

# ENVIRONMENTAL CRITERIA FOR DETERMINATION OF RECYCLED CONTENT OF MATERIALS

## EC101

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## PREFACE

ICC-ES issues Environmental Criteria (ECs) to provide interested parties with information on the requirements for obtaining an ICC-ES Verification of Attributes Report (VAR). An ICC-ES VAR provides independent verification of a manufacturer's environmental claims and product attributes. ECs address the production stage of the report subject, beginning with raw material acquisition through final manufacturing and packaging, and may also include information on projections for installation, use, reuse, and end-of-life, where specifically stated therein. This EC is effective as of the date referenced above and may be amended from time to time.

All VARs must comply with the applicable EC in effect on the date of issuance or reissuance of the report. Any technical changes to the EC will be marked within the EC. A solid vertical line (|) shall be placed in the margin within the EC to indicate a change, addition, or deletion from the previous edition. A deletion indicator (➔) shall be placed in the margin where wording has been deleted.

ICC-ES may consider alternate approaches to those contained in this EC, provided the applicant submits valid data demonstrating that the alternate approach is at least equivalent to the requirements set forth in this EC, subject to approval by ICC-ES staff. Notwithstanding that a product, material, or type or method of construction meets the requirements set forth in this EC, or that it can be demonstrated that valid alternate ECs are equivalent to the requirements in this document, ICC-ES retains the right to refuse to issue or renew a VAR, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

This EC is limited to the scope statement in Section 1.2 and is not intended to construe a comprehensive environmental claim where considerations are given to other environmental trade-offs, impacts or full life cycle assessment.

*Environmental Criteria are developed for use solely by ICC-ES for purpose of issuing ICC-ES VARs.*

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# ENVIRONMENTAL CRITERIA FOR DETERMINATION OF RECYCLED CONTENT OF MATERIALS (EC101)

## 1.0 INTRODUCTION

**1.1 Purpose:** This document provides a procedure for verification of the percentage and type of *recycled content* of products, for evaluation in an ICC-ES Sustainable Attributes Verification and Evaluation, Verification of Attributes Report (VAR).

**1.2 Scope:** Reports issued under this Environmental Criteria (EC) address raw material acquisition and production stages. Life cycle assessment considerations are outside the scope of this EC. Report users are responsible for determining compliance with applicable codes, standards and environmental regulations.

**1.3 Applicability:** *Recycled content* of materials shall be evaluated based on criteria in the following:

**1.3.1** 2021 and 2018 IgCC Section 901.4.1.1 (2015 and 2012 IgCC Section 505.2.2)

**1.3.2** 2022 and 2019 CALGreen Sections A4.405.3 and A5.405.4

**1.3.3** ICC 700 Section 604

**1.3.4** ASHRAE Standard 189.1 Section 9.4.1.1

**1.3.5** ANSI/GBI 01-2021 and 2019 Section 10.4.1.1 (ANSI/GBI 01-2010 Sections 10.1.2.1 and 10.2.2.1)

**1.3.6** LEED 2009 Credit MR4

**1.3.7** LEED 2009 Homes Credit MR2.2

**1.3.8** LEED 2014 (v4) for Building Design & Construction MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials

**1.3.9** LEED 2014 (v4) for Homes Design and Construction MR Credit: Environmentally Preferable Products

**1.3.10** LEED 2014 (v4) for Building Operations And Maintenance MR Credit: Purchasing – Facility Maintenance and Renovation

### 1.4 Referenced Documents:

**1.4.1** ASTM E2114-08, Standard Terminology for Sustainability Relative to the Performance of Buildings, ASTM International.

**1.4.2** 2021, 2018, 2015 and 2012 *International Green Construction Code*<sup>™</sup> (IgCC), International Code Council.

**1.4.3** 2022 and 2019 California Green Building Standards Code (CALGreen), California Building Standards Commission.

**1.4.4** 2020, 2015, 2012 and 2008 National Green Building Standard<sup>™</sup> (ICC 700-2020, ICC 700-2015, ICC 700-2012 and ICC 700-2008), National Association of Homebuilders.

**1.4.5** ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2020 and 2017 (ANSI/ASHRAE/USGBC/IES Standard 189.1-2009, 2011 and 2014) – Standard for the Design of High-Performance Buildings (Except Low-Rise Residential Buildings), American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

**1.4.6** ANSI/GBI 01-2021, 2019 and 2010 Green Building Assessment Protocol, Green Building Initiative, Inc.

**1.4.7** LEED<sup>®</sup> 2009 for New Construction and Major Renovations, U.S. Green Building Council, Inc.

**1.4.8** LEED<sup>®</sup> for Homes Rating System, Version 2008, U.S. Green Building Council, Inc.

**1.4.9** LEED<sup>®</sup> 2009 for Schools New Construction and Major Renovations, U.S. Green Building Council, Inc.

**1.4.10** LEED<sup>®</sup> 2009 for Core and Shell, U.S. Green Building Council, Inc.

**1.4.11** LEED<sup>®</sup> 2009 for Commercial Interiors, U.S. Green Building Council, Inc.

**1.4.12** LEED<sup>®</sup> 2014 (v4) for Building Design and Construction, U.S. Green Building Council, Inc.

**1.4.13** LEED<sup>®</sup> 2014 (v4) for Homes Design and Construction, U.S. Green Building Council, Inc.

**1.4.14** LEED<sup>®</sup> 2014 (v4) for Building Operations And Maintenance, U.S. Green Building Council, Inc.

### 1.5 Terms and Definitions:

**1.5.1 General:** Unless otherwise provided for in this document, the definitions of terms shall be as set forth in ASTM E2114.

**1.5.2 In-process Recycled Material – Treated:** Waste material generated within a process where a recovery operation process is required prior to the reuse of the material that changes the physical or chemical nature of the material and where the material would otherwise be sent to landfill. This type of waste is considered a type of pre-consumer waste.

**1.5.3 Post-consumer Recycled Content:** The proportion of *recycled material* in a product generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product that can no longer be used for its intended purpose. This includes returns of material from the distribution chain. (2021 and 2018 IgCC Section 301; 2015 and 2012 IgCC Section 202)

**1.5.4 Pre-consumer Recycled Content:** The proportion of *recycled material* in a product diverted from the waste stream during the manufacturing process. Pre-consumer *recycled content* does not include reutilization of material such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it. (2021 and 2018 IgCC Section 301; 2015 and 2012 IgCC Section 202)

**1.5.5 Recycled Content:** Proportion, by weight, of *recycled material* in a product or product packaging.

**1.5.6 Recycled Material:** Material consisting of post-consumer, pre-consumer and/or in-process material.

## 2.0 REQUIRED DATA

**2.1 Product Description:** Information on the product to be evaluated. The information shall include the product name, style, part or model number, physical description, and a production flowchart for the overall manufacturing process. Additionally, all relevant specifications must be provided for the product, the components and/or constituents used to manufacture the product, and the components used with the product in the final assembly. Specifications must be consistent with the products as described in the submitted test reports and quality documentation. As an example, for

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mixed materials (wet and dry), the following must be provided:

- i. Specifications of incoming materials, or the date of the signed, controlled document that describes each constituent and its specification.
- ii. Mix ratios of the constituents, or the date of the signed, controlled document that describes the mix ratio.
- iii. Finished product specifications (for example, for wet products, specific gravity and viscosity; for formed products, weight, compressive strength, etc.).

When agreed to by ICC-ES, in lieu of providing the actual specifications, the applicant may identify the controlled document that describes the product specifications, provided the document is identified by a revision level and/or date.

When the product specifications are not provided to ICC-ES except through reference to a controlled document as described in the preceding paragraph, the controlled document describing the product specifications shall be made available to the inspection agency for their review and their verification, during the qualifying inspection described in Section 3.3, that the product specifications are consistent with the product described in the original qualifying data.

**2.2 Packaging and Identification:** A description of the packaging method and field identification of the product shall be submitted. Identification shall include the ICC-ES VAR number.

**2.3 Recycled Content Determination:** The following information shall be provided:

**2.3.1** Specification of the gross weight of the total product along with the weight of all individual raw materials used in the product.

**2.3.2** Identification of any recycled raw materials, the type of recycled raw material and the weight of each recycled raw material used in the product.

**2.3.3** Certificates issued by the collector(s) of the recycled raw material, if applicable.

**2.3.4** Identification of all suppliers for the recycled raw materials, including alternate and secondary suppliers.

**2.3.5** Reports of tests and/or inspections conducted on all recycled raw materials and used to verify that they are recycled.

**2.4 Recycled Content Calculation:** Calculations to establish the amount and type of *recycled content* of the report subject shall be as follows:

The *recycled content* value of a product shall be determined by weight and expressed in percentage (%) rounded to the nearest whole number. The recycled content shall be calculated based on the total weight of each type of recycled raw material going into production of the product divided by the total weight of all the raw materials used to produce the finished product.

Total raw materials shall include all materials that are components of the finished product, including, but not limited to, additives, binding agents and bonding resins.

**2.4.1** For products containing water, the dried weight of the finished product shall be used in the calculations. The weight for each product for which evaluation is sought shall be based upon the naturally dry condition of the product. The product shall be conditioned for a minimum of 24 hours at an ambient temperature of 72°F (22°C) or for a period and temperature as set forth in the product manufacturer's installation instructions. The conditioning time and temperature shall be clearly stated in the test report.

**2.4.2** The percentage of *recycled content* reported shall be categorized as percentage of *post-consumer recycled content*, percentage of *pre-consumer recycled content*, and percentage of *in-process recycled material – treated*. Figure 1 provides a simple flowchart example of *recycled content* types.

### 3.0 QUALITY CONTROL

**3.1 Required Elements of the Quality System Documentation:** Quality system documentation shall be submitted that meets the following requirements:

**3.1.1** The documentation shall be signed and dated by an authorized representative of the manufacturer.

**3.1.2** The documentation shall clearly state the facility name of the manufacturing location, the street address and telephone number, and the name of the contact person at the facility.

**3.1.3** There shall be provisions for the quality system documentation to be reviewed at least annually. A record of revisions shall be maintained.

**3.1.4** The documentation shall indicate how the evaluated product is to be identified in the field. This information shall be consistent with the information in the "Identification" section of the VAR, and should include a copy of the product label or a description of what is included on the label. Product labeling shall include, at a minimum, the report holder's name, the VAR number (ICC-ES VAR-XXXX), and information required by the applicable environmental criteria.

**3.1.5** Based on the product labeling, the quality system shall provide a means to trace finished product back to the production and quality control records at the manufacturing facility.

**3.1.6** The documentation shall describe the manufacturing process.

**3.1.7** The documentation shall include provisions for the documenting of product changes, evaluation of product changes and notification to the appropriate parties.

**3.1.8 Incoming Materials:** The documentation shall include procedures regarding inspections or tests that are conducted on incoming materials, or other means used to determine that the materials meet specifications (for example, mill test reports, certificates of analysis, certificates of compliance, etc.). If incoming material requiring a certificate at the time of receipt does not carry a certificate, then the documentation shall contain provisions for the material to be segregated until it has been appropriately tested or inspected, or the certificate is received.

**3.1.9 In-process Quality Control:** The documentation shall describe in-process quality control procedures, including how manufacturing processes are

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monitored to ensure that the product is consistently manufactured within the allowable tolerances.

**3.1.10 Final Inspection:** The documentation shall detail any final inspections and/or tests that are conducted before the product is labeled and shipped, to ensure that the finished product complies with specifications and applicable design values.

**3.1.11 Nonconforming Materials:** The documentation shall specify how nonconforming materials—incoming materials, materials in production, and finished materials—are segregated from production until a decision is made as to their disposition.

**3.1.12** When products are manufactured at multiple locations, the report applicant shall submit quality system documentation for each of the manufacturing sites.

**3.1.13** When the product is manufactured by a party other than the report holder, a form provided by ICC-ES to the applicant to cover this circumstance shall be submitted.

**3.2** The following declarations shall be provided to ICC-ES in a signed and dated affidavit from the report holder:

**3.2.1** The ICC-ES name, mark, or report number will only be used on products that are in compliance with the VAR and the quality system documentation.

**3.2.2** The report holder will promptly investigate and respond to ICC-ES when apprised by ICC-ES of complaints concerning product performance.

**3.2.3** The report holder agrees to permit ICC-ES representatives to examine, at distribution points and the manufacturing plant, any product labeled as being in conformance with the VAR.

**3.2.4** ICC-ES will be notified in writing if there is a significant change in the product, manufacturing procedures or quality system documentation from what was evaluated upon issuance of the VAR.

**3.3** Prior to issuance of a VAR, an initial on-site inspection of the manufacturing facility shall be conducted by an ICC-ES representative or a representative of an accredited inspection agency with the proper technical disciplines.

**3.4** At the time of re-examination of a VAR, a third-party inspection of the manufacturing facility shall be conducted as a condition of reissuance of the report. This inspection shall verify that no changes to the manufacturing process,

raw materials or quality program as they relate to the *recycled content* of the finished product have occurred.

### 4.0 VAR REQUIREMENTS

**4.1** The VAR shall verify the specific product and colors for which data was submitted.

**4.2** The VAR shall state the minimum percentage (by weight) of total *recycled content* and percentage (by weight) of each type of *recycled content* (post-consumer, pre-consumer and/or *in-process recycled material – treated*).

**4.3** The VAR shall include the following statements:

“The total percentage of recycled content reported is based upon assigning an equal value for each type of recycled content used in accordance with 2021 and 2018 IgCC Section 901.4.1.1 (2015 and 2012 IgCC Section 505.2.2), ICC 700-2020, ICC 700-2015, ICC 700-2012 and ICC 700-2008 Section 604.1 and ANSI/ GBI 01-2021 and 2019 Section 10.4.1.1 (ANSI/GBI 01-2010 Section 10.1.2). Where the recycled content values are used for determination of compliance with requirements other than the IgCC, ICC 700 and ANSI/GBI 01, the total percent of recycled content must be calculated in accordance with the percentage requirements stated in that document.”

“Due to the variability of costs and volume, the recycled content percentage listed in this report is based upon weight (mass). The use of cost or volume as the method for calculation is outside the scope of this report. ”

**4.4** Where the VAR subject is regulated by the scope of the *International Building Code*<sup>®</sup> (IBC) and/or *International Residential Code*<sup>®</sup> (IRC), and is the subject of a current ICC-ES evaluation report, the following statement shall be included:

“See ICC-ES evaluation report ESR-XXXX for compliance with IBC and/or IRC code requirements.”

**4.5** Where the VAR subject is regulated by the scope of the International Codes but is not the subject of a current ICC-ES evaluation report, the following statement shall be included:

“Evaluation of the VAR subject for compliance with the requirements of the IBC and/or IRC is outside the scope of this evaluation report and evidence of compliance must be submitted by the permit applicant to the Authority Having Jurisdiction for approval.” ■

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## RECYCLED MATERIAL DEFINITION FLOWCHART

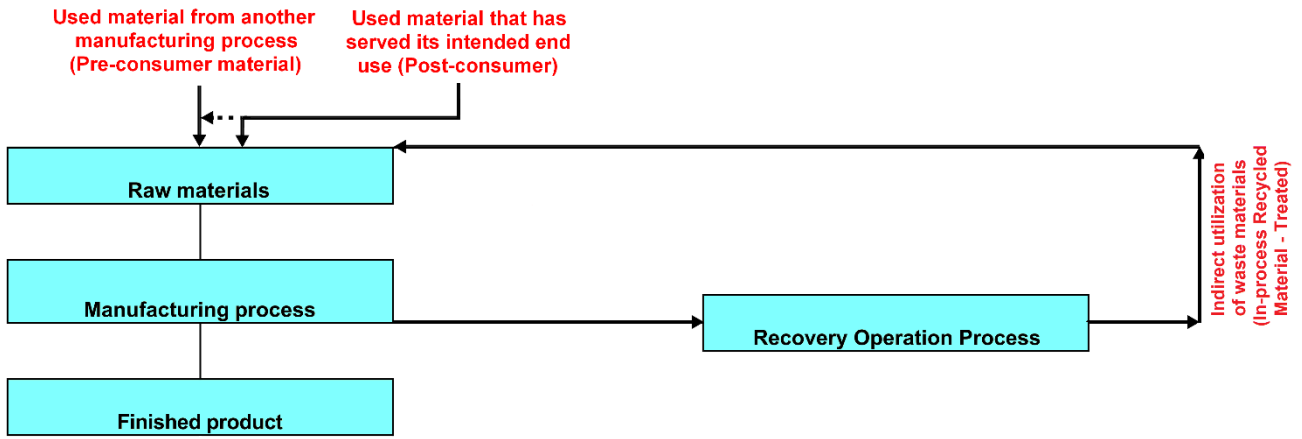


FIGURE 1

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## APPENDIX A

The following examples are provided for illustrative purposes and are intended to provide an aid in performing calculations of *recycled content*. They do not represent any actual manufacturer's product or material.

### EXAMPLE 1 PRODUCT - CONCRETE MIX

RAW MATERIALS	% BY WEIGHT	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – TREATED
Water	N/A <sup>1</sup>	0	0	0
Cement	14.9	0	0	0
Fly ash	3.5	100	0	0
Coarse aggregates	49.8	0	0	0
Fine aggregates	31.8	0	0	0

<sup>1</sup>For products containing mixing water as an ingredient, such as concrete in the above example, where the water is lost during the process leading up to the final finished product, the weight of mixing water is excluded from the calculation of the total material weight.

In this example, the fly ash is the only *recycled material* and is a 100% pre-consumer *recycled material* since fly ash is a material diverted from the waste stream during another manufacturing process.

Therefore, the total *recycled content* of the concrete mix in this example is:

PRODUCT	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – AS IS	% TOTAL RECYCLED CONTENT
Concrete mix	3.5	0	0	4

### EXAMPLE 2 PRODUCT – GLASS

The main ingredients of float glass are silica sand, soda ash, limestone, dolomite, alumina and cullet. Cullet is broken or recycled waste glass that goes through a crushing process and is added back to the batch. Cullet may be used as a substitute for the mix of virgin raw materials used in making glass and therefore replaces silica sand to a certain extent. In the example below, cullet comes from two different sources – factory cullet that consists of 'Treated' rejects from the glass manufacturing process itself which is classified below as "*In-process recycled content – treated*" and external cullet that is collected from waste generated from households and is classified "*Post-consumer recycled content*."

The *recycled material* calculation is:

RAW MATERIALS	% BY WEIGHT	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – TREATED
Silica sand	60.6	0	0	0
Soda Ash	13	0	0	0
Limestone	8.4	0	0	0
Dolomite	4	0	0	0
Cullet from consumer industry	5	0	100	0
Cullet from in-process waste	8	0	0	100
Alumina	1	0	0	0

Therefore, the total *recycled content* of the glass in this example is:

PRODUCT	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – TREATED	% TOTAL RECYCLED CONTENT
Glass	0	5	8	13

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### EXAMPLE 3 PRODUCT – FIRECLAY BRICKS

This is an example of a brick composed of fireclay (complying with ASTM C 673) that is made from recovered waste product from the coal extraction process. Since this is a fired product, the yield/weight loss during the firing process (which includes moisture and loss on ignition) is excluded. After deducting the weight loss during firing, the % *recycled content* is as follows:

RAW MATERIALS	% BY WEIGHT	% BY WEIGHT LOST AFTER FIRING	ADJUSTED % BY WEIGHT AFTER FIRING	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – TREATED
Fireclay	100	20	80	100	0	0

The calculation of *recycled content* is as follows:

- Assume a total raw material weight of 100 g
- During firing process the weight lost (moisture and loss on ignition) = 20% = 20 g

This results in an adjusted raw material weight = 80 g

Since fireclay is the 100% of the raw material, the *recycled content* for fire clay shall be = 80 g/80 g = 100%

Therefore, the total *recycled content* of this fireclay brick is:

PRODUCT	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – TREATED	% TOTAL RECYCLED CONTENT
Fireclay	100	0	0	100

### EXAMPLE 4 PRODUCT – CELLULOSIC INSULATION

Cellulosic insulation contains wastepaper, so the weight of wastepaper is determined on a naturally dried basis.

In this example, the cellulosic insulation contains 75% recycled waste coming from the post-consumer waste stream as one of its main raw materials. The % *recycled content* is as follows:

RAW MATERIALS	% BY WEIGHT	% LOSS OF MOISTURE	% BY NATURALLY DRIED WEIGHT	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – TREATED
Recycled newsprint	75	13.34	65	0	100	0
Other materials	25	0	25	0	0	0

The calculation is as follows:

- Assume a total raw material weight of 100 g
- Weight of recycled content = 75 g
- Weight of other materials = 25 g

The adjusted naturally dried weight of recycled newsprint = 75 g – 10 g of moisture loss = 65 g

The adjusted total raw material weight = 65 g + 25 g = 90 g

This results in a % *recycled content* = 65 g / 90 g = 72.2%

Therefore, the total *recycled content* of this cellulosic insulation is:

PRODUCT	% PRE-CONSUMER RECYCLE CONTENT	% POST-CONSUMER RECYCLE CONTENT	% IN-PROCESS RECYCLE CONTENT – TREATED	% TOTAL RECYCLED CONTENT
Cellulose insulation	0	72.2	0	72

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### EXAMPLE 5 PRODUCT – GYPSUM BOARD

In this example, a gypsum board product is composed of extracted gypsum, recycled gypsum and recycled paper. The material content of the product is as follows:

RAW MATERIALS	% BY WEIGHT	% LOSS DURING PRODUCTION	% PRE-CONSUMER RECYCLED CONTENT	% POST-CONSUMER RECYCLED CONTENT	% IN-PROCESS RECYCLED CONTENT – TREATED
Gypsum	74	0	0	0	0
Recycled gypsum	25	0	0	25	0
Recycled paper	1	10	0	100 <sup>1</sup>	0

<sup>1</sup>10% of the recycled paper is trimmed off prior to being used in the production of the finished gypsum board product. Therefore, this needs to be taken into consideration in the calculation (100% - 10% loss = 90% total *recycled content*).

The calculation is as follows:

- Assume a total raw material weight of 100 g
- Weight of recycled gypsum content = 25 g
- Weight of recycled paper content = 0.9 g

The adjusted total raw material weight = 25 g (recycled gypsum) + 0.9 g (recycled paper) = 25.9 g

Therefore, the total % *recycled content* of the gypsum board is:

RECYCLED MATERIALS	% PRE-CONSUMER RECYCLE CONTENT	% POST-CONSUMER RECYCLE CONTENT	% IN-PROCESS RECYCLE CONTENT – TREATED	% TOTAL RECYCLED CONTENT
Recycled gypsum	0	25	0	26
Recycled paper	0	0.9	0	