GREEN NEOPRENE?

There has been a lot of talk in the surf world about "green" wetsuits. Most of the claims revolve around the use of neoprene made from limestone rather than petroleum. Many of us at Patagonia wear wetsuits, but until 2005 none of us had ever made one. When we first decided to get into the business, we went to visit the raw material manufacturers to learn what kinds of materials were available, their relative advantages and drawbacks (including environmental), and how neoprene is made.

A wetsuit is made of foamed rubber, sometimes called a sponge. It can be laminated on one or both sides with fabric – usually polyester or nylon in a jersey knit. The pieces are glued and/or stitched together to make a wetsuit, and then the seams can be sealed to prevent water leakage.

The sponge is made from polychloroprene rubber chips, commonly called neoprene. These are melted and mixed together with foaming (blowing) agents and pigment, usually carbon black, and baked in an oven to make it expand.

To make the polychloroprene chips, the manufacturer polymerizes chloroprene monomers, which means reacting small molecules together to produce the large macromolecules (polymers) that make up rubber. There are two methods of manufacturing chloroprene monomer. The most common method – Method 1 – takes butadiene through a two-step process of chlorination and subsequent dehydrochlorination. The butadiene for Method 1 is derived from petroleum. The less commonly used method – Method 2 – is to dimerize acetylene (react two acetylene molecules together to form a double molecule), and then hydrochlorinate the dimer. The acetylene for Method 2 is derived from limestone.

Most people can imagine the environmental impacts of something made from petroleum. Like gasoline and most synthetic chemicals, the origins of butadiene for making chloroprene via Method 1 start with oil exploration and drilling. Then the crude must be transported. (Images of the Trans-Alaska Pipeline, the Exxon Valdez, and birds dying in oil spills come to mind.) At the refinery, components of crude oil are broken apart and separated to make different organic compounds, including butadiene.

The environmental impacts of something derived from limestone, however, are largely unfamiliar. Like oil, limestone is a limited, nonrenewable resource that is mined from the earth with cranes, backhoes and dump trucks the size of houses. The crushed limestone is fed into a furnace and heated to extremely high temperatures (over 3,600° F) in an energy-intensive process. From the furnace, components are reacted with other chemicals to make products such as acetylene gas.

Chloroprenes derived from either petroleum or limestone are chemically equivalent. Polymerized and made into chips, limestone-based polychloroprene is not inherently stronger or more flexible than petroleum-based polychloroprene, nor does it insulate better. Any advantage one fabric has over the other is in the differences in manufacturing methods to create the sponge.

We use limestone-based polychloroprene for most of our neoprene products, and we feel that reducing our dependence on oil and oil-derived chemicals is important. That said, both petroleum- and limestone-based polychloroprene have equally significant environmental impacts, although limestone spills are a lot easier to clean up.

Polychloroprene, from any raw material, creates the greater part of a wetsuit's environmental impact; the other components, such as nylon or polyester fabric, play a much smaller role. We have reduced the environmental impact of our wetsuits by using recycled polyester and chlorine-free wool in the lining. These materials are more environmentally friendly than virgin polyester or chlorine-treated wool, and the warmth provided by our Regulator grid structure enables us to use less neoprene.

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It's great that surfers are interested in "green" wetsuits. But limestone doesn't make a wetsuit more environmentally friendly. We really need to push for innovative new materials and construction methods. For example, if we could replace polychloroprene with a completely different material, we may be able to make a significant reduction in the impact of wetsuits on the environment.

Another way we could further "green" a wetsuit is to focus on the adhesives in both the lamination and gluing processes. Solvents used in these processes evaporate into the air during manufacturing, polluting the environment with VOCs (volatile organic compounds). Converting to nontoxic, more environmentally friendly methods of laminating fabric to neoprene and gluing cut pieces would greatly reduce a wetsuit's environmental footprint.

These are the challenges that Patagonia and the surf industry must face in order to make a truly "green" wetsuit.