

CODING FORMS FOR SRC INDEXING

Microfiche No.		OTS0001150	
New Doc ID	FYI-OTS-0794-1150	Old Doc ID	
Date Produced	04/02/86	Date Received	07/26/94
		TSCA Section	FYI
Submitting Organization		EASTMAN KODAK CO	
Contractor			
Document Title		INITIAL SUBMISSION: LETTER FROM EASTMAN KODAK CO TO DYNAMAC CORP REGARDING DIMETHYL TEREPHTHALATE LOSSES TO THE ENVIRONMENT WITH ATTACHMENTS, DATED 04/02/86	
Chemical Category		DIMETHYL TEREPHTHALATE	

FYI-0794-1150



FYI-94-031150  
INIT 07/26/94



April 2, 1986

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Mr. Louis Borghi  
Senior Scientist  
Dynamac Corporation  
The Dynamac Building  
11140 Rockville Pike  
Rockville, Maryland 20852

Dear Mr. Borghi:

Subject: Dimethyl Terephthalate Losses to the Environment

As requested in your letter dated February 10, 1986, Eastman Kodak Company is providing information concerning releases of dimethyl terephthalate (DMT) to the environment from manufacturing and processing operations. Eastman Kodak has participated in two surveys concerning DMT emissions. The results from these surveys are as follows.

Hydroscience's Report on Carolina Eastman Company

On December 6 and 7, 1977, Hydroscience, Inc. visited Carolina Eastman Company located in Columbia, South Carolina, to study our Terephthalic Acid (TPA) and our Dimethyl Terephthalate (DMT) plants. Hydroscience, Inc. were working under contract to EPA to prepare the report "Crude Terephthalic Acid, Dimethyl Terephthalate, and Purified Terephthalic Acid" which is included as Report 5 in EPA's publication on Organic Chemical Manufacturing, Volume 7: Selected Processes (EPA-450/3-80-028b).

The emission data on the DMT process at Carolina Eastman Company is summarized in Table E-7 in the report. This table is attached as Appendix A for your reference. The report also includes studies on five companies which produce either TPA or DMT. The emission summary for a typical DMT plant is in Table VII-1 of the report. This table is attached as Appendix B for your reference. The emission factors from this table indicate that the particulate emissions of DMT would be approximately 0.02 wt%.

Mr. Louis Borghi

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April 2, 1986

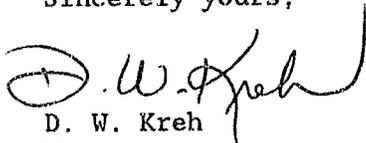
Informal Request from EPA on DMT Emissions

On February 10, 1986, EPA called Tennessee Eastman Company asking whether we could verify EPA's estimate of 1.5 wt% of DMT production being lost to the environment during manufacturing and processing. The estimate was from an ITC report EPA was reviewing for TSCA use. We estimated the losses and reported to EPA that based on limited data, the estimate of 1.5% was way too high. EPA asked whether it was less than 1.0% and we confirmed that it was.

Based on more detailed investigations, we conclude that DMT emission losses to the environment from our Tennessee facility are approximately 0.02 wt% of the DMT production. DMT emission losses from our South Carolina facility are approximately 0.0002 wt% of the DMT production.

If you have any questions concerning this information, contact Joanne Schaich at (615)229-2580.

Sincerely yours,



D. W. Kreh  
Manager  
Material Safety Program

jrs

Enclosure

cc: Dr. Robert H. Brink, Executive Secretary, Interagency Testing  
Committee, 401 M Street, S.W., Washington, D.C. 20460

Table E-7. Direct Emissions from Dimethyl Terephthalate Process (Carolina Eastman)

Emission Source	Emission Control Device (ECD)	Pollutant	Pollutant Flow (lb/1000 lb of Product)	
			Before ECD	After ECD
TA slurry mix tanks, vents	Atmosphere	MeOH, o-xylene	0.0090	0.0090
TA slurry feed tanks, vents	Atmosphere	MeOH, o-xylene	0.0186	0.0186
Vent from sludge recovery	Contact condenser	o-Xylene, others	0.0913	0.0084
Decanter	Atmosphere	o-Xylene	$7 \times 10^{-6}$	$7 \times 10^{-6}$
Jet seal pot vent	Atmosphere	o-Xylene	$.3 \times 10^{-7}$	$3 \times 10^{-7}$
Product transfer	Solvent absorber	DMT	0.171	
		MeOH	0.0113	0.146
Sludge hood vent	Scrubber	Particulate	$12 \text{ g/m}^3$	$2.97 \text{ mg/m}^3$
Sludge hood vent	Scrubber	Particulate	$15 \text{ g/m}^3$	$1.25 \text{ mg/m}^3$

## Appendix B

Table VII-1. Emission Summary for Typical Plant Producing  
Dimethyl Terephthalate via C-TPA  
(Capacity: 269 Gg/yr)

Emission	Vent Designation (Fig. III-1)	VOC Emission Rate (kg/hr) <sup>a</sup>	
		Uncontrolled	Controlled
Slurry mix tank vents	A	30.72	1.23
Reactor sludge transfer vents	B	b	0.34 <sup>c</sup>
Vacuum-jet condenser vent	D	10.44	1.98
Methanol flash still vent	F	0.61	0.61
Storage vents			
Crude DMT	C	2.80	0.028
Methanol	G,H	3.99	0.40
DMT	L	d	5.84 <sup>e</sup>
Other storage	I-K	0.92	0.92
Fugitive	M	20.43	5.45
Secondary			
Process boiler	E	0.06	0.06
Incinerator	N-P	NS <sup>f</sup>	NS
Wastewater treatment	Q,R	NS	NS
		69.9	16.8

<sup>a</sup>Based on 8760-hr/yr operation.

<sup>b</sup>Particulate emission of 1.17 kg/hr.

<sup>c</sup>Emission resulting from vaporization of o-xylene scrubbing liquid.

<sup>d</sup>Particulate emission of 5.53 kg/hr.

<sup>e</sup>Emission resulting from vaporization of methanol scrubbing liquid.

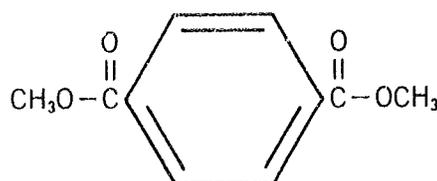
<sup>f</sup>Not significant.

Eastman CHEMICALS



Publication No. GN-309B\*  
March 1981

DIMETHYL TEREPHTHALATE  
DMT



CAS No. 120-61-6

Dimethyl Terephthalate (DMT) undergoes the normal reactions of an aromatic acid ester. It exhibits the characteristic high melting and boiling points and excellent thermal stability shown by many terephthalic acid derivatives. The good solubility of DMT at elevated temperatures in common organic solvents (see Table 2) and its generally greater ease of handling as compared with terephthalic acid make it a convenient starting material for the synthesis of other derivatives of terephthalic acid.

DMT is used in the synthesis of unsaturated polyester resins. Low acid number unsaturated or reactive polyester resins with good performance properties can be prepared. Because DMT is an ester, a two-stage process should be used in which the glycol is reacted with DMT before the unsaturated acid is charged into the reaction mixture.

DMT is also used in the preparation of reactive polyester resins for powder coatings.

\*Replaces X-135 and GN-309A.

Several typical properties of DMT are shown in Table 1, solubility at elevated temperatures in Table 2, and viscosity characteristics in Figure 1.

Table 1  
Typical Properties of DMT\*

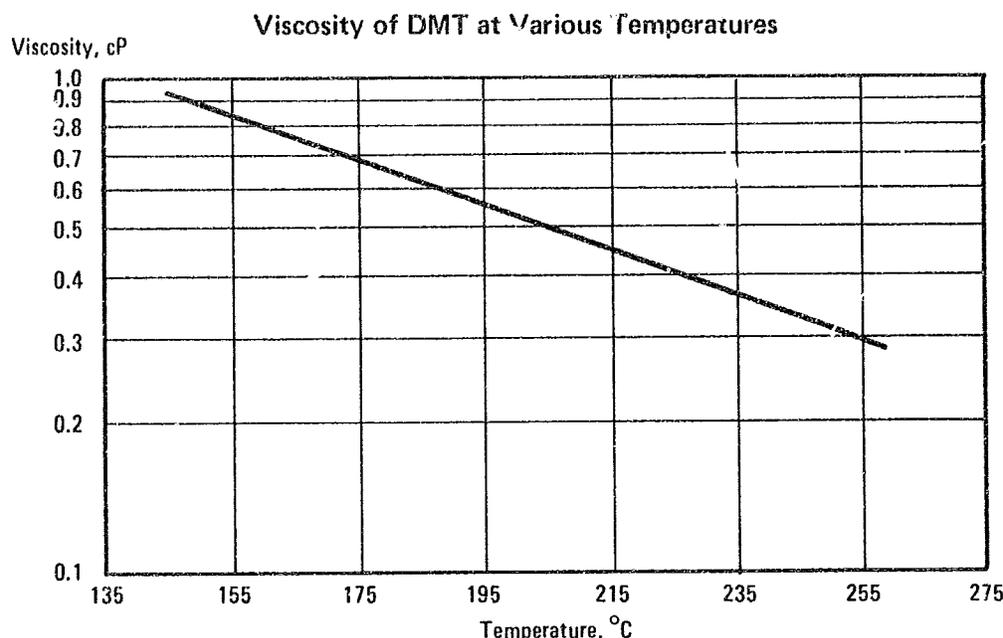
Empirical formula	$C_{10}H_{10}O_4$
Molecular weight (theoretical)	194.18
Physical form	Small briquettes, flakes, or molten
Color	White
Melting point, °C	140.6
Acid number	0.07 max.
Sulfur (by x-ray fluorescence), ppm	10
Iron, ppm	<0.5
Appearance of melt	Clear and free of suspended matter
Melt color, Pt-Co scale, ppm	
Initial	<15
After 2 hr at 250°C	<100
Flash point, Micro Cleveland Open Cup, °C (°F)	153 (308)
Autoignition temperature, °C (°F)	519 (965)
Viscosity, as function of temperature	See Figure 1
Vapor pressure, mm Hg (torr) at	
142°C	10
208°C	100
234°C	200
270°C	500
288°C	760
DOT Labels Required	None
DOT Classification	Not regulated

*\*These typical properties are reported for information only. Eastman makes no representation that the material in any particular shipment will conform to the listed properties.*

Table 2  
Solubility of DMT at Elevated Temperatures

Solvent	Boiling Point of Solvent, °C	Solubility, g/100 g of solvent
Diethylene glycol	245	400
Butyl acetate	120	400
Ethylenediamine	117	25
Ethylene dichloride	84	100-400
Carbon tetrachloride	77	25
Acetone	56	25

Figure 1



### SAFETY PRECAUTIONS

**Toxicity.** Studies of the toxicity of dimethyl terephthalate (DMT) have been conducted by the Health, Safety, and Human Factors Laboratory, Eastman Kodak Company, Rochester, New York, and others.

DMT has an oral LD<sub>50</sub> of greater than 6590 mg/kg for rats and greater than 3200 mg/kg for mice. When the solid compound moistened with water was held in occluded contact with the skin of guinea pigs for 24 hours, it produced only slight irritation, and there was no evidence of skin absorption; the maximum test dose was 5.0 g/kg. The compound was tested for eye irritation in rabbits and produced only slight transient irritation. In a standardized sensitization test, the compound failed to sensitize any of 10 guinea pigs to which it was applied. The

compound was added to the diet of rats at levels of 0.25, 0.5 and 1.0% for 96 days. Except for a significant reduction in average body weight accompanied by a reduced diet efficiency at the 1.0% level, there was no effect on feed intake, weight gain, behavior, hematology determinations, serum chemistry determinations, relative and absolute liver and kidney weights, gross pathology, or histopathology.<sup>1</sup> Two groups of rats were exposed to dust levels of 16.5 mg/m<sup>3</sup> and 86.4 mg/m<sup>3</sup> for 4 hours/day for 58 days. Except for signs of irritation noted intermittently at the high dose, there was no effect on behavior, weight gain, hematology determinations, serum chemistry determinations, relative and absolute liver and kidney weights, gross pathology, or histopathology.<sup>1</sup> DMT was tested for cancer-causing activity with F344 rats and B6C3F1 mice in the Carcinogenesis Testing Program, Division of Cancer Cause and Prevention, National Cancer Institute. It was concluded that under the conditions of this bioassay, DMT was not carcinogenic.<sup>2</sup>

**Human Experience.** DMT has caused no significant adverse effects in humans; rare individuals have developed apparent skin sensitization to DMT. Of course, skin contact with molten DMT will cause severe thermal burns and proper work practices and protective equipment should be used to prevent such contact.

**Handling and Storing.** The attached Material Safety Data Sheet provides safety precautions that should be observed in the handling and storing of DMT.

**References.**

<sup>1</sup> Krasavage WJ, Yanno FJ, Terhaar CJ. Dimethyl terephthalate (DMT): acute toxicity, subacute feed and inhalation studies in male rats. *Am Ind Hyg Assoc J* 1973;34:455-462.

<sup>2</sup> Federal Register 1979; 44:52339.

**FOR ADDITIONAL INFORMATION**

FROM THESE AREAS	VISIT OR WRITE TO	OR CALL
The UNITED STATES except states listed below	EASTMAN CHEMICAL PRODUCTS, INC.* Industrial Chemicals Division, B-280 Kingsport, Tennessee 37662	Toll-free (800) 251-0351 (From within Tennessee, call (800) 352-0301) TWX: (810) 574-5174 Telex: 553450 Cable: EASTCHEM, Kingsport, Tennessee
States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming	Western-states representative: WILSON & GEO. MEYER & COMPANY Santa Fe Springs, California 90670, 12805 Busch Place Portland, Oregon 97217, 12200 N. Jantzen Avenue, Suite 210 Englewood, Colorado 80111, 5680 South Syracuse Circle Seattle, Washington 98109, 318 Queen Anne Avenue, North South San Francisco, California 94080, 270 Lawrence Avenue	(213) 946-2311 (503) 285-1468 (303) 741-1355 (206) 284-1620 (415) 871-1770
CANADA, LATIN AMERICA (except BRAZIL), AUSTRALIA, and NEW ZEALAND	EASTMAN CHEMICAL INTERNATIONAL LTD.* Kingsport, Tennessee 37662, P. O. Box 431 (Toronto) Don Mills 403, Ontario, Canada M3C 1J5, 40 Wvnford Drive Montreal, Quebec, Canada H4B 2L7, 2525 Cavendish Blvd., Suite 115 (Sydney) Chatswood, New South Wales, Australia 2067, 3-9 Spring Street, Suite No. 3, P. O. Box 426 Puerto Rico: Dial direct (toll free)	(615) 247-0411 (416) 449-0160 (514) 483-1180 (411) 411-3399 (800) 251-0351
BRAZIL	EASTMAN CHEMICAL BRASILEIRA LTDA.* Sao Paulo, Brazil, Rua George Eastman, Caixa Postal 225	542-8463
EUROPE, AFRICA, the MIDDLE EAST, and the NEAR EAST	EASTMAN CHEMICAL INTERNATIONAL A.G.* Baarerstrasse 8, Postfach 220, CH-6301 Zug, Switzerland 75012 Paris, France, 10 Rue Villiot 20124 Milan, Italy, Via Rosellini 12 Hemel Hempstead, Herts, HP1 1JU England, P. O. Box 66, Kodak House, Station Road	(042) 232525 (1) 317-87-45 (02) 688-45C (0442) 41171
The FAR EAST	EASTMAN CHEMICAL INTERNATIONAL COMPANY* Kingsport, Tennessee 37662, P. O. Box 431 Hong Kong, 1506 Guardian House, P. O. Box 47025, Morrison Hill Post Office	(615) 247-0411 5-748351

\*Marketing affiliates of Eastman Kodak Company

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Publication No. GN-309B March 1981	MSDS(s) needed with this publication: <b>5702</b> (or EEC equivalent)
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MATERIAL SAFETY DATA SHEET

EASTMAN CHEMICAL PRODUCTS, INC.  
Kingsport, Tennessee 37662

For Health Hazard Information, call: (615) 229-6094, 8am-5pm (Eastern), Mon.-Fri.  
(615) 229-4374 at all other times

For other information, call: (615) 229-4041 Date of Preparation: 07-27-83

Approved by U. S. Department of Labor: Essentially Similar to OSHA-20

SECTION I. IDENTIFICATION

- Product Name: Dimethyl Terephthalate
- Synonym: DMT
- Formula:  $C_{10}H_{10}O_4$
- Molecular Weight: 194.18

SECTION II. PRODUCT AND COMPONENT HAZARD DATA

A. COMPONENT:	Approx. Percent	TLV <sup>***</sup>	CAS Reg. No.
Dimethyl terephthalate	100	None	120-61-6

\*\*See Section VI-A for additional information on exposure limits.

B. PRECAUTIONARY LABEL STATEMENTS:

FIRST AID: If burned by contact with molten material, cool as quickly as possible with water and see a physician for treatment of burn.

NOTICE: Refer to NFPA Pamphlet No. 654, "Prevention of Fire and Dust Explosions in the Chemical, Dye, Pharmaceutical, and Plastics Industries," if this material is to be reduced to or collected as a powder.

SECTION III. PHYSICAL DATA

- Appearance and Odor: White solid; clear liquid when molten; virtually odorless.
- Boiling Point: 284°C (543°F); (Sublimes)
- Melting Point: 141°C (286°F)
- Specific Gravity ( $H_2O = 1$ ): Approx 1.05 (Molten)
- Vapor Pressure: 100 mm Hg at 208°C
- Percent Volatile by Volume: Not determined.
- Vapor Density (Air = 1): 6.7
- Evaporation Rate (= 1): Not determined.
- Solubility in Water: Negligible in solid form.

#### SECTION IV. FIRE AND EXPLOSION HAZARD DATA

- Flash Point: 153°C (308°F)  
Method Used: MCOC
  - Autoignition Temperature: 519°C (965°F); method used: ASTM D-2155
  - Extinguishing Agent: Water Spray, Dry Chemical, CO<sub>2</sub>, Foam
  - Special Fire-Fighting Procedures: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Fire fighters should be a safe distance away from a molten DMT fire if water is used to control the fire.
  - Unusual Fire and Explosion Hazards: Refer to NFPA Pamphlet No. 654, "Prevention of Fire and Dust Explosions in the Chemical, Dye, Pharmaceutical, and Plastics Industries," if this material is to be reduced to or collected as a powder.
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#### SECTION V. REACTIVITY DATA

- Stability: Stable.
  - Incompatibility: Oxidizing materials can cause a reaction.
  - Hazardous Decomposition Products: As with any other organic material, combustion will produce carbon dioxide and probably carbon monoxide.
  - Hazardous Polymerization: Will not occur.
- 

#### SECTION VI. TOXICITY AND HEALTH

##### A. EXPOSURE LIMITS

- Workplace Environmental Exposure Level (WEEL): 10 mg/m<sup>3</sup> total mass, 5 mg/m<sup>3</sup> respirable mass, (8-h TWA for a 40-h wk), AIHA, 1982.
- An industrial hygiene analytical method is available to health and safety professionals upon request.

##### B. EXPOSURE EFFECTS

Inhalation: No specific hazard known to Eastman.

Eyes: No specific hazard known to Eastman. Any material gotten into the eye may be irritating.

Skin: Molten material will produce thermal burns. Human data suggest that dimethyl terephthalate can produce dermatitis. (1)

##### C. FIRST AID

Eyes: Any material gotten into the eye should be washed out and medical attention obtained if symptoms are present after washing.

Skin: Immediately wash with soap and plenty of water. If burned by contact with molten material, cool as quickly as possible with water and see a physician for treatment of burn.

#### D. ANIMAL TOXICITY DATA

<u>Test</u>	<u>Species</u>	<u>Result</u>	<u>Toxicity Classification (2)</u>
Acute oral LD <sub>50</sub>	Rat	>6590 mg/kg (3)	Practically nontoxic*
Acute oral LD <sub>50</sub>	Mouse	>3200 mg/kg (4)	Slightly toxic*
Dermal LD <sub>50</sub>	Guinea pig	>5000 mg/kg (4)	
Skin irritation	Guinea pig	Slight (3)	
Skin sensitization	Guinea pig	None (3)	
Eye irritation	Rabbit	Slight (4)	

\*For maximum level tested.

Rats were fed diets containing 0.25%, 0.5%, or 1.0% of the compound for 96 days; other than a significant decrease in body weight gain in the 1.0% dose group, no biologically significant findings were noted in feed intake, hematology, clinical chemistry, body/organ weights (liver and kidney), and histopathology. (3)

Rats were exposed to airborne concentrations of 16.5 or 86.4 mg/m<sup>3</sup>, 4 h/day, 5 days/wk, for 58 exposures; no biologically significant findings were noted in weight gain, hematology, clinical chemistry, body/organ weights (liver and kidney), and histopathology. (3)

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#### SECTION VII. PERSONAL PROTECTION AND CONTROLS

##### A. RESPIRATORY PROTECTION

An appropriate NIOSH-approved respirator for dust and fume should be worn if needed.

##### B. VENTILATION

General: Recommend at least 10 air changes per hour for good general room ventilation.

Local Exhaust: If needed to control dust and fume. See Section VI-A for detailed information on exposure limits.

##### C. SKIN AND EYE PROTECTION

Safety glasses should be worn in any type of industrial operation. Gloves should be worn to protect against thermal burns.

##### D. OTHER CONTROL MEASURES

A safety shower and washing facilities should be available. Wash thoroughly after handling.

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#### SECTION VIII. SPECIAL STORAGE AND HANDLING PRECAUTIONS

No special precautions are known to Eastman.

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**SECTION IX. SPILL, LEAK, AND DISPOSAL PRACTICES**

**Steps to be Taken in Case Material is Released or Spilled:** Collect and contain for salvage or disposal.

**Waste Disposal Method:** Incineration. Observe all federal, state, and local laws concerning health and environment.

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**SECTION X. ENVIRONMENTAL EFFECTS DATA**

**A. SUMMARY:** This product has been tested for environmental effects. Some laboratory test data and published data (4, 5) are available for this product, and these data have been used to provide the following estimate of environmental impact:

This product has a low potential to affect secondary waste treatment micro-organisms. It has a moderate potential to affect aquatic organisms and the germination and growth of some plants. It is expected to be biodegradable and is not likely to bioconcentrate. If diluted with a large amount of water, this product released directly or indirectly into the environment is not expected to have a significant impact. (4)

**B. OXYGEN DEMAND DATA**

- COD: 1.70 g/g (4)

**C. ACUTE AQUATIC EFFECTS**

- 96-h LC<sub>50</sub>; Fathead minnow: 3.0-30 mg/L (4)  
- 96-h LC<sub>50</sub>; Water flea: 40% mortality noted at 30 mg/L (4)

**D. SECONDARY WASTE TREATMENT EFFECTS**

- 5-h IC<sub>50</sub>: >5000 mg/L (4)

**E. BIOCONCENTRATION POTENTIAL**

- Octanol/water partition coefficient: Log P = 2.25; P = 1.78 (5)

**F. PLANT GERMINATION EFFECTS**

No adverse effects at:

- Ryegrass 30 mg/L (4)  
- Radish 30 mg/L (4)  
- Lettuce 30 mg/L (4)

**G. PLANT SEEDLING EFFECTS**

No adverse effects at:

- Marigold >33 mg/L (4)  
- Radish >10 mg/L (4)  
- Corn >33 mg/L (4)  
- Lettuce >33 mg/L (4)

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SECTION XI. TRANSPORTATION

DOT Hazard Classification: Not regulated by DOT

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SECTION XII. REFERENCES

1. Medical records, Tennessee Eastman Co., Kingsport, Tennessee.
  2. H. C. Hodge and J. H. Sterner. Tabulation of toxicity classes. Am. Ind. Hyg. Assoc. Q. 1949; 10:93-96.
  3. W. J. Krasavage, F. J. Yanno, and C. J. Terhaar. Dimethyl terephthalate (DMT): acute toxicity, subacute feeding and inhalation studies in male rats. Am. Ind. Hyg. Assoc. Q. 1973; 34:455-461.
  4. Unpublished data, Health, Safety, and Human Factors Laboratory, Eastman Kodak Co., Rochester, New York.
  5. A. J. Leo and C. Hansch, Editors. Chemical parameter data base, Medicinal Chemistry Project, Pomona College, Seaver Chemistry Laboratory, Claremont, California, July 10, 1980.
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