American Polywater's
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Trichloroethane and CFC Alternatives

Why Replace Them? They Work Fine.

For decades, a solvent called "1,1,1-Trichloroethane" was used for a variety of telephone construction and outside plant maintenance functions. "Trichlor" is also known as "Type B Cleaner ", "methyl chloroform,", "trike," and "TCA". A second solvent cleaner, 1,1,1 trichlorotrifluoroethane, often called CFC 113 or Freon® 113, was also popular in telephone central office work for light circuit and contact cleaning.

These two solvents have some things in common as well as some differences. Trichlor was a more powerful degreaser. It was used for tough cleaning like asphaltic cements, cable filling gels, and other types of grease. CFC 113 was used where stronger solvents might ruin plastics, such as relays, contacts, and circuit boards.

Both solvents are very fast evaporating, with the CFC 113 being the faster of the two. The wet film disappears in only a few seconds from a surface wiped with either of the solvents. Both trichlor and CFC 113 are non-flammable, that is, they have no flash point, and thus, a minimal fire/explosion hazard.

But the final thing these two solvents have in common is the reason we need alternatives. Both solvents are Class 1 ozone depleters, and their production and import has been banned in industrialized nations by international treaty. In developing countries, the solvents are still being phased out, but a longer time period.

The end result is, even where these solvents are still available, their days as cleaning solvents are numbered, and alternatives must be found.

How/Why Solvents Work

To consider alternatives, we must first understand more about these solvent cleaners. Why did they work? What are their important performance characteristics?

Three important solvent properties have already been mentioned:

1) Solvency Power
2) Evaporation Rate
3) Combustion Character

Several other important properties, depending on specific end use, would be:

4) Dielectric Properties
5) Residue
6) Interaction with Plastics, Cables, etc.
7) Environmental and Toxicological Properties

What's Available?

For some period, only a few solvent alternatives to Trichlor and CFC 133 were available for telecommunications use. Mixtures of paraffin with citrus distillates called terpenes were used. Those familiar with cable cleaning recognize the "orange juice" smell of these cleaners. Alcohol was also used, particularly on fiber optic cable. While both these alternatives have some good points, they also have deficiencies. Isopropyl alcohol **is not effective at cleaning** many kinds of grime. The orange-base solvents **evaporate much slower** than trichlor, and thus take longer to dry off contacts, parts, etc.

Solvent experts realize there are no "drop-in" substitutes for trichlor. In any alternative, compromises are unavoidable. Are there alternatives that offer a better balance of properties than the alcohol and orange-base? To answer, let's look at properties for the solvents above as well as some new enhanced cleaners available from American Polywater®.

Solvency Power/Cleaning Effectiveness

A cleaner's effectiveness varies with the substance to be cleaned. For instance, we know that kerosene dissolves and cleans axle grease better than water does. On the other hand, water dissolves salt, while kerosene doesn't.

One way to measure a solvent cleaner's effectiveness is to use the cleaner on the specific grime/grease, etc. While subjective, differences in cleaning effectiveness are still obvious. The results of testing on typical telephone grime are presented below.

SOLVENT/ CLEANER	SUBSTANCE			
	C-Cement	Filling Gel	Animal Oil (Lanolin)	Silicone Grease
1,1,1-Trichloroethane	Excellent	Excellent	Good	Fair
Isopropyl Alcohol	Poor	Fair	Good	Poor
Orange-base Solvent	Excellent	Good	Good	Excellent
Type GX Cleaner	Excellent	Excellent	Fair	Good
Type HP Cleaner	Excellent	Excellent	Good	Excellent
Water	Poor	Poor	Poor	Poor

This chart confirms that alcohol is not a good substitute for a number of trichlor cleaning uses. There are solvent cleaners that equal and even surpass trichlor's cleaning effectiveness. The orange-base material and American Polywater's® Type GX and HP do very well.

Evaporation Rate

Evaporation rate testing is straightforward in concept. Weight loss of solvent through evaporation is measured over time, and a loss rate is established. Often, these rates are compared with some other "standard" solvent, on a "times faster than" basis.

The chart below presents evaporation rate data. Note that water is used as the "comparison" evaporation rate.

SOLVENT/CLEANER	EVAPORATION (times faster than water)
1,1,1-Trichloroethane	120
Isopropyl Alcohol	25
Orange-base Solvent	0.2
Type GX Cleaner	20
Type HP Cleaner	0.8
Water	1

We see evaporation is an area where compromise is necessary. While the alcohol and Type GX Cleaner are fast evaporating, they're not as fast as trichlor. However, as anyone in a warm climate can tell you, trichlor can be too fast. It evaporates before the cleaning is done and excess must be used. The table shows why the orange-base solvents are considered too "slow"; they evaporate over 500 times slower than trichlor.

Most of the evaporation rate concern is based on field convenience and efficiency ... the faster the evaporation, the better ... no waiting for something "to dry." However, the faster a solvent evaporates, the quicker its vapor reaches significant concentrations in the air (breathing exposure). To balance vapor exposure and operational efficiency, a cleaning solvent should evaporate fast enough not to slow down the job, but not so fast that excess is needed.

The chart shows that a range of evaporation rates is possible. Field trials can choose the best balance for any particular situation or use.

Combustion Properties and Hazard

A common, although not the only, measure of the combustibility of a solvent is its flash point. This is the solvent temperature when enough vapors form over an excess of solvent to develop a combustible mixture in air. Flash points for the solvents we have been discussing are:

SOLVENT/CLEANER	FLASH POINT (Closed Cup)
1,1,1-Trichloroethane	None below boiling point
Isopropyl Alcohol	53°F
Orange-base Solvent	180°F
Type GX Cleaner	54°F
Type HP Cleaner	145°F
Water	None

We see that all the proposed substitutes for trichlor have a flash point. Field craftspeople have experience with isopropyl alcohol and have used it safely for years. It is important to understand that the alternatives for trichlor are combustible liquids and can produce flammable mixtures in air if too much solvent is vaporized in a closed-in area. Safe use means restricting quantities to avoid high vapor concentrations, avoiding fire or flame, etc.

Summary

Reasonable alternatives for trichlor exist today. Such alternatives can clean and degrease just as effectively as trichlor. Different evaporation rate levels are available. The alternatives are combustible and must be handled in a safe manner.

As we'll discuss in future issues of "TeleTopics", alternatives can be formulated with some superior properties to trichlor, specifically in compatibility with engineering plastics and in dielectric performance.

Free Trial

If you are interested in trying alternatives to trichlor, please call American Polywater customer service at **1-800-328-9384**. We'll supply appropriate samples with MSDSs, etc. If you require safety approval at your company, call and we'll get safety information to the appropriate people. The sooner you act, the better.

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