

*A technical issue of increasing importance to our customers is KEMET's action in the environmental arena. Dr. G. M. Sastry, the author of the following article, is a member of KEMET's Technology Department and plays a key role in promoting alternatives to potentially hazardous substances in KEMET operations.*

*Dr. John Piper  
Vice President, Technology*

## **Reduction in Chlorofluorocarbons, Chlorinated Hydrocarbons, and Hazardous Wastes at KEMET**

*by Dr. G. M. Sastry*

KEMET is committed to a policy of conducting business in such a way as to protect the health and safety of the public and the environment. Our comprehensive program of eliminating all chlorofluorocarbons (CFCs) and chlorinated hydrocarbons (CHCs) and greatly reducing hazardous wastes from our operations has been given additional impetus by the newly reauthorized Clean Air Act and the international Montreal Protocol to eliminate ozone-depleting solvents. This paper describes the organization and progress of KEMET's program to eliminate or substantially reduce the release of potentially hazardous substances used in our operations worldwide.

### **Structure of the Program**

KEMET's environmental goals and policies are the same worldwide. The primary responsibility for achieving the goals rests with each of our manufacturing plants. They must address environmental solutions specific to their own product lines, meeting KEMET's policies and procedures and satisfying EPA (USA) and SEDUE (Mexico), respectively. Cross-functional and inter-plant teams make sure the best approaches are recognized, supported and implemented. The Technology Department at KEMET serves as a resource in developing less harmful alternatives to CFCs and CHCs, and in reducing hazardous wastes in KEMET operations.

Overall, coordination and goal setting are provided by the Corporate Health, Safety, and Environmental Protection Department. The dramatic improvements described in this article were achieved through the teamwork of all support and manufacturing functions at KEMET.

### **CFCs and CHCs**

Chlorofluorocarbons and their close cousins, chlorinated hydrocarbons, have been in use in the electronics industry for years as cleaning solvents to remove oils,

fluxes, etc. Ironically, they were originally considered prime solvents because they are nonflammable, effective cleaners, and were believed to have a very low potential for human and environmental hazard. Recent information demonstrates that CFCs and some CHCs are the major contributors to the depletion of the ozone layer in the stratosphere, and much of the policy in the Montreal Protocol and the Clean Air Act is concerned with eliminating use of these solvents.

### **CFCs**

In 1988 KEMET manufacturing functions used about 11,000 pounds of CFCs. Through prompt action similar to that described below for CHCs, we expect to use less than 500 pounds in 1991. We are continuing our effort to eliminate CFCs entirely from non-manufacturing operations (e.g., refrigeration, and air conditioning) as suitable alternatives become available.

### **CHCs**

CHCs have been used at KEMET as flux cleaners and solvents for release agents for many years. Prior to 1987, KEMET's efforts concentrated on minimizing CHC exposure in the workplace. In 1987, we initiated a remediation program designed to eliminate CHCs completely by the end of 1993.

As Figures 1 and 2 illustrate, we have been very successful in replacing CHCs in both our United States and Mexico operations. By changing materials and/or eliminating flux cleaning after the soldering operations in our manufacturing process, we have been able to greatly reduce the release of CHCs without compromising the quality or reliability of our products. Among the alternatives to flux cleaning now in place are:

- use of standard rosin flux and elimination of solvent wash
- use of standard rosin flux, cleaning with an aqueous saponifier, followed by a deionized water rinse
- substitution of standard flux with a low-residue flux, thus eliminating the need for a solvent wash

Additional methods currently being developed include the substitution of water-soluble fluxes and the use of alternate solvents.

### **Hazardous Wastes**

The term "hazardous waste," as defined by the United States Environmental Protection Agency, includes KEMET materials ranging from solder-coated wire to barium titanate-based dielectric sheet. We have reduced the generation of these wastes significantly at all opera-

tions by either eliminating their use or designing them out of new products.

Our strategies for waste reduction include:

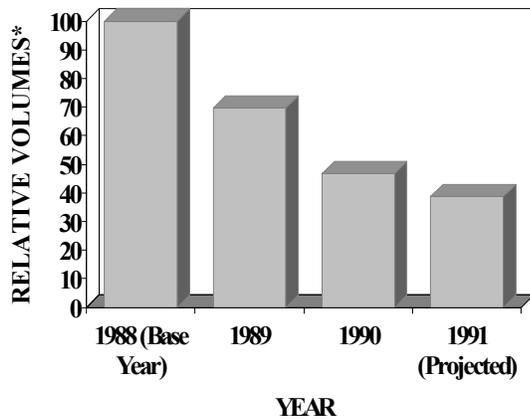
- recycling of waste through the original supplier of the raw material
- development of engineering changes incorporating concentration of materials in process (e.g., flocculation) and post-concentration of the waste byproducts prior to their disposal (e.g., filtration)
- elimination of process steps

Figure 3 demonstrates progress in our US hazardous waste reduction program begun in 1988.

### Conclusions

The dramatic reductions we have made in hazardous substance production and release are the direct result of the team efforts combining plant and corporate resources. Particularly important has been educating every level of our workforce about the need to control, reduce, and eventually eliminate these substances from our operations. By continuing to train our personnel to search for alternatives to potentially hazardous substances, we expect to eventually eliminate the use of CFCs, CHCs and hazardous wastes from KEMET operations.

### Reduction in Chlorinated Hydrocarbons Usage in KEMET's United States Plants



\* These are adjusted in all Figures to reflect the annual changes in Manufacturing Volumes

Figure 1

### Reduction in Chlorinated Hydrocarbons Usage in KEMET's Mexican Plants

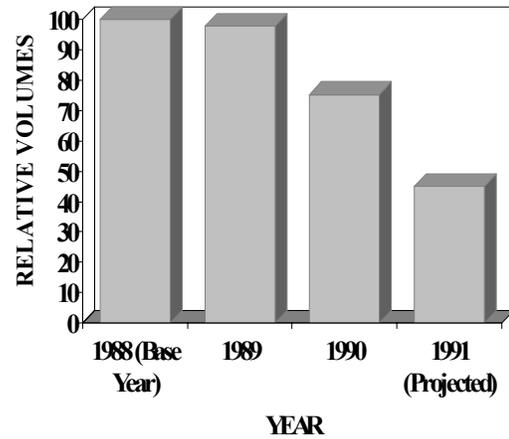


Figure 2

### Reduction in Hazardous Waste Generation

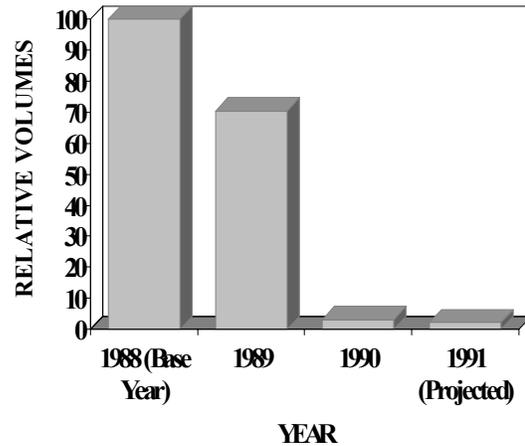


Figure 3

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