American Polywater's
TechnicalTalk
A PUBLICATION FOR ENGINEERS INVOLVED IN ELECTRICAL CABLE INSTALLATION

ROUTE TO:

Volume 9

ELECTRICAL CLEANING SOLVENTS
Part 3

Parts 1 and 2 of Electrical Cleaning Solvents discussed the EPA-mandated elimination of trichloroethane-based electrical cleaners. Properties of alternative solvents were examined.

Part 3 will look at another aspect of electrical cleaners: "vapor toxicity" and its control. We'll see how safe use of cleaners depends on evaporation rate and field use method.

Exposures

Field users' primary exposure to solvents is via inhalation (lungs). Because electrical cleaners evaporate, there are airborne vapors and a breathing exposure to the vapors.

Things we inhale can be toxicants or asphyxiants. Carbon monoxide (auto exhaust) and hydrogen cyanide (gas chamber) are examples of toxic gases. Gases like helium and nitrogen are asphyxiants. If they're not mixed with enough oxygen, they can smother us. Obviously, life-sustaining oxygen is neither a toxicant or asphyxiant. How do *solvent vapors* fit? How is their toxicity determined?

Toxicity of Vapors & Gases

What we need to know about airborne vapors is whether, and under what conditions, they're "safe." Industrial hygiene groups have answered this question, and established "safe working levels" for vapors or gases in air (40-hour-per-week exposure). These are called "Threshold Limit Values" (TLV's) or "Permissible Exposure Limits" (PEL's). TLV's describe the *maximum* recommended working level for an *average* human. They are "concentrations" in air, and are most often given as parts per million (ppm). One ppm is .0001 percent by weight in air.

TLV's of Airborne Gases and Solvent Vapors

The TLV's of the solvents in the following table vary from 2 to 1000 ppm (parts per million in air). Some solvents "do not have" a TLV (ND). This does not mean uncontrolled vapor exposure is safe. It means not enough data is available for experts to establish a "safe working level."

GASES	TLV	SOLVENT VAPORS	TLV
Carbon Monoxide	50 ppm	Ethanol	1000 ppm
Methane	ND*	Methyl Ethyl Ketone	200 ppm
Carbon Dioxide	5000 ppm	Trichloroethane	350 ppm
Ammonia Gas	50 ppm	Perchloroethylene	25 ppm
		Carbon Tetrachloride	2 ppm
		Freon 113	1000 ppm
		Octane	ND*
		Citrus Solvent	ND*

* Not Determined

What Creates Solvent Vapors?

The concentration of solvent in the air in a closed environment (vault, room, etc.) is determined by the following factors.

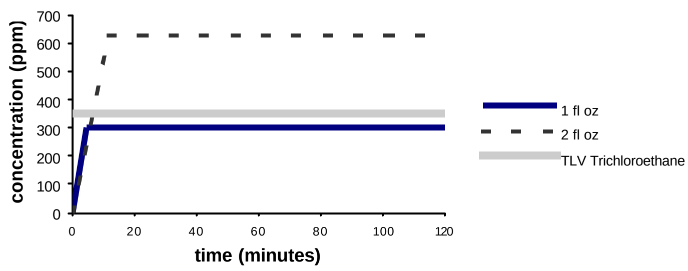
(1) Amount of solvent used (evaporated).
(2) Speed of the solvent evaporation.
(3) Vapor dispersion (concentration areas in the vault).
(4) Size of enclosure.
(5) Ventilation (natural or mechanical, including efficiency for solvent type and room shape).

Individual examination of these factors will show how we can control them for safer solvent use.

American Polywater created a computerized model which estimates solvent concentration over time in an enclosure. The model bases projections on enclosure size, solvent evaporation rate, temperature, solvent type and amount, use method, and ventilation rate.

Amount Used

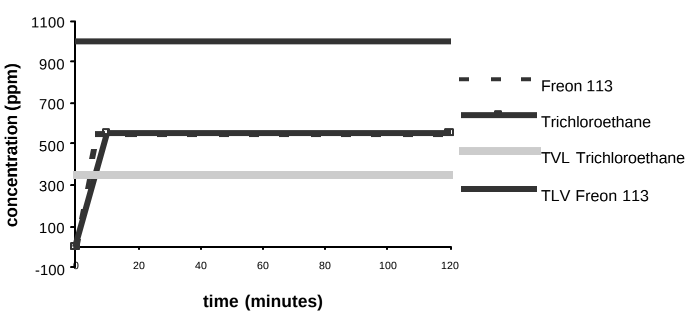
Graph #1 from the model shows two different amounts of trichloroethane evaporated in a vault. Both amounts are fully evaporated in 10 minutes. Trichlor's TLV of 350 ppm is shown as the heavy horizontal line. We see that *twice as much solvent results in twice the air concentration*. In this case, the higher amount has put trichlor *above its maximum safe level* of 350 ppm.



Graph. 1 Two different amounts of Trichloroethane evaporated

TLV Effect

Graph #2 shows solvents with different TLV's. It compares trichlor with Freon 113 (2 fl. oz. of each). The two solvents evaporate at about the same speed, and the lines rise at roughly the same rate. Again, in 10 minutes, both solvents are fully evaporated. However, since Freon 113 has a much higher TLV (1000) than trichlor, the resulting air concentrations are acceptable for the Freon, but not for the trichlor.

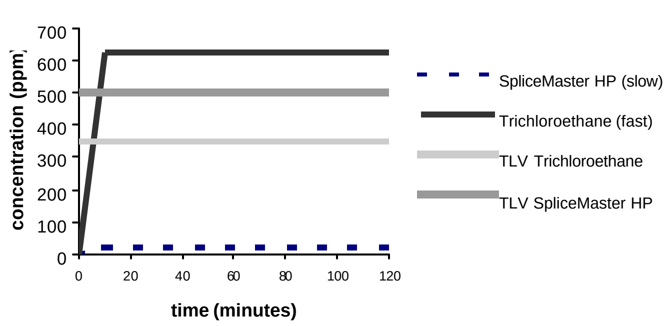


Graph 2. Equal amounts Trichloroethane and Freon 113 evaporated

Evaporation Rate

Graph #3 shows solvents with different evaporation rates. The trichlor evaporates more than 500 times faster than the SpliceMaster® HP.

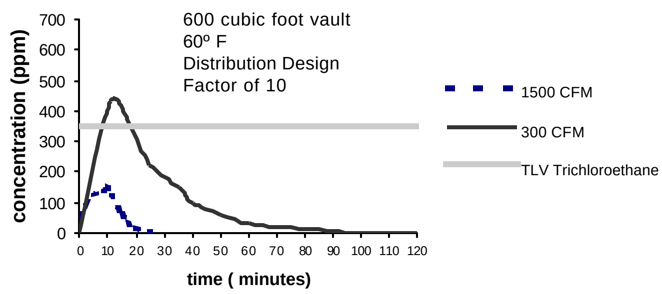
The slower drying SpliceMaster® HP releases very little vapor in the air over normal use time. While the trichlor is fully evaporated and at roughly 600 ppm in 10 minutes, the SpliceMaster® HP is at less than 25 ppm. As the graph shows, the removal of the used solvent rag from the vault at 10 minutes allows no release of vapor or increase in concentration.



Graph 3. Equal amounts evaporated of Trichloroethane and SpliceMaster® HP (different evaporation rates)

Ventilation

If solvent vapor levels are above safe working maximums, ventilation or protective breathing cannisters may be needed. Graph #4 shows two different levels of ventilation for 2 fl. oz. of trichlor evaporated. We see that the higher ventilation rate is required to keep the trichlor vapors below their TLV.



Graph 4. Two fl. Oz. Of Trichloroethane with 300 and 1500 CFM ventilation

Engineering Safe Field Operations

The graphs indicate several ways to control solvent exposure.

(1) Choose a less toxic solvent (higher TLV).
(2) Use the minimum amount of solvent needed to do the job; i.e., restrict quantity released.
(3) Choose as slow an evaporation rate as is practical for the timely completion of the task.
(4) Establish methods minimizing solvent exposure, including removing the used rag from the enclosure.
(5) If necessary, use mechanical ventilation to reduce vapors to safe working levels.

The PEL-PAC® Solution

American Polywater's SpliceMaster® PEL-PAC® Package accomplishes the above objectives. Each package contains a precisely charged minimum amount of solvent. The solvents have relatively high TLV's. The SpliceMaster® Solvents are available with different evaporation rates for specific field needs. American Polywater has the expertise to adapt the analysis shown to your specific situations. Just ask if interested.

Video and Back Issues

The "Electrical Cable Cleaning" video described in the last issue has been very well received. It covers field methods for splicing with slower drying cleaners, and much more

If you would like ***samples*** of the PEL-PAC® Packages, please call our Customer Service Department toll free at **1-800-328-9384**.

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