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**Concerns raised over styrene and butadiene in
Target Technologies' PRO-MAX 37 TPE**

The information provided below is in response to a customer's concern over styrene and butadiene in PRO-MAX 37 TPE and the perception that it is a health concern.

Listed below are the concerns and responses from Cody Bates, President of TDL Plastics, an independent third party with a Master' Degree in Environmental Science:

1. The main components of the PRO-MAX 37 TPE product are styrene and butadiene, both are carcinogens and VOCs, similar to the benzene found in crumb rubber.

Yes, styrene and butadiene are both carcinogens. In fact, either the monomer or oxidated monomer of most polymer bases (ethylene, propylene, etc.) are also listed as carcinogens. The good news is that this product does not contain either of these chemicals in their natural or free state. Butadiene is a gas and styrene is a liquid at room temperatures. SBS and SEBS are not the principal components of PRO-MAX 37 TPE – they actually make up less than 20% of the material.

This infill, like so many other materials that you deal with on a daily basis are actually polymers made up of these base chemicals. Once these polymers are made, these base chemicals are locked within the polymer chain and then considered extremely safe. One such product is high impact polystyrene. The reason that high-impact polystyrene is interesting is because it is solely made of polymerized styrene and butadiene rubber which gives it its impact strength.

High-impact polystyrene has long been used in the food industry and is considered from a toxicological standpoint safe for food contact. Plastic knives, forks, spoons, serving dishes, cups, food storage containers, and a whole host of other food related items are made solely of high-impact polystyrene, which *only* contain the two materials in question. Below is a link referencing some studies of such:

<http://plasticfoodservicefacts.com/main/Safety/Safety-of-PS-Foodservice-Products>

Another source of information that could be helpful is the FDA. The FDA has approved polystyrene and high-impact polystyrene for use in food contact applications based off of years of toxicology and chemical extraction data. Another bright spot for PRO-MAX 37 TPE is that these are not the major components of this material. They are two of the elements in this ethylene based polymer chain, which is used for water bottles, milk containers, and almost all food storage bags.

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To address the VOC part of the question; yes styrene and butadiene can both evaporate when in their natural form and are then considered volatile organic compounds. Since in this product these two materials are locked in the backbone of the polymer chain, they do not evaporate or sublime out and cause it to give off volatile organic compounds. If it did, it would be losing a valuable part of its polymer matrix and then this material would simply break down to dust. This does not occur. Any of the chemicals of concern that may be left in the polymer are volatilized out in an extrusion process twice. Once when the material is made and once when Felix compounds it. The extruders are designed to pull a vacuum on the molten material and take all of the VOC's off of the molten resin.

2. Cancer from chemical exposure has a long latency and may not show up for 10-30 years. Acute toxicity should not be a health standard. No studies on long-term exposure have been done to prove safety.

Correct. There can often be a long latency between exposure to the chemical and the health effects of that chemical exposure. What we can measure though, is the availability of those chemicals for exposure. All of the testing, including the testing for prop 65 in California has shown that none of the materials in question are migrating out of this polymer and are thus not available for exposure. Without a pathway or method of exposure to these monomer chemicals, there is no long-term health risks from the chemicals being locked away within the polymer matrix of this material.

3. The presence of the carcinogens means that exposure is possible and creates risk, the "precautionary principle" of risk assessment would recommend choosing a product without carcinogens.

The precautionary principle does need to be considered, but only a partial consideration. If this principle is used to its fullest extent as the only method for assessing risk, then we would be paralyzed from any action. Now that you understand that the chemicals noted above are locked up within the polymer matrix, let me give a similar example that might cause unwarranted fear.

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An automobile has a whole host of very nasty chemicals in it. Gasoline, antifreeze, brake fluid, transmission fluid, oil, grease, plastic components, even windshield wiper fluid is toxic. However, all of these are held in place within the automobile and do not come in contact with humans. Using an extreme precautionary principal approach would cause one to choose to walk barefoot over this or any other mode of wheeled transportation because of the risk involved. You couldn't even ride a skateboard because of the cyanide used in the manufacture of the polyurethane wheels.

A pragmatic approach is necessary when considering the best infill to use.

4. Inhalational exposure of off gassed VOC's is a concern as well as accidental ingestion (dust or small particles).

As described above, PRO-MAX 37 TPE is not a source of VOC's because the chemicals of interest are locked in the polymer chains that make up the material.

The shape of the material being semi-ovoid keeps the material from breaking down in the field like some products that are in a ground form like crumb rubber. If a non-uniform, non-round of ovoid shape rubbed continuously in between one's index finger and thumb, the infill tends to break small fragments off and reduce in size, leading to particles small enough to be suspended in the air. When this same non-uniform shaped infill is put under the stress of cleats twisting and shock loading on a field, the same break down can happen. The roundness of this material is achieved by the underwater cutting process that allows the dust that occurs with many other manufacturing processes to be avoided. Both of these factors combined cuts down on inhalation hazards associated specifically with this infill.

5. Weighing the alternatives ultimately requires balancing the risks involved and how much control you will have on mitigating risk. Exposing children to a carcinogen may be a greater long term risk than the residual pesticides on cork or coconut material which can be washed off.

This is true and since this material does not pose a carcinogenic risk, as defined by California's very stringent Proposition 65, the next risk that must be assessed is the inhalation hazard associated with a material that breaks down over time. The reason that Felix Compounds has



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chosen not to go with organic fillers in PRO-MAX 37 TPE is that those materials can break down over time as the shells or husks or whatever is used as fillers dry out and become brittle. This not only leads to a much dustier playing surface and airspace surrounding the field but much

more frequent replacement of the infill on the field because it will have lost its original G-Max properties, thus increasing the injury risk to those on the field.

6. Risk assessment is based on health and should be a primary concern regardless of the recreational benefits of a product (such as ability to drain water or increase usage in inclement weather etc.)

Agreed. This is why Felix Compounds formulated the PRO-MAX 37 in such a way to make it safe for those on the field and why TTII realizes while not inexpensive, is the safest alternative to crumb rubber currently on the market.

Cody Bates
President
TDL Plastics