ECOLINK.

Clean Ideas for Industry

Phase-out of HCFC-141b – History, Timeline and Alternatives

On January 1, 2003, a specific class of industrial solvents, Hydrochlorofluorocarbons or HCFC's, will be banned from production in the United States. For those who participated in the phase-out of 1, 1, 1 trichloroethane and CFC's in the 1990's this is a deja-vu experience, albeit on a more limited scale. However, many Ecolink customers have come to rely on HCFC's, used in the formulation of **Ecolink 2005**, as part of their critical cleaning toolbox.

This paper presents a brief history of the regulatory issues behind the HCFC phase-out, details of the phase-out, an introduction to Ecolink's HCFC replacements and technical guidance for their testing, implementation and use.

History of the Problem

The idea that chlorinated solvents, refrigerants and other chemicals might be destroying earth's protective ozone shield surfaced in the mid '70's. In 1978, when the idea of ozone-depletion became a mainstream theory, the EPA banned CFC propellants in aerosol cans. In 1985 the ozone hole in the Antarctic was detected. The evidence began to add up, and the theories evolved into accepted scientific fact. It became clear that chlorinated solvents were part of the problem. A series of international meetings culminated in the 1987 Montreal Protocol, which mandated the gradual phase-out of ozone depleting substances, worldwide.

In April 1991, new NASA ozone depletion data revealed that the earth's ozone layer was being destroyed much faster than previously believed. EPA Director Reilly publicly called this new data "startling and alarming". The Montreal Protocol, which had been adopted by 43 countries, was amended to end the production of CFC-113 and 1, 1, 1 trichloroethane by December 31, 1995.

To smooth the transition away from the millions of pounds of CFC's and 1, 1, 1 trichloroethane used in industrial applications, EPA authorized the continued use of HCFC solvents based on their slightly lower ozone-depletion potential. This "acceptable interim solvent" exemption for HCFC's ends on January 1, 2003, and users will be forced to develop strategies for implementing effective alternatives.

Ecolink has spent the last several years formulating, testing and marketing safe, cost-effective alternatives to HCFC-141b. Just as Ecolink helped hundreds of military, aerospace, utility and industrial solvent users switch from 1,1,1 and CFC's in the 90's, we are committed to support our customers through this final regulatory transition.

Details and Impact of the HCFC Phase-out

The first question asked by our customers is, "How long will products containing HCFC-141b, such as Ecolink 2005, continue to be available to me?" Although Ecolink can simplify the process of alternative selection, (we currently offer a series of environmentally compliant, high-performance alternatives to Ecolink 2005), we understand that testing and approval of new products can take time. Therefore Ecolink is committed to supply Ecolink 2005 to our customers throughout their transition.

While the phase-out language forbids production or import of HCFC's after January 1, 2003, it does allow users to consume the balance of the available material produced prior to the phase-out. Using the 1995 phase-out of CFC's as a guide, we believe that HCFC raw material will continue to be available to Ecolink, and therefore to our customers, well into 2003. As a result we believe that all of our customers will have time to comfortably transition to the Ecolink replacement products of choice, with no disruption to their daily workflow.

An introduction to Ecolink's HCFC replacements

When crafting HCFC alternatives, Ecolink draws from its extensive experience as a leading manufacturer of environmentally preferred cleaning products. We have developed Ecolink alternatives based on a clear understanding of our customers' needs. Using HCFC-141b performance as baseline, (and improving on it when possible), we considered the following key factors:

- Superior removal of oil, grease, flux and other contaminants
- Non-flammable in bulk or per aerosol flame-extension tests
- Rapid evaporation after cleaning
- Absence of residue after cleaning
- Low toxicity profile
- Low odor
- Acceptable exposure limits in typical usage environments
- Free of water, therefore safe on electrical equipment
- Safe on common materials of construction

As we learned during the CFC and 1, 1, 1 trichloroethane replacement efforts, there is rarely one single product that will be the "magic bullet" drop-in alternative for all cleaning challenges. The key to successful product identification begins with a precise understanding of the cleaning objectives and restrictions surrounding each user's particular situation. To insure that we can meet and exceed the performance expectations of all of our customers, Ecolink has carefully designed a family of high-performance alternatives. The following table highlights the characteristics, features and applications of these Ecolink products.

Table One – The Ecolink Family of HCFC-141b Alternatives

Product Name	Applications	Performance Advantages	Performance Disadvantages	Toxicity	Material Compatibility
ECC	Light soil removal	Dries rapidly, cleans well, cost effective	Flammable	Low toxicity	Good
Eco Spray	Contact cleaning, light soil removal from solvent-sensitive substrates	Similar to CFC-113, no flashpoint, rapid drying, no residue	May not remove some soils	Low toxicity	Excellent
Ecolink 3005	Contact cleaning, light to moderate soil removal	Similar to CFC-113, no flashpoint, rapid drying, no residue	May not remove some soils	Low toxicity	Good
Phase III (TCE)	Heavy-Duty degreasing	Superior soil removal, rapid drying, no residue	Low exposure limits	Moderate toxicity, ventilation required	Aggressive on many plastics
Positron	Degreasing, contact cleaning	Good solvency, removes most soils	Moderate dry time	Low toxicity	Test on rubber and plastic
Triagen	Heavy-Duty degreasing	Superior soil removal, rapid drying, no residue	Low exposure limits	Moderate toxicity, ventilation required	Aggressive on many plastics

Guidance for Testing and Implementing HCFC Replacements

Based on your specific applications, a review of general characteristics, as well as specific chemical qualities, can help determine which products most closely match 141b in a specific application.

Since each of the available replacements has its own performance characteristics, it is important to test the actual replacements in the intended applications. In some cases, it may be wise to introduce two different chemistries to replace HCFC-141b. Given the high cost of some of the alternatives, introducing a second product may be an excellent way to insure cost-effective operations. For example – using Positron for general purpose degreasing and Ecolink 3005 for contact and critical cleaning.

When considering alternatives, we recommend the following steps:

1. Identify the various applications that need to be addressed, using the chemical(s) selected.
2. Determine the most important criteria in each of the applications. Flammability? Dry time? Solvency? Then prioritize these requirements for each application.

3. Using the material provided by Ecolink and the support of your Ecolink representative, determine which product(s) are most likely to succeed in each of the applications.
4. Determine what type of testing is needed in each case, by whom and how the results will be captured and analyzed.
5. Ecolink will provide necessary samples and technical support throughout the evaluation period.

The table below can help you evaluate alternatives to HCFC-141b. Other factors may be added, based on your specific requirements. The Ecolink Technical Department can help construct technical evaluation tools to support your specific process:

Table Two – Technical Specifications of Ecolink Alternatives to HCFC-141b

Product Name	**Flashpoint**	**KB Value**	**Vapor Pressure Bulk form**	**Vapor Pressure Aerosol Form**	**Boiling Point**	**Plastic Safety***	**VOC**
ECC	Extremely flammable	30	114 mm Hg @ 20°C	2.2 psi @ 68°F	204° F	Safe on many	100%
Eco Spray	None, per aerosol flame extension test	15	Not available in bulk form	3.5 psi @ 70°F	111° F	Safe on most	Exempt per SCAQMD
Ecolink 3005	None, per aerosol flame extension test	30	496 mm Hg @ 25°C	9.6 psi @ 77°F	97° F	Safe on many	Partially Exempt
Phase III (TCE)	None, per aerosol flame extension test	129	59 mm Hg @ 20°C	1.1 psi @ 68°F	189° F	Extremely aggressive on plastics	100%
Positron	Flammable	38	.0526 mm Hg @ 20°C	< 1 psi @ 68°F	348° F	Safe on many	100%
Triagen	None, per aerosol flame extension test	125	111 mm Hg @ 20°C	2.1 psi @ 68°F	160° F	Safe on few	100%
Ecolink 2005 (HCFC-141b)	None, per aerosol flame extension test	56	586 mm Hg @ 20°C	11.3 psi @ 68°F	89.6° F	Safe on some plastics	Was exempt

This is the time to begin evaluating HCFC-141b alternatives. Your Ecolink representative is ready to provide all of the necessary support to insure that this transition can be concluded in a timely and cost effective fashion. We look forward to working with you.

* It is always a good idea to run tests on all solvents that may be used on plastics or rubber to insure compatibility on your specific substrate. Ecolink maintains detailed compatibility data on many materials, which may be useful in making your final determination.