"CO2 contribution to the environment for Plastic Cooling Tower Fills"

We have seen a customer specifying a specific plastic such as PP (polypropylene plastic) because they wanted to have a plastic which had the lowest CO_2 contribution. Of the plastics used in industrial applications, PVC has the lowest CO_2 footprint. Please see the attached chart (European Commission - www.lca.jrc.ec.europa.eu) which reports the CO_2 footprint for a group of plastics. It shows that PP has 40% higher CO_2 contribution measuring the product and production CO_2 contribution compared to PVC (cradle to gate). This is a common way of measuring CO_2 contribution. An addition consideration is the post production contribution.

CO_2 Contribution Summary PVC to PP		
	PVC	**PP**
Product and production	1.2 Kg CO_2 /Kg	1.7 Kg CO_2/Kg

End Use Consideration/Post Production		
	PVC	**PP**
Product life in Cooling Towers*	average life 15 year	less than 10 years
Product performance for film fills**	100%	97%
Safety ***	High	Low

The life cycle effects the replacement product CO_2 contribution. PP is more ultraviolet (UV) unstable and if not properly formulated will become quickly brittle. Brentwood has reviewed many cooling towers using PVC and other plastic fills and rigid PVC formulated to CTI standard 136 has shown superior service life.

PP is a very hydrophobic plastic and in film fills does not wet-out well, which affects the thermal performance of the cooling tower even when using similar high performance fill designs. This lower thermal performance of PP fill requires increased pump and fan energy to handle the required heat dissipation. The increase in energy consumption has a CO_2 contribution. The 3% lower performance considers circulating water that has average water hardness, for waters with lower hardness, the PP fill performance will be lower.

Recently a major fire of PP fill, which was reported to meet CTI's E84 flame spread requirements occurred at Equate Petrochemicals. The majority of plastic fills will not contribute any CO_2 to the atmosphere for 100's of year if the plastic is recycled or left to naturally degrade. The pictured forced draft hyperbolic tower put into the atmosphere an estimated half million kg of CO_2 in 7 hours. The supplier reported that the PP product met CTI E84 flame spread of 25 or less. However, the fill supplier reported the test value generated by the ASTM E-84 test but did not disclose to customers that the PP FR product melted and burned on the floor of the test apparatus. The test requires the test material stay in the test area for the complete burning time to give an accurate flame spread. The E84 test is designed to give a comparison of flame spread to wood (red oak) which has an arbitrary rating of 100. Typically PVC will have an FSI between 5 to 15 and burns 1/6 slower wood.

A simple field evaluation which will simulate the E84 flame spread is to cut a 1/2 " (1 cm) by 6" (15 cm) strip of plastic fill. Light the test sample with a match for about 10 seconds while supporting it in an ashtray. Compare the burning rate of the plastic fill to a long wood match stick or thin wood strip. PVC will burn slower than the wood and stops burning when the flame is removed.