.

In the case of the USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode LCA study, the system boundaries include the following system processes: raw material extraction, raw material production, raw material transportation, product manufacturing and waste management, product transportation to the distribution centers and to jobsites, installation and use of the ceiling panel and end of life product disposal and/or recycling.

Any onsite generated energy and purchased electricity is included in the system boundary. The extraction, processing and delivery of purchased primary fuels, e.g., natural gas and primary fuels used to generate purchased electricity, are also included within the boundaries of the system. The significance of ancillary materials (e.g., paints, surfactants, de-foamer, packaging materials, etc.) is also included within the system boundary (subject to established cut-off criteria).

In the case of the grid LCA study, the system boundaries include the following system processes: production of the galvanized steel coils, transport of these coils to USG production facilities where the steel coil is cleaned, coated (optional depending on intended purpose) and slit and optionally transported to additional production facilities where the coated steel is formed into finished grid components. These finished grid components are then packaged, installed and are largely recycled at end-of-life. Any onsite generated energy and purchased electricity is included in the system boundary. The extraction, processing and delivery of purchased primary fuels, e.g., natural gas and primary fuels used to generate purchased electricity, are also included within the boundaries of the system. The significance of ancillary materials (e.g., paints, surfactants, de-foamer, packaging materials, etc.) is also included within the system boundary (subject to established cut-off criteria).

Assumptions

No significant assumptions have been made. All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production raw materials and processes. All of the material and energy flows have been accounted.

Cut-off Criteria

The cut-off criteria for including or excluding materials, energy and emissions data of the study are as follows:

- Mass – If a flow is less than 1% of the cumulative mass of the model it may be excluded, providing its environmental relevance is not a concern.
- Energy – If a flow is less than 1% of the cumulative energy of the model it may be excluded, providing its environmental relevance is not a concern.
- Environmental relevance – If a flow meets the above criteria for exclusion, yet is thought to potentially have a significant environmental impact, it was included.

The sum of the excluded material flows did not exceed 5% of mass, energy or environmental relevance. Both the ceiling panel and grid LCAs were in compliance with the above cut-off criteria. No processes were neglected or excluded. Capital items for the production processes (machines, buildings, etc.) were not taken into consideration.

Transportation

Shipping distances for the key raw materials are shown below.

Transport of Ceiling Panel Raw Materials (Cloquet)		
Raw Material	Distance (miles)[2]	Mode of Transport
Slag (Post-Industrial)	< 400	Barge
Mineral Wool	< 200	Truck
Perlite	< 1450	Rail
Recycled Paper	< 150	Truck
Starch	< 300	Truck
Clay	< 900	Rail

Transport of Ceiling Panel Raw Materials (Greenville)		
Raw Material	Distance (miles)[2]	Mode of Transport
Slag (Post-Industrial)	< 150	Truck
Mineral Wool	< 800	Truck
Perlite	<1150	Rail
Recycled Paper	< 400	Truck
Starch	< 150	Truck
Clay	< 400	Truck

Transport of Grid Raw Materials		
Raw Material	Distance (miles)[2]	Mode of Transport
Hot-dipped Galvanized Steel Coil	< 500 (volume weighted average)	Truck
Pigmented Coating	< 750 miles	Truck

Period Under Consideration

The study includes an intermediate “cradle-to-gate” life cycle assessment for the production of mineral wool used in the production of the USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products. The study also includes a “cradle-to-grave” life cycle assessment for USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode acoustical panels. Both LCA studies draw on both primary plant data, collected from USG’s Red Wing, MN and Walworth, WI mineral wool production facilities and from USG’s wet felted acoustic ceiling operation and from their suppliers, as well as secondary US life cycle inventory (LCI) data. The primary life cycle inventory data was collected over a one-year period and represents plant data for the 2011 and/or 2012 years.

The study also includes the results of a “cradle-to-grave” life cycle assessment for the Intermediate Duty DX/DXL grid. It draws on both primary plant data, collected from USG’s grid production facilities and from their suppliers, as well as secondary US life cycle inventory (LCI) data. The primary life cycle inventory data was collected over a one-year period and represents plant data for the 2011 and/or 2012 years.

Background Data

The LCA models used for both studies were created using the GaBi 6 software developed by PE International GmbH. The GaBi database provided the life cycle inventory data for several of the raw materials used in mineral wool and ceiling panel production.

2. Shipping distances (rounded up to the next highest 50 miles) for the key raw materials are shown above. Actual distances were used in the analysis.

Data Quality

The quality of data used in this LCA study is considered to be “good to high” quality. All of the data for mineral wool production, ceiling panel production and grid production is taken from the 2011 and 2012 production years. All relevant production steps have been modeled. All raw material and energy inputs were taken directly from plant data and represent the actual usages used in the production of these products. All secondary processes taken from the GaBi database are representative of the technologies used in the ceiling panel processes, are geographically relevant and are less than 10 years in age. These processes have been critically reviewed by PE for consistency, precision and reproducibility. No significant assumptions have been made.

Allocation

There were no allocations of co-products necessary for this study.

Notes on the Use Stage

All USG ceiling products carry a lifetime (30-year) warranty. However, the useful life of ceiling panels and grid, properly maintained and cleaned, can be expected to have a service life equal to that of the building, here assumed to be 50 years.

End-of-Life Scenario

While USG encourages recycling of its ceiling panels through its take back program, all ceiling panel waste generated at end-of-life is assumed to be disposed of in an appropriate landfill.

Description of the Assessment Results and Analysis

Life Cycle Stages Assessed

1. Production
2. Distribution
3. Installation and Use
4. End-of-Life

Primary Energy by Life Cycle Stage

Impact Category	Unit	Production	Distribution	Installation	End-of-Life	Total
Primary Energy	MJ	13.04	1.26	0.02	0.23	14.55

Impact Category	Unit	Production	Distribution	Installation	End-of-Life	Total
Primary Energy	%	89.63	8.65	0.14	1.58	100.0

Non-renewable Primary Energy by Life Cycle Stage

Primary Non-renewable Energy of All Life Cycle Stages by Source per Square Foot Produced						
Type	Unit	Production	Distribution	Installation	End of Life	Total
Hard Coal	MJ	3.59	0.01	0.00	0.01	3.61
Lignite	MJ	0.10	0.00	0.00	0.01	0.10
Natural Gas	MJ	5.96	0.09	0.00	0.04	6.10
Oil	MJ	1.00	1.14	0.01	0.16	2.31
Uranium	MJ	0.56	0.01	0.00	0.01	0.57
Total	MJ	11.20	1.25	0.02	0.22	12.70

Primary Non-renewable Energy of All Life Cycle Stages by Source per Square Foot Produced						
Type	Unit	Production	Distribution	Installation	End of Life	Total
Hard Coal	%	34.8	1.0	6.3	5.4	30.8
Lignite	%	0.9	0.1	2.2	2.3	0.8
Natural Gas	%	50.2	7.5	16.3	16.5	45.2
Oil	%	9.1	91.0	72.3	73.3	18.7
Uranium	%	5.0	0.4	3.0	2.5	4.5
Total	%	100.0	100.0	100.0	100.0	100.0

Renewable Primary Energy by Life Cycle Stage

Primary Renewable Energy of All Life Cycle Stages by Source per Square Foot Produced						
Type	Unit	Production	Distribution	Installation	End of Life	Total
Hydropower	MJ	0.10	0.00	0.00	0.00	0.10
Wind Power	MJ	0.05	0.00	0.00	0.00	0.05
Solar Power	MJ	1.67	0.01	0.00	0.01	1.69
Geothermics	MJ	0.02	0.00	0.00	0.00	0.02
Total	MJ	1.84	0.01	0.00	0.01	1.86

Primary Renewable Energy of All Life Cycle Stages by Source per Square Foot Produced						
Type	Unit	Production	Distribution	Installation	End of Life	Total
Hydropower	%	5.4	22.8	11.4	11.6	5.5
Wind Power	%	2.9	6.1	14.5	13.5	2.9
Solar Power	%	90.8	68.5	74.1	74.6	90.6
Geothermics	%	1.0	2.6	0.0	0.2	1.0
Total	%	100.0	100.0	100.0	100.0	100.0

Water and Waste Consumption by Life Cycle Stage

Impact Category	Unit	Production	Distribution	Installation	End-of-Life	Total
Water Consumption	kg (L)	11.08	0.12	0.02	0.23	11.45

Impact Category	Unit	Production	Distribution	Installation	End-of-Life	Total
Waste Generation	kg (L)	0.433	0.008	0.046	0.597	1.084

USG Ceilings™ Brand: Radar™ Firecode®, Radar™ ClimaPlus™ Firecode®, Radar™ ClimaPlus™ High-NRC/High-CAC Firecode®
Wet Felted Mineral Fiber Ceiling Panels

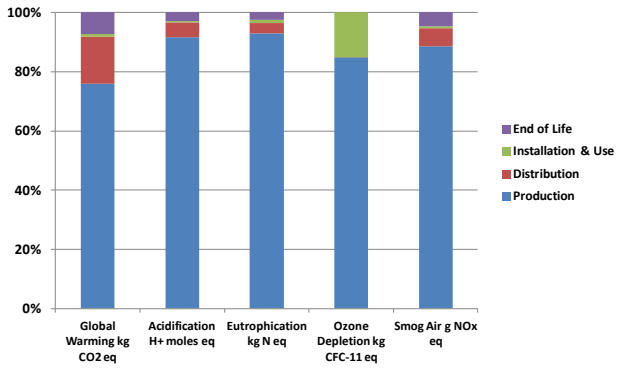
According to ISO 14025

Life Cycle Impact Assessment

Impact Assessment Method: TRACI			
Impact Measure	RADAR FIRECODE Ceiling Panel Family	Intermediate Duty DX/DXL Grid	Total for Grid and Ceiling Panels
Global warming (kg CO2 eq)	0.572	0.222	0.794
Acidification (H+ moles eq)	0.115	0.0396	0.155
Eutrophication (kg N eq)	1.91E-04	1.03E-04	2.94E-04
Ozone depletion (kg CFC-11 eq)	4.19E-10	1.88E-08	1.93E-08
Smog (g NOx eq)	1.20E-06	4.59E-07	1.66E-06
Impact Assessment Method: CML			
Global warming (GWP100) (kg CO2 eq)	0.572	0.222	0.794
Acidification (kg SO2eq)	2.12E-03	7.34E-04	2.85E-03
Eutrophication (kg PO4 eq)	2.67E-04	1.07E-04	3.74E-04
Ozone layer depletion (ODP) (kg CFC-11 eq)	5.02E-10	1.61E-08	1.66E-08
Photochemical oxidation (kg C2H4 eq)	2.60E-04	9.54E-05	3.56E-04

Values cited represent a volume weighted average for USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode products produced at the Cloquet, MN and Greenville, MS production facilities.

Impact Assessment Method: TRACI



Interpretation

Production Process Impacts

The LCA study on the USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode ceiling panels was dominated by the production stage. Mineral wool represented the highest impact of the raw materials. Gas usage during the core drying stage was the key input influencing the LCIA results. The high overall usage of gas during drying is directly related to the amount of evaporative water carried into the drier in the wet basemat. Improvements are being directed at minimizing this water load and also improving overall heat recovery measures employed in this process.

Installation Stage

Installation impacts were associated with transport of the 7% install scrap to a proper landfill for disposal and the associated landfill impacts. These installation impacts can be minimized by extending USG's ceiling panel take-back program to include the recovery and recycling of install scrap material.

Use Stage

Because of the standard usage of this product, there were no impacts associated with the use stage.

End of Life Impacts

End-of-life impacts were associated with transport of the ceiling panels to a proper landfill for disposal and the associated landfill impacts. These end-of-life impacts can be minimized by gaining wider acceptance and use of USG's ceiling panel take-back program thereby eliminating the landfill impacts.

Additional Information, Evidence and Test Results

Biopersistence of Mineral Wool Fibers

Slag wool fiber, based on its solubility and particle size, has been classified as "not classifiable as to its carcinogenicity to humans" (Group 3) by the International Agency for Research on Cancer (IARC). Primary routes of exposure are inhalation, eyes, and skin. Follow installation instruction and MSDS to reduce any effects.

VOC Emissions

USG certifies that USG Ceilings Radar Firecode, Radar ClimaPlus Firecode and Radar ClimaPlus High-NRC/High-CAC Firecode ceiling panels are Low-Emitting, defined as below the emissions of the concentrations for each individual volatile organic compound as specified in the *Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers Version 1.1* [CDPH/EHLB/Standard Method V1.1 (February 2010); aka, chamber testing portion of CA Section 01350] and ASTM Guide D5116-06.

References

PCR	Product Category Rules for Environmental Product Declarations – ceiling panels for suspended ceiling systems. Confirmed by IBU Advisory Board October, 2010
IBU 2006	Leitfaden Umwelt-Produktdeklarationen (Ausgabe 20.01.2006) für die Formulierung der produktgruppen-spezifischen Anforderungen der Umwelt- Produktdeklarationen (Typ III) für Bauprodukte, (Guideline for Setting Up the Product Category Requirements of AUB Declarations (Type III) for Construction Products) Institut Bauen und Umwelt e.V. bau-umwelt.com

Standards and Laws

ISO 14025	ISO 14025: 2007-10, Environmental Labelling and Declarations - Type III - Environmental Declarations - Principles and Procedures (ISO 14025:2006); German and English version
ISO 14040	ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006); German and English version EN ISO 14040:2006
ISO 14044	ISO 14044:200610, Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006); German and English version EN ISO 14044:2006