Material and Waste: The Life-Cycle Issue

The "life history" of most building materials is one of waste. Ninety-four percent of the material that contributes to productivity of the average product in the United States has already become a waste by-product by the time the product gets to the end user. This includes building products. If packaging is accounted for, the percentage is higher. Waste in this regard is defined as materials released into the air, water, or soil that are not usable by any other life form on earth. Nature, for the most part, knows no waste. Each organism's "waste" is "food" for another life form. Man is the only life form that systematically produces waste in the true sense, i.e., material that is no longer useful by any other organism on earth. The toxins, heavy metals, and other materials that we regularly produce as by-products of our complex manufacturing processes are truly waste. Once released into the biosphere, these materials accumulate and can enter the food chain. These materials can bio-accummulate in organisms. There is growing evidence of a cumulative impact on the lives of many organisms. Amphibians, for example, are particularly susceptible to these impacts. Lower in the food chain, with shorter gestation periods and skins that absorb materials directly, they tend to be more immediately affected by toxins within their environment. A Missouri botanical research organization, for example, has predicted that the world population of frogs will be reduced by 50 percent within 10 years.[2] There are increasing concerns within the scientific community that the accumulation of toxins is having a detrimental effect on life at many levels.

The solution to this problem is not to find better ways to deal with pollution once it is made. The solution is rather to redesign the things that we make to eliminate the toxins in the first place. What is not acceptable in the end is "down-cycling." Down-cycling is the recycling of materials–plastics for example–into a lesser product. Recovering mixed plastics to use in lumber is a short-term solution, for example. While this extends the life of the materials involved–the plastics–it only delays the eventual disposal of the material in a landfill with the toxins involved. Such recycling is a short-term solution at best.

The objective is to recycle into products in such a way that material is never lost to the overall system–it simply evolves into another form. The model for this is nature itself. In doing so, there are two ways we can emulate nature. The first way is to make products that include only compounds that are

biodegradable, i.e., they are part of nature. The second way is to design products so that they can eventually be recycled. Recycling in this case means producing materials that can be recycled into another product. Many carpets are now designed and manufactured so that they can be eventually remanufactured into more carpet. Furniture manufacturers, equipment suppliers, and others are also beginning to redesign their products in a similar fashion.

THE LIFE CYCLE OF A CHAIR

For most of the history of the design profession, the knowledge of materials and products has been limited largely to short-term knowledge that extends from the showroom through installation. This knowledge represents only a small part of the history of these materials and products. For example, consider a simple desk chair. The chair may consist of several dozen materials, including the metals, paints, fabrics, plastics, foams, glues, and lubricants that go into the final product. Each of these components in turn is made of a set of materials that have gone into producing that component. The paint will be the end product of the interactions of dozens of different chemicals and processes. Each of those chemicals has a history going back to the original raw material sources. The aluminum fittings have previously traveled over many continents as the raw material was processed. The steel has a similar story.

For most products today, the history of production is one of pollutants at every step released in one way or the other into the air, water, and soil. Those emissions represent a large percentage of the overall waste that results from the production of the chair. Each step also uses energy in various forms with its resulting pollution. Each material that goes into the final chair has a similar history. Each material or subcomponent is delivered to the manufacturer's assembly plant. Those materials will generally have been transported from some distance. They will generally have come from plants that use great quantities of energy and other resources. The plants, primarily those located outside the United States, will frequently be unsafe and unhealthy for the workers. The waste generated will be great. The chair is finally delivered to the building site from a distant factory by transportation that is itself inefficient. It will be delivered to the job site with packaging material that will have been used once and will end up in a landfill.

While the chair is in use, there is a good chance that it will give off gases that are evaporating from the glues, foams, and other material that went into its