Carlisle TyrFil:

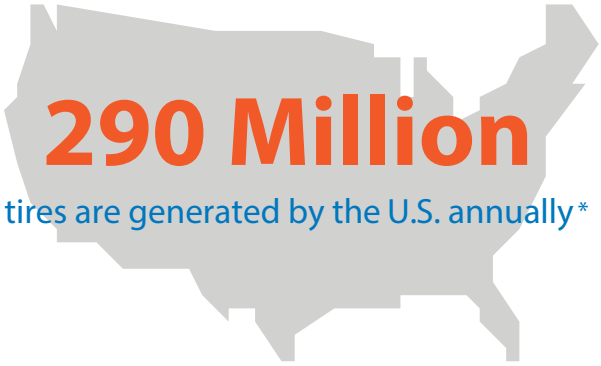
Leading Sustainability in the Flatproofed Tire Industry

TyrFil™
A CARLISLE BRAND

Introduction

According to the World Business Council for Sustainable Development (WBCSD), an estimated one billion tires reach the end of their lives every year. Over 290 million are generated by the U.S. alone. Furthermore, an estimated four billion tires are currently already in landfills and stockpiles worldwide. Sustainability in the tire and tire flatproofing industries is a topic that draws a lot of public attention. The Tire Industry Project, an initiative of the WBCSD and nearly a dozen manufacturers, aims to take action on sustainability challenges unique to their industry. The very presence of this initiative shows that environmentally sound disposal of scrap tires and the sustainable use of natural resources continue to be top priorities for tire manufacturers, distributors and retailers today.

While tire waste is an enormous problem for various environmental and health/safety reasons, the good news is that impactful solutions are already being implemented. Purchasing quality products that reduce tire consumption, as well as recycling scrap tire material into usable end market solutions will help ensure that the tire industry becomes increasingly more sustainable.



of the millions of tires sold in the U.S. each year are recycled.

The Problem

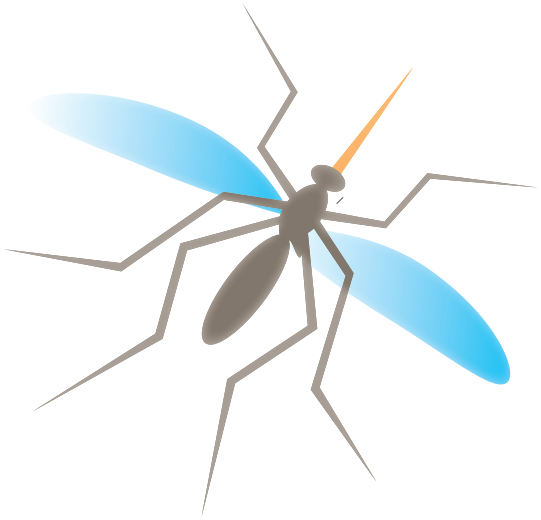
Tires are one of the most problematic sources of waste because of the alarming amount of fossil fuels and other raw materials used to produce the tires as well as the negative consequences of landfilling tires once they reach the end of their lives. The E.U. Landfill Directive has banned tires from landfills in the European Union. Forty-eight states in the U.S. have some laws or regulations dealing specifically with the disposal of scrap tires, with forty states banning whole tires from landfills. Eleven of these states even ban cut or shredded tires from landfills. Three Canadian provinces ban landfilling of tires. Despite all of these rules and restrictions, a significant portion of scrap tires continues to be dumped illegally or stored in stockpiles. According to the EPA, only an estimated 50 percent of the millions of tires sold in the U.S. each year are recycled. That means that 50 percent are either being landfilled or dumped illegally—both of which can have disastrous consequences.

The Impact

WBCSD identifies two main problems with landfilling and stockpiling scrap tires: the negative impact on the environment and the bevy of health and safety risks associated with landfills and tire dumping sites. Scrap tire recovery and recycling programs not only decrease the usage of fossil fuels and other raw materials that go directly into the product, but they also reduce associated economic costs such as exploration, mining, transportation and processing costs.

The environmental, health, and economical effects of landfills and stockpiles are massive and detrimental. One major health concern is fires. Tire stockpiles can catch on fire, releasing harmful toxins into the air, soil and water. The fires can require months, sometimes years, to extinguish due to the oil in the tires and the high heat production of tire rubber.

Tire fires frequently become major hazardous materials incidents that affect entire communities and often require neighborhood evacuations.



The second major health concern is that landfills and tire stockpiles are ideal breeding grounds for mosquitoes and other pests. According to the EPA, tires are associated with the introduction and dispersal of certain mosquito species. This poses significant health risks as fatal diseases like the West Nile virus, dengue fever and malaria have been linked to such breeding grounds.

Another concern associated with dumping scrap tires into landfills is that whole tires require a lot of space. According to the EPA, 75 percent of the space a tire occupies is void. Tires, both whole and processed, quickly fill a landfill and do not compact or decompose for 50-80 years. Over time, whole tires also float to the top of the landfill, often breaking through liners or closure caps, requiring additional financial resources.

The Solution

According to tire industry associations such as the Rubber Manufacturers Association, The World Business Council for Sustainable Development and major tire manufacturers, there are several approaches to properly managing scrap tires. The tires can be utilized for energy generation (i.e. tire-derived fuel), recycled (i.e. converted into recreational surfaces or new rubber products), or legally landfilled.

The tire flatproofing industry offers several solutions to support sustainability related to polyurethane-filled (commonly known as foam-filled) pneumatic tires.

Reuse

Keeping Pneumatic Tires Away From The Dump

The first method focuses on the casing of the tire. When the tread is worn on a polyurethane-filled tire, but the casing is still functional, the tire can be retreaded. Carlisle TyrFil's tests with various retreaders demonstrated that there is no degradation in any of its polyurethane fill, including cured material composed of virgin material blended with recycled tire fill and/or rubber crumb, even after four retreading cycles.

If the carcass of a polyurethane-filled pneumatic tire is damaged, the cured tire fill can still be recovered and recycled through a special grinding process.

When the tread is worn on a polyurethane-filled tire, but the casing is still functional, the tire can be retreaded.

The benefits of tire fill eliminate tens of millions of tires each year from reaching landfills.

If the casing is damaged beyond repair, it can still be utilized in numerous innovative applications. For example, the casing can be ground into rubber crumb. Rubber crumb is used in asphalt, sports and playing fields and playgrounds. According to the EPA, 83% of all tire crumb is utilized as tire-derived aggregate (TDA) in civil engineering projects or as ground rubber.

Recycle

Re-Fill With Used Fill

The second recycling method offered by the tire flatproofing industry focuses on the cured tire fill inside pneumatic tires. If the carcass of a polyurethane-filled pneumatic tire is damaged, the cured tire fill can still be recovered and recycled through a special grinding process. This method of recycling is one that is not offered in the solid rubber tire market, as solid rubber tires are too hard and nearly impossible to recycle.

Carlisle TyrFil, the global leader of tire flatproofing and productivity technologies, has created sustainable options to ensure flatproofing with TyrFil™ polyurethane liquid fill can be both economically and environmentally rewarding.

The benefits of the company's sustainability focus are two-fold: resource conservation and value creation. Carlisle TyrFil is committed to minimizing the consumption of non-renewable raw materials while maximizing value creation to its customers and stakeholders.

Closed-Loop On-Site Recycling System

Carlisle TyrFil is the exclusive provider of the Green Machine™ Recycling System and the patented AutoFil Recycler™ System. Through the use of the AutoFil and Green Machine Recycling Systems, Carlisle TyrFil has been able to prevent more than 150 million pounds, or the equivalent of 7.3 million tires, from being dumped into landfills since 2002. To put the number into perspective, 7.3 million tires is the equivalent of approximately 112 Olympic-size swimming pools. By using the AutoFil or Green Machine Recycling Systems, Carlisle TyrFil's dealers and processors have also been able to reduce the amount of non-renewable petroleum distillates by over 125,000 barrels.

Reduce

Waterx-Based Tire Fill Formulas

For decades, oil-based tire fill formulas have been used successfully to flatproof Off-the-Road (OTR) tires. The idea of using water in lieu of oil was very appealing to Carlisle's Technology Team for several reasons: water is abundant, low cost, environmentally friendly and safe to use. In 2009, TyrFil™ EcoFil, a unique, patented 2-part eco-based flatproofing material, was introduced to the market.

There are currently two different application-specific formulations available in the TyrFil EcoFil product line: TyrFil EcoFlex (15 Shore-A durometer) and TyrFil EcoFil (28 Shore-A durometer). TyrFil EcoFil was originally developed for aerial work platforms (AWPs), but it can be used now as a direct replacement for most standard oil-based flatproofing products.

TyrFil EcoFil differs from standard oil-based flatproofing material in the following ways:

- Is made from a proprietary blend of renewable resources making it a more environmentally responsible product.
- Has a 50% reduced dependency on aromatic oils. As a result, TyrFil EcoFil is better for the environment, and costs less than other flatproofing products.
- Is 100% virgin polymer. No fillers are used that would reduce peak product performance.
- Will not support combustion. TyrFil EcoFil is safer to use than standard oil-based.

Disposal of cured TyrFil EcoFil is handled the same way as standard oil-based flatproofing products. However, TyrFil EcoFil has 50% less aromatic oil in it which lessens the ecological impact on landfills. As previously stated, TyrFil EcoFil does not support combustion thus reducing the overall impact on the environment.

Using these innovative systems, tires can be filled with up to 65% recycled materials. Since up to 65% of the tire fill is recycled material, the amount of virgin materials such as toluene diisocyanate (TDI), polyols and petroleum distillates is also reduced by up to 65%, thus reducing the residual carbon footprint.

Typical Blend Materials

Granulated Recycled Oil-Based Fill
Rubber Crumb
Rubber Crumb & Recycled Oil-Based Fill Mix

The Green Machine allows tire dealers to use a ratio of 65/35 by volume (or 50/50* by weight —this figure is +/- 2%) of recycled material and virgin TyrFil flatproofing material. The AutoFil Machine allows a ratio of either 65/35 or 55/45 by volume depending on the application. The environmental benefit can be illustrated by looking at the 65/35 volume ratio in one of the most frequently filled tires, a 13.00-24 that can take 500 pounds of fill:

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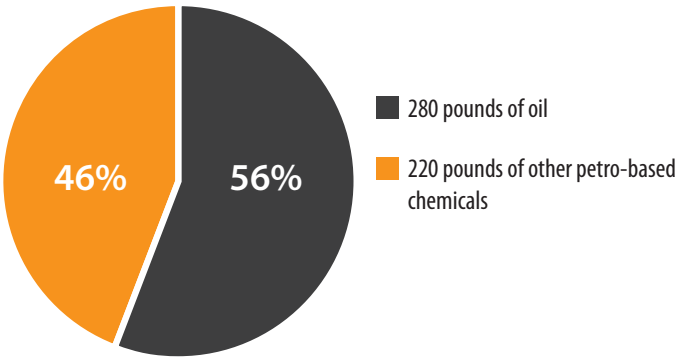
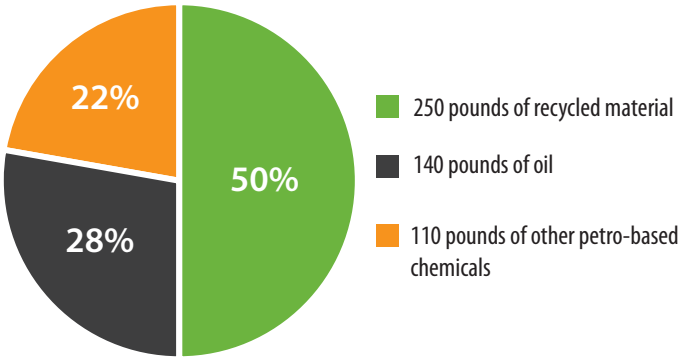
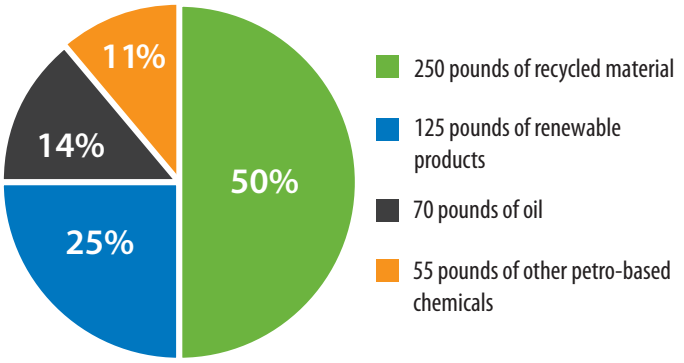
Traditional Fill = 500 pounds



Recycling System with Traditional Fill = 500 pounds



Recycling System with TyrFil EcoFil = 500 pounds



Green Machine

AutoFil

Continual Sustainability Performance Improvement

Carlisle TyrFil evaluates its operations according to three main sustainability performance criteria: functional performance, added economic value and environmental quality.

Functional Performance

The computer systems of the AutoFil and Green Machine have been field-proven for more than a decade to meter and mix controlled amounts of liquid tire fill and granulated tire fill to a homogenous TyrFil mixture that fills the tire exactly the same as virgin liquid tire fill. When tested by independent laboratories, the end result was found to provide equivalent or superior durability compared to virgin TyrFil™ flatproofing.

Added Economic Value

The AutoFil and Green Machine Recycling Systems provide big profit in a small space, as it requires a mere 400 square feet to operate. In addition, the process allows dealers to lower costs by using up to 65 percent less virgin tire fill. When using the AutoFil Machine, the product can be recycled on-site without any added transportation or landfill disposal costs.

Environmental Quality

The AutoFil and Green Machine Recycling Systems completely eliminate the need to scrap cured tire fill in landfills because they recycle 100 percent of cured oil-based tire fill. This significantly decreases the harmful environmental effects of scrap tires.

Approximately half of the tire fill installed in North America is used by original equipment manufacturers (OEMs). In 2005, after more than two years of research and development with its OEM customers, Carlisle TyrFil introduced the OE Belt Drive Recycler System which mixes up to 40% content of engineered recycled rubber crumb derived from scrap tires with virgin tire fill.

Since introduction in 2005, Carlisle TyrFil's OEM customers have used more than 30 million pounds of recycled rubber, resulting in the consumption of 2.5 million scrap tires. An added bonus is that the recycled rubber crumb and virgin oil-based tire fill mixture can be recycled by Carlisle TyrFil's aftermarket dealers using the AutoFil or Green Machine Recycling System.

How We're Doing

- Because of Carlisle TyrFil's strong sustainability focus, more than 150 million pounds of used tire fill has not been dumped into landfills. That number is equivalent to approximately 7.3 million tires, or 112 Olympic-size swimming pools.

- By using the patented AutoFil Recycler System or the Green Machine, Carlisle TyrFil's dealers and processors have been able to reduce the amount of non-renewable petroleum distillates by over 125,000 barrels.

- As of 2014, Carlisle TyrFil increased the total amount of recycled tire fill in the entire flat-proofing industry to approximately 92.5 million pounds. That number is equivalent to approximately 4.6 million tires.

- As a result of Carlisle TyrFil's innovative thinking and patented technology, the company increased the total sustainable material content of its products from 20 percent in 2008 to 48 percent in 2014, a 140 percent increase.

The Carlisle TyrFil Recycling Technology has prevented more than 150 million pounds of used tire fill from being dumped into landfills.

- In 2009, Carlisle TyrFil launched the sustainable innovative product line, TyrFil EcoFil. This new tire fill was specifically developed for the Aerial Work Platform (AWP) applications. TyrFil EcoFil is a water-based material that increases the sustainable material content up to 70 percent.

- Carlisle TyrFil has planted over 195,000 trees through their sustainability partnership with American Forests, visit www.OneToteOneTree.org for more information.

- Carlisle TyrFil also operates as a zero waste, zero emission manufacturer.

- During the past few years, Carlisle TyrFil has introduced next generation technology that significantly reduces the usage of oil, petrochemicals, toxic metals, and other environmentally harmful compounds. Carlisle TyrFil's sustainability initiatives have resulted in safer manufacturing environments for their employees and customers.

Rolling Toward the Future

Tire industry suppliers, distributors and dealers must continue developing innovative, cost-effective solutions to reduce the environmental, health, and economical effects of tire operations and scrap tire disposal. Making quality, innovative, longer-lasting products will help reduce the total number of tires that reach the end of their lives each year. Finding creative ways to recycle and reuse scrap tires can help provide cost-efficient, durable, and functional materials for everything from playground surfaces to filling potholes. Even when tires reach the end of the road, they can "re-tire" in style and provide use for years to come.

To find out more about how your organization can take advantage of Carlisle TyrFil's' water-based formulas and recycling technology to lower costs while reducing the impact on the environment, call (800) 821-4147 or visit www.CarlisleTyrFil.com

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Commitment to Sustainability

Carlisle TyrFil is committed to investing in R&D which supports the sustainability of our environment.

As the industry leader in tire flatproofing solutions for the past 45 years, Carlisle TyrFil has made providing environmentally supportive products a long-term strategic business priority. As a zero waste, zero emission manufacturer, Carlisle TyrFil has proved that innovation and sustainability can coexist and become a competitive advantage.

During the past decade, Carlisle TyrFil has introduced next generation technology that significantly reduces the usage of oil, petrochemicals, toxic metals and other environmentally harmful compounds. Carlisle TyrFil's sustainability initiatives have resulted in safer manufacturing environments for our employees and our customers.

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