World Resources Institute

Sustainable Enterprise Program
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Specialty Glass, Inc.: Cost Accounting and Hazardous Wastes

The Company, Its Products, and Markets

For more than a decade, WRI's Sustainable Enterprise Program (SEP) has harnessed the power of business to create profitable solutions to environment and development challenges. BELL, a project of SEP, is focused on working with managers and academics to make companies more competitive by approaching social and environmental challenges as unmet market needs that provide business growth opportunities through entrepreneurship, innovation, and organizational change.

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Specialty Glass, a privately owned company located in the Pacific Northwest of the United States, manufactured about 30 percent of the world's supply of colored sheet glass for stained-glass windows and lamps. Specialty was a high-volume, low-margin producer with about $12 million in annual sales. The majority (50-60 percent) of sales were to the stained glass market (e.g., arts and crafts shops, stained glass artists). The remaining sales were to overseas specialty lighting manufacturers who received the shipped glass, incorporated it into lighting products, and shipped the finished products back to the United States. Although other manufacturers produced specialty sheet glass in North America, Specialty (with 160 employees) was substantially larger than any of these competitors (typically with five to six employees each).

Specialty used both day tanks (where melting, cooking, and usage take place in a 24-hour cycle) and continuous furnaces (where molten glass is removed at the same rate that raw materials are added). Continuous furnaces produce glass that withstands more stress than other sheet glass. Continuous furnaces require large amounts of electricity, affordable for Specialty because of the relatively low price of electricity in the Pacific Northwest. Continuous furnaces also require a substantial capital investment. These high capital and operating costs kept many of Specialty's smaller competitors from investing in similar equipment. Consequently, Specialty had a competitive advantage in producing this glass. Apparently, the limited size of the worldwide market kept even the better-capitalized firms from entering it.

This case was prepared by Dr. Christine H. Stinson, Associate Professor of Business Administration, Darden Graduate School of Business Administration, University of Virginia. *The case is intended to serve as the basis for class discussion rather than as an illustration of effective or ineffective management strategies. It is based on material collected for Green Ledgers. Case Studies in Corporate Environmental Accounting a 1995 publication of the World Resources Institute (WRI), edited by Daryl Ditz, Janet Ranganathan, and R. Darryl Banks.*

The Manufacturing Process

Specialty manufactured glass on a batch basis. For each production run, the precursors of glass (sand, soda ash, and limestone) and coloring chemicals were mixed together. Because some of the colorants were hazardous, they were mixed with the cullet in a closed weighing room, then put into an electric furnace. Furnace smoke and weighing room dust were ventilated into a baghouse (a room separated from the plant by a series of fabric filters that help separate solid particulates from the air).

After the furnace melted the glass and oxidized the colorants, the new sheet glass was formed, cooled, and removed from the furnace. If the glass broke during cooling or subsequent handling, it was crushed into cullet. Sometimes this cutlet was recycled through the furnace; however, it was not always possible to reuse cullet because the original mix may have included some chemicals whose composition changed when heated.

Specialty's continuous manufacturing process mixed fine ash from the different glasses: this ash was collected from the cloth filters in the baghouse. Specialty generated about 15,300 pounds of fine ash as well as an additional 2,700 pounds of other hazardous waste each year. Specialty paid approximately $1.75/pound (or $31,500/year) to dispose of the ash and other hazardous waste.

The finished glass was cut into desired dimensions and packed for shipping. Because the glass had to be well protected during shipping, about one-tenth of Specialty's product cost was from packaging. Any remaining glass fragments were crushed into cullet, which was either recycled internally or sold.

Environmental Issues

Several pigments used as coloring in the manufacture of yellow, orange, and red glass were highly toxic, hazardous chemicals. Both glaze and glass producers had searched unsuccessfully for less toxic pigments. Specialty Glass was one of only two U.S. manufacturers still making ruby-red glass; because of environmental concerns, its manufacture in Europe had been banned by a European Union directive. Consequently, groups building new churches in Florida or new mosques in North Africa usually bought the ruby-red glass for their stained-glass windows from Specialty.

The coloring chemicals were the primary source of Specialty's environmental issues – hazardous waste disposal and air emissions. For example, increasingly restrictive regulations on the manufacture of cadmium oxide, the main colorant in ruby-red glass, threatened to cause manufacturers to stop producing this chemical. Asarco had been Specialty Glass's main supplier of cadmium oxide, but it had already discontinued production. Some current suppliers were moving their cadmium oxide production out of the United States; they melted the cadmium into glass, crushed the glass, and shipped the crushed glass back to their U.S. customers.

A news item from *Greenwire* (November 27, 1995, Vol. 5, No. 144) described a typical outcome of human exposure to cadmium: "High concentrations of cadmium may be responsible for increased levels of kidney disease in residents living along the Jinx River in Japan's Toyama prefecture, according to a new study by the Toyama Medical and Pharmaceutical U. The Mitsui Mining and Smelting Co. in 1968 released cadmium into the Jinzu River, causing at least 181 Toyama prefecture residents to suffer from the 'excruciatingly painful' Itai Itai disease. The Itai Itai outbreak 'ranks as the second worst pollution-related disease' in Japan, after the Minamata mercury poisoning episode. In 1984 and 1995, the researchers tested the urine of 111 women in five cadmium-contaminated areas and 17 women in an uncontaminated area. All were born between 1914 and 1929 and gave birth when cadmium poisoning in the region became more severe. In 1995, 63.1% of the women showed signs of a kidney disorder, compared with 43.2% in 1984."

In 1990 and 1991, when state environmental regulators became concerned with the "visible plume" of smoke from Specialty's stack, Specialty installed emission controls that eliminated the "visible" component of their air emissions. By 1992, Specialty technical staff realized that their operations would probably be limited by additional regulatory constraints on air emissions in the near future. In the extreme, the company might be closed down and their jobs (in a relatively small, specialized industry) might disappear. Specialty also faced the same regulations as non-specialty glass manufacturers (i.e., limits on the particulates in air emissions without regard to their toxicity). Already, more restrictive emission requirements for cadmium were pending before the local air quality control board. In anticipation of these new regulations, Specialty Glass started sampling the air emissions from its smokestacks.

The stack sampling showed that Specialty was still emitting measurable amounts of cadmium into the atmosphere. In response, Specialty installed the furnace baghouse described above; it captured 99.7 percent of the toxic particulates from the weighing room and furnace that were previously emitted into the air. This arrangement was the "best available technology" (the standard used to judge regulatory compliance) for limiting cadmium emissions, but it did not ensure future compliance if more advanced technologies were developed in the future.

Hazardous Wastes

Hazardous solid wastes were produced when cadmium burned off during the manufacturing process and was captured as ash in the stack. Hazardous wastes were also generated from spilling and breakage that ended up on the plant floor. However, not all broken glass became hazardous waste. For example, Specialty's white glass cullet was sold to a marble manufacturer who made "industrial marbles" for mixing the paint stored inside spray paint cans.

Specialty had been shipping its cadmium wastes to an Oregon landfill until it stopped accepting any that contained cadmium. These wastes were subsequently trucked to a waste processor in Arkansas (the only U.S. landfill accepting cadmium-containing ash). As one of the company's engineers pointed out, "We have the alternative of mixing the cadmium-containing ash from our stacks with melted glass, thus creating glass-encased solidified cadmium. The glass encasement prevents diffusion or leaching of any hazardous materials contained in the glass pellets. However, because the solidification process would be construed to be 'treating' hazardous wastes (under RCRA and related federal environmental regulations), we would have to apply for a permit to operate as a Treatment, Storage, and Disposal (TSD) Facility, and this application process involves a lengthy and expensive regulatory review with no guarantee that our proposal would receive regulatory approval." Specialty took its floor sweepings (of glass fragments) and melted them into new glass that it crushed and sold for use in roads and driveways; these glass pellets were then a "product" and not a hazardous "waste."

Pricing

Specialty Glass charged essentially the same price for the different colors of sheet glass. This price was based on the average cost of input materials and labor that were common to all its products plus a proportional share of overhead. Some colors were priced higher than others when their direct-materials or direct-labor costs were higher. For example, some coloring pigments were more volatile than others; these less stable pigments required more pigment per square foot of finished glass as well as more labor during production.

Discussion Questions

1. Specialty Glass included the cost of waste disposal in overhead. Would Specialty's estimate of the "true cost" of producing different products change significantly if this cost were traced directly to the various colored glasses according to the cost of disposing of the different ashes?

2. Was Specialty incurring other environmental costs? If so, what were they? Would Specialty's estimate of the "true cost" of producing different products have changed significantly if these costs were traced directly to the different glass products?

3. Specialty Glass was owned by one individual. This fact was reflected in the limited amount of information available about different product costs, relative profitability of the products, and the company's business risks. If Specialty Glass were publicly traded (or if the current owner wanted to undertake an initial public offering of shares in the company), what financial and business risk (including environmental risk) disclosures would be required?

4. What options did Specialty Glass have with respect to the environmental issues? What were the financial and strategic strengths and weaknesses of each of these options?