



***An Life Cycle Impact Reduction Action Plan based on a product specific LCA using EN 15804 or ISO 21930 to mitigate or reduce life cycle impacts of 1 m<sup>2</sup> of floor covering manufactured from post-consumer recycled California tire rubber in varying thicknesses by U.S. Rubber Recycling Inc. in Colton California***

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### About U.S. Rubber Recycling, Inc.

Established in 1996, U.S. Rubber manufactures premium sports flooring, acoustical underlayment and vegetation control matting. Survivor™ SportFloor is the worldwide competitive flooring choice for chain clubs, private clubs, professional sports teams, colleges, and the U.S. military. QuietSound™ Acoustical Underlayment provides optimal sound abatement for foot traffic and other interior noises that typically occur in commercial and residential, multi-story buildings. ClearSight™ Vegetation Control is the ideal roadside management treatment to prevent vegetation growth under and around guardrails, signposts, and fencing.

The primary raw material for U.S. Rubber’s products is **post-consumer recycled crumb rubber**, which is a derivative of discarded tires from California landfills. Since January 2015, U.S. Rubber has qualified for, and participated in, the Tire Incentive Program that is administered by CalRecycle (the Department of Resources Recycling and Recovery). California leads the nation with an approximate 65 percent diversion rate for all materials (including rubber tires), which improves economic vitality and environmental sustainability.

## Introduction

A life cycle analysis is a tool to help manufacturers understand their environmental impacts but not all impacts are easily changeable in the scope of product manufacturing. For this reason, a contribution analysis is performed to help the manufacturer understand the impacts and how they relate to each other. For this analysis the TRACI 2.1 Global Warming impact was chosen, measured in CO<sub>2</sub>e. When examining this impact, the focus is on the “why” of the numbers but also the reality of what can be adjusted to lower the overall impact of the products. Global Warming Impact is used because its hotspots are typically due to energy usage. Where energy is consumed, money is being spent to buy that energy in some form.

The LEED v4.1 Rating System outlines the procedures for reporting the manufacturer’s intent to reduce the carbon footprint of their product. Below is the requirements of LEED v4.1 to fulfill this credit option.

### ***Life Cycle Impact Reduction Action Plan (value at 50% by cost or 1/2 product)***

*The manufacturer has produced a product specific LCA using EN 15804 or ISO 21930 for the product and has provided a publicly available action plan to mitigate or reduce life cycle impacts. The action plan must be product-specific using the specified PCR functional unit, be critically reviewed, and must include the following information:*

- ✓ Description of the LCA conducted including the dataset, software or platform used by manufacturer to complete the analysis.*
- ✓ Identification of the largest life cycle impact areas identified in the analysis and a narrative description of the impact areas targeted for reduction in the action plan.*
- ✓ Description of specific steps anticipated in implementation of the action plan. Include proposed changes in formulation or manufacturing processes that are planned as part of impact reduction strategy.*
- ✓ Specific dates and a full timeline for completion of all the steps described in the action plan.*

## Approach

In their third-party, critically reviewed LCA for the creation of their EPD, U.S. Rubber discovered their products' average greatest impact was in manufacturing through purchased electricity. The EPD and the LCA were created using the EPD Product Category Rule (PCR) *Construction Products and Construction Services* v2.3 2012:01 and Sub-PCR-F *Resilient, Textile and Laminate Floor Coverings* 2012:01; International Standards Organization (ISO) 14025:2006 Environmental labels and declarations, Type III environmental declarations-Principles and procedures; ISO 14044:2006 Environmental management, Life cycle assessment- Requirements and guidelines; and ISO 14040:2006 Environmental management, Life cycle assessment-Principles and framework and EN 15804 or ISO 21930 (*as part of the PCR requirements*). They were created using OpenLCA software with the ecoinvent 3.4 database. The table below outlines the impacts of U.S. Rubber's products using the TRACI 2.1 method. Global Warming is the greatest impact numerically therefore, this is the impact that U.S. Rubber focused on for reduction through this Life Cycle Impact Reduction Action Plan.

Table 1: LCI Impact results using TRACI in Open LCIA Methods for each of U.S. Rubber's products studied.

<b>Results (A1-A3) for 1 m2 of flooring covering manufactured from post-consumer recycled tire rubber in varying thicknesses (TRACI)</b>					
	<b>Acidification</b>	<b>Eutrophication</b>	<b>Global Warming</b>	<b>Ozone Depletion</b>	<b>Photochemical ozone formation</b>
<b>Product</b>	<b>kg SO2 eq</b>	<b>kg N eq</b>	<b>kg CO2 eq</b>	<b>kg CFC-11 eq</b>	<b>kg O3 eq</b>
Underlayment, 2mm	2.66E-03	1.15E-03	1.26E+00	7.46E-08	3.83E-02
Underlayment, 3mm	3.99E-03	1.74E-03	1.90E+00	1.12E-07	5.77E-02
Underlayment, 5mm	6.64E-03	2.89E-03	3.15E+00	1.87E-07	9.59E-02
Underlayment, 6mm	7.98E-03	3.47E-03	3.79E+00	2.24E-07	1.15E-01
Underlayment, 9mm	1.20E-02	5.20E-03	5.68E+00	3.36E-07	1.73E-01
Underlayment, 10mm	1.33E-02	5.78E-03	6.31E+00	3.74E-07	1.92E-01
Underlayment, 12mm	1.60E-02	6.94E-03	7.58E+00	4.48E-07	2.30E-01
Underlayment, 4mm	5.32E-03	2.31E-03	2.53E+00	1.49E-07	7.68E-02

Underlayment, 7mm	9.32E-03	4.05E-03	4.42E+00	2.62E-07	1.34E-01
Underlayment, 8mm	1.06E-02	4.63E-03	5.05E+00	2.99E-07	1.54E-01
Underlayment, 11mm	1.46E-02	6.36E-03	6.95E+00	4.11E-07	2.11E-01
Underlayment, 13mm	1.73E-02	7.52E-03	8.21E+00	4.86E-07	2.50E-01
Underlayment, 14mm	1.86E-02	8.09E-03	8.84E+00	5.23E-07	2.69E-01
Underlayment, 15mm	2.00E-02	8.67E-03	9.47E+00	5.61E-07	2.88E-01
Underlayment, 16mm	2.13E-02	9.24E-03	1.01E+01	5.97E-07	3.07E-01
SportFloor, 3mm	2.24E-02	1.26E-02	5.46E+00	7.70E-07	2.75E-01
SportFloor, 6mm	4.49E-02	2.51E-02	1.09E+01	1.54E-06	5.50E-01
SportFloor, 8mm	6.39E-02	3.58E-02	1.56E+01	2.19E-06	7.84E-01
SportFloor, 9mm	7.90E-02	4.42E-02	1.92E+01	2.71E-06	9.68E-01
SportFloor, 12mm	8.98E-02	5.02E-02	2.19E+01	3.08E-06	1.10E+00
Confetti, 3mm	5.36E-03	2.38E-03	2.44E+00	1.38E-07	7.69E-02
Confetti, 6mm	1.07E-02	4.76E-03	4.89E+00	2.76E-07	1.54E-01
Confetti, 8mm	1.53E-02	6.77E-03	6.95E+00	3.93E-07	2.19E-01
Confetti, 9mm	1.89E-02	8.37E-03	8.60E+00	4.85E-07	2.71E-01
Confetti, 12mm	2.15E-02	9.51E-03	9.77E+00	5.51E-07	3.08E-01

QuietSound Acoustical Underlayment has the lowest impact of the three products studied: QuietSound, Survivor SportFloor, and Confetti. This is because it has the lowest amount of raw materials (kg) per functional unit (m<sup>2</sup>), it has a 94.99% recycled content of both post-consumer and postindustrial rubber, and the distance the recycled tire rubber travels to reach the U.S. Rubber facility is less than six miles. The second lowest impact was for Confetti flooring for the same reasons as the QuietSound except Confetti has a higher density therefore more material (kg) per functional unit (m<sup>2</sup>). Lastly was the Survivor SportFloor. This product has the same amount of material per functional unit as Confetti but lacks post-industrial recycled content; it is still composed of post-consumer recycled tire rubber but contains no waste rubber from U.S. Rubber's manufacturing operations. In addition, it has the greatest

travel distances in its supply chain. The crumb rubber for the Survivor SportFloor is sourced from a facility in Sacramento adding 200+ truck miles to the impact. The product also uses up to 80% EPDM which is sourced from Malaysia. This has both truck miles and ocean transport contributing to its overall impact. Table 2 below depicts the contribution to each stage in the product LCA and its relative impact.

Table 2: Contribution analysis for 1 functional unit of QuietSound, 5 mm, Confetti 5mm, or Survivor 5mm using TRACI 2.1 Global Warming Impact in CO2e

<b>Contribution analysis for U.S. Rubber’s Products Using TRACI 2.1 Global Warming Potential, measured in kg CO2e for 1 functional unit, m2 of finished product, 12 mm, ready to ship</b>						
Product	A1					
	Raw Materials	Packaging	A1 Total	A2	A3	TOTAL
QuietSound	2.28	0.04	2.32	0.08	5.18	7.58
	30.0%	0.51%	30.6%	1.10%	68.3%	100%
Confetti	2.43	0.05	2.49	0.03	7.25	9.77
	24.9%	0.64%	25.5%	0.31%	74.2%	100%
Survivor	10.7	0.05	10.7	3.77	7.36	21.9
	48.9%	0.32%	49.1%	17.2%	33.7%	100%

The contribution analysis displays the impacts of three major factors affecting the overall impact of the products. First is the use of EPDM purchased from Malaysia. This two-part factor has one part that is inherent in the product. EPDM has a higher impact than postconsumer recycled tire rubber because it is composed of virgin material to make synthetic rubber. This does not change significantly based on supplier. The second part of the impact is the product’s origin, Malaysia. U.S. Rubber has not chosen to address this impact at this time. Purchased electricity is where they can positively affect their Global Warming impact first.

The largest impact to Global Warming for QuietSound and Confetti is the electricity used for manufacturing. This is also a large percentage of Survivor’s impact but because the percentages are relative and its high raw material impact previously discussed, it is not a majority but a major contributing factor. Electricity usage is high throughout the products’ cradle-to-gate life cycle. This starts with the recycling process to turn tires into useable crumb rubber as this is a completely mechanical

process using eclectic powered machines. (Part of the raw material processing) Then the actual manufacturing of the products from the recycled rubber (crumb rubber) adds another layer of impact from electricity usage. The biggest impact from electricity usage by U.S. Rubber is not just to the environment but to the company’s bottom line. Every dollar spent on utilities is money not invested in the company’s competitive future. This can negatively affect U.S. Rubber’s competitiveness in the marketplace because of the high overhead.

In an effort to make their products more environmentally friendly and reduce unnecessary overhead, U.S. Rubber decided to engage in two projects to save electricity in their manufacturing processes. The first project is a lighting retrofit which will save 45,595 kWh/year. The second project is a solar panel installation resulting in generating greater than 607,000 kWh/per year. This will offset a minimum of 93% of the electricity purchased from Colton Electricity, their energy provider. This reduces their impact both for their operations and products.

## Results

The lighting project will replace all florescent lighting fixtures and lamps in the factory and office areas with LED fixtures and lights. This will reduce the products’ impacts 2-4%, saving a minimum of .33 kg CO<sub>2</sub>e per year/per product. The timeline for this project is completion by 3/1/2020. The modeled savings, using OpenLCA and TRACI 2.1 impact Method are in the Table 3.

QuietSound and Confetti benefit from the solar energy project the most because manufacturing is a large part of their footprint. The resulting <4% impact after the solar installation is from the 7% electricity purchase and the use of propane in the tow motors to move the material. Survivor contains EPM sourced from Malaysia therefore transportation for this product is 9% of the product’s overall impact but still saves 4.6 kg CO<sub>2</sub>e per year. The timeline for this project is the completion by 7/1/2020. The projected savings of CO<sub>2</sub>e in Global Warming Potential are modeled below in OpenLCA.

*Table 3: Contribution analysis of U.S. Rubber's products after the lighting retrofit project is complete.*

<b>Contribution analysis for U.S. Rubber’s Products after the lighting retrofit Using TRACI 2.1 Global Warming Potential. Measured in kg CO<sub>2</sub>e for 1 functional unit, m<sup>2</sup> of finished product, 12 mm, ready to ship</b>	
Product	

	A1	A2	A3	TOTAL	SAVED
QuietSound	4.03	0.08	3.13	7.25	0.33
	55.6%	1.17%	43.2%	100%	4.40%
Confetti	4.94	0.03	4.34	9.31	0.46
	53.0%	0.34%	46.6%	100%	4.72%
Survivor	13.3	3.77	4.34	21.4	0.50
	62.1%	17.6%	20.3%	100%	2.28%

The solar system consists of 930, 375W modules, inverters and power optimizers. Inverters bring increased production, lower cost and a longer lifespan to the solar system. The system was designed based on two criteria. First, how much space was available for solar panels to be placed. Optimal spaces are areas that are not impacted by shade or obstructions, are compliant with code, and do not interfere with the business's day to day activities. The next consideration was U.S. Rubber’s energy profile. How much energy was being consumed and when it was being consumed in order to determine what the optimal system size system would be the best investment. Based on this the solar system was sized at:

930 375W Modules

465 Power Optimizers

11 Inverters

In addition, the system will have real-time monitoring. This allows U.S. Rubber to monitor the production of their system anywhere they have access to the internet to ensures optimal performance. Table 4 below depicts the overall reduced impact in Global Warming Potential (GWP) for U.S. Rubber’s products based on the 93% reduction in purchased electricity in A3, manufacturing.

Table 4: Contribution analysis of U.S. Rubber's products after the solar panel installation is complete.

<b>Contribution analysis for U.S. Rubber’s Products after the solar panel Installation Using TRACI 2.1 Global Warming Potential. Measured in kg CO2e for 1 functional unit, m2 of finished product, 12 mm, ready to ship</b>					
Product	A1	A2	A3	TOTAL	SAVED

QuietSound	4.09	0.02	0.14	4.26	5.51
	96.2%	0.50%	3.34%	100%	56.42%
Confetti	4.95	0.02	0.20	5.17	2.41
	95.9%	0.31%	3.82%	100%	31.86%
Survivor	15.4	1.67	0.20	17.3	4.6
	89.2%	9.69%	1.14%	100%	21.20%

Conclusion

This Life Cycle Impact Reduction Action Plan is based on U.S. Rubber’s third-party verified LCA for one m2 of floor covering manufactured from post-consumer recycled tire rubber in varying thicknesses. This study was created using OpenLCA and ecoinvent 3.4 database. From this study, U.S. Rubber identified two projects to reduce its largest impact, Global Warming in accordance with TRACI 2.1 methodology. The first project is a lighting retrofit from florescent to LED scheduled to be completed by 3/2020. The second project is a solar panel installation to reduce the company’s purchased electricity to around 3-7% of its previous purchased amount. This project is scheduled to be completed 9/1/2020.