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Project Summary

Investigation of Possible Uses of Surplus CFC/Halon Chemicals

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This project investigates the possibility of alternate uses for surplus chlorofluorocarbon (CFC)/halon chemicals as they are replaced in their traditional service roles. These uses may be beneficial new products or substances that are nonhazardous to the environment.

Potential transformation technologies were identified from a study of literature. The two-carbon-atom (C_2) CFCs and the halons offer the greatest range of possible products. The possibility of using existing CFC/halon manufacturing facilities to produce new products by changing feedstocks is discussed.

Halons are assumed to have no transformation supply since residual demand for halons in their traditional roles would consume the entire available supply. Market supply calculations for CFCs were based on a number of "what if" scenarios chosen to represent low, medium, and high transformation supply cases. In reality, there is significant uncertainty in the estimates of CFC supply for transformation. CFC-12 represents about 70% of the total transformation supply bank. An engineering assessment of CFC-12 transformation chemistry is presented.

The study concludes that there is significant uncertainty in the transformation supply of CFCs and that no transformation process offers an immediate, clear, and economically viable option for CFC transformation.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Overview

This project investigated the possibility of alternate uses for surplus chlorofluorocarbon (CFC)/halon chemicals as they are replaced in their traditional service roles. These uses may be beneficial new products or substances that are nonhazardous to the environment. The CFC/halons investigated in this study were: CFC-11, HCFC-22, CFC-114, R-500, Halon-1211, Halon-2402, CFC-12, CFC-113, CFC-115, R-502, and Halon-1301.

This study emphasized the U.S. market; however, where data were available, global estimates were sought.

The study had three major components:

(1) Identification of potential transformation technologies.
(2) Identification of potential U.S. markets for transformation.
(3) Engineering evaluation of the transformation technologies.

The potential transformation technologies were identified from a study of reports in the literature of chemical reactions involving the targeted CFC/halons. A wide variety of reaction types are reviewed, with the C_2 CFCs and the halons offering the greatest range of possible products. In general, any transformation process will require a fairly pure feedstock. The possibility of using existing CFC/halon manufacturing facilities to produce new products by changing feedstocks is discussed. Difficulties relating to product separation are specially noted.

The market supply for transformation was assumed to include recoverable and newly made CFC/halons. The manufacture of CFC/halons specifically for transformation was not considered. A recent United Nations Environment Program (UNEP) report had indicated that, in the absence of a prohibition on use (as opposed to manufacture), residual demand for halons in their traditional roles would consume the entire available supply. Halons are assumed to have no transformation supply. Data on projected future end uses of the various CFCs were not available; consequently, market supply calculations are based on a number of "what if" scenarios. These were chosen to represent low, medium, and high transformation supply cases. In reality, there is significant uncertainty in the estimates of CFC supply for transformation. The distribution of the CFC types shows CFC-12 to have the largest potential transformation supply: it represents about 70% of the total bank.

An engineering assessment of CFC-12 transformation chemistry is presented. In a pyrolysis reaction with methane, CFC-12 is converted to vinylidene fluoride, the monomer for poly (vinylidene fluoride) production. This monomer is currently produced via a different route. However, there is an expanding demand for the polymer The process may have an add-on application in developing countries where CFC-12 production is in place. For the process to be a commercial success, it is probable that some process optimization will have to be undertaken, especially in the area of product separation.

The significant observations in the study were:

- There is significant uncertainty in the transformation supply of CFCs
- No transformation process offers an immediate, clear, and economically viable option for CFC transformation.

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The complete report, entitled "Investigation of Possible Uses of Surplus CFC/Halon Chemicals," (Order No. PB93-229771; Cost: $27.00; subject to change) will be available only from:
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5285 Port Royal Road
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The EPA Project Officer can be contacted at:
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