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DUPONT

MSDS

VPS00022

Revised 22-AUG-1994

Printed 1-SEP-1994

PYRALUX(R) PC 1000 (VAPORS)

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Tradenames and Synonyms
VAPORS FROM PYRALUX(R) PC 1000

Company Identification
MANUFACTURER/DISTRIBUTOR
DuPont
1007 MARKET STREET
WILMINGTON, DE 19898

PHONE NUMBERS

Product Information	1-800-441-7515
Transport Emergency	CHEMTREC 1-800-424-9300
Medical Emergency	1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
BENZOPHENONE	119-61-9	10-30
METHYL ETHYL KETOXIME	96-29-7	30-70
*BUTANOL	71-36-3	10-20
N-BUTYL ISOCYANATE	111-36-4	1-10

During thermal curing (120C/250F or higher), the following is released, but at levels below the detectable limits of GC/MS:

1,6-HEXAMETHYLENE DIISOCYANATE	822-06-0

(Continued)

COMPOSITION/INFORMATION ON INGREDIENTS (Continued)

Components that may evolve during lamination may also include:

ETHYL ACETATE	141-78-6	30-60
1-METHOXY-2-PROPANOL	108-65-6	30-60
2-METHOXY-1-PROPANOL	70657-70-4	1-5
*METHYL ETHYL KETONE	78-93-3	1-5
*XYLENES	1330-20-7	1-5

* Regulated as a Toxic Chemical under section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

Components (Remarks)
The concentrations are based on GC/MS analyses of film vapors in thermal curing, the principal step where vapor evolution occurs. The quantity of vapors will depend on the specific curing cycle (typical is ~0.5 lbs of volatiles per 1000 mil square feet).

HAZARDS IDENTIFICATION

Potential Health Effects

Equipment used for curing must be adequately exhausted. Consult the Du Pont publication, "Handling and Safety Considerations for the PYRALUX(R) PC Curing Process". Following curing, vapors may continue to be evolved in sufficient concentration so as to require exhausting until the surface temperature of the coated panel drops below 65C/150F.

During thermal curing, small amounts of 1,6-hexamethylene diisocyanate (HDI) and n-butyl isocyanate (BI) are liberated when the film is heated to temperatures >120C/250F. Measurements within the curing oven can show concentrations of HDI & BI occurring during heat-up and the first 45 minutes of cure. For this reason, curing ovens should not be opened during the interval from the time the oven reaches 120C/250F until the end of the cycle. It is recommended that the oven be allowed to cool down to 65C/150F after the cure cycle before removing cured samples. Workplace airborne monitoring during a 4-hr period of continuous full oven load curing did not show any detectable amounts of HDI or BI. No

(Continued)

HAZARDS IDENTIFICATION(Continued)

detectable levels of HDI & BI are present in fully cured films.

HUMAN HEALTH EFFECTS OF OVEREXPOSURE:

Skin contact with the vapors or vapor condensate may result in skin irritation with discomfort or rash; or allergic skin rashes. Skin exposure may result in methemoglobinemia with symptoms of weakness, shortness of breath and bluish discoloration of the nose, earlobes, lips and skin.

Eye contact with the vapors may result in eye irritation with discomfort, tearing, or blurring of vision.

Inhalation of the vapors may cause irritation of the upper respiratory passages, with coughing and discomfort. Prolonged inhalation of the vapors may produce nonspecific discomfort, such as nausea, headache, or weakness. Overexposure may cause pulmonary edema (body fluid in the lungs) with wheezing, abnormal lung sounds, severe shortness of breath and bluish discoloration of the skin. Effects may be delayed. Repeated exposure may cause asthma-like reactions and chronic lung disorders with impairment of pulmonary function.

TOXICITY DATA FOR COMPONENTS:

BENZOPHENONE
Inhalation 4 hour ALC: > 330 ppm in rats
Skin absorption LD50: 3535 mg/kg in rabbits

This compound may cause skin, eye, nose and throat irritation. Skin contact may cause a rash. Skin permeation may occur in toxic amounts.

METHYL ETHYL KETOXIME
Inhalation 4 hour ALC: > 4.8 mg/L in rats
Skin absorption LD50: < 1850 mg/kg in rabbits

The compound is a mild skin irritant, is corrosive in the eye, and is a skin sensitizer in animals. However, there are no reports of human sensitization. Skin permeation can occur in toxic amounts. Inhalation or skin exposure may result in methemoglobinemia with symptoms of weakness, shortness of breath and bluish discoloration of the nose, earlobes, lips and skin. Red blood cell destruction with anemia may occur. High overexposure may cause lung irritation with symptoms of cough, discomfort and shortness of breath. Methyl ethyl ketoxime does produce genetic damage in mammalian cell cultures but not in bacterial systems or in animals.

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HAZARDS IDENTIFICATION (Continued)

BUTANOL
Inhalation 4 hour LC50: > 8000 ppm in rats
Skin absorption LD50: 3400 mg/kg in rabbits

The compound is a moderate skin irritant and a severe eye irritant. Toxicity described in animals from short exposures by inhalation include anaesthetic effects, respiratory irritation, and death from cardiac and respiratory arrest after aspiration. The compound does not produce genetic damage in bacterial or mammalian cell cultures. Developmental toxicity (reduced fetal weights) was observed only at maternally toxic dose levels.

N-BUTYL ISOCYANATE
Inhalation 4 hour LC50: 16.6 ppm in rats
Skin absorption ALD: 700mg/kg in rabbits

This compound is a skin, eye, nose and throat irritant. Contact with the eye can cause corrosion with corneal and conjunctival ulceration. It can permeate the skin in toxic amounts. Inhalation can lead to irritation of the upper respiratory passages, with coughing and discomfort. Gross overexposure can cause death.

1,6-HEXAMETHYLENE DIISOCYANATE
This compound may cause skin, eye, nose, throat and lung irritation and allergic skin rashes. Inhalation may cause runny nose, scratchy throat and cough. Overexposure may cause pulmonary edema (body fluid in the lungs) with wheezing, abnormal lung sounds, severe shortness of breath and bluish discoloration of the skin. Symptoms may be delayed. Repeated exposure may cause asthma-like reactions and chronic lung disorders with impairment of pulmonary function.

METHYL ETHYL KETONE
Inhalation 2 hour LC50: 4000 ppm in rats
Skin absorption LD50: 10,200 mg/kg in rabbits

The compound is a mild skin irritant and is an eye irritant. Inhalation produced anaesthetic effects, and pulmonary changes. Chronic effects of inhalation in animals include liver effects and increased plasma cholinesterase levels. Application of 2 mL of the compound to the skin of guinea pigs for 31 weeks resulted in mild peeling of the skin. Slight developmental toxicity as evidenced by an increased incidence of minor skeletal variants was observed in litters of rats exposed to 3000 ppm, a dose level which also produced maternal toxicity. The compound does not produce genetic damage in bacterial cell cultures or animals.

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HAZARDS IDENTIFICATION (Continued)

XYLENES
Inhalation 6 hour LC50: 5984 ppm in rats
Skin absorption LD50: 12,182 mg/kg in rabbits

This compound is a skin, eye, nose and throat irritant. Prolonged skin contact can cause defatting, redness, blisters and dehydration of the skin. Skin permeation can occur in toxic amounts. Inhalation can cause nausea, headache, weakness, dizziness, confusion, incoordination and loss of consciousness.

ETHYL ACETATE
Inhalation 4 hour ALC: >8000 ppm in rats
Skin absorption ALD: >20 mL/kg in rabbits

This compound may cause eye irritation with discomfort, tearing, or blurring of vision; or irritation of the upper respiratory passages. Higher exposures may lead to these effects: temporary nervous system depression with anaesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness. Significant skin permeation after contact appears unlikely. There are no reports of human sensitization.

1-METHOXY-2-PROPANOL ACETATE &
2-METHOXY-1-PROPANOL ACETATE
Skin absorption LD50: >5000 mg/kg in rabbits

Eye contact may cause slight eye irritation and slight corneal injury. This material is essentially non irritating to the skin. Prolonged skin contact with very large amounts of PGMEA may cause drowsiness. Amounts ingested incidental to industrial handling are not likely to cause injury. However, ingestion of larger amounts may cause injury. Single exposure to vapors is not likely to be hazardous. Repeated excessive exposures may cause irritation to the upper respiratory tract and liver or kindey effects. Exposures having no adverse effects on the mother should have no effect on the fetus (based on the tests of the non-acetate.) Results of in vitro mutagenicity tests have been negative.

Carcinogenicity Information
None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

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FIRST AID MEASURES

First Aid

INHALATION:

If inhaled, remove to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT:

Flush skin with water after contact. Wash contaminated clothing before reuse.

EYE CONTACT:

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION:

Ingestion is not an expected route of exposure.

NOTE TO PHYSICIANS:

Absorption of this product into the body may lead to the formation of methemoglobin that, in sufficient concentration, causes cyanosis. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body, including scalp and nails, is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, one milligram per kilogram of body weight, may be of value. Cyanocobalamin (Vitamin B12), one milligram intramuscularly, may speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposure.

FIRE FIGHTING MEASURES

Flammable Properties

Flammable limits in Air, % by Volume	
LEL	not determined
UEL	not determined

Fire and Explosion Hazards:

Ovens used for curing should contain a fresh air purge to prevent vapors from accumulating where they might exceed the LEL. Consult the Du Pont publication, "Handling and Safety Considerations for the PYRALUX(R)-PC Curing Process".

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FIRE FIGHTING MEASURES (Continued)

Fire Fighting Instructions
Wear self-contained breathing apparatus.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)
NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures
For condensate, soak up with inert absorbent material and place in waste container for disposal.

HANDLING AND STORAGE

Handling (Personnel)
Avoid breathing vapors or mist. Avoid contact with eyes, skin, or clothing.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls
Use sufficient exhaust on curing equipment to keep exposures below recommended limits. Recommended temperatures for lamination and curing should be maintained to minimize vapor generation.

Personal Protective Equipment
RESPIRATORY:
Self-contained breathing apparatus for fire fighting and mist or spray exposures, if necessary.

GLOVES:
Use neoprene gloves when handling laminator interior exhaust system and interior surfaces of connected duct work. Before removing gloves, decontaminate by washing with soap and water.

Exposure Guidelines
Applicable Exposure Limits
BENZOPHENONE

PEL (OSHA)	None Established
TLV (ACGIH)	None Established
AEL * (Du Pont)	None Established
WEEL (AIHA)	5 mg/m3, 8 Hr. TWA

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EXPOSURE CONTROLS/PERSONAL PROTECTION (Continued)

METHYL ETHYL KETOXIME	
PEL (OSHA)	None Established
TLV (ACGIH)	None Established
AEL * (Du Pont)	50 ppm, 8 Hr. TWA
WEEL (AIHA)	10 ppm, 8 Hr. TWA
BUTANOL	
PEL (OSHA)	100 ppm, 300 mg/m3
TLV (ACGIH)	50 ppm, 152 mg/m3, Skin
AEL * (Du Pont)	Ceiling 25 ppm, 8 Hr. TWA 50 ppm, 15 minute TWA
N-BUTYL ISOCYANATE	
PEL (OSHA)	None Established
TLV (ACGIH)	None Established
AEL * (Du Pont)	0.01 ppm, 8 & 12 Hr. TWA 0.02 ppm, 20 minute TWA
1,6-HEXAMETHYLENE DIISOCYANATE	
PEL (OSHA)	None Established
TLV (ACGIH)	0.005 ppm, 0.034 mg/m3, 8 Hr. TWA
AEL * (Du Pont)	None Established
ETHYL ACETATE	
PEL (OSHA)	400 ppm, 1,400 mg/m3, 8 Hr. TWA
TLV (ACGIH)	400 ppm, 1,440 mg/m3, 8 Hr. TWA
AEL * (Du Pont)	None Established
1-METHOXY-2-PROPANOL	
PEL (OSHA)	None Established
TLV (ACGIH)	None Established
AEL * (Du Pont)	10 ppm, 8 & 12 Hr. TWA
WEEL (AIHA)	100 ppm, 8 Hr. TWA
METHYL ETHYL KETONE	
PEL (OSHA)	200 ppm, 590 mg/m3, 8 Hr. TWA
TLV (ACGIH)	200 ppm, 590 mg/m3, 8 Hr. TWA
AEL * (Du Pont)	STEL 300 ppm, 885 mg/m3 200 ppm, 8 & 12 Hr. TWA 300 ppm, 15 minute TWA
XYLENES	
PEL (OSHA)	100 ppm, 435 mg/m3, 8 Hr. TWA
TLV (ACGIH)	100 ppm, 434 mg/m3, 8 Hr. TWA
AEL * (Du Pont)	STEL 150 ppm, 651 mg/m3 100 ppm, 8 Hr. TWA 150 ppm, 15 minute TWA

* AEL is Du Pont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

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PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Evaporation Rate	<1 (butyl acetate = 1)
Solubility in Water	insoluble
Odor	mild acrylate odor
Appearance	: Vapors are normally colorless, but may appear as white smoke in the absence of exhaust ventilation. Vapors may condense as clear yellow liquid or a white crystalline solid.

STABILITY AND REACTIVITY

Incompatibility with Other Materials
None reasonably foreseeable.

DISPOSAL CONSIDERATIONS

Waste Disposal
When required, vapor discharges to atmosphere should be properly permitted.

REGULATORY INFORMATION

U.S. Federal Regulations
This product complies with TSCA inventory reporting requirements.

HER INFORMATION

Additional Information
PRECAUTIONARY STATEMENTS FOR VAPOR CONDENSATE AND VACUUM PUMP OIL:

WARNING! CAUSES EYE, SKIN AND RESPIRATORY IRRITATION.

Oil in vacuum pump will collect and concentrate less volatile components. Condensate will contain higher percentages of less volatile components. The less volatile components include acrylate monomers which may cause delayed skin burns and may cause skin sensitization. Avoid contact with eyes, skin and clothing. Avoid breathing mist or vapor. Wash thoroughly with soap and water after handling. Laminators and curing equipment used to process PYRALUX(R) PC film should be designed with adequate ventilation to exhaust these vapors from the workplace. Vapors may condense on cold surfaces in exhaust ducts. Check these surfaces for condensate build-up before handling

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OTHER INFORMATION(Continued)

INFORMATION ON THE CLEAN AIR ACT OF 1990 TITLE VI, SECTION 611:

CONCERNING OZONE DEPLETING SUBSTANCES -

DuPont Riston(R), Vacrel(R), VALU(TM), and PYRALUX(R) photopolymer resists and solder masks do NOT contain and are NOT manufactured with either Class I or Class II Ozone Depleting Substances.

For further information regarding the safe use of this material, please refer to DuPont technical bulletin "Handling and Safety Considerations for the PYRALUX(R) PC Curing Process."

MEDICAL USE
CAUTION: Do not use in medical applications involving permanent implantation in the human body. For other medical applications see DuPont CAUTION Bulletin No. H-50102.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

DUPONT ELECTRONIC MATERIALS
14 ALEXANDER DRIVE
RESEARCH TRIANGLE PARK, NC 27709
919-248-5046 OR 919-248-5027

End of MSDS