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A POLLUTION ABATEMENT CONCEPT; MINIMUM SOLVENTS LIST OF SOLVENT CLEANERS RECOMMENDED FOR USE AT THE NAVAL AIR REWORK FACILITIES

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AIRTASK NO. A340-0000/001B/6F57-572-401
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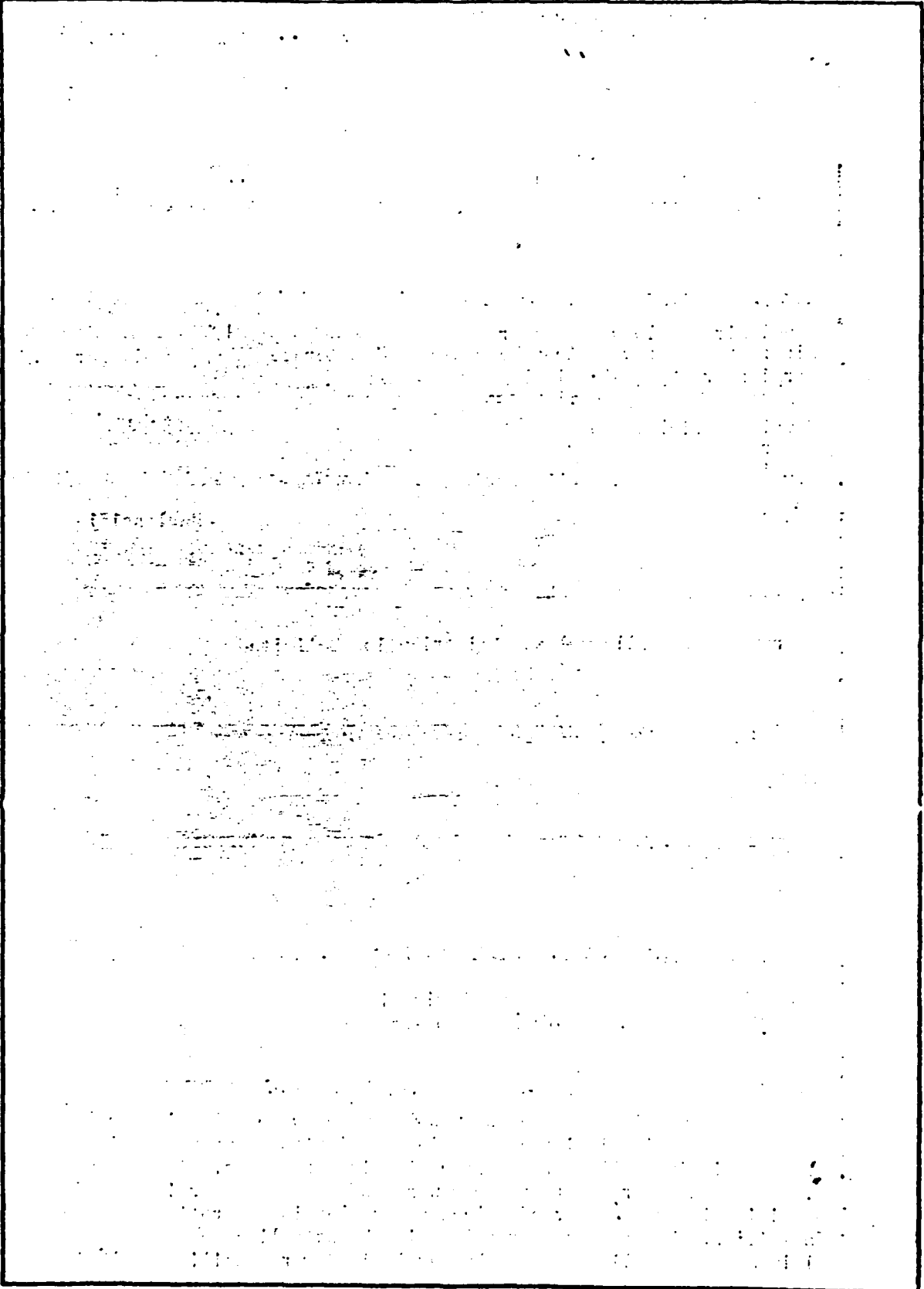
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I N T R O D U C T I O N

One method of achieving pollution abatement or the reduction of the adverse effects of waste solvents on the environment is to eliminate or minimize the number of hazardous, toxic and duplicate solvents and solvent mixtures used for cleaning processes. Specifically, it is the objective of this project to attain these goals for cleaning operations at the Naval Air Rework Facilities (NAVAIREWORKFACS) and to this end, a study was initiated to eliminate or minimize solvents used for cleaning and degreasing at these naval facilities. Considerations of solvent and mixtures used as thinners and diluents for coating systems were omitted, because for such systems both the nature of the solvents and solvents mixture ratios are critical to the performance of the end system. Any modification would require an extensive and in-depth study of these systems since any change could adversely affect the intended efficacy of both the solvent and solvents system. This project was conducted under reference (a).

A P P R O A C H

A study was conducted on most types and volumes of solvents used annually by the NAVAIREWORKFACS for cleaning operations. Emphasis was directed to the physical, and chemical nature, the physiological effect on the human system, and the number of different solvents serving the same or equivalent functions that could be replaced by more safe and acceptable ones.

C O N C L U S I O N S

It is concluded from the results of this study on the minimization of solvents that fifteen different solvents are presently being used individually for all NAVAIREWORKFACS cleaning and degreasing operations. Of these, eight are seen to be able to satisfactorily and effectively fulfill the requirements for all the operations. Table I lists these eight solvents with recommended applications.

Thus, by reducing the number of different solvents serving the same or similar functions and by simultaneously replacing undesirable solvents with non or less pollutive and non or less toxic ones, it is concluded that a large degree of pollutive abatement can be effectively achieved.

R E C O M M E N D A T I O N S A N D D I S C U S S I O N S

As reported in reference (b), the result of a survey of the NAVAIREWORKFACS, of which five of six responded, indicated that a total of over 800,000 gallons of individual types of solvents are being used annually for cleaning operations and that there are fifteen individual solvents

that comprise this total volume. Note that these surveys are not all inclusive and other cleaning solvents may have been overlooked.

One important property of a solvent as reported in reference (b) that could possibly serve advantageously to reduce the number of solvents used is the "solubility parameter", a thermodynamic method for estimating solubilities and defined as the square root of the cohesive energy density of the solvent under consideration. A preliminary study of this property indicates that it can be an advantageous method for selecting the proper solvent for the solute in question. Implementation and effective application of the solubility parameter would aid in further reducing the minimum solvents list. However, an extensive study is required to establish the solubility parameter relationship of the solvents and soil or "dirt" encountered at the NAVAIREWORKFACS so that workers will be able to select the most appropriate and effective solvent for each specific cleaning process.

Recommendations and the basis for the minimization and elimination of each solvent listed herein are detailed in reference (b). It is recommended that further studies be planned to establish the solubility parameter values and actual solvency degree for all "dirt" that is to be solvent cleaned at the NAVAIREWORKFACS.

Additionally, it is recommended that Table I be implemented and made readily available for reference at all appropriate locations where solvent cleaning and degreasing operations are conducted at the NAVAIREWORKFACS.

R E F E R E N C E S

- (a) AIRTASK A340/0000/001B/6F57-572-401 Work Unit VQ301, Pollution Control in Aircraft Materials
- (b) NAVAIRDEVCEEN Report No. NADC-79278-60 "Substitution and Minimization of Solvent Cleaners Used at the Naval Air Rework Facilities" dtd 5 Mar 1980

TABLE I. RECOMMENDED MINIMUM SOLVENTS AND SAFETY USE CHART

SOLVENT RECOMMENDED FOR USE	GOVERNMENT SPECIFICATION	USE IN PLACE OF	GOVERNMENT SPECIFICATION	COMMENTS
Stoddard (Varsol)	PD-680 Type I & II	Toluene Xylene (5)	TT-T-548 TT-X-916	Where presence of solvent residue is not important
1,1,1-Tri-chloroethane (Methyl Chloroform)	MIL-T-81533 OT-620	Toluene Xylene (5)	TT-T-548 TT-X-916	Where presence of solvent residue is not desirable
Stoddard (Varsol)	PD-680 Type I & II	Kerosene (1)	WV-K-211 WV-K-220	Compositions and performance characteristics are both very nearly similar
1,1,1-Tri-chloroethylene (Methyl Chloroform)	MIL-C-81533	Trichloroethylene (2)	OT-634	Trichloroethylene should not be used for any application
Acetone	0A-51-F	MEK (3) (Methyl Ethyl Ketone) Toluene	TT-M-261 TT-T-548	Where specification states that acetone or MEK can be used Where specification states that a low boiling ketone or toluene can be used Where specification states that toluene or MEK can be used; where specification states that toluene, MEK or acetone can be used

TABLE I - RECOMMENDED MINIMUM SOLVENTS AND SAFETY USE CHART

SOLVENT RECOMMENDED FOR USE	GOVERNMENT SPECIFICATION	USE IN PLACE OF	GOVERNMENT SPECIFICATION	COMMENTS
Ethyl Acetate	TT-E-751	MEK (Methyl Ethyl Ketone) (5)	TT-M-261	Where specification states that either MEK or ethyl acetate can be used
Isopropanol (Isopropyl Alcohol)	TT-I-735	Methanol (4) (Methyl alcohol)	OM-232	Methanol is very toxic
Methylene Chloride (Dichloromethane) OR 1,1,1-Trichloroethane (Methyl Chloroform)	MIL-M-6998 MIL-D-6998 MIL-C-81533	Trichloroethylene (2)	OT-634	Where specification states that either three solvents can be used
Aliphatic Naphtha	TT-N-95	Lacquer Thinner (Solvent Mixture) MEK	TT-M-266	Aliphatic naphtha is less toxic
Freon TF (1,1,2-Trichloro 1,2,2-Trifluoroethane)	MIL-C-81302		TT-M-261	Where application is indicated or required in the specification

(1) Duplicate solvent - no need to stock

(2) Potential carcinogen

(3) Five times more toxic than acetone

(4) Very toxic

(5) More toxic and hazardous



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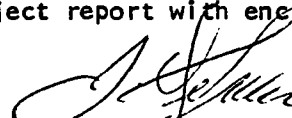
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