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Greener and Safer

Some Potential Choices for Interior Materials for Buildings Undergoing Construction or Renovation

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This manual is funded by the Western New York Council on Occupational Safety & Health (WNYCOSH) under a Special Legislative Grant #CO90318.

Greener and Safer: some potential choices for interior materials for buildings undergoing construction or renovation

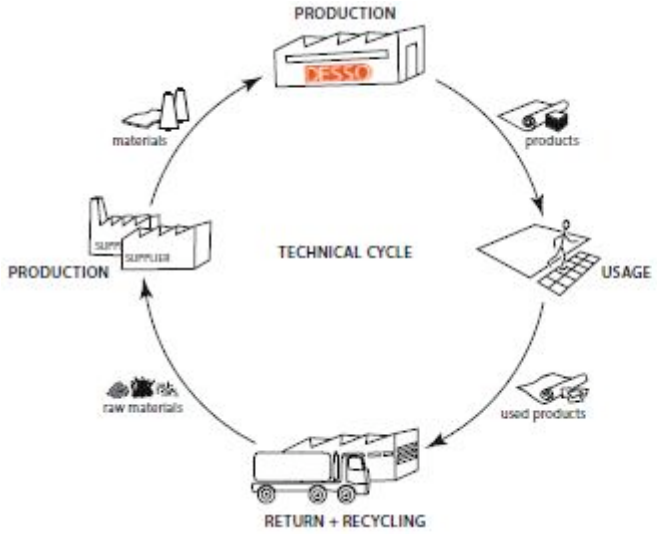
What is good for the environment is *not automatically safer for workers*, but it should be possible to make choices to that are both "greener" and "safer".

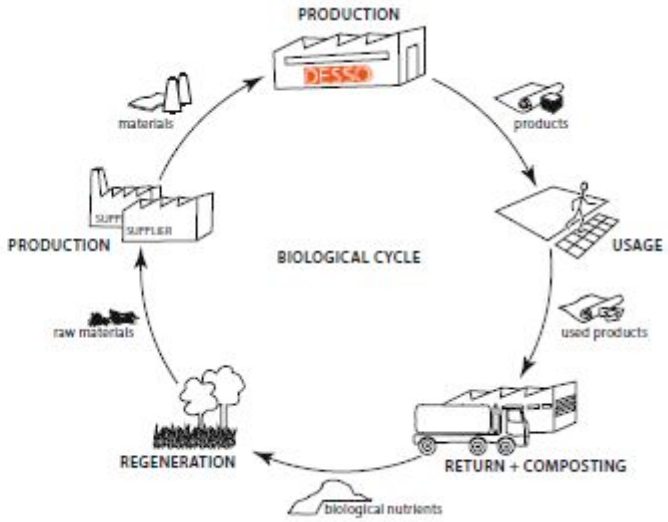
This guide aims to help you to be "greener and safer" by planning ahead – prevention through design by making good choices of materials. Sometimes choices are interconnected and may have multiple benefits. USCDC/NIOSH has piloted a program, in collaboration with OSHA, AIHA, and many others, called "prevention through design" (PtD). The concept of PtD can be defined as: *Addressing occupational safety and health needs in the design process to prevent or minimize the work-related hazards and risks associated with the construction, manufacture, use, maintenance, and disposal of facilities, materials, and equipment.* Eliminating hazards through planning, organization, and engineering as we take our knowledge about old and new hazards and examine the challenges created by new technologies and adaptations of work activities to perform green jobs. This approach aims to eliminate hazards and control risks "at the source" or as early as possible in the life cycle of items or workplaces. (USCDC/NIOSH)

The products discussed below represent some potential choices for interior materials for buildings undergoing construction or renovation with consideration given for the safety and health of the workers using/installing the product and for the workers maintaining the product after installation, as well as for the workers occupying the building (such as indoor air quality concerns.)

What is "green" anyway? There are many approaches and measures of this idea. "Green" has begun to mean many things: environmentally-sound, sustainable development, locally-made or locally-derived, biodegradable, less energy-intensive, and many more concepts. For this guide, we will aim to use products, goods, and services which meet the needs of the present without compromising the ability of future generations to meet their own needs. So, we will try to judge our activities, products, or processes according to their effects on the biosphere and the welfare of humans. (Maher, 2008) We can choose high-quality products that are durable – frugality is as much an ecological idea as an economic one. (Ivanko, 2009) Keep in mind that the term 'biodegradability' alone doesn't mean anything unless it is specified where and how something will degrade. If the item is actually going to be disposed in a landfill or incinerated, then its biodegradability potential is never realized – so defining biodegradability as 'decomposing in a reasonable amount of time using the customary methods of disposal' really doesn't apply. If a product is labeled as "compostable" then it should have American Society for Testing and Materials (ASTM) approval and Biodegradable Products Institute (BPI) certification – that way you will know its fate in a compost facility. (Yepsen, 2009)

Where possible, "green" should include whether a product has been evaluated for its full life cycle. One such approach is certification Cradle-to-Cradle. (McDonough, 2002; Simard, 2004; MBDC website) Note that this is not Cradle-to-Grave. Environmental contamination and degradation, including endocrine disrupting effects, have shown that products, and the chemicals used to make them, do not "rest easy in their graves." After all, if a chemical or product is not biodegradable or is unable to experience its biodegradable potential, it doesn't really "go away" upon disposal, it just goes somewhere else. A Cradle-to-Cradle approach addresses the true LIFE CYCLE of a product (see figure below). Products which originate in the technical cycle could be designed, manufactured, and handled so that they stay completely within a technical cycle. Similarly, items which arise from materials found in nature could be processed and handled so as to stay totally within a biological cycle. That way, items arising in the technical cycle would not contaminate items in the biosphere. Products which have received certification Cradle-to-Cradle are noted as such in the information below.





The products discussed below represent some potential choices for interior materials for buildings undergoing construction or renovation. These categories endeavor to present items and/or ideas that may involve:

- A product made from recycled material(s)
- A product that may be recycled at the end of its useful life, especially upcycled – that is, used to make another item like itself – this completes the technical cycle referred to above. Often, materials are downcycled (such as plastic bottles made into fabric or plastic bags made into synthetic wood) which serves the purpose of recycling on a temporary basis, but could be viewed as a slower trip to the landfill.

To be even greener, see if any of the items referred to below could be obtained locally – to minimize the pollution generated by transporting the item to your building site.

What is safer? In a broad view, when we choose safer materials, we protect…

- Workers manufacturing, transporting, and handling the material
- Workers installing the material
- Workers cleaning, repairing, or otherwise maintaining the material
- Occupants of buildings exposed during installation, exposed to offgases of new materials after installation, and exposed to chemicals used to clean or maintain the material

Moreover, we protect the environment…

- Air, soil, water during use of the material
- Air, soil, water during "disposal" of the material

…and this protects our health as well since we all use air, soil, and water, either directly or indirectly.

You may already being doing lots of "green" things, such as

- Maybe you already know your carbon footprint and are endeavoring to decrease it.
- Do you use the greenest source(s) of energy for your building?
- Do you recycle?
- Do you compost?
- Do you use IPM (integrated pest management) rather than pesticides?
- Do you have a green purchasing policy for all purchases?
- Do you use green cleaning products?
- Do you have waste reduction efforts in place?

In the categories shown below, consideration was given to:

- Green choices for interior construction materials; or if the item isn't usually considered green, does the manufacturer make it in as green a way as possible?
- Green choices for demolition – preferably as deconstruction – so that, once the useful life of the product is over, can it be reused? By yourself or others?
- Green choices to lessen maintenance of the item (and its related chemical and energy usage); by choosing items for durability, finishes, etc. That way, maintenance can be minimized as well – this can further reduce exposure for building operations and for occupants to its cleaning and maintenance chemicals.
- Green choices to produce better indoor air quality, such as by reducing offgassing of new materials or by selecting a product that will not foster mold growth or by choosing a product which can be cleaned easily with nontoxic cleaners.

The U. S. Green Building Council is a leading non-profit organization dedicated to sustainable building design and construction. The Council is the developer of the LEED building rating system. LEED certification provides independent, third-party verification that a building project meets the highest green building and performance measures. LEED can be a powerful driver toward making many of the good choices shown below because those choices can contribute points toward LEED certification, so

reference to its ratings is made below. There are both environmental and financial benefits to earning LEED certification. LEED-certified buildings are designed to:

- Lower operating costs and increase asset value.
- Reduce waste sent to landfills.
- Conserve energy and water.
- Be healthier and safer for occupants.
- Reduce harmful greenhouse gas emissions.
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities.
- Demonstrate an owner's commitment to environmental stewardship and social responsibility.

Choice of materials will also be useful to enable future options of deconstructing, as opposed to demolishing, materials or structures after their useful life. Materials should be recyclable at the end of their useful life. If you are currently looking at renovation and remodeling, consider deconstructing the portions of the building being renovated and reusing what you can yourself or by selling or making it available to others. This reduces waste, creates green jobs, and provides high-quality recycled materials for new construction.

In 1999, the USDHHS funded projects to explore deconstruction as a community development tool. Deconstruction is not really a new idea: Hechinger's, the model for today's Home Depot and Lowe's building supply companies, began in 1911 as a deconstruction/resale company, selling recovered building materials. Now, over 500 for-profit and non-profit enterprises take down buildings through deconstruction. As the cost of disposing of construction and demolition materials has risen, increased efficiency in deconstruction techniques and the value (embodied energy and labor) of recovered wood, bricks, and electrical infrastructure has risen too. Deconstruction is completely compatible with traditional demolition of foundations and recycling of aggregate and nonrecoverable wood. As the state of art of recycling has matured, states have begun to ban C&D disposal because the material is so easily processed and reused if kept segregated. (Seldman, 2009) You might consider creating a new mindset on a job site in which materials aren't considered waste until no alternative to disposal can be found – scrutinizing everything for recycling, salvage, or re-use alternatives. Construction materials account for 30% of the total waste produced annually in the U.S. Segregating wastes is ideal, although co-mingling of materials in a dumpster may be an option with the hauler separating materials at his processing center. (Walter, 2010)

Walls and/or ceilings: drywall; tile backer board; plaster

Maybe you've been looking for an alternative to traditional drywall.

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
EcoRock Serious Materials, Inc.	Cradle-to-Cradle Certified	Uses 80% less energy to produce because naturally cured and dried, rather than calcined and oven-dried as in gypsum drywall production. Made of 80% post-industrial recycled waste, including waste from steel and cement plants. Fully reutilized at end of life; can be returned to the production of EcoRock and other building materials as a valuable raw material.	Expected to have less dust generation during installation than conventional drywall.	Expected to have less dust generation during installation. Outperforms all other mold resistant drywall by 50%, scoring the highest ASTM D3273 rating of 10 out of 10, showing zero mold growth over a six week period (other published tests go only four weeks). No harsh anti-fungal chemicals are used on its surface or within its core.
Shikkui plaster Tagawa Sangyo Co., Ltd.	Cradle-to-Cradle certified	A traditional plaster product used for over 1000 years.	Less labor-intensive as a single layer application may be all that is needed; without further sanding to achieve the desired finish. Consider formulations without diatomite to minimize exposure to crystalline silica (during any sanding).	No volatiles or offgassing expected from the formulations.

Tiles or related surfacing materials for interior floors and/or walls

Hard flooring surfaces can be useful to minimize entrapment of dirt and allergens or mold growth (as may occur with carpets).

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
Limix Tagawa Sangyo Co., Ltd.	Cradle-to-Cradle Certified Can be used towards LEED credits	Limix is a Shikkui plaster-based building material that is formed under extremely high pressure to achieve properties similar to marble. Due to the non-baking technology, all its natural components are preserved in the original, though compressed, form. It is fully recyclable. 85% less energy consumption and low CO2 emissions during manufacturing (compared to baked ceramic tiles).	Anticipated similar to normal tile. Use low VOC adhesives for installation.	Offgassing will also depend upon the use of low VOC adhesives for installation. Product reported as naturally killing bacteria, viruses, fungi and molds due to high alkalinity. Product reported to absorb VOC gases and odors. Continuously absorbs CO2 as installed final product (total CO2 absorption: 297g / 1 kg of Limix). Reported as naturally anti-static, preventing dust accumulation. Reported as naturally humidity-regulating.
Las Vegas Rock Natural Stone Floor tiles Las Vegas Rock	Cradle-to-Cradle Certified Applicable toward LEED Innovation in Design criterion	A meta-quartzite natural stone product that can be customized to meet specific design and budgetary criteria. Suitable for commercial/residential projects, interior/exterior applications, architectural/landscape design, and building stone.	Use low VOC adhesives for installation.	Offgassing will also depend upon the use of low VOC adhesives for installation Cleanable with power washing using vinegar, as well as a plastic bristle brush.

Royal Mosa Unglazed Floor Tiles Royal Mosa	Cradle-to-Cradle certified	Ceramic tile.	Installation with regular tile cement. Requires a thorough cleaning before grouting.	Cleanable with microfiber mops and water; but not coated mopping cloths. Periodic deep cleaning may be needed to remove limescale derived from hard water used for regular maintenance. Penetrating cleaners are not recommended.
IceStone Durable Surface IceStone LLC	Cradle-to-Cradle certified LEED points IceStone can contribute to: MR 4.1, MR 4.2, MR 5.1, MR 5.2, ID, EQ 4.1	Made of 100% recycled glass in a cement matrix.	Use low VOC adhesives for installation.	Each slab is VOC-free. Offgassing will depend upon the use of low VOC adhesives for installation.

Floor Coverings Other Than Tile or Carpet

Hard flooring surfaces can be useful to minimize entrapment of dirt and allergens or mold growth (as may occur with carpets). Local, reclaimed wood floors would be a terrific green choice; however, new, engineered products are also available (even usable below grade), as is a natural linoleum alternative to vinyl floor coverings.

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
Marmoleum and other natural linoleum products Forbo, Inc.		Made from linseed oil, tree resin, and other natural materials such as wood flour. Considered durable. Biodegradable.	Also available as tiles. Use low VOC adhesives for installation.	Depends also upon use of low VOC adhesives for installation. Cleanable with a neutral cleaner using a rotary brush machine or manually.
Cork		Made from the bark of the cork oak tree. Available as flooring and as underlayment. Biodegradable.	Use low VOC adhesives for installation. Some cork may be installable as a floating floor.	Depends upon use of low VOC adhesives for installation.
Solid wood, either new or reclaimed wood	If new wood, should be FSC-certified. If reclaimed and imported wood, should be certified by Rainforest Alliance's SmartWood Rediscovered program	If reclaimed wood, then is from trees already cut down and thus incurs no further harvesting of new wood. Verify the source to obtain locally-salvaged materials (or re-use salvaged materials from your own buildings). Should be free of lead paint. Avoid treated wood such as former railroad ties,	Verify the source; should be free of lead paint and not chemically-treated (such as former railroad ties, telephone poles, or pressure-treated lumber). May require kiln-drying to stabilize the wood or kill insects. May require labor to remove nails and other metal. Inspect for fungal contamination (mold). May require sawing or planing. Will probably require a coating or sealer – use low VOC	Depends upon use of low VOC adhesives for installation. Depends upon use of low VOC coating or sealer. Consider durability of any coating, to minimize need for re-application.

		telephone poles, or pressure-treated lumber. Biodegradable.	products; consider natural oils or waxes if possible.	
Appalachian Real Hardwood Floors; Epic engineered hardwood Anderson Products in hardwood family of brands	Appalachian Hardwood domestic collections are certified "Verified from U.S. Renewing Forests." Appalachian Hardwood's exotic collections are "Verified Legal" under the (NWFA) National Wood Flooring Association's (RPP) Responsible Procurement Program which is recognized by the Forest Stewardship Council, US, as a stepwise approach to 100% FCS certified timber. Appalachian Hardwood Floors comply with the recently revised Lacey Act forbidding the importation of illegally-logged timber products into the U.S. All offshore purchases submitted to the Rainforest Alliance for third party auditing of chain of custody. Epic hardwood's veneer is obtained from North American managed forests deemed sustainable by the U.S.	Uses rustic species and character hardwoods that at one time would have been sorted out and sold as scrap. Limited finish warranties from 30 to 50 years. Epic hardwood's inner layer is made from recycled sawmill by-products created in the manufacture of other products. Uses roughly 50% less newly-forested wood in production than conventional 3/8" engineered products and less than 1/3 the amount used in comparable solid wood flooring. Epic hardwood can be installed at any grade level - even below - where solid hardwoods present problems.	Use low VOC adhesives for installation.	Depends upon use of low VOC adhesives for installation. Appalachian products are GREENGUARD (see below) Air Quality Certified for Children and Schools and meet California Air Quality Board (CARB2) requirements.

	Department of Agriculture.			
Bamboo flooring	Bamboo not yet certified by an FSC-equivalent; sustainability practices unknown as some areas have been bulldozed for bamboo plantations.	Renewable and biodegradable. Technically, bamboo is a grass and regrows faster than trees typically do.	Use low VOC adhesives for installation. Less adhesives required if installed as a floating floor.	Depends upon use of low VOC adhesives for installation. Less adhesives required if installed as a floating floor.

Carpet

Hard flooring surfaces can be useful to minimize entrapment of dirt and allergens or mold growth, as may occur with carpets. However, there may be locations for which carpet is necessary, such as rugs at doorways to collect dirt and moisture, or in areas where carpet is useful for reducing noise.

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
Carpet – natural materials	Carpet and Rug Institute Certified	Materials: wool, jute, hemp, seagrass, cotton. If using non-CRI-certified products, check the backing material for its environmental sustainability and potential for offgassing.	Depends upon installation method: adhesives, mechanical fasteners, or without adhesives. Use low VOC adhesives.	Depends upon composition; CRI certification should reduce offgassing potential from carpet and backing. Depends upon installation method: adhesives, mechanical fasteners, or without adhesives. Dependent upon use of low VOC adhesives.
Shaw Industries several products, such as: • EcoSolution Q – Patcraft • Zeftron nylon • SolutionQExtreme nylon	Cradle-to-Cradle Certified Usable toward LEED Certification in several categories, including Indoor Environmental Quality: Low Emitting Materials Credit 4.3	Carpet is 25% recycled material. At end of lifecycle, can be completely recycled into product of equal quality. These product lines made by a manufacturing process which turns recycled materials into raw nylon for remanufacturing. This diverts carpet waste from landfill to reuse, simultaneously reducing need for virgin materials.	Depends upon installation method: adhesives, mechanical fasteners, or without adhesives. Use low VOC adhesives.	Low offgassing (LEED). For SolutionQExtreme nylon carpet – acid-type stains (most common stains) can be cleaned with water only.

Kaleidoscape Carpet Tile Joy Carpets Inc.	Certified by US Green Building Council	Friction-backing eliminates need for adhesives. Backing is PVC-free. Carpet pile of 100% nylon. Recyclable.	Friction-backing eliminates need for adhesives.	Friction-backing eliminates need for adhesives. Individual tiles can be removed for cleaning or replacement. Clean with hot water only. In some cases soap may be used, but heavy-duty cleansers are not required.
InterfaceFLOR as carpet tiles or broadloom InterfaceFLOR Inc.	InterfaceFLOR can contribute to two LEED Innovation in Design credits. Credits are available for climate neutral products and products certified under the Sustainable Carpet Assessment Standard (SCAS or National Sanitation Foundation-140-2007e). Entire product line is climate-neutral Cool Carpet™ and nearly 100% of the product line is SCAS certified.	Products backed with GlasBacRE range from 49-74% total recycled content with a minimum of 18% post-consumer content.	Some products can be installed using glue-free adhesive squares which adhere tiles to one another and create a "floating" floor. There are no liquid components, so VOCs are virtually eliminated and there is no odor.	Some products can be installed using glue-free adhesive squares which adhere tiles to one another and create a "floating" floor. There are no liquid components, so VOCs are virtually eliminated and there is no odor.
Desso carpet as carpet tiles or broadloom Desso D.V.	Cradle-to-Cradle certified	As per Cradle-to-Cradle criteria.	Depends upon installation method: adhesives, mechanical fasteners, or without adhesives. Use low VOC adhesives.	Reported as having ability to improve indoor air quality through the capture of fine dust. Depends upon composition. Depends upon installation method: adhesives, mechanical fasteners, or without adhesives. Dependent upon use of low VOC adhesives.
Shaw Industries: carpet with EcoWorx carpet backing.	Cradle-to-Cradle certified LEED credits for low-	EcoWorx was recognized by the EPA with the Presidential Green Chemistry Challenge Award	Depends upon installation method: adhesives, mechanical fasteners, or without adhesives. Use low VOC adhesives.	Low VOC offgassing as per Carpet and Rug Institute;

	emitting materials	in 2003.The first 100% sustainable, non-PVC carpet backing system. 40% recycled content for backing; 20% recycled post-consumer content for carpet. Described as infinitely recyclable.		

The Carpet and Rug Institute's Green Label and Green Label Plus testing programs, overseen by independent labs, are designed for architects, builders, specifiers and facility managers who want assurances that carpet and adhesive products meet the most stringent criteria for low chemical emissions and help improve indoor air quality. Currently, carpet, cushion and adhesives as well as vacuum cleaners are tested in these programs. Working in cooperation with California's Sustainable Building Task Force and the Department of Health Services, Indoor Air Quality section, the carpet industry voluntarily enhanced its Green Label program for carpet and adhesives to meeting the testing protocol used by the Collaborative for High Performance Schools (CHPS). CRI has exceeded the CHPS criteria in several respects, including testing annually for specific chemicals. These programs, which test for and certify low emissions from carpet, cushion and adhesives, have earned CRI recognition as an American National Standard Institute (ANSI) green certification body. The CRI Green Label Plus logo indicates that the product has been tested and certified by an independent laboratory and has met stringent criteria for low emissions.

Insulation

Below are green choices for classic fiberglass, as well as other types of fiberglass-free insulation and expanding foam-in applications. Expanding foam may require certified applicators from a distributor. Expanding foam in a can is also available for small jobs.

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
DOW SAFETOUCH Fiberglass-Free Insulation Dow Building Solutions	Cradle-to-Cradle certified	Same insulating properties as fiberglass. Manufactured from polyester, with no formaldehyde binders, no acrylic binders and no borates.	Manufactured from polyester, so it would not be expected to be irritating to bare skin. It has no formaldehyde binders, no acrylic binders and no borates.	Manufactured from polyester, so it would not be expected to be irritating to bare skin. It has no formaldehyde binders, no acrylic binders and no borates.
AttiCat® Expanding Blown-In PINK Fiberglas™ Insulation Owens Corning Sales, LLC	Cradle-to-Cradle certified	Loosefill insulation, also called "blown-in" insulation, is made of virgin PINK fiber glass insulation. Non-combustible and non-corrosive, does not require the addition of fire-retardant chemicals.	Blown-in application, typically applied in hard-to-reach areas and enclosed cavities— including walls and ceilings. Same hazards as expected for fiberglass, but with a green manufacturing process.	It will not rot or decay, support fungus or mold growth or provide sustenance for insects or vermin.
BioFoam® extruded panels Synbra Technology	Cradle-to-Cradle certified	Expandable Polylactic acid (PLA), a sustainable and biologically degradable polymer from renewable sources.		Since biodegradable, it may be able to rot or decay, support fungus or mold growth or provide sustenance for insects or vermin.
Icynene LD-R-50™ spray foam insulation	Can contribute toward credits/points under LEED-NC, LEED for	100% water-blown, HFC- and PBDE-free and made using renewable and	Icynene® is distributed through a network of licensed dealers who complete the installation on site for	100% water-blown, HFC- and PBDE-free. An isocyanate (polyurethane) product, thus is

(expanding foam) GOLD SEAL 400 canned spray foam Icynene	Schools, and the ICC 700 National Green Building Standard.	recycled materials. Castor oil has been used in place of a portion of the petroleum-based polyol. Exceeds the minimum renewable requirement for a bio-based material (testing in accordance with ASTM D 6866). Extracted from the castor plant, castor oil is a natural ingredient whose production has low energy dependence and requires no pesticides, fungicides or man-made irrigation, and has a higher yield by weight (~40%) than soya oil (~17%).	each custom application. GOLD SEAL 400, a related product, is a canned spray foam sealant for doing small jobs of sealing and weatherproofing.	expected to be a potential sensitizer during spraying and until curing is complete.
BioBased Soy-foam insulation 501w and 1701s (expanding foams); Soy Seal sealant canned spray foam BioBased Insulation Inc.	SoySeal is certified by GREENGUARD (see below) for Children & Schools indoor air quality certification. Can contribute toward credits/points under LEED for several categories including innovation in design.	100% water-blown, HCFC- and CFC-free, biologically-based spray polyurethane foam insulation made by replacing a portion of the petroleum content with bio-based content. The bio-based products contain 3-16% bio-content in the finished foam.	BioBased Soy-foam insulation is distributed through a network of licensed dealers who complete the installation on site for each custom application. SoySeal is a canned spray foam sealant for doing small jobs of sealing and weatherproofing. An isocyanate (polyurethane) product, thus is expected to be a potential sensitizer during spraying and until curing is complete.	100% water-blown. No CFCs or HCFCs in the finished foam. SoySeal is certified by GREENGUARD for Children & Schools indoor air quality certification. An isocyanate (polyurethane) product, thus is expected to be a potential sensitizer during spraying and until curing is complete.

The GREENGUARD Environmental Institute (GEI) oversees third-party certification programs that identify acceptable product emission standards and certify low-emitting products. GEI also establishes building standards designed to control mold and moisture. The GREENGUARD Children & Schools Certification Program's requirements comply with the State of California's Department of Public Health Services Standard Practice for Specification Section 01350 (California Section 01350) for testing chemical emissions from building products used in schools and other environments. As such, GREENGUARD Children & Schools Certified products can be used to earn valuable credits in the CHPS Best Practices Manual for K-12 schools, the US Green Building Council's LEED ® Green Building Rating Systems, the Green Guide for Healthcare, the NAHB Green Building Guidelines, Green Globes, Regreen and many other building codes, standards and specifications.

Ceiling tiles

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
Tierra™ Acoustical Ceiling Tile Armstrong World Industries	Cradle-to-Cradle certified	45% of product is jute, a rapidly-renewable natural fiber that grows from seed to harvest in 90 days, and 23% of product is post-consumer recycled materials. No-added formaldehyde. Tiles can be recycled at the end of their useful life through the Armstrong Ceiling Recycling Program.	Anticipated same as for other ceiling tile installations.	Low emissions expected.

Countertops and surfaces

For food service applications, check for approval by the National Sanitation Foundation (NSF).

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
Indure, Durum, Orient, Seeta, and Tiikeri product lines TorZo Surfaces	Can contribute to LEED certification	Formaldehyde-fee, inert non-hazardous acrylic resin infusion process; remainder of material depends upon product line. *Indure* is 65% recycled wood fiber-based boards; *Durum* is over 70% wheat straw; *Orient* is over 75% recycled chips; *Seeta* is over 70% sunflower seed hulls; *Tiikeri* is over 50% sugar cane stalks.	Machining uses standard carbide-based tooling and gluing can be done using a Titebond III adhesive, or a 2-part solid surface epoxy. Fabricated projects can be coated using any name brand urethane or conversion varnish. Products are compatible with most all lines of sustainable water-based coatings.	Offgassing will depend upon the use of low VOC adhesives and coatings for installation.
IceStone Durable Surface IceStone LLC	Cradle-to-Cradle certified Can contribute to LEED points: MR 4.1, MR 4.2, MR 5.1, MR 5.2, ID, EQ 4.1	Made of 100% recycled glass in a cement matrix.	Use low VOC adhesives for installation. For use as countertops, backsplashes, bathroom vanities, table tops, interior walls, and commercial flooring, shower and bathtub surrounds, and kitchen sinks. IceStone surfaces can be mounted vertically or horizontally.	Each slab is VOC-free. Offgassing will depend upon the use of low VOC adhesives for installation.
Bio-Glass Coverings Etc, Inc.	Cradle-to-Cradle certified Products help contribute	Made of 100% recycled glass. 100% recyclable.		

	toward points with the LEED certification.			
Glass2 Glass2 International Inc.	Cradle-to-Cradle certified	Made of 99% recycled glass and no resin. Glass base, contains no glue or chemicals. Does not contain radioactive elements.	Use low VOC adhesives for installation. Virtually scratch-resistant, can be repaired if scratched. Can be fabricated by both stone and glass fabricators. Cold and heat resistant, allowing for use as outside cladding, as well as kitchen countertops, tables, floor or wall cladding, stairwells, columns, furniture tops, bathroom vanities, shower stalls, and tub surroundings.	Offgassing will depend upon the use of low VOC adhesives for installation.
100 Percent® 3Form	Can help projects earn up to 2 LEED credits for recycled content (4.1 & 4.2).	Panels made from 100% post-consumer recycled high density polyethylene; over 1000 milk bottles go into each panel.	Use low VOC adhesives for installation.	Offgassing will depend also upon the use of low VOC adhesives for installation. Carries Greenguard Indoor Air Quality Certificate.
EcoTop Surfaces Products	FSC-certified post consumer recycled paper Products help contribute toward points with the LEED certification.	Formed from a 50/50 blend of post-consumer recycled paper and rapidly renewable bamboo fiber, then bound with a 100% water-based system.	Use low VOC adhesives for installation.	Offgassing will depend upon the use of low VOC adhesives for installation. During the fabrication process of a countertop, the edges and surface are usually sanded to a 220 grit and polished to a satin luster, then the EcoTop Finish is applied --this is a non-toxic, clear water-based vegetable oil/carnauba wax emulsion. Regular 'daily' care is to simply wipe and dry the surface. Periodically, apply a new coat of the EcoTop Finish and buff. If surface damage from exceptionally hard wear has occurred or if someone has cut on

				the countertop instead of a cutting board, lightly scorched it with a hot pan, or deeply scratched it by dragging a rough cast iron utensil or similar across it, then the surface can be sanded out and then recoated with the Finish.
Paperstone Paperstone Products	Enables a project to acquire LEED points toward certification.	PaperStone® is a sustainable composite material made from 100% post-consumer recycled paper, PetroFree™ phenolic resins and natural pigments. After trimming to length, resin-saturated sheets are stacked and moved into a press where they are fused together under heat and pressure. Paper sheet count determines the thickness of the finished panels.	Use low VOC adhesives for installation. Panels are 5' wide and variety of lengths and thicknesses. Its superior strength allows innovative cantilevered designs up to 18-inches of unsupported overhang when using 3/4-inch material.	Offgassing will depend upon the use of low VOC adhesives for installation. It is heat resistant to 350°F and has been certified 'food safe' by National Sanitation Foundation. Surface cuts or mars may be sanded or rubbed out with an abrasive pad and treated with PaperStone® Finish. PaperStone® emits no radon gases and is VOC-free.
r50; r100 Richlite Products	If paper purchased, then from FSC-Certified sources. Enables a project to acquire LEED points toward certification.	Richlite® is made primarily of paper purchased from FSC-Certified sources and/or recycled paper. The paper is treated with phenolic resin then pressed and baked to create solid sheets. r50 contains 50% old corrugated cardboard (post-consumer waste). r100 is made with 100% recycled paper (post-consumer waste) and is certified by FSC.	Use low VOC adhesives for installation. Long spans and extended cantilevers used without adding extra support. 3/4"-thick material is structurally stable with a 12" overhang, 1"-thick material is stable up to an 18" overhang, and 1 1/2"-thick is stable up to 24".	Offgassing will depend upon the use of low VOC adhesives for installation. Does not off-gas. It is heat resistant to 350°F and has been certified 'food safe' by National Sanitation Foundation. Most spills and light stains may be cleaned with soap and warm water and scrubbed with a soft bristle brush. More stubborn stains may be repaired by a light refinishing of the material.

Shetkastone All Paper Recycling Inc.	Designed to be Cradle-to-Cradle (although not listed as certified) LEED: 1 point: MR Credit 4.1; 1 point: MR Credit 4.2 Recycled Content, 20 percent (This point is an additional reward for exceeding MR Credit 4.1.)	100 % post-consumer and post-industrial recycled fibers, including cardboard, newsprint, retired U.S. currency, and other paper. Total recycled content varies from 55 – 90 %, depending on the color chosen. Binders may include plaster, plastic, polyester, or paper glue with a topical sealant which is usually a zero VOC finish. At the end of its life cycle, the old countertop can be recycled back to ShetkaStone and used to make a new ShetkaStone product.	Use low VOC adhesives for installation.	Offgassing will depend upon the use of low VOC adhesives for installation. For everyday cleaning, wipe with a damp cloth, then wipe dry. For scratches, wash the area where the scratch is located; gently wet sand with green Trizac paper in a circular pattern. Rinse the Trizac paper periodically during this process to remove any built-up residue. Once the entire scratch has been removed, lightly wet sand with a grey Scotchbrite pad in a circular motion, then clean the surface with water and dry thoroughly.
Kirei board Kirei	All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for several LEED criteria, including Low Emitting Materials.	Made from reclaimed sorghum straw and no-added formaldehyde adhesive.	Use low VOC adhesives for installation.	Depends upon use of low VOC adhesives for installation. All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for LEED points for Low Emitting Materials.

Cabinets, cupboards, and shelving

Local, reclaimed wood would be a terrific green choice. Engineered and recycled-content products are also available.

Product and Manufacturer	"Green" criteria	Environmental view of the issue – its lifecycle	Occupational Safety and Health view of the issue – exposure of the construction worker or installer	Occupational Safety and Health view of the issue – exposure of the building occupant or building maintenance staff (indoor environment issues or IAQ)
Kirei board Kirei	All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for several LEED criteria, including Low Emitting Materials.	Made from reclaimed sorghum straw and no-added formaldehyde adhesive.	Use low VOC adhesives for installation.	Depends upon use of low VOC adhesives for installation. All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for LEED points for Low Emitting Materials.
Kirei coco Kirei	FSC-certified plywood as backer board All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for several LEED criteria, including Low Emitting Materials.	Made from reclaimed coconut shells, low or no VOC resins and adhesives, and sustainably harvested wood backer. Uses coconut shells left after edible portion is harvested; a material which historically has been burned or discarded to landfill.	Available as square foot tiles or as 4' x 4' panels. Use low VOC adhesives for installation.	Depends upon use of low VOC adhesives for installation. All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for LEED points for Low Emitting Materials.
Kirei Wheatboard Kirei	Kirei Wheatboard All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for several LEED criteria, including Low	As an alternative to formaldehyde-emitting wood-derived medium-density fiberboard or MDF. Available in a variety of densities. As a substitute for wood, uses wheat	Available in thicker sizes than conventional MDF and in custom sizes and thicknesses. Use low VOC adhesives for installation.	Depends upon use of low VOC adhesives for installation. All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for LEED points for Low Emitting Materials.

	Emitting Materials.	stalks left after edible portion is harvested; a material which historically has been burned or discarded to landfill.		
Kirei Bamboo Kirei	Bamboo not yet certified by an FSC-equivalent; sustainability practices unknown as some areas been bulldozed for bamboo plantations. LEED credits: Indoor Environmental Quality – Credit 4.1 Low-emitting adhesives and sealants (To receive this credit specify Kirei Zero NAUF bamboo panels) Materials and Resources – Credit 6 – Rapidly Renewable Resources	Made from bamboo and no-added formaldehyde adhesive.	Available as plywood panels. Use low VOC adhesives for installation.	Depends upon use of low VOC adhesives for installation. All Kirei products will meet California's stringent new CARB air quality standards, as well as qualifying for LEED points for Low Emitting Materials.
Solid wood, either new or reclaimed wood	If new wood, should be FSC-certified. If reclaimed and imported wood, should be certified by Rainforest Alliance's SmartWood Rediscovered program	Reclaimed wood is from trees already cut down and thus incurs no further harvesting of new wood. Verify the source to obtain locally-salvaged materials (or re-use salvaged materials from your own buildings). Local reclaimed wood preferred. Some reclaimed wood is imported but can be verified as reclaimed by Rainforest Alliance's SmartWood	Use low VOC adhesives for installation. For reclaimed wood, verify the source; should be free of lead paint; and not chemically-treated (such as railroad ties, telephone poles, or pressure-treated lumber); may require kiln-drying to stabilize the wood or kill insects; may require labor to remove nails and other metal. Verify the source; should be free of lead paint and not chemically-treated (such as former railroad	Depends upon use of low VOC adhesives for installation. Depends upon use of low VOC coating or sealer. Consider durability of any coating, to minimize need for re-application.

		Rediscovered program preferred; FSC-certified if new.	ties, telephone poles, or pressure-treated lumber). May require kiln-drying to stabilize the wood or kill insects. May require labor to remove nails and other metal. Inspect for fungal contamination (mold). May require sawing or planing. Will probably require a coating or sealer – use low VOC products; consider natural oils or waxes if possible.	

If you have questions or need further information on GREENER AND SAFE building materials or green products, contact WNYCOSH at 716-833-5416 or e-mail germainharnden@wnycosh.org or send your request to: 2495 Main St., Suite 438, Buffalo, New York 14214.

References:

Carpet and Rug Institute (CRI). Green Label/Green Label Plus. http://www.carpet-rug.org

Green America's *National Green Pages, a directory of products and services for people and the planet.* For further information, see http://www.GreenAmericaToday.org

GREENGUARD Environmental Institute. http://www.greenguard.org

Ivanko, J. D. 2009. Be a conserver, not a consumer. *Natural Home Magazine* (July/August): 48.

Maher, F. J. 2008. Sustainability: shifting environmental health and safety into high gear. *The Synergist* (Oct): 41.

MBDC Cradle-to-Cradle Certification. http://c2c.mbdc.com

McDonough, W. et al. 2002. *Cradle to cradle: remaking the way we make things.* North Point Press, NY.

Natural Home's Resource Guides. For further information, see http://www.naturalhomemagazine.com

Seldman, N. 2009. Evolution of deconstruction. *Biocycle* (June): 22.

Simard, J. P. 2004. A new vision: inspiration and strategic change on the path to sustainability. *Green@Work (Winter):* 34.

U. S. Green Building Council. http://www.usgbc.org

USCDC/NIOSH. Prevention through design: green, safe and healthy jobs. http://www.cdc.gov/niosh/topics/PtD/greenjobs.html.

Walter, J. 2010. Sustainable waste management on residential construction sites. *Northeast Sun* (Spring): 29.

Wilson, A. and Piepkorn, M. (Eds.) 2008. *Green Building Products.* BuildingGreen. Battleboro, VT.

Websites for the manufacturers listed above.

Yepsen, R. 2009. Compostable products go mainstream. *Biocycle* (July): 25.