FINAL REPORT

LITERATURE SEARCH ON TOXIC AND CARCINOGENIC COMPONENTS OF PAINT

NIOSH Contract No. 210-76-0108

by

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The current chemical agents used in paint and chemical coating that are considered to be toxic or carcinogenic are reviewed. The toxic or carcinogenic agents in various paint and chemical coating compositions are listed. Metal primer, decorative and building paint, and industrial and marine paint compositions are discussed. The types of solvents and chemicals found in paints are discussed. The authors conclude that two areas of major concern related to employee exposure to toxic and carcinogenic agents in paints and chemical coatings are the large amount and varied types of solvents used and the metallic compounds present.

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ABSTRACT

To aid NIOSH in determining those toxic and carcinogenic components of paint by a literature search and contact with paint manufacturers or their trade association. The information obtained to be evaluated to list the toxic and carcinogenic components of paints and chemical compositions.

CONTRACT NO. 210-76-0108

FIRST DRAFT OF FINAL REPORT
TASK ORDER NO. 4

LITERATURE SEARCH ON TOXIC AND CARCINOGENIC COMPONENTS OF PAINT

Bendix Launch Support Division
Special Projects
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I. INTRODUCTION

Paints and chemical coatings are widely used in industry for protection of manufactured products against corrosion and deterioration, and also for visual enhancement of the product. As these paints and chemical coatings are being used in ever increasing quantities and applications with the development of new and better compounds daily, there is an increasing employee exposure to the chemical agents contained in these compounds. The development in recent years of synthetic coatings, which contain many chemical agents and solvents known or suspected of being toxic or carcinogenic create a health hazard to those employees using these paints and chemical coatings. The purpose of this task was to determine the current chemical agents used in paints and chemical coatings that are considered to be toxic or carcinogenic based on published lists of NIOSH and OSHA toxic and carcinogenic materials. This information is required to aid in determining the need for future research in this area.

II. TASK SPECIFICATIONS

In order to identify the toxic or carcinogenic components of paints and chemical coatings, a literature search was necessary to determine which chemical agents are currently being used in various pigments, extenders, driers, solvents, and resins. After identification of such agents, a review of published NIOSH and OSHA lists of toxic and carcinogenic materials was required to ascertain which agents were included on the listings.

Contact was established with paint manufacturers and their trade associations to obtain current information on paint and chemical coating formulations. Requests for detailed information were made in order to compare agents in these current specific formulations against the general types of formulations

for data comparison. In addition, percentages of chemical agents in the specific formulations were requested to identify the parameters of potential problem areas as related to employee exposure to these agents.

III. TASK REPORT

A. Literature Search

A review of "Outlines of Paint Technology"[1] and "Surface Coatings and Finishes"[2] identified the following toxic or carcinogenic agents in various paint and chemical coating compositions.

1. White Pigments and Extenders:

Aluminum	Inorganic Lead
Antimony Oxide	Magnesium Compounds
Barium	Zinc Oxide
Crystalline Silica	

2. Color Pigments and Dryers:

Benzidine	Inorganic Lead
Cadmium	Manganese
Calcium	Sodium Hydroxide
Carbon Black	Sulfur Dioxide
Chromium VI	Tin
Inorganic Iron	Vanadium Compounds

3. Solvents:

Acetone	Dimethylformamide
Alkanes	Dioxane
Benzene	2-Ethoxyethyl Acetate
n-Butyl Acetate	Ethyl Acetate
Butyl Carbitol	Ethyl Alcohol
sec-Butyl Acetate	Ethyl Benzene
Butyl Cellosolve	Ethyl Dichloride
Camphor	Ethylene Glycol
Carbon Tetrachloride	Isoamyl Alcohol
Chloroform	Isobutyl Acetate
Cyclohexane	Isobutyl Alcohol
Cyclohexanone	Isophorone
Diacetone Alcohol	Isopropyl Acetate
Dichloroethyl Ether	Isopropyl Alcohol
Diisobutyl Ketone	Mesityl Oxide
Dimethacetamide	Methyl Acetate
Dimethyl Ketone	Methyl Alcohol

1. Outlines of Paint Technology, W. M. Morgans Ph.D., F.R.I.C., Charles Griffin & Company Ltd., 42 Drury Lane, London, England, W.C.2, 1969
2. Surface Coatings & Finishes, Philip L. Gordon, Ph.D., and George J. Dolgin, Chemical Publishing Co., Inc., 212 Fifth Ave, New York, N.Y. , 1954

3. Solvents (cont'd)

Methyl Amyl Alcohol	Perchloroethylene
Methyl n-Amyl Ketone	n-Propyl Acetate
Methyl Cellosolve	Propyl Alcohol
Methyl Cellosolve Acetate	Propylene Dichloride
Methyl Ethyl Ketone	Refined Petroleum
Methyl Isobutyl Ketone	Tetrahydrofuran
Methylene Chloride	Toluene
Naphthalene	1,1,1,-Trichloroethane
Nitroethane	1,1,2,-Trichloroethane
Nitromethane	Trichloroethylene
1-Nitropropane	Turpentine
2-Nitropropane	Vinyl Toluene
	Xylene

4. Synthetic Resins:

Formaldehyde	Maleic anhydride
Indene	Methyl methacrylate

Further review of this literature provided some basic formulations for various types of paints and chemical coatings with general percentages of components. A representative sample of these basic formulations are as follows:

1. Metal Primers: There are five basic metal primers in use in industry today that contain toxic or carcinogenic agents. These are: non-setting red lead; calcium plumbate; zinc chrome; lead cyanamide; and zinc dust. Non-setting red lead contains from 60 percent to 82 percent red lead by weight as lead oxide. Calcium plumbate primer contains approximately 70 percent by weight of calcium plumbate, and the lead is contained as lead oxide and accounts for a large percentage of the compound. Zinc chrome primer contains approximately 46 percent by weight of iron oxide and zinc chromate. In addition, this primer contains a solvent of approximately 10 percent by weight in the oil alkyl, which is generally xylene. Zinc dust primers contain solvents which are usually xylene. The xylene content is approximately 0.5 percent to 12 percent of the

primer. Lead cyanamide primer is formulated similar to non-setting red lead, and the metal is a lead-cyanamide complex.

2. Decorative and Building Paints: There are many formulations for decorative and building paints. A few that contain toxic or carcinogenic agents will be discussed. Decorative undercoats contain approximately 5.5 percent crystalline silica, 4 percent solvent such as xylene, and 0.2 percent cobalt naphthenate, which contains approximately 0.005 percent cobalt. Finishing coats consist of gloss and enamel paints, both oil and water base. With the discontinued use in recent years of lead oxide as a pigment, except for certain outdoor oil gloss enamels, the main components containing toxic or carcinogenic agents are the colored pigment bases and the solvents for the oil base paints. For instance, a typical formulation for a green oil gloss finishing paint contains 21.0 by weight of chrome green with a 0.1 percent by weight of cobalt naphthenate. The cobalt is 6 percent by weight in the cobalt naphthenate. The alkyd gloss enamels will generally contain pigments and solvents composed of these agents. A good example is a standard black alkyd gloss which contains 2.7 percent carbon black by weight, an alkyd solvent (which may be xylene, of approximately 30 percent of the composition) and a drier containing 6 percent cobalt, which is less than 1 percent of the composition.

3. Industrial and Marine Paints: Due to the surface protection requirements criteria for this class of coatings, a larger percentage contain toxic and carcinogenic agents. A typical chlorinated rubber

paint of the semi-gloss "thick" type will contain approximately 42 percent xylene. A typical cellulose acetate, which is used in strippable coatings, will contain approximately 66 percent acetone. A typical grey oil-resisting machinery enamel will generally contain 0.7 percent carbon black, 28 percent xylene in the alkyd solution, and 21 percent refined petroleum products. A typical quick-drying alkyd white gloss paint will contain approximately 50 percent solvents, usually as xylene and a cobalt drier with the cobalt content less than 1 percent. A typical epoxy ester paint will contain approximately 24 percent solvent which is usually xylene. A typical white gloss enamel, based on a two-part epoxy resin, will contain as solvents approximately 25 percent xylene and 11 percent methyiso-butyl ketone.

Due to the nature of marine paints, almost all of them contain toxic or carcinogenic agents. Most of the anti-fouling paints contain either copper, mercury, or tin compounds. The formulations require a considerable amount of the metal compounds ranging from 7 percent to 25 percent in the compositions.

B. Survey Results

In order to obtain current detailed formulations with percentages of ingredients in paints and chemical coatings, information was requested from the National Paint and Coatings Association, Washington D.C., and from nine paint manufacturers. In no instance was the requested information supplied. The consensus of those firms replying to the request was that they could not provide such information because: Detailed

formulations were company secret and could not be published; of the sheer number of formulations produced (over 4,000 in one case), and they had recently completed a "Directive Ingredient Questionnaire" survey by the Consumer Product Safety Commission and felt it was too much to duplicate that effort again so soon.

Contact with the Bureau of Biomedical Science, U.S. Consumer Product Safety Commission verified that the above survey had been conducted, however the data could not be made available to private concerns. A related publication suggested by some of the companies and the National Paint & Coatings Association that might be of some value in this research was the "Raw Materials Index"[3]. This index is a comprehensive listing of types and suppliers of solvents, chemical specialties, drying oils, and resins. The index does not supply the detail desired but does give some information on most of the products listed. The section on solvents is subdivided into various classes and provides information on boiling range, flash point, evaporation rate, lbs./gallon, aniline point, kauri butanol value, and composition by percent volume. The subdivisions of this section are as follows:

Aliphatic Hydrocarbons
Aromatic Hydrocarbons
Alcohols
Esters
Ketones
Glycol Ethers
Chlorinated Solvents
Nitro paraffins
and miscellaneous solvents

The only toxic or carcinogenic agents in the aliphatic hydrocarbon solvents of interest are alkenes. In the listing, the products contain from 0 percent to 42.5 percent alkenes. A partial listing is tabulated in the Appendix, Section I.

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[3]Raw Materials Index, National Paint & Coatings Association, 1500 Rhode Island Ave. N.W., Washington, D.C.

In the aromatic hydrocarbon solvents, once again the agents of interest are the alkenes. In the listing, the products contain from 39 percent to 100 percent alkenes. A partial listing is tabulated in Section I of the Appendix.

Of the alcohol solvents listed, only a few are of concern, which are tabulated in Section I of the Appendix. The ester solvents listed are between 85 percent and 99.5 percent purity. A sample listing is tabulated in Section I of the Appendix.

The ketone solvents listed are between 95 percent and 99.8 percent purity. A sample listing is tabulated in the Appendix, Section I. The glycol and glycol ether solvents of interest are noted in the sample listing tabulated in the Appendix, Section I.

A sampling of the chlorinated solvents and nitro paraffin solvents with their producers are tabulated in Section I of the Appendix. Of the miscellaneous solvents listed, four of them are of interest and tabulated in the Appendix, Section I.

The section on chemical specialties is subdivided into various classes and supplies information on metallic compound percentages and other compounds that contain toxic or carcinogenic agents. The subdivisions of this section are:

Driers - Drying Salts
Metallic Soaps and Flatting Agents
Non-Metallic Flatting Agents
Dispersed Flatting Agents
Plasticizers
Stabilizers
Wetting Agents
Viscosity Suspension and Flow Control Agents
Antifoaming Agents
Antiskinning Agents
Preservatives
Miscellaneous Additives

The driers-drying salts listed are generally metallic compounds of aluminum, cobalt, copper, iron, lead, manganese, nickel, zinc, and zirconium. The compounds are classified and listed as acetates, hydrates, carbonates, sulfates, nitrates, linoleates (liquid and solid), octoates, naphthenates, neodecanoates, tallates, water dispersible, and miscellaneous. The tabulation lists the metal, percent metal in the compound, producer, and trade name in many cases. A representative sample is tabulated in the Appendix, Section II.

The metallic soap and flatting agents are listed as metal stearate compounds of aluminum, magnesium, calcium, lithium, barium, and zinc. The tabulation lists the metal, percent metal oxide in the compound, producer, and trade name. A representative sample is tabulated in the Appendix, Section II. The non-metallic and dispersed flatting agents all contain synthetic silica, silica dispersion, or a silica/olefin dispersion.

Of the various types of plasticizers listed, the only ones of concern in regards to toxic or carcinogenic agents are phthalates and phosphates. A partial listing is tabulated in the Appendix, Section II.

The stabilizers listed in the index contain compounds of barium, cadmium, lead, tin, zinc, organotin compounds, and oxime. A sample listing is tabulated in Section II of the Appendix.

In the subsections on wetting agent, viscosity suspension and flow control agents, antifoaming agents, and antiskinning agents, only two items were noted to be of interest in regard to toxic or carcinogenic

characteristics. These were 2-nitropropane and oxime. Some sample listings from the subsection on preservatives are tabulated in the Appendix, Section II.

A review of the drying oil section of the index did not indicate any items of interest from a toxic or carcinogenic agent standpoint.

The resin section of this index is quite extensive and lists approximately 54 different classifications of resins. Due to the high number of classifications, there will be no attempt to list them all. Generally speaking, as mentioned earlier in this report, the ingredients of a toxic or carcinogenic nature in this report are the solvents found in the resin compounds. However, a sample listing is tabulated in the Appendix, Section III to indicate the data contained in this section.

IV. CONCLUSIONS

The data contained in the "Raw Materials Index" gives good guidelines and information on toxic and carcinogenic agents contained in paint and chemical coating formulations. However, specific percentages of the agents are not often noted due to the proprietary nature of the individual formulations. The chemical agents, in most cases, can be identified for a specific formulation by using this index.

The conclusion reached by this research is that there are two areas of major concern related to employee exposure to toxic and carcinogenic agents contained in paints and chemical coatings. The first and foremost is the large amount and varied types of solvents contained in these compositions. As the solvent list identifies 57 toxic or carcinogenic agents used in

compounding paints and chemical coatings, employee exposure to these agents is very great. The second area of concern is the metallic compounds present in the various pigments, extenders, and driers used in paint and chemical coating formulations. Many of these metallic compounds contain agents of toxic and carcinogenic properties and, although not present in the formulations in large percentages, in most cases do present potential health problems to those employees in industry exposed to them.

V. APPENDIX

SECTION I - SOLVENTS

ALIPHATIC HYDROCARBONS

Trade Name	Producer	Composition, Vol. % Alkenes
Rubber Solvent-C	Ashland Oil Co.	5.2
Sol B-8	Shell Oil Co.	7.5
Solvent No. 5	Exxon Oil Co.	5.1
Skellysolve "C"	Skelly Oil Co.	1.5
Tolu-Sol® 19EC	Shell Oil Co.	18.6
Super Lacolene	Ashland Oil Co.	20.0
Espesol® 210-66	Charter Oil Co.	8.8
Sol 69	Shell Oil Co.	0.4
VM & P Naphtha	ARCO Oil Co.	8.0
Kermac 100W	Kerr-McGee Corp.	12.0

AROMATIC HYDROCARBONS

Trade Name	Producer	Composition, Vol. % Alkenes
Toluene	ARCO Oil Co.	100.0
Espesol® 1 °Toluene	Charter Oil Co.	99.0+
Cyclo Sol® 37	Shell Oil Co.	87.4
Xylene	Exxon Oil Co.	99.5
50 Solvent	ARCO Oil Co.	39.0
Espesol® 5300	Charter Oil Co.	51.0
Panasol® RX-21	Amoco Oil Co.	99.5
TS-28B	Shell Oil Co.	76.3
HAN®	Exxon Oil Co.	80.0
Hi-Sol 4-3	Ashland Oil Co.	95.0

APPENDIX

SECTION I - SOLVENTS

ALCOHOL SOLVENTS

Trade Name	Producer	% Purity
Isoamyl Alcohol	Publicker Industries	--
Methyl Amyl Alcohol	Ashland Oil Co.	98.0
Methyl Isobutyl Carbinol	Shell Oil Co.	98.0
Cyclohexanol	Dow Badische Co.	96.0

ESTER SOLVENTS

Trade Name	Producer	% Purity
Methyl Formate	Celanese Corp.	97.5
Ethyl Acetate, 85-88%	Eastman Co.	85.0
Isopropyl Acetate, 99%	Union Carbide Co.	99.0
n-Propyl Acetate	Ashland Oil Co.	96.0
sec-Butyl Acetate	Ashland Oil Co.	--
Isobutyl Acetate	Celanese Corp.	98.0
n-Butyl Acetate	Publicker Industries	90.0
Ethyl Acetate	Celanese Corp.	99.5

KETONE SOLVENTS

Trade Name	Producer	% Purity
Methylal	Celanese Corp.	97.0
Acetone	Exxon Chemical Co.	99.5+
Methyl Ethyl Ketone	Shell Chemical Co.	99.5
Methyl Isobutyl Ketone	Eastman Co.	99.0
Mesityl Oxide	Exxon Chemical Co.	97.0
Diacetone Alcohol	Shell Chemical Co.	--
Methyl n-Amyl Ketone	Eastman Co.	99.0

KETONE SOLVENTS (cont'd)

Trade Name	Producer	% Purity
Cyclohexane	Celanese Corp.	99.8
Cyclohexanone	Ashland Oil Co.	99.7
Diisobutyl Ketone	Union Carbide Corp.	--
Isophorone	Exxon Chemical Co.	99.0+

GLYCOL & GLYCOL ETHER

Trade Name	Producer	Chemical Composition
Ethylene Glycol	Olin Corp.	
Dowanol PM	Dow Chemical Co.	Propylene glycol monomethyl ether
Ektasolve® EM	Eastman Co.	Ethylene glycol monomethyl ether
Methyl Oxitol®	Shell Chemical Co.	Ethylene glycol monomethyl ether
UCAR® Solvent LM	Union Carbide Co.	Propylene glycol monomethyl ether

CHLORINATED SOLVENTS

Trade Name	Producer
Methyl Chloride	Ashland Oil Co.
Chloroform	Dow Chemical Co.
1,1,1-Trichloroethane	Ashland Oil Co.
Ethylene Dichloride	Ashland Oil Co.
Trichloroethylene	Ashland Oil Co.
Propylene Dichloride	Dow Chemical Co.
1,1,2-Trichloroethane	Dow Chemical Co.
Perchloroethylene	Ashland Oil Co.

CHLORINATED SOLVENTS (cont'd)

Trade Name	Producer
Dichloroethyl Ether	Dow Chemical Co.
Nitromethane	Ashland Oil Co.
Nitroethane	Commercial Solvents Corp.
1-Nitropropane	Commercial Solvents Corp.
2-Nitropropane	Commercial Solvents Corp.

MISCELLANEOUS SOLVENTS

Trade Name	Producer
Isopropyl Ether, 94%	Exxon Chemical Co.
Dimethylacetamide	DuPont Co.
Dimethylformamide	DuPont Co.
Tetrahydrofuran	DuPont Co.

APPENDIX

SECTION II - CHEMICAL SPECIALTIES

DRIERS AND DRYING SALTS

Metal Compound	% Metal	Trade Name	Producer
Cobalt Acetate	24.0	--	Mooney Chemical Co.
Cobalt Hydrate	61.25	--	Witco Chemical Co.
Cobalt Carbonate	46.5	--	Ferro Chemical Co.
Cobalt Sulfate	21.0	--	Shepherd Chemical Co.
Cobalt Nitrate	19.8	--	Shepherd Chemical Co.
Cobalt Linoleate	6.0	--	Shepherd Chemical Co.
Manganese Linoleate	8.0	--	Shepherd Chemical Co.
Cobalt Octoate	12.0	Hexogen	Cincinnati Milacron Chemicals Inc.
Manganese Octoate	6.0	Calalox	Ferro Chemical Co.
Iron Octoate	6.0	Octoate	Tenneco Chemical Co.
Iron Naphthenate	6.0	Nap-All	Mooney Chemical Co.
Cobalt Naphthenate	6.0	Nap-All	Mooney Chemical Co.
Cadmium Naphthenate	12.0	Nap-All	Mooney Chemical Co.
Cobalt Neodecanoate	21.0	Ten-Cem	Mooney Chemical Co.
Cobalt Tallate	6.0	Uversol	Mooney Chemical Co.
Iron Tallate	6.0	--	Mooney Chemical Co.
Water Dispersible Cobalt	6.0	WD	Ferro Chemical Co.
Miscellaneous Iron	12.0	Neo-Nap	Mooney Chemical Co.
Miscellaneous Cobalt	21.0	254	Tenneco Chemical Co.

SECTION II - CHEMICAL SPECIALTIES

METALLIC SOAP AND FLATTING AGENTS

Metal	% Metal Oxide	Trade Name	Producer
Calcium	9.9	Aero No. 8	American Cyanamid
Zinc	14.0	Aero No. 23 U.S.P.	American Cyanamid
Lead	30.0	V-2 Fused	Tenneco Chemical Co.
Aluminum	10.5	22	Witco Chemical Co.
Barium	23.6	Witco	Witco Chemical Co.

PLASTICIZERS

Chemical Type	Trade Name	Producer
Dibutyl Phthalate	Dibutyl Phthalate	Allied Chemical Co.
Diethyl Phthatate	--	Union Oil Co. of California
Dimethyl Phthalate	--	Union Oil Co. of California
DiC2-Ethylhexyl Phthatate	Jayflex® DOP	Exxon Chemical Co.
Triphenyl Phosphate	--	Union Oil Co. of California
Tributyl Phosphate	TBP	Monsanto Chemical Co.

STABILIZERS

Chemical Type	Trade Name	Producer
Barium-Cadmium-Zinc	Advalite RN-481	Cincinnati Milacron Chemicals
Calcium-Zinc	Advalite F-402	Cincinnati Milacron Chemicals
Organotin Mercaptide	Advalite TM-180	Cincinnati Milacron Chemicals
Organotin	Advalite TM-303	Cincinnati Milacron Chemicals
Calcium-Zinc	651	Ferro Chemical Co.
Organotin	840	Ferro Chemical Co.
Barium-Cadmium	1212A	Ferro Chemical Co.

STABILIZERS (cont'd)

Chemical Type	Trade Name	Producer
Stannous Octoate	860	Ferro Chemical Co.
Zinc	5019	Ferro Chemical Co.
Zinc-Lead Complex	5373	Ferro Chemical Co.
Organo Sn	Nuostabe V-1528	Tenneco Chemical Co.
Oxime	Troykyd® Antiskin	Troy Chemical Co.
Basic Lead Sulfate	HALBASE T	Hammond Lead Products

PRESERVATIVES

Chemical Type	Trade Name	Producer
Mercury 11%	PMO 11	Cincinnati Milacron Chemicals
Mercury 18%	PMA 18	Cincinnati Milacron Chemicals
Mercury 59.5%	Advacide 60	Cincinnati Milacron Chemicals
Tributyl Tin Oxide	Car Ban TO	Cincinnati Milacron Chemicals
Organotin	Advacide N-628	Cincinnati Milacron Chemicals
Phenyl Mercury Oleate	Troysan PMO 30	Troy Chemical Co.
Phenylmercuric Borate	Troysan PMB	Troy Chemical Co.

APPENDIX

SECTION III - RESINS

ALKYDS-DRYING OIL MODIFIED

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Coroc Resin T-1-A2-50	Cook Paint & Varnish Co.	Xylene	50
Cargill 3120-2	Cargill Inc.	Xylene/Butyl Alcohol	50
Syntex® 75	Celanese Corp.	Xylene	55
323-011	Conoco Chemicals Co.	Xylene/VMP Naptha	50
50A-50	Farnow Inc.	Xylene	50
Chempol 11-3910	Freeman Chemical Corp.	Xylene/Mineral Spirits	50
313-X-50	Haynie Products Inc.	Xylene	50
Varkyd® 599-50X	McCloskey Varnish Co.	Xylene	40
11-147	Reichhold Chemicals Co.	Xylene	50
AL-2308	Reliance Universal Inc.	Xylene	50
AL-4322	Reliance Universal Inc.	Toluene	60
Lankyd® 1442-60	Washburn-Lanson Co.	Xylene	60

ALKYDS-NON DRYING & SEMIOXIDIZING OIL MODIFIED

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Calyd A-79	Baltimore Paint Co.	Xylene	60
Mirasol 123-6-T	C.J. Osborn Chemicals	Toluene	60
Mirasol 123-6-X	C. J. Osborn Chemicals	Xylene	60
Duraplex ND-77B	Rohm & Haas Co.	Xylene	60
12-010	Reichhold Chemicals Co.	Toluene	50
Super Alkyd 512-50X	Thibaut & Walker Co.	Xylene	50

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SECTION III - RESINS

ALKYDS-RESIN MODIFIED

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Cargill 6253	Cargill Inc.	Xylene	40
Syntex® 121	Celanese Corp.	Xylene/Naptha	50
Amberlac 292X	Rohm & Haas Co.	Xylene	48
LanKyd® 1643	Washburn-Lanson Co.	Xylene	50

ALKYDS-COPOLYMERS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Coroc Resin RC-772-A2	Cook Paint & Varnish Co.	Xylene	50
SY-2005	Reliance Universal Inc.	Toluene/Xylene	50
X70VC409	Sherwin-Willians Co.	Toluene	60
Kentrol® 1013	Textron Inc.	Xylene	60

POLYESTER-OIL FREE ALKYDS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Cyplex 1544	American Cyanamid Co.	High Flash Aromatic Solvent/Diacetone Alcohol	65
Chempol 11-3819	Freeman Chemical Corp.	Xylene/Butyl Cellosove	60
1263	Stephan Chemical Co.	Ethylene Glycol Monoethyl Ether Acetate	50

EPOXY ESTER

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Epi-Tex 183	Celanese Corp.	Xylene	50
Epi-Tex 1486	Celanese Corp.	Ethylene Glycol Monoethyl Ether Acetate	50

EPOXY ESTER (Cont'd)

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Mirasol 601-X	C. J. Osborn Chemicals	Xylene	50
NP-1006	Reliance Universal Inc.	Xylene/Toluene	50
EKZ-2010	Union Carbide Corp.	Xylene	50

EPOXY SOLUTIONS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Epi-Rez 202	Celanese Corp.	Ethylene Glycol Mono-ethyl Ether Acetate	40
Araldite® 488N-40	Ciba-Geigy Co.	Methyl Ethyl Ketone	40
D.E.R. 671-MK75	Dow Chemical Co.	Methyl Iso-butyl Ketone	75
Epon® Resin 1007-CT-55	Shell Chemical Co.	Methyl Iso-butyl Ketone/ Toluene	55
EKS-2391	Union Carbide Corp.	Ethyl Cellosolve	75
Vanoxy® 53-B-40	R.T. Vanderbilt Co.	Methyl Ethyl Ketone	40

POLYAMIDES

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Epi-Cure X-70-8515	Celanese Corp.	Xylene	70
CIBA Polyamide 800 1T-60	Ciba-Geigy Co.	Isopropyl Alcohol/ Toluene	60
Cropolamid L-100 CX	Crosby Chemicals Inc.	Ethyl Cellosolve/ Xylene	60
Emerez 1502	Emery Industries Inc.	Xylene	70
Versamid® 230TP75	General Mills Chemicals	Propyl Alcohol/ Toluene	75
Epon® Curing Agent V-30-XF-60	Shell Chemical Co.	Xylene/ Butyl Alcohol	60

APPENDIX

SECTION III - RESINS

UREA RESINS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Beetle® 220-8	American Cyanamid Co.	Xylene/Isobutyl Alcohol	50
21-675 Beckamine®	Reichhold Chemical Co.	Isopropyl Alcohol	75
AM-1008	Reliance Universal Inc.	Toluene	50

MELAMINE & MELAMINE TYPE RESINS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Cymel® 1125-85-37	American Cyanamid Co.	Butyl Cellosolve	85
Cargill 3387	Cargill Inc.	Isopropyl Alcohol/ Isobutyl Alcohol	80

VINYL SOLUTIONS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
1758	Stresen-Ruter International	Xylene	19
MA-28-18	Union Carbide Corp.	Methyl Acetate	28
AT 33	Union Carbide Corp.	Toluene	33

ACRYLIC SOLUTIONS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Elvacite® 6010	Dupont Co.	Methyl Ethyl Ketone	40
311-120	Conoco Chemicals Co.	Methyl Cellosolve Acetate/Toluene	60
Acryloid® AT-63	Rohm & Haas Co.	Xylene	50
Synthemul® 90-587	Reichhold Chemicals Inc.	n-Propyl Acetate	65

APPENDIX

SECTION III - RESINS

STYRENE AND VINYL TOLUENE POLYMER SOLUTIONS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Piccolastic® FT	Pennsylvania Industry Chemical Corp.	Toluene	55
Lankyd® 1482	Washburn-Lanson Co.	Xylene	50

SILICONES & SILICONES-MODIFIED

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
R-631	Union Carbide Corp.	Xylene	50
Chempol 12-2601	Freeman Chemical Corp.	Xylene/Butyl Cellosolve	60
Lankyd® 3031	Washburn-Lanson Co.	Methyl Cellosolve Acetate	50

PURE PHENOLIC-HEAT-HARDENING SOLUTIONS AND DISPERSIONS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Varcum 5270	Reichhold Chemical Co.	Butyl Alcohol/Methyl Ethyl Ketone/Isopropyl Alcohol	52
BKS-2600	Union Carbide Corp.	Ethyl Acetate	54

URETHANES - ASTM TYPE 1
ONE-PACKAGE PRECURED

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Chempol® 18-0022	Freeman Chemical Corp.	Xylene	50
Spenkel® F78-50T	Spencer Kellogg Co.	Toluene	50

URETHANES - ASTM TYPE 2
ONE-PACKAGE MOISTURE CURED

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
13-330 Urotuf®	Reichhold Chemicals Inc.	Xylene/Methyl Cellosolve Acetate	42
Spenlite® M22-40X	Spencer Kellogg Co.	Xylene	40

APPENDIX

SECTION III - RESINS

URETHANES - ASTM TYPE 5
TWO-PACKAGE POLYOL

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Spenkel® P49-755	Spencer Kellogg Co.	Ethyl Acetate	75
1114	Stepan Chemical Co.	Xylene	60
1263	Stepan Chemical Co.	Methyl Cellosolve Acetate	50

URETHANE LACQUERS

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
X-1513-30	Cargill Inc.	Methyl Cellosolve Acetate/Methyl Ethyl Ketone/Isopropyl Alcohol	30
XP-2430	Spencer Kellogg Co.	Isopropyl Alcohol/ Toluene	30

MISCELLANEOUS RESINS
LIQUID AND SOLUTION

Trade Name	Producer	Solvent	Nonvolatile % Avg. Wgt.
Cellolyn 95-80T	Hercules Co.	Toluene	80
13-006	Reichhold Chemical Co.	Xylene	50