ENVIRONMENTAL PRODUCT DECLARATION

ENSEMBLE™

ACOUSTICAL DRYWALL CEILING
UNITED STATES GYPSUM COMPANY
WALWORTH, WI

The Ensemble Acoustical Drywall Ceiling represents a revolutionary approach to building design. Installed and finished like traditional wallboard, this system provides a nondirectional, monolithic appearance with a fine finish while maximizing sound absorption. The result is a surface that looks like standard finished drywall but absorbs sound like traditional ceiling panels.

UL CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
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Ensemble™
Acoustical Drywall Ceiling

According to ISO 14025, ISO 21930:2007 and EN 15804

1.0 General Information

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	USG
DECLARATION NUMBER	4787352797.109.1
DECLARED PRODUCT	USG Ensemble™ Acoustical Drywall Ceiling
REFERENCE PCR	FPInnovations, “Product Category Rules for North American Gypsum Boards”, 2013.
DATE OF ISSUE	September 30, 2018
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 Life cycle assessment results Testing results and verifications

The PCR review was conducted by:	PCR Review Panel
	Thomas Gloria, Chair
	www.FPinnovations.ca
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Grant R. Martin
	Grant R. Martin, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas S. Gloria
	Thomas P. Gloria, Industrial Ecology Consultants

This EPD conforms with ISO 21930:2007 & EN 15804

Ensemble™
Acoustical Drywall Ceiling

According to ISO 14025

2.0 Product Information

2.1 Product Description

The USG Sheetrock® Brand Ensemble™ panels consist of perforated 5/8" USG Sheetrock® Brand EcoSmart Panels Firecode 30® gypsum board laminated front and back with non-woven scrims. During installation, these panels are screwed to the USG Drywall Suspension grid where the Ensemble™ panels are finished using joint tape and joint compound using traditional drywall installation methods. On the back surface of the Ensemble™ panels is installed USG Ensemble™ High-NRC Backer panels (860 sf per 1,000 of installed Ensemble™ system) and USG Fiberock® Brand End-joint Backer panels (140 sf per 1,000 of installed Ensemble system). Finally, the face of the installed Ensemble™ panels is spray coated using USG Ensemble™ Spray Applied Finish resulting in a monolithic drywall ceiling that is acoustically absorptive. The USG Ensemble™ Acoustical Drywall Ceiling then consists of installed USG Sheetrock® Brand Ensemble™ panels plus High-NRC Backer panels, USG Fiberock® Brand End-Joint Backer panels and USG Ensemble™ Spray Applied Finish.

FEATURES
- Nondirectional, monolithic appearance with fine finish
- Special perforated USG Sheetrock® Brand panels to optimize sound performance
- Installs and finishes similar to traditional wallboard
- NRC 0.80 and CAC 44
- High light-reflective finish (LR-0.85) reduces fixture and energy use
- Acoustically transparent spray-applied finish

2.2 Designated Application

The Ensemble™ system is intended for interior ceiling applications in commercial buildings.

2.3 Product Data

Table #1: Summary of the general data for Ensemble™ panels

Product Data: Sizes and Types	Thickness	Panel Weight in lb/ft^2 (kg/m^2)	Core Type
5/8" Ensemble™ Panels	5/8" (15.9 mm)	1.66 lb/ft^2 (8.10 kg/m^2)	gypsum

2.4 Technical Data

Table #2: Summary of the technical data for the Ensemble™ panel

Technical Data	Value and Units/Test Results /Statement	Referenced documents and links
"R" factor-thermal resistance in US unit (SI unit)	Not applicable for this perforated panel	ASTM C518
Material Safety Data Sheet – Yes/No	Yes	Available at usg.com
Mold Resistance	Not Applicable	ASTM C1396
Water absorption	Not Applicable	ASTM C473
Total water absorption	Not Applicable	ASTM C473
Surface burning characteristics		
Flame Spread	15	ASTM E84
Smoke Developed	0	ASTM E84
Foil Application: (if applicable), Desiccant Method Test	Not Applicable	ASTM C1396
Abuse/impact resistance test (if applicable)	Not Applicable	ASTM C1629
Total Recycled Content (%)	East Chicago, IN: 97%	As defined in ISO 14021
Pre-consumer (%)	East Chicago, IN: 92%	As defined in ISO 14021
Post-consumer (%)	East Chicago, IN: 5%	As defined in ISO 14021

Table #3: Summary of system components for the Ensemble™ Acoustical Drywall Ceiling

Products	Item Number	Sizes	Packaging	Quantity	Notes
USG Drywall Suspension Main Tees	**DGLW26**	12′	16 pc. carton	192 LF/ctn	Main Tees 16″ o.c., no cross tees
Indexed Support Bar	**ISB109**	109″	16 pc. carton	145 LF/ctn	48″ o.c.
Indexed Support Bar Attachment Clip	**ISBAC**	N/A	100 pc. carton 25 pc. carton	N/A	Attach at main tee/ISB intersection 48″ o.c.
5/8″ USG Sheetrock® Brand Ensemble™ Panels	**ENSPNL112A**	5/8″ x 9′-4″	26 pc. unit	970.3 sq. ft./ unit	Gypsum panel highly engineered to perform like an acoustical ceiling panel
1″ USG Ensemble™ High-NRC Backer Panels	**ENSHINRC**	16″ x 48″	4 pc. unit	21.3 sq. ft./carton	Acoustical base mat for High NRC, CAC
5/8″ USG Fiberock® Brand End-Joint Backer Panel	**ENSFIBEJB**	5/8″x15.5″ x 48″	1 pc. unit	5.2 sq. ft./panel	Backer for floating end-joints
USG Sheetrock® Brand Paper Joint Tape	—	250′ roll	1 pc. unit	20 roll/ ctn 5000 LF/ ctn	Specially formulated paper tape
USG Sheetrock® Brand All Purpose Joint Compound	**USAPJC**	4.5 gal. pails	Single pail 48 pail pallet	216 gal./pallet	Coverage 450 sq. ft./4.5 gal. pail
USG Sheetrock® Brand Ensemble™ Ceiling Compound	**ENSCJC**	4.5 gal. pail	Single pail 48 pail pallet	216 gal./pallet	Coverage 480 sq. ft./4.5 gal. pail
USG Ensemble™ Spray-Applied Finish, White	**ENSSPRAF**	4.5 gal. pail	Single pail 48 pail pallet	216 gal./pallet	Coverage 100 sq. ft./4.5 gal. pail

2.5 Placing on the Market/Application Rules

Standard application rules for Ensemble™ panels are available on usg.com.

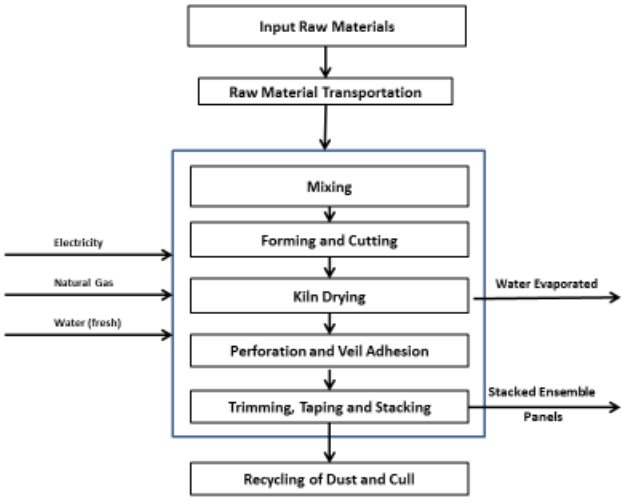
2.6 Product Formulation

	Measurement	Value
Product Specifications for Ensemble™ Panels	Thickness	5/8 in. (15.9 mm)
	Lengths	8′ and 9′4″ (2438 and 2845 mm)
	Width	4′ (1219 mm)
	Weight (nominal)	1.66 lbs./ ft2 (8.10 kg/m2)
	Edges	Tapered

	Additive	Amount (kg/1000 sq. ft.)
Product Formulation for Ensemble™ Panels	Gypsum	613
	Fiberglass (core)	1.4
	Paper	39
	Additives	18
	Scrims + Adhesive	39

Product formulation values for the EcoSmart Firecode 30® gypsum board were taken from the East Chicago, IN plant.

2.7 Manufacturing



The manufacture of Ensemble™ panels starts with the combining of the dry ingredients in a screw conveyor, feeding of this dry ingredient mixture into a pin mixer where these dry ingredients are mixed with water and wet additives. The resulting slurry is fed between two sheets of paper; facing paper (Manila) on the bottom and backing paper

(Newslined) on the top. The wet gypsum board is allowed to hydrate after which the hard board is cut and transferred into a kiln for evaporation of excess water. After removal of the evaporative water, the board is cut to its final size, perfed with nominal ¼" holes and veils are adhesively applied front and back. End tapes are then applied and the resulting product is ready for shipment. Any gypsum board not meeting quality control specifications is recycled on-site.

2.8 Environment and Health during Manufacturing

All appropriate equipment required by federal, state and local regulations are in place at all USG manufacturing facilities.

2.9 Packaging

A quantity of units is collected and placed on sleutters (i.e., spacers) for easy pick-up by fork lift trucks.

2.10 Product Installation

In a typical ceiling application, USG Sheetrock® Brand Ensemble™ panels are fastened to USG Drywall Suspension using standard metal screws. The joints of the installed Ensemble™ panels are then finished with standard joint tape and joint compound after which an acoustically transparent USG Ensemble™ Spray Applied Finish is spray applied. USG Ensemble™ High-NRC Backer panels are applied to portions (i.e., 86% by area) of the back surface of the installed Ensemble™ product to increase the acoustical absorption properties of the overall system. USG Fiberock® Brand End-joint Backer panels are applied to portions (i.e., 14% by area) of the back surface of the installed Ensemble™ product to achieve a smooth final product. The result is a monolithic ceiling that has acoustical properties (i.e., absorbs sounds).

Standard rules and practices for installing and finishing the USG Ensemble™ Acoustical Drywall Ceiling are available online at usg.com.

2.11 Environment and Health during Use Stage

USG Sheetrock® Brand Ensemble™ panels are not a hazardous material as defined by the OSHA Hazard Communication Standard and is not a controlled product under WHMIS (Workplace Hazardous Materials Information System).

2.12 Reference Service Life

The reference service life for this cradle-to-grave (A1-C4) analysis is reported as 60 years as dictated by the gypsum board PCR. This is equal to the buildings' useful life if properly installed and maintained.

2.13 End-of-Life

All Ensemble™ panels as well as ancillary materials (i.e., joint tape, joint compound, USG Ensemble™ Spray Applied

Finish, USG Ensemble™ High-NRC Backer panels and USG Fiberock® Brand End-joint Backer panels) are disposed of in a construction and demolition waste landfill at end-of-life.

2.14 Further Information

Additional information can be found at usg.com

3.0 LCA: Calculation Rules

3.1 Declared or Functional Unit

5/8" USG Sheetrock® Brand Ensemble™ panels	Value and Units
Functional Unit	1,000 sq. ft.
Conversion to kg	753 kg

3.2 System Boundary

The system boundaries are cradle to grave (modules A1-C4) and include the following system processes in the production of 5/8" USG Sheetrock® Brand Ensemble™ Panels: raw material extraction, raw material production, raw material transportation from suppliers to the production facility, product manufacturing and waste management, distribution, installation (consists of installed USG Sheetrock® Brand Ensemble™ panels plus High-NRC Backer panels, USG Fiberock® Brand End-joint Backer panels and USG Ensemble™ Spray Applied Finish), use and end-of-life.

3.3 Estimates and Assumptions

All paper raw material and energy data is specific to the manufacture of USG Manila and Newslined papers at the USG paper mill located in Otsego, MI. All USG Sheetrock® Brand EcoSmart Firecode 30® gypsum board raw material and energy inputs are specific to product produced at the East Chicago, IN gypsum board plant.

3.4 Cut-off Criteria

The cut-off criteria for input flows to be considered within each system boundary were as follows:

Mass – if a flow is less than 1% of the cumulative mass of the model flows it may be excluded, providing its environmental relevance is minor.

Energy – if a flow is less than 1% of the cumulative energy of the system model it may be excluded, providing its environmental relevance is minor.

The sum of the excluded material flows must not exceed 5% of mass, energy or environmental relevance.

3.5 Data Requirements and Data Sources

Manufacturer specific data was obtained from the United States Gypsum plants in East Chicago, IN and Otsego, MI.

3.6 Allocation

The LCI data was collected for the 2016 production year. Raw material and energy inputs were allocated to the USG Sheetrock® Brand EcoSmart Panels Firecode 30® based on the mass of those panels.

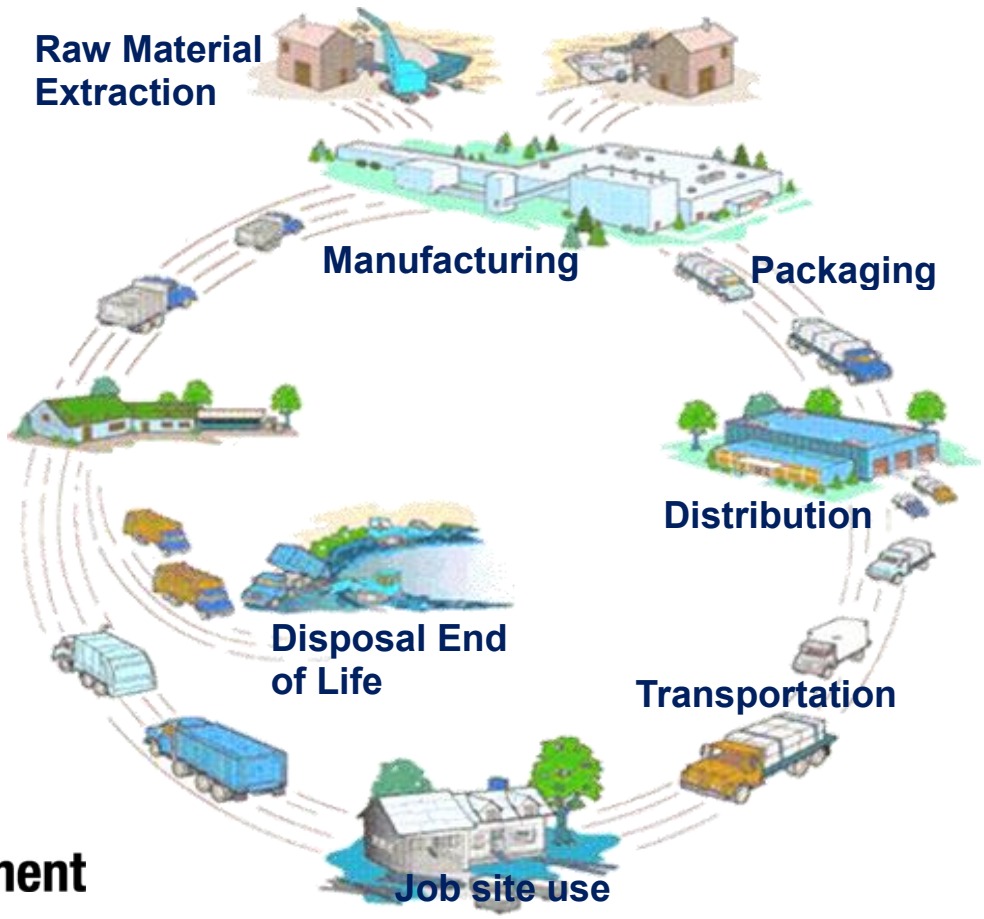
3.7 Comparability of EPDs

Environmental declarations from different programs may not be comparable. The comparison of the environmental performance of gypsum boards using the EPD information shall be based on the product's use in and its impacts on or within the building, and shall consider the complete life cycle (all information modules).

Full conformance with the PCR for North American Gypsum Boards ensures EPD comparability when all stages of a product's life cycle have been duly considered; however, variations and deviations are possible.

4.0 LCA Scenarios and Additional Technical Information

Life Cycle Flow Diagram



A4 module - Construction stage - Transport to the building site		
Technical factors	**Value**	**Units (per FU)**
Liters of fuel	0.54	l/100km
Transport distance (mass average for all components of the Ensemble System)	685	km
Capacity Utilization	0.67	%
Gross density of products transported (Ensemble panel/Fiberock panel/acoustical backerboard)	483 / 477 / 104	kg/m^3

A5 module - Construction stage - Installation in the building		
Technical Factors	**Value**	**Units (per FU)**
Ancillary inputs for installation	0	kg
Water Use	0	m3
Other resource use	0	kg
Electricity consumption	0	KWh
Other energy carriers	0	MJ
Waste material resulting from installation	~ 144	kg
Waste materials (specified by type) and the following treatment (e.g., recycling, energy recovery, landfill)	~ 144 to landfill	kg
Dust in the air	0	kg

B1 module - Use stage - Use of application of the installed product (B1)		
Technical Factors	**Value**	**Unit**
RSL	60	years
VOC	< 9	µg/m^3

B2 module - Use stage - Maintenance		
Technical Factors	**Value**	**Units (per FU)**
Information on maintenance (Description or source where description can be found)	usg.com	-
Maintenance cycle	0	Number/RSL
Water consumption	0	m3
Ancillary inputs for maintenance	0	kg
Other resources	0	kg
Electricity consumption	0	KWh
Other energy carriers	0	MJ
Waste material resulting from maintenance (specify materials)	0	kg

B3 module - Use stage - Repair		
Technical factors	**Value**	**Units (per FU)**
Information on the repair process	usg.com	-
Information on the inspection process	usg.com	-
Repair cycle	0	Number/RSL
Water consumption	0	m3
Ancillary inputs for repair	0	kg
Other resources	0	kg
Electricity consumption	0	KWh
Other energy carriers	0	MJ
Waste material resulting from repair	0	kg

B4/B5 module - Use stage - Replacement/Refurbishment		
Technical factors	**Value**	**Units (per FU)**
Replacement cycle	0	Number/RSL
Electricity consumption	0	KWh
Liters of fuel	0	l/100 km
Replacement of worn parts	0	kg
Reference service life	60	years

B6 and B7 modules - Use stage - operation energy use and operational water use		
Technical Factors	**Value**	**Units (per FU)**
Water consumption	0	m3
Electricity consumption	0	KWh
Other energy carriers	0	MJ
Equipment output	0	KWh

C1-C4 modules - End-of-Life		
Technical factors	**Value**	**Units (per FU)**
Product waste collected separately	0	kg
Product waste collected as mixed construction waste	1302	kg
Components for reuse (CRU)	0	kg
Materials recycling (MR)	0	kg
Materials for energy recovery (MER)	0	MJ
Material for disposal to landfill (MDL)	1302	kg

5.0 LCA Results

Part 1- Description of the system boundary (X: included in LCA; MND- module not declared)															
Product stage				**Construction process stage**				**Use stage**				**End of life stage**			
Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste processing	Disposal
A	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**
X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Part 2- Results of the LCA- ENVIRONMENTAL IMPACT: 1000 sq. ft of installed Ensemble™ panels including ancillary materials (i.e., joint tape, joint compound, USG Ensemble™ Spray Applied Finish, USG Ensemble™ High-NRC Backer panels and USG Fiberock® Brand End-joint Backer panels).

Parameter	Units	Modules included in LCA: A1-C4
Global warming potential	kg CO2-Eq.	1,554
Depletion potential of the stratospheric ozone layer	kg CFC-11 Eq.	1.16 E-05
Acidification potential	kg SO2 Eq.	17.3
Eutrophication potential	kg N Eq.	4.39 E-01
Photochemical ozone creation potential	kg O3 Eq.	95.0
Abiotic Depletion potential-fossil fuels	MJ	2,981

Part 3- Results of the LCA- RESOURCE USE: 1000 sq. ft of Ensemble™ panels well as ancillary materials (i.e., joint tape, joint compound, USG Ensemble™ Spray Applied Finish, USG Ensemble™ High-NRC Backer panels and USG Fiberock® Brand End-joint Backer panels)

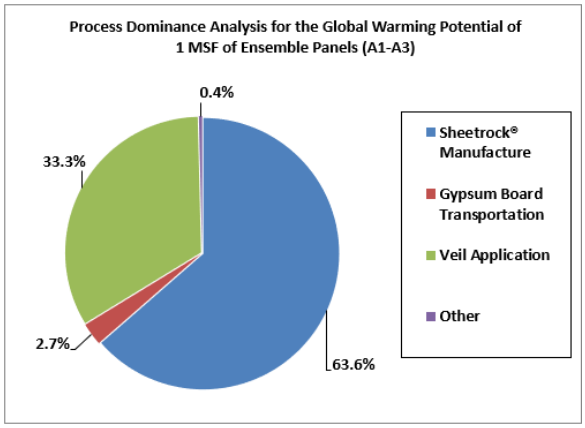
Parameter	Units	Modules included in LCA: A1-C4
Use of non-renewable primary energy resources (NRPE)- excluding NRPE used as raw materials	MJ, HHV	30,395
NRPE, fossil	MJ, HHV	29,266
NRPE, nuclear	MJ, HHV	1,129
Use of NRPE used as raw materials	MJ, HHV	0.00
Use of non-renewable secondary fuels	MJ, HHV	0.00
Use of non-renewable material resources	kg	731
Use of renewable primary energy resources (RPE)- excluding RPE used as raw materials	MJ, HHV	1,559
Use of RPE used as raw materials	MJ, HHV	0.00
Use of renewable secondary fuels	MJ, HHV	0.00
Use of renewable material resources	kg	40.6
Use of secondary material	kg	1,333
Net use of fresh water	m^3	8.40

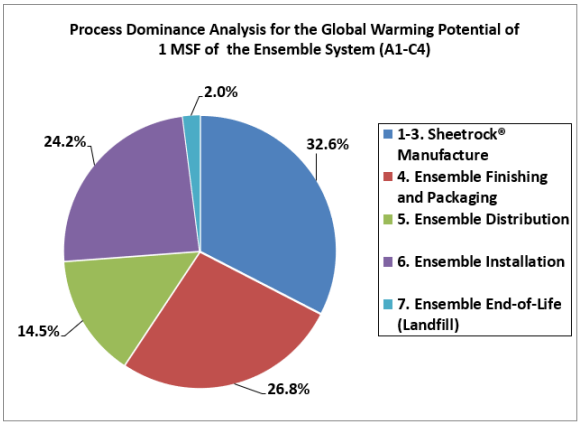
Part 4- Results of the LCA- OUTPUT FLOWS and WASTE CATEGORIES: 1000 sq. ft of Ensemble™ panels well as ancillary materials (i.e., joint tape, joint compound, USG Ensemble™ Spray Applied Finish, USG Ensemble™ High-NRC Backer panels and USG Fiberock® Brand End-joint Backer panels)		
Parameter	**Units**	**Modules included in LCA: A1-C4**
Hazardous waste disposed	kg	2.98 E-03
Non-hazardous waste disposed	kg	3,346
Radioactive waste disposal	kg	0.378
Components for re-use	kg	0.00
Materials recycling	kg	0.00
Materials for energy recovery	kg	0.00
Material for disposal to landfill	kg	3,346

6.0 LCA Interpretation

The figure below graphically depicts relative contributions for both the cradle-to-gate and cradle-to grave production of 1000 sq. ft. of the USG Ensemble™ Acoustical Drywall Ceiling. The significant sources of greenhouse gases are generated during the manufacture of the USG Sheetrock® Brand EcoSmart Firecode 30® gypsum board from combustion of natural gas and indirectly the consumption of electricity at the generating plant.

Declarations based on this PCR are not comparative assertions; that is, no claim of environmental superiority can be inferred or implied.





7.0 Additional Environmental Information

Additional information can be found at usg.com/sustainability.

8.0 References

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7. Jane C. Bare, Gregory A. Norris, David W. Pennington, and Thomas McKone, 2003; TRACI-The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts, Journal of Industrial Ecology, Volume 6, Number 3–4, 2003.

8. Dr. Lindita Bushi and Mr. Jamie Meil, “A Cradle-to-Gate Life Cycle Assessment of 1/2” Regular and 5/8” Type X Gypsum Wallboard” Prepared for the Gypsum Association by the Athena Institute, 2011.

9. Dr. Mark Englert, “A Cradle-to-Grave (A1-C4) Life Cycle Assessment of the USG Sheetrock Brand Ensemble™ Monolithic Acoustical Ceiling System, 2017 (Confidential)