

**APPENDIX VIII-A**

**Environmental Requirements Applicable to  
EVOH Production Facility**

94F-0246

EA2  
000919



## Interoffice Correspondence

To: Y. Ozeki  
From: D. W. Clark  
Subject: ENVIRONMENTAL ASSESSMENT DATA

Date: August 31, 1992  
File: DWC-120-92  
Copies: Claggett, Ozeki, McHugh, Richardson, Suzuki, Tomita

Attached is a listing of all applicable Federal and State laws which apply to the operation of the Pasadena plant.

With regard to the environment; effects of the production of EVOH resins, the following comments are offered:

1. The following chemicals are reported as being released to the environment under SARA Title III, TOXIC CHEMICAL RELEASE INVENTORY.
  - A. Acetaldehyde
  - B. Ethylene
  - C. Methanol
  - D. Vinyl Acetate
2. None of the above listed chemicals are released to any receiving bodies of water. They have been released as fugitive or point source emissions only. The total amount of hydrocarbon emission reported in 1992 for the calendar year 1991 was 60,009 LBS.
3. The plant produces the following waste materials:
  - A. Hazardous liquid waste produced is composed of water, vinyl acetate, methyl acetate, methanol, acetic acid, and butyl acetate. This material is disposed of by incineration in a fuels recovery program.
  - B. Hazardous solid waste - EVAC paste. This waste is placed in fiber drums and incinerated in a fuels recovery program.
  - C. Non-Hazardous Solid Waste - EVOH paste. This waste is also placed in fiber drums and incinerated in a fuels recovery program.
  - D. Non-Hazardous Solid Waste - Scrap EVOH. This waste is placed in Gaylord containers and then incinerated in a fuels recovery program.
  - E. Trash - This is normal trash material such as packaging, garbage and other miscellaneous material which is placed in dumpsters and landfilled. No material from the producing plant is allowed in with this material.

ENVIRONMENTAL ASSESSMENT DATA

DWC-120-92

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4. Effectively, all waste with the exception of trash is placed into fuels recovery where it is incinerated, thus having no environmental impact by being totally destroyed.

Please advise me if you require additional information.



D. W. Clark

DWC/djm

Attachment

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# ENVIRONMENTAL LAWS AND REGULATIONS

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## FEDERAL LAWS:

- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- Clean Water Act
- Clean Air Act
- Emergency Planning and Community Right-to-Know Act (SARA, TITLE III)
- Safe Drinking Water Act
- Resource Conservation and Recovery Act

## FEDERAL REGULATIONS:

- 40 CFR Part 50  
National Primary and Secondary Ambient Air Quality Standards
- 40 CFR Part 51  
State Implementation Plan Requirements
- 40 CFR Part 52  
Approval and Promulgation of State Implementation Plans (Subpart SS, Texas)
- 40 CFR Part 60  
New Source Performance Standards
- 40 CFR Part 61  
National Emission Standards for Hazardous Air Pollutants
- 40 CFR Part 81  
Air Quality Planning Areas
- 40 CFR Part 110  
Oil Pollution Prevention
- 40 CFR Part 112  
Oil Pollution Prevention
- 40 CFR Part 122  
NPDES Permit Program

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## ENVIRONMENTAL LAWS AND REGULATIONS

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- 40 CFR Part 141  
National Primary Drinking Water Regulations
- 40 CFR Part 245 through 256  
Solid Waste Management
- 40 CFR Part 260 through 271  
Hazardous Waste Management
- 40 CFR Part 302  
Designation, Reportable Quantities, and Notification Requirements for Hazardous Substances under CERCLA
- 40 CFR Part 355  
Emergency Planning and Notification under CERCLA
- 40 CFR Part 370  
Hazardous Chemical Reporting and Community Right-to-Know
- 40 CFR Part 372  
Toxic Chemical Release Reporting
- 40 CFR Part 414  
Effluent Limitation Guidelines for the Organic Chemicals, Plastics, and Synthetic Fibers Industry
- 40 CFR Part 172, 173, 178, 179, 192  
Department of Transportation Regulations Dealing with Hazardous Materials

### TEXAS LAWS:

- Texas Clean Air Act
- Texas Coastal Oil and Hazardous Spill Prevention and Control Act
- Texas Hazard Communication Act
- Texas Hazardous Substances Spill Prevention and Control Act
- Texas Solid Waste Disposal Act
- Texas Toxic Chemical Release Reporting Act
- Texas Water Quality Acts

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## ENVIRONMENTAL LAWS AND REGULATIONS

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### TEXAS REGULATIONS

- TAC, Title 25 -- Health Services, Part I  
Texas Department of Health, Chapter 325  
Solid Waste Management
- TAC, Title 31 -- Natural Resources and Conservation  
Part III  
Texas Air Control Board
- TAC, Title 31 -- Natural Resources and Conservation, Part IX  
Texas Water Commission, Chapter 305  
Consolidated Permits
- TAC, Title 31 -- Natural Resources and Conservation, Part IX  
Texas Water Commission, Chapter 307  
Surface Water Quality Standards
- TAC, Title 31 -- Natural Resources and Conservation, Part IX  
Texas Water Commission, Chapter 309  
Effluent Standards
- TAC, Title 31 -- Natural Resources and Conservation, Part IX  
Texas Water Commission, Chapter 319, 321, and 323  
Texas Wastewater Treatment Regulations
- TAC, Title 31 -- Natural Resources and Conservation, Part IX  
Texas Water Commission, Chapter 335  
Industrial Solid Waste and Municipal Hazardous Waste

THD, Water Hygiene Division, Rules and Regulations for Public Water Systems

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**APPENDIX VIII-B**

**Plant Operating Permit**

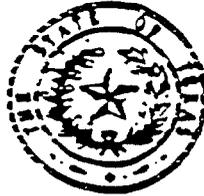
# TEXAS AIR CONTROL BOARD

5330 HWY. 290 EAST  
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February 22, 1989

FEB 27 1989

Mr. E. W. Sandner  
Plant Manager  
EVAL COMPANY OF AMERICA (EVALCA)  
11500 Bay Area Boulevard  
Pasadena, Texas 77507

E. W. SANDNER

Re: Permit Amendment  
Operating Permit R-9576  
Styrene Vinyl Alcohol Resins  
Plant  
Pasadena, Harris County  
Account ID No. HG-1310-5

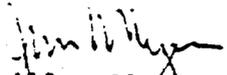
Dear Mr. Sandner:

This is in response to your permit application, Form PI-1, concerning the proposed amendment to Permit R-9576. We understand that you propose to debottleneck your Phase I Resins Plant.

Pursuant to Rule 116.5 of Regulation VI of the Texas Air Control Board, Permit R-9576 is hereby amended in accordance with your proposal. This information will be incorporated into the existing permit file. Enclosed are a revised emission allowable table and provisions pages. Please return the previously issued table and provisions pages to this office.

Your cooperation in this matter is appreciated. If you have further questions, please contact Mr. Johnny Vermillion of our Permits Division.

Sincerely,

  
Allen Eli Bell  
Executive Director

Enclosures

cc: Mr. Herbert W. Williams, Jr., Regional Director, Houston  
Mr. Allison R. Peirce, Director, Harris County Pollution Control  
Department, Pasadena  
Charles D. Bessire, II, D., Director, Pasadena City Health  
Department, Pasadena

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## GENERAL PROVISIONS

R-9576

1. Equivalency of Methods - It shall be the responsibility of the holder of this permit to demonstrate or otherwise justify the equivalency of emission control methods, sampling or other emission testing methods and monitoring methods proposed as alternatives to methods indicated in the provisions of this permit. Alternative methods shall be applied for in writing and shall be reviewed and approved by the Executive Director prior to their use in fulfilling any requirements of this permit.
2. Sampling Requirements - If sampling of stacks or process vents is required, the holder of this permit must contact the Quality Assurance Division of the Texas Air Control Board (TACB) prior to sampling to obtain the proper data forms and procedures. The holder of this permit is also responsible for providing sampling facilities and conducting the sampling operations at his own expense.
3. Appeal - This permit may be appealed pursuant to Rule 103.81 of the Procedural Rules of the TACB and Section 6.01 of the Texas Clean Air Act. Failure to take such appeal constitutes acceptance by the applicant of all terms of the permit.
4. Construction Progress - Start of construction, construction interruptions exceeding 45 days and completion of construction shall be reported to the appropriate regional office of the TACB not later than 10 working days after occurrence of the event. This provision shall not apply to operating permits.
5. Recordkeeping - Information and data concerning production, operating hours, sampling and monitoring data, if applicable, fuel type and fuel sulfur content, if applicable, shall be maintained in a file at the plant site and made available at the request of personnel from the TACB or any local air pollution control program having jurisdiction. The file shall be retained for at least two years following the date that the information or data is obtained.

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GENERAL PROVISIONS

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3. Piping, Valves, Pumps and Compressors in Volatile Organic Compound (VOC) Service

- A. These provisions shall not apply (1) where the VOC has an aggregate partial pressure or vapor pressure of less than 0.5 psia at 100°F or at maximum process operating temperature if less than 100°F or (2) to piping and valves smaller than two inches nominal size.
- B. Construction of new and reworked piping, valves, pump and compressor systems shall conform to applicable ANSI, API, ASME or equivalent codes.
- C. New and reworked underground process pipelines in VOC service shall contain no buried valves such that fugitive emission monitoring is rendered impractical.
- D. To the extent that good engineering practice will permit, new and reworked valves and piping connections shall be so located to be reasonably accessible for leak-checking during plant operation.
- E. New and reworked piping connections in VOC service shall be welded or flanged. Screwed connections are permissible only on piping smaller than two-inch diameter. All connections shall be hydrotested or gas tested at 100 percent or more of the maximum operating pressure and adjustments made as necessary to obtain bubble-tight, leak-free performance.
- F. New and reworked valves installed as replacements at this facility in VOC service shall be tested prior to operation by hydrostatic or gas testing in-place or by an appropriate bench test such that the valves do not leak to the atmosphere during testing.
- G. Valves in VOC service shall be monitored by leak-checking for fugitive emissions at least quarterly using a VOC detector.
- H. Except as may be provided for in the special provisions of this permit, all new and reworked pump and compressor shafts shall be equipped with a shaft sealing system that prevents or detects emissions of VOC from the seal. Seal systems designed and operated to prevent emissions need not be monitored. These seal systems may include but are not limited to dual pump seals with barrier fluid at higher pressure than process or seals degassing to vent control systems kept in good working order. All pump and compressor seals emitting VOC shall be monitored with a VOC leak detector at least quarterly or the seals shall be equipped with an automatic seal failure detection system.

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GENERAL PROVISIONS

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- I. Damaged or leaking valves, flanges and compressor and pump seals found to be emitting VOC in excess of 10,000 ppmv or found by visual inspection to be leaking (e.g. dripping liquids, shall be tagged and replaced or repaired. Every reasonable effort shall be made to repair a leaking component, as specified in this paragraph, within 15 days after the leak is found. If the repair of a component would require a unit shutdown which would create more emissions than the repair would eliminate, the repair may be delayed until the next scheduled shutdown. All leaking components which cannot be repaired until the unit is shut down for turnaround shall be identified for such repair by tagging. The Executive Director, at his discretion, may require early unit turnaround or other appropriate action based on the number and severity of tagged leaks awaiting maintenance during the next turnaround.
- J. The results of the required fugitive monitoring and maintenance program shall be made available to the Executive Director or his designated representative upon request. Records shall indicate appropriate dates, test methods, results and corrective actions taken.
- K. Fugitive emission monitoring required by TACB Regulation V, an applicable New Source Performance Standard, Title 40 Code of Federal Regulations Part 60 (40 CFR 60) or an applicable National Emission Standard for Hazardous Air Pollutants (40 CFR 61) may be used in lieu of Items G through J of this provision.

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## SPECIAL PROVISIONS

R-9576

1. The total emissions of air contaminants from any of the sources shall not exceed the values stated on the attached table entitled "Emission Sources - Maximum Allowable Emission Rates."
2. This facility shall comply with all requirements of Environmental Protection Agency Regulations on Standards of Performance for New Stationary Sources promulgated for VOC Emissions from the Synthetic Organic Chemical Manufacturing Industry: Distillation Unit Operations and Equipment Leaks of VOC in 40 CFR 60, Subparts A, III and IV.
3. Safety relief valves that discharge to the atmosphere only as a result of fire or failure of utilities are exempt from General Provision No. 7, provided that each valve is equipped with a rupture disc upstream. A pressure gauge shall be installed between the relief valve and rupture disc to monitor disc integrity or an equivalent method approved by the TACB shall be implemented. All leaking discs shall be replaced at the earliest opportunity but no later than the next process shutdown.
4. The boiler shall be equipped with a staged fuel low nitrogen oxide ( $\text{NO}_x$ ) burner or an approved equivalent which will provide less than 0.12 pound  $\text{NO}_x$ /MM Btu.
5. The holder of this permit shall keep records of the resin flow rates through the dryers of each line (A, B, IIA and IIB) and the packaging silos in pounds per day and the amount of acetic acid added to each line in pounds per day. Records shall be maintained of the acetic acid content of the resin at the outlet of the No. 3 Dryer for each line and outlet of the packaging silos as determined daily by an approved method. This data along with the flow rate information will be used to calculate a daily average pound per hour acetic acid emission rate from the dryers and the downstream processing equipment for each line to determine compliance with Special Provision No. 1. Sampling shall be conducted once each month and when the "types" of product are changed. The sample period shall be for two consecutive days so as to reflect two daily average acetic acid emissions. Records shall be made available to representatives of the TACB upon request.
6. There shall be no visible emissions from the dryers (Phase I Emission Points No. [EPNs] 2A through 2F2, 25A through D, 28 and 29 and Phase II EPNs 52A through 52F, 78 and 79), chip pelletizing and packaging silos (Phase I EPNs 22A through H, 23 and 24 and Phase II EPNs 72A through 72H, 73 and 74), dust collection vents (EPNs 26 and 76) or extruder hoppers (EPNs 27 and 77).

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SPECIAL PROVISIONS  
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7. Storage Tanks V-5101 through V-5120, V-5123, V-8104, V-8105 and V-8107 shall be routed to a flare with no less than 98 percent destruction efficiency.
8. Storage Tanks V-5121.1, V-5121.2, V-5122 and V-8106 shall be routed to an acetic acid scrubber with an efficiency of no less than 95 percent.

Revised February 22, 1989

R-9576

Revised 2/22/89

This table lists all sources of air contaminants on applicant's property emitted by the facility covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

AIR CONTAMINANT DATA													
EMISSION POINT ID (1)	SOURCE NAME (2)	EMISSION RATES*											
		VOC (3)		NOX (4)		SO2 (5)		PART (6)		CO (7)		(7)	
		#/HR	1/Y	#/HR	1/Y	#/HR	1/Y	#/HR	1/Y	#/HR	1/Y	#/HR	1/Y
	Phase I												
1	Flare	2.33	10.19	0.29	1.29	0.002	0.01	0.01	0.05	0.07	0.32		
2A	Dryer I 1A	2.97	13.0						0.001				
2B	Dryer I 2A	0.29	1.27						0.001				
2C1	Dryer I 3A1	0.14	0.62					0.004	0.011				
2C2	Dryer I 3A2	0.14	0.62					0.004	0.011				
2D	Dryer I 1B	2.97	13.0						0.001				
2E	Dryer I 2B	0.29	1.27						0.001				
2F	Dryer I 3B1	0.14	0.62					0.004	0.011				
2F2	Dryer I 3B2	0.14	0.62					0.004	0.011				
3A	Coagulation Vent 1A	0.86	3.78										
3B	Coagulation Vent 1B	0.86	3.78										
5	Acetic Acid Scrubber I	0.10	0.45										
6A	Chip Wash Vent 1A		<0.01										
6B	Chip Wash Vent 1B		<0.01										
7	Cooling Tower I		<0.01										

(1) Emission point identification - either specific equipment designation or emission point number from plot plan.

(2) Specific point source name. For fugitive sources use area name or fugitive source name.

(3) Volatile organic compounds as defined in General Rules 101.1.

(4) Total oxides of nitrogen.

(5) Sulfur dioxide.

(6) Particulate matter.

(7) Other contaminants. Carbon monoxide

(8) Fugitive emissions are an estimate only and should not be considered as a maximum allowable emission limit.

\* Emission rates are based on the following operating schedule:  
Hrs/day \_\_\_\_\_ Days/week \_\_\_\_\_ Weeks/year \_\_\_\_\_ or Hrs/year 8760

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

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R-9576

Revised 2/22/89

This table lists all sources of air contaminants on applicant's property emitted by the facility covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

AIR CONTAMINANT DATA													
EMISSION POINT ID (1)	SOURCE NAME (2)	EMISSION RATES*											
		VOC (3)		NOX (4)		SO2 (5)		PART (6)		CO (7)		(7)	
		#/HR	1/Y	#/HR	1/Y	#/HR	1/Y	#/HR	1/Y	#/HR	1/Y	#/HR	1/Y
8	Wastewater Pool 1	0.64	2.80										
9	Boiler	0.25	1.08	12.35	54.08	0.05	0.23	0.441	1.932	3.09	13.52		
F10	Fugitives - Phase I (8)	9.70	42.48										
22A-H	8 Chip Silos							0.096	0.024				
23	5 Pelletizing Silos							0.013	0.06				
24	2 Packaging Silos							0.002	0.01				
25A	Dryer 11A - 12A							0.001	0.006				
25B1	Dryer 12A - 12A							0.001	0.003				
25B2	Dryer 12A - 13A2							0.001	0.003				
25C	Dryer 11B - 12B							0.001	0.006				
25D1	Dryer 12B - 13B1							0.001	0.003				
25D2	Dryer 12B - 13B2							0.001	0.003				
26	Dust Collection Vent 1								<0.01				
27	Extruder Hopper 1							0.002	0.023				
28	Pelletizing Dryer 1							0.002	0.008				

- (1) Emission point identification - either specific equipment designation or emission point number from plot plan.
- (2) Specific point source name. For fugitive sources use area name or fugitive source name.
- (3) Volatile organic compounds as defined in General Rules 101.1.
- (4) Total oxides of nitrogen.
- (5) Sulfur dioxide.
- (6) Particulate matter.
- (7) Other contaminants. Carbon monoxide.
- (8) Fugitive emissions are an estimate only and should not be considered as a maximum allowable emission limit.

\* Emission rates are based on the following operating schedule:  
 Hrs/day \_\_\_\_\_ Days/week \_\_\_\_\_ Weeks/year \_\_\_\_\_ or Hrs/year 8760

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

9/86

R-9576

Revised 2/22/89

This table lists all sources of air contaminants on applicant's property emitted by the facility covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

AIR CONTAMINANT DATA

EMISSION POINT ID (1)	SOURCE NAME (2)	EMISSION RATES*											
		VOC (3)		NOX (4)		SO2 (5)		PART (6)		CO (7)		(7)	
		#/HR	T/Y	#/HR	T/Y	#/HR	T/Y	#/HR	T/Y	#/HR	T/Y	#/HR	T/Y
29	Pellet Dryer I							0.003	0.012				
	Phase II												
51	Flare	2.4	10.7	0.4	1.5	<0.01		0.01	0.05	0.08	0.4		
52A	Dryer II-1A	3.1	13.6						<0.01				
52B	Dryer II-2	0.3	1.3						<0.01				
52C	Dryer II-3A	0.3	1.3					<0.01	0.02				
52D	Dryer II-1B	3.1	13.6						<0.01				
52E	Dryer II-2B	0.3	1.3						<0.01				
52F	Dryer II-3B	0.3	1.3						<0.01				
53A	Coagulation Vent II-A	0.9	3.9					<0.01	0.02				
53B	Coagulation Vent II-B	0.9	3.9										
55	Acetic Acid Scrubber II	0.1	0.5										
56A	Chip Wash Vent II-A		<0.01										
56B	Chip Wash Vent II-B		<0.01										

- (1) Emission point identification - either specific equipment designation or emission point number from plot plan.
- (2) Specific point source name. For fugitive sources use area name or fugitive source name.
- (3) Volatile organic compounds as defined in General Rules 101.1.
- (4) Total oxides of nitrogen.
- (5) Sulfur dioxide.
- (6) Particulate matter.
- (7) Other contaminants. Carbon monoxide.
- (8) Fugitive emissions are an estimate only and should not be considered as a maximum allowable emission limit.

\* Emission rates are based on the following operating schedule:  
 Hrs/day \_\_\_\_\_ Days/week \_\_\_\_\_ Weeks/year \_\_\_\_\_ or Hrs/year 8760

7/3/89

## EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

9/86

R-9576

Revised 2/22/89

This table lists all sources of air contaminants on applicant's property emitted by the facility covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

AIR CONTAMINANT DATA													
EMISSION POINT ID (1)	SOURCE NAME (2)	EMISSION RATES*											
		VOC (3)		NOX (4)		SO2 (5)		PART (6)		(7)		(7)	
		#/HR	T/Y	#/HR	T/Y	#/HR	T/Y	#/HR	T/Y	#/HR	T/Y	#/HR	T/Y
57	Cooling Tower		<0.01										
58	Wastewater Pit		<0.01										
F60	Fugitives (8)		46										
72A-H	Chip Silos								0.03				
73	5 Pelletizing Silos								0.02	0.07			
74	2 Packing Silos									<0.01			
75A-D	4 Dryer Pneumatic Filters								0.005	0.02			
76	Dust Collector Vent II									<0.01			
77	Extruder Hopper								0.005	0.02			
78	Pelletizing Dryer II									<0.01			
79	Pelletizing Dryer Hopper II								0.003	0.01			

(1) Emission point identification - either specific equipment designation or emission point number from plot plan.

(2) Specific point source name. For fugitive sources use area name or fugitive source name.

(3) Volatile organic compounds as defined in General Rules 101.1.

(4) Total oxides of nitrogen.

(5) Sulfur dioxide.

(6) Particulate matter.

(7) Other contaminants.

(8) Fugitive emissions are an estimate only and should not be considered as a maximum allowable emission limit.

\* Emission rates are based on the following operating schedule:  
Hrs/day \_\_\_\_\_ Days/week \_\_\_\_\_ Weeks/year \_\_\_\_\_ or Hrs/year 8760

**APPENDIX VIII-C**

**Multilayer, Multimaterial Polypropylene Containers**

**EVALCA**

**Recycling Multilayer,  
Multimaterial  
Polypropylene  
Containers**

*Properties, Processability  
and Potential Markets*  
**Study Phases 1, 2 and 3**



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## Introduction

Recently, the "recyclability" of disposable plastic products has become a major concern of consumer packaged goods producers, distributors and the buying public. It is also a concern of manufacturers of packaging materials and plastic resin suppliers.

Steady increases in the amount of solid waste "thrown away" in the United States coupled with a decline the number of landfills available in which to bury it have led to a crisis in the handling of municipal solid waste. Once a relatively small portion of local taxes covered the cost of the removal of trash from residences; now that proportion has grown significantly.

While plastics of all types comprise only seven percent by weight (18% by volume) of the solid waste sent to landfills, plastics have been blamed for a disproportionate share of the solid waste problem. Many people believe erroneously that wastes other than plastics, such as paper, yard waste and food wastes, degrade efficiently in landfills, and therefore, have less impact on the solid waste issue.

The truth is that landfills are not conducive

to the biodegradation process for any material. Landfill excavations have unearthed 10-year old, still readable newspapers, for example. In fact, more than 60% of the weight of trash dumped in the average landfill is paper and yard waste. These materials also account for an estimated 45% of landfilled solid waste by volume.

To reduce the need for landfill space, EVALCA recommends three approaches, depending upon the waste being disposed of. First, recycle as much glass, metal, plastic and paper as possible; the first three have the highest scrap value of the waste stream. Preferably, recyclables should be collected as part of the regular curbside municipal waste disposal system. Where feasible, backyard composting of household yard and kitchen waste should be encouraged.

Second, EVALCA then recommends incineration of waste that cannot be recycled and recovery of the heat energy thus produced. Finally, anything remaining that cannot be disposed of by other means should be landfilled.

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## Recycling Plastics

The components of landfills and their proportions are only part of the issue of the recyclability of plastics, however. Unfortunately, misinformation has arisen from questions concerning which plastics can be recycled. Currently, used milk, water and juice jugs made from high density polyethylene and one- and two-liter soda pop bottles produced from PET (polyethylene terephthalate) are being recycled and used for carpet backing, fiberfill, strapping (PET) and less critical applications, such as plastic "lumber." Some recycled HDPE material is also being made again into bottles, this time to hold products other than foods.

The answer gets a little less certain when the bottles being recycled were originally used for household detergents and chemicals, such as bleach. It gets

completely confusing when the original plastic containers were coextruded, i.e., made of several layers of different materials.

While some public statements have been made to the contrary, EVAL Company of America has found that plastics used in multilayer containers, when reclaimed using existing technology, have properties similar to, and in some cases, higher than, those of the predominant material.

EVALCA bases this claim on extensive studies, some of which will be described in the following pages. Other companies and plastics trade associations have also conducted similar studies with similar results. The recyclability of multilayer, multimaterial, plastic containers is a fact.

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## Recyclability Studies

EVAL Company of America's program shows the feasibility of recycling multilayer, multimaterial packages by comparing the physical property data of a variety of recycled multilayer, multimaterial

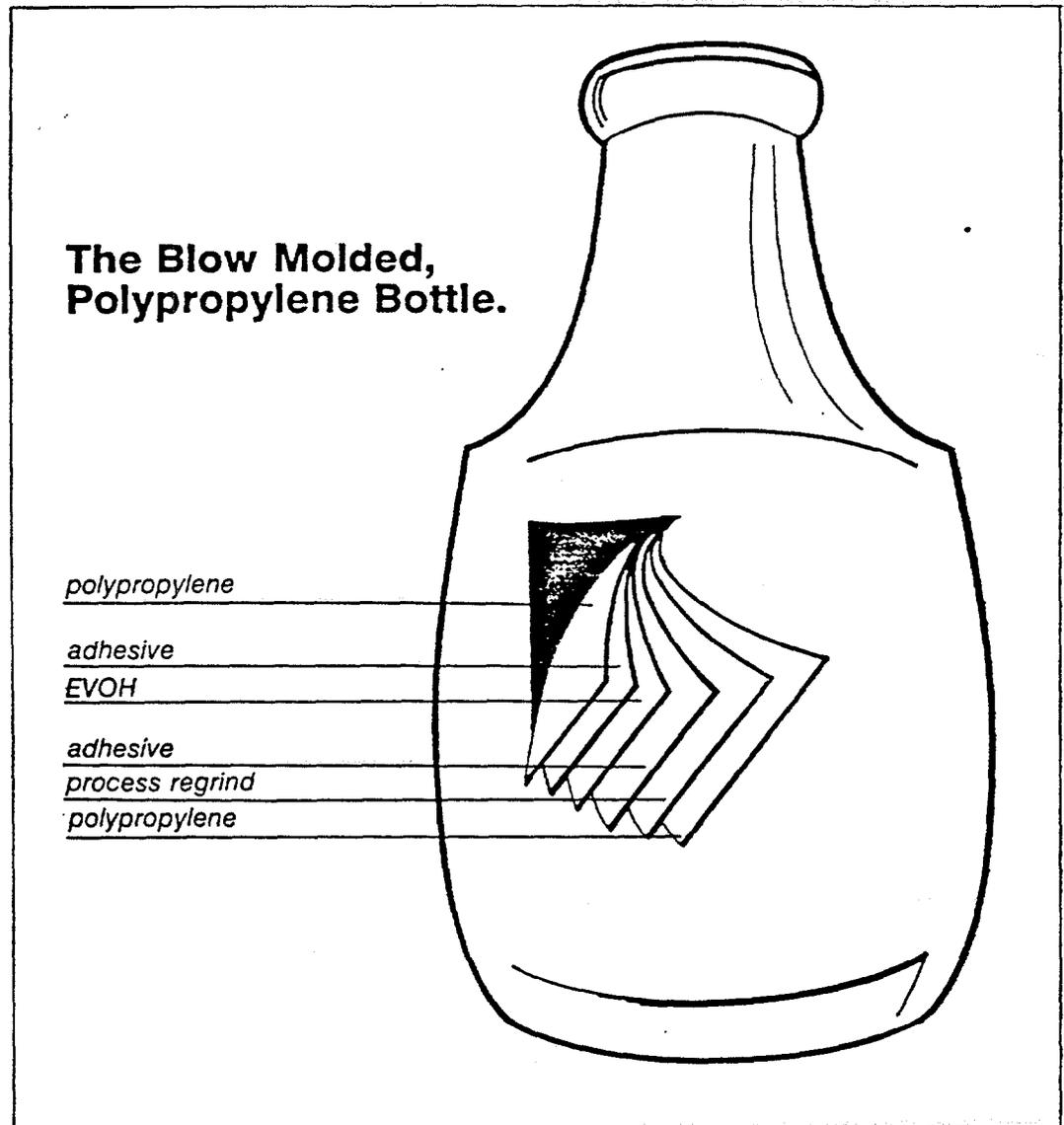
packaging structures to those of monolayer packaging and virgin resin. In these studies, the primary structural layers are made from polypropylene, as is the virgin resin to which they are compared.

## Overall Results

The results of these studies show that multilayer, multimaterial containers can be recycled using current processes. The results also show that the physical properties of the multilayer regrind are very similar to that of monolayer regrind. In other words, the multilayer regrind properties are very close to those of their primary ingredient, the structural layer; in this case, polypropylene.

This data indicates that multimaterial containers could either be used in a commingled recyclable stream or separated according to their primary component and used for higher value-added markets.

Recently, the Plastic Bottle Institute (PBI), a division of The Society of the Plastics Industry, Inc. (SPI), has completed a study concerning the recyclability of post-consumer multilayer ketchup bottles made primarily from polypropylene. The results of their study parallel those of EVALCA's, and has led PBI to suggest "... that existing laws be changed or interpreted to permit the use of the Society of the Plastics Industry, Inc. code '5-PP' for polypropylene multilayer containers, in order to enhance recycling at their highest value."



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## **EVALCA Study Procedures**

*In the EVALCA study, the properties comparisons were made on the following materials:*

### **Phase 1**

#### **Multilayer Sheet**

containing 5% by weight EVOH (EVAL® E 105 ethylene vinyl alcohol barrier resin, 5 MI, 44% ethylene incorporated) and 4 wt.% adhesive, fabricated similarly to hot fill bottles, ground up and injection molded into test plaques

Three different sheets were fabricated, each containing 5% EVOH, but having different structural layers made from Quantum Chemical Corporation polypropylene resins, as follows;

- Petrothene® PP 8000-GK polypropylene homopolymer
- Petrothene® PP 7200-AF polypropylene random copolymer
- Petrothene® PP 8404-ZJ polypropylene impact copolymer

#### **Multilayer Sheet**

containing 30% by weight EVOH (EVAL® E 105) and 10 wt.% adhesive, fabricated similarly to single-serve retort bowls and processed as sheet above

#### **Monolayer Sheet**

containing no EVOH, but fabricated and processed as sheet above

Virgin polypropylene injection molded into test plaques

This phase of the study can be subdivided for ease of organization as follows:

- 1A—Homopolymer PP resin and sheet structural layers
- 1B—Random copolymer PP resin and sheet structural layers
- 1C—Impact copolymer PP resin and sheet structural layers

### **Phase 2**

**Multilayer Retort Container** (commercially available, No. 307), containing 37% virgin impact copolymer polypropylene  
44% process regrind (polypropylene)  
4% tie-layer resin  
15% EVAL® E 105 barrier resin

In this phase of the study, properties of 100% multilayer retort container regrind, ground and injection molded into plaques, were compared to properties of process streams containing:

- 3% multilayer regrind and 97% monolayer regrind
- 5% multilayer regrind and 95% monolayer regrind
- 10% multilayer regrind and 90% monolayer regrind
- 100% monolayer regrind
- virgin polypropylene

Combs and bookshelves were also molded from 100% multilayer materials

### **Phase 3**

**Ketchup bottle process scrap** (commercial multilayer bottles used to package Del Monte, Hunts and Heinz Ketchup).

The combined scrap contained:

- 58% virgin random copolymer polypropylene
- 32% process regrind
- 5% EVOH
- 5% tie-layer resin

In this phase of the study, properties of 100% ketchup bottle regrind were compared to properties of process streams containing:

- 5% multilayer regrind and 95% monolayer regrind
- 10% multilayer regrind and 90% monolayer regrind
- 20% multilayer regrind and 80% monolayer regrind
- virgin polypropylene

Combs and 16 oz. Boston Round bottles were also produced from 100% multilayer material. The properties of the bottles were compared to bottles produced from virgin polypropylene.

## **EVALCA Study Results**

The tensile strength (ASTM D 638); flexural modulus (ASTM D 790), Izod impact strength (ASTM D 256) and heat deflection temperature (ASTM D 648) of the plaques made from various materials

were measured, along with processability via spiral flow studies. In addition, blow molded bottle properties were determined from test bottles made in Phase 3. See the Appendix for tables of test results.

## Tensile Strength

Figures 1 and 2 and Table 1 (Appendix) provide data on the range of tensile strengths, both at yield and at break, obtained on plaques formed from the multilayer sheet regrind fabricated from the three polypropylene grades in Phase 1 and from the retort bowl and ketchup bottle scrap regrinds of Phases 2 and 3.

Multilayer (5% EVOH) regrind tensile strength at yield was only 1.2% less than that of virgin homopolymer PP; at break, the EVOH-containing plaque was 4.3% more. The plaque containing 30% EVOH had significantly higher tensile strength, measuring 18% more psi at yield and 27% more at break.

This pattern was repeated when a PP random copolymer was used as the structural layer. The multilayer (5% EVOH) regrind tensile strength at yield was 6% higher than that of virgin PP. The variation at break was greater: about 12.5%. The plaque containing 30% EVOH exhibited significantly greater tensile strengths than virgin PP: 26% higher at yield and 82% higher at break.

With an impact copolymer PP grade as the structural layer, there was little change in the overall pattern. While the actual numbers were of course different than with the other PP grades, the tensile strength of the multilayer (5% EVOH) plaques was slightly higher than that of virgin PP; the tensile strength of the 30% EVOH-containing multilayer plaques was consistently greater than that of virgin PP.

In the Phase 2 and 3 studies incorporating commercially available multilayer

containers, the tensile strengths of the regrind streams composed of 10% multilayer and 90% monolayer materials closely approximated the tensile strength of virgin PP, varying only 2-2.5% away from the PP pellets' measurement at yield.

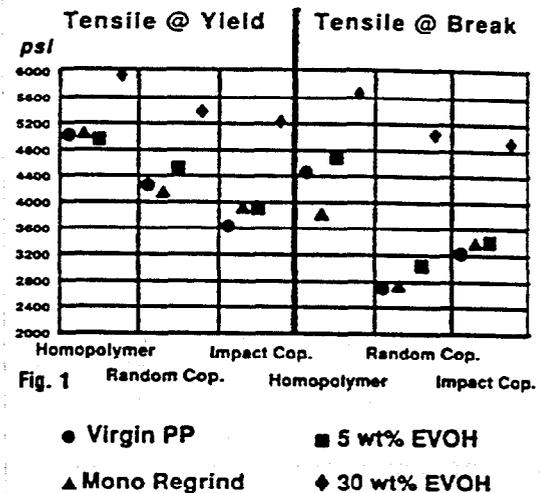


Fig. 1

● Virgin PP      ■ 5 wt% EVOH  
▲ Mono Regrind      ◆ 30 wt% EVOH

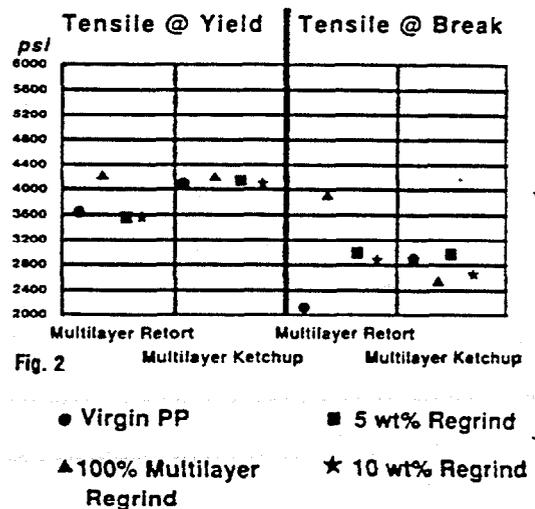


Fig. 2

● Virgin PP      ■ 5 wt% Regrind  
▲ 100% Multilayer Regrind      ★ 10 wt% Regrind

## Flexural Modulus

Flexural modulus, a measurement of the stiffness of a plastic, also varied little between multilayer plaque regrind containing 5% EVOH and virgin PP. Multilayer homopolymer regrind with 5% EVOH had 1% and 2% flexural modulus measurements 1% and 0.8% higher than virgin PP, respectively. The regrind containing 30% EVOH was, as expected, much stiffer, with measurements 25% and 20% greater than virgin PP, respectively (Figures 3 and 4, Appendix Table 2).

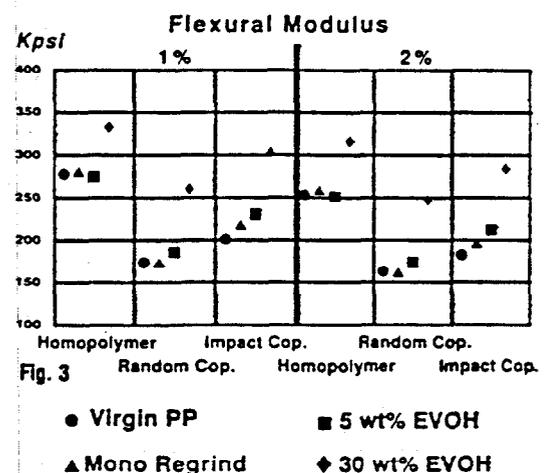
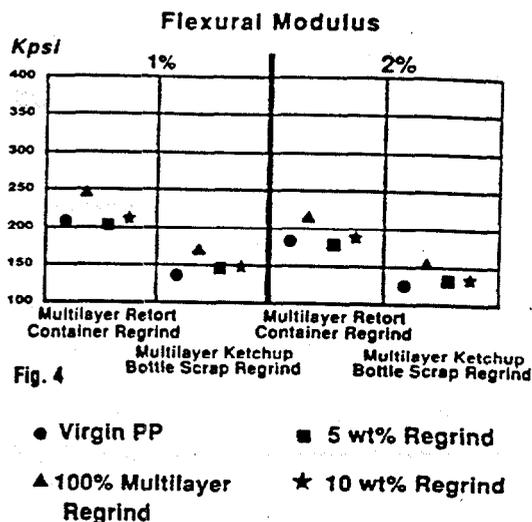


Fig. 3

● Virgin PP      ■ 5 wt% EVOH  
▲ Mono Regrind      ◆ 30 wt% EVOH

## Flexural Modulus (cont.)

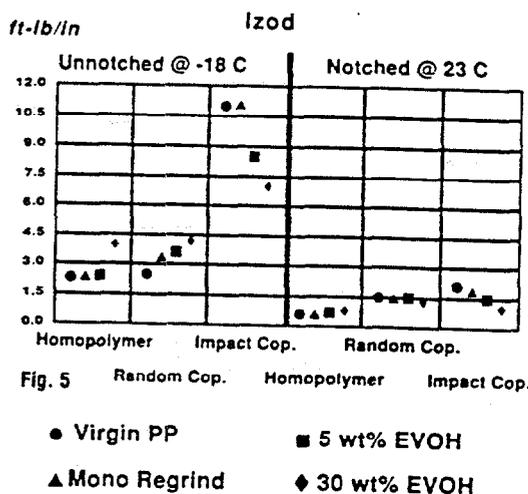
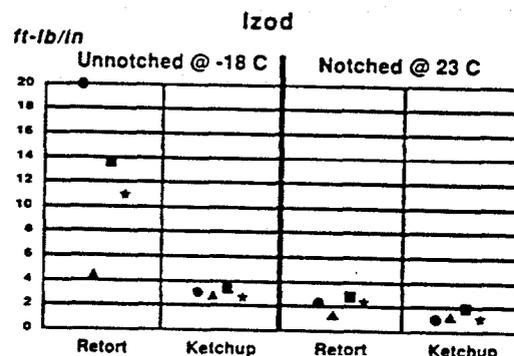


Random copolymer regrinds containing 5% EVOH had 1% and 2% flexural modulus levels about 7% higher than virgin PP, while regrinds with 30% EVOH were approximately 50% stiffer. Impact copolymer regrinds with 5% EVOH had flexural modulus measurements 16% and 14% higher than virgin impact copolymer PP resins. Re-grinds with 30% EVOH were 55% and 50% higher, respectively.

When the flexural modulus test was performed on commercial multilayer retort container regrind, which incorporated 15% EVOH, measurements of the 10% multilayer/90% monolayer stream were slightly more than 3% higher than virgin PP. Reground ketchup bottle multilayer scrap containing 5% EVOH had flexural modulus readings about 8.5% higher than that of virgin PP.

## Izod and Gardner Impact Strength

Notched Izod impact strength, measured in ft-lb/in. at 23°C, varied little between homopolymer multilayer regrind plaques containing 5% EVOH and virgin homopolymer PP. The same pattern was true for random copolymer samples. However, impact copolymer multilayer regrind with 5% EVOH showed a 28% decline in Notched Izod impact strength. The multilayer regrind containing 30% EVOH showed a small increase in Notched Izod over virgin PP with the homopolymer, similar levels with the random copolymer and a 52% decrease with the impact copolymer (Figures 5 and 6, Appendix Table 3).



Unnotched Izod impact strength, measured at -18°C, varied little between multilayer homopolymer regrind containing 5% EVOH as virgin homopolymer PP. However, the random copolymer multilayer regrind showed a 44% increase in Unnotched Izod over that of virgin random copolymer PP, from 2.5 to 3.6 ft-lb/in. The measurement with the impact copolymer was however, 23 percent less than that of virgin impact copolymer PP. The regrinds containing 30% EVOH were 74% higher, 68% higher and 45% lower in Unnotched Izod levels than virgin homopolymer, random copolymer and impact copolymer PP, respectively.

## Izod and Gardner Impact Strength (Cont.)

When Izod levels for multilayer retort container regrind were measured, a similar pattern emerged. Notched Izod measurements for the 10% multilayer/90% monolayer regrind stream closely approximated that of virgin PP. Multilayer ketchup bottle scrap in the same proportion exhibited a 12% increase in Notched Izod. Unnotched Izod levels decreased 45% when the 10% multilayer retort container stream was compared to virgin PP; levels decreased 13% when the resin was compared to the 10% multilayer ketchup bottle regrind.

Gardner impact strength tests were also run on the multilayer ketchup bottle regrind. At 23°C, the Gardner impact level for virgin PP and the monolayer/multilayer combination regrind streams was the same; the 100% multilayer regrind stream showed a 13% drop. At -18°C, the Gardner impact strengths of the 10%, 20% and 100% multilayer regrind streams were twice as high as those of virgin PP and the 5% multilayer stream (Appendix Table 4).

## Heat Deflection

Heat deflection measures the temperature at which a material "deflects" or bends under a specified load. The addition of 5% EVOH to the regrind increased the polypropylene's resistance to deflection 9% in the case of the homopolymer PP and 27% in the case of the random copolymer. No significant change was seen with the impact copolymer. Similar results (+6%, +20%, +3%, respectively) were also found with the 30% EVOH-containing regrind, when compared to virgin PP (Figure 7, Appendix Table 5).

Regrind retort containers with 15% EVOH also exhibited heat deflections very close to that of virgin PP. Minimal differences resulted across all the proportions of monolayer and multilayer regrind streams when compared to virgin PP (Figure 8)

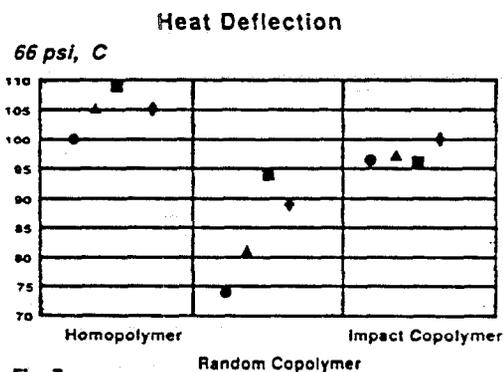


Fig. 7

- Virgin PP
- ▲ Mono ReGrind
- 5 wt% EVOH
- ◆ 30 wt% EVOH

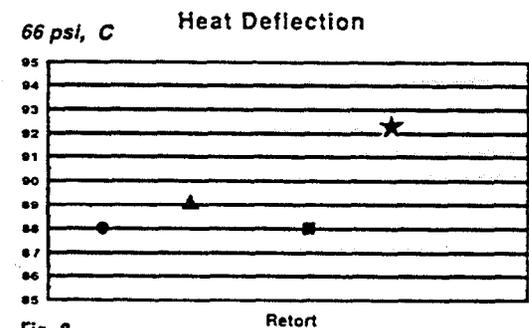


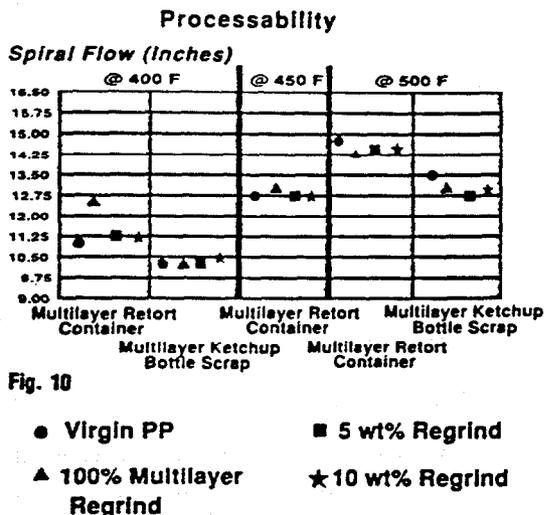
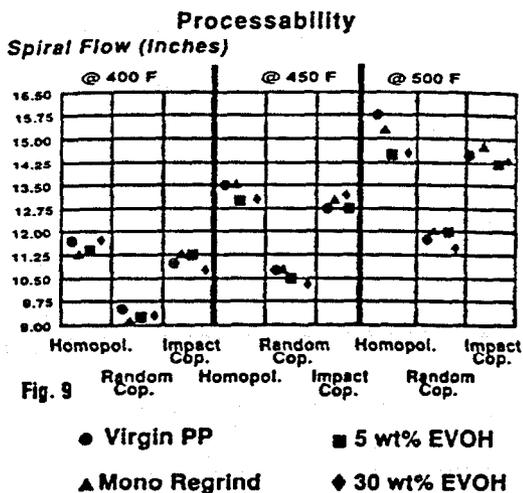
Fig. 8

- Virgin PP
- ▲ 100% Multilayer ReGrind
- 5 wt% ReGrind
- ★ 10 wt% ReGrind

## Processability

Spiral flow studies were performed at 400°F, 450°F and 500°F on virgin PP and monolayer and multilayer regrind plaques containing homopolymer, random copolymer and impact copolymer PP, as well as on multilayer retort container and multilayer ketchup bottle scrap regrind.

In all cases, the variation was negligible, indicating that the addition of EVOH to a polypropylene container should not affect the processability of recycled material significantly (Figures 9 and 10, Appendix Table 6).



**Blow Molded Bottle Properties**

The multilayer ketchup bottle scrap regrind was also blown into 16-oz. Boston Round bottles and subjected to top load strength and environmental stress crack resistance tests. The ketchup bottle regrind exhibited approximately 35% greater top load strength (column crush) than Boston

Round bottles blown from virgin PP. Top load ESCR in the ketchup bottle regrind was more than twice that of the virgin PP. It was also found that the addition of 4% of GF-20, a thermal stabilizer, improved the surface appearance of the reground multilayer bottle (Appendix Table 7).

**Conclusions**

The regrind control plaques fabricated in the laboratory from known quantities and materials and the regrinds made from commercially available retort container and ketchup bottle scrap have properties similar to those of virgin polypropylene. In some cases, the addition of large amounts of EVOH—30% by weight—significantly increased measurements of tensile strength and flexural modulus.

This study adds to the growing body of evidence supporting the inclusion of multilayer containers in the same recycling stream as the predominant structural layer,

instead of relegating them to the low value catch-all of "mixed plastics." In other words, a multilayer container with layers of EVOH bound to structural layers of polypropylene could be recycled along with monolayer polypropylene containers and yield ground materials with essentially the same properties as the recycled monolayer containers alone. EVOH-containing structures then could be recycled along with higher value-added plastics, enhancing their recyclability and adding to their already proven efficiency, economy and convenience as food packaging in their "first life."

**Some Markets for Recycled Plastics**

More than 60 billion lbs of plastic are sold in the United States annually. The largest proportion are thermoplastics—such as polyethylene and polypropylene—which can be recycled relatively easily. The reuse of these resins reduces raw material costs to manufacturers and plastics' contribution to the solid waste stream.

Today, substantial markets exist for recycled polyethylene terephthalate (PET) and high density polyethylene (HDPE) resins. These include:

- |                  |                      |
|------------------|----------------------|
| Geotextiles      | Fiberfill            |
| Carpet face yarn | Industrial strapping |
| Carpet backing   | Non-food containers  |
| Drums/pails      | Trash cans           |

Post consumer plastic waste is collected as a mixture of many types of plastics. Although it is possible to separate high volume plastics such as soda bottles (PET) or milk bottles (HDPE), currently in many places, other plastic components fall into what is called "mixed plastics recycling." High volume products that could be manufactured from mixed materials include:

## **Some Markets for Recycled Plastics (cont)**

**Waterfront and water erosion control materials**, made from commingled plastics material impervious to marine corrosion. Barnacles and other marine life are not attracted to them and they will not damage boats.

**Road markers, carstops, traffic bollards and silent policemen**, molded products resistant to gas, oil, salt, sunlight, chemicals and insects and able to withstand a great deal of abuse.

**Landscape timbers**, which could consume 500 million pounds of recycled mixed plastic waste, instead of the approximately 12 million wooden landscape timbers used annually in the U.S. Molded timbers will not rot or corrode. They do not contain materials that will leach into the ground after exposure to the environment. These timbers will last a long

time and reduce maintenance costs in homes, parks, golf courses and other outside areas where timbers are used for landscaping or erosion control.

**Park and Playground Equipment**, molded products shaped and manufactured into a wide variety of applications for outdoor use. They are splinter-free and long wearing.

**Pallets**, for materials handling; currently, 300 million wooden pallets are used annually. If one percent of them were made from recycled plastic, 370 million pounds of recycled mixed plastic waste would be consumed. Plastic pallets are long wearing and splinter-free.

Other potential markets exist in agriculture, industry, marine engineering, recreation and civil engineering.

## **Plans for Future Study**

EVALCA continues to research the properties of recycled EVOH-containing plastics. This report covers the following phases of the overall study:

**Phase 1:** Investigation of the properties of regrind from typical structures used for retortable containers and hot-fill bottles.

**Phase 2:** Evaluation of the regrind produced from a commercially available multilayer retort container.

**Phase 3:** Evaluation of the properties of typical multilayer ketchup bottle process scrap.

Currently in process are the following:

**Phase 4:** Evaluation of the properties of/ and fabrication of products from post-consumer multilayer ketchup bottles.

**Phase 5:** Evaluation of the properties of/ and fabrication of products from post-consumer multilayer retort containers

**Phase 6:** Investigation of the properties of blends of HDPE monolayer bottle regrind and PP multilayer bottle regrind

Future phases of the study will look into the following:

**Phase 7:** Investigation of the properties of post-consumer HDPE multilayer juice bottles.

**Phase 8:** Investigation of the properties of various other multilayer packages, such as LDPE/EVOH, PS/EVOH and LLDPE/EVOH

For further information about the use of mixed plastic products contact:

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## Appendix

Table 1: Tensile Strengths of Polypropylene Resin and Monolayer and Multilayer Structures

Phase of Study	Structure	Tensile Strength @ Yield, psi	Tensile Strength @ Break, psi
1A Homopolymer	Virgin PP	5,020	4,460
	Monolayer regrind	5,030	3,800
	5 wt.% Multilayer regrind	4,960	4,680
	30 wt.% Multilayer regrind	5,940	5,670
1B Random Copolymer	Virgin PP	4,260	2,780
	Monolayer regrind	4,130	2,720
	5 wt.% Multilayer regrind	4,530	3,130
	30 wt.% Multilayer regrind	5,380	5,050
1C Impact Copolymer	Virgin PP	3,630	3,230
	Monolayer regrind	3,900	3,360
	5 wt.% Multilayer regrind	3,910	3,400
	30 wt.% Multilayer regrind	5,230	4,920
2 Multilayer Retort Container Regrind	Virgin PP	3,640	2,120
	100% Monolayer regrind	3,590	2,540
	100% Multilayer regrind	4,210	3,900
	97% Mono/3% Multi	3,570	3,050
	95% Mono/5% Multi	3,560	2,990
	90% Mono/10% Multi	3,570	2,840
3 Multilayer Ketchup Bottle Scrap Regrind	Virgin PP	4,020	2,900
	100% Multilayer regrind	4,330	2,520
	95% Mono/5% Multi	4,190	2,990
	90% Mono/10% Multi	4,120	2,710
	80% Mono/20% Multi	4,190	2,720

## Appendix

Table 2: Flexural Modulus of Polypropylene Resin and Monolayer and Multilayer Structures

Phase of Study	Structure	Flexural Modulus 1% Kpsi	Flexural Modulus 2% Kpsi
1A Homopolymer	Virgin PP	278	253
	Monolayer regrind	279	257
	5 wt.% Multilayer regrind	275	251
	30 wt.% Multilayer regrind	333	316
1B Random Copolymer	Virgin PP	174	163
	Monolayer regrind	172	160
	5 wt.% Multilayer regrind	186	174
	30 wt.% Multilayer regrind	260	247
1C Impact Copolymer	Virgin PP	201	183
	Monolayer regrind	216	195
	5 wt.% Multilayer regrind	230	212
	30 wt.% Multilayer regrind	303	284
2 Multilayer Retort Container Regrind	Virgin PP	208	183
	100% Monolayer regrind	206	181
	100% Multilayer regrind	249	229
	97% Mono/3% Multi	209	184
	95% Mono/5% Multi	203	179
	90% Mono/10% Multi	213	189
Multilayer Ketchup Bottle Scrap Regrind	Virgin PP	137	126
	100% Multilayer regrind	169	153
	95% Mono/5% Multi	146	133
	90% Mono/10% Multi	149	135
	80% Mono/20% Multi	154	139

Table 3: Izod Impact Strength of Polypropylene Resin and Monolayer and Multilayer Structures

Phase of Study	Structure	Unnotched Izod @-18°C, ft-lb/in.	Notched Izod @ 23°C, ft-lb/in.
1A Homopolymer	Virgin PP	2.3	0.6
	Monolayer regrind	2.3	0.5
	5 wt.% Multilayer regrind	2.4	0.7
	30 wt.% Multilayer regrind	4.0	0.8

## Appendix

Table 3 Continued: Izod Impact Strength of Polypropylene Resin and Monolayer and Multilayer Structures

1B Random Copolymer	Virgin PP	2.5	1.5
	Monolayer regrind	3.3	1.4
	5 wt.% Multilayer regrind	3.6	1.5
	30 wt.% Multilayer regrind	4.2	1.3
1C Impact Copolymer	Virgin PP	11	2.1
	Monolayer regrind	11	1.8
	5 wt.% Multilayer regrind	8.5	1.5
	30 wt.% Multilayer regrind	7.0	1.0
2 Multilayer Retort Container Regrind	Virgin PP	20	2.3
	Monolayer regrind	19	2.2
	100% Multilayer regrind	4.2	1.2
	97% Mono/3% Multi	15	2.3
	95% Mono/5% Multi	13	2.3
	90% Mono/10% Multi	11	2.4
3 Multilayer Ketchup Bottle Scrap Regrind	Virgin PP	3.1	0.98
	Multilayer regrind	2.7	1.1
	95% Mono/5% Multi	3.0	1.3
	90% Mono/10% Multi	2.7	1.1
	80% Mono/20% Multi	2.4	1.1

Table 4: Gardner Impact Strength of Polypropylene Resin and Regrinds of Monolayer and Multilayer Structures

Phase of Study	Structure	Gardner Impact Strength, ft-lb/in.	
		@ 23°C	@ -18C
	Virgin PP	180	2.0
	100% Multilayer regrind	157	4.0
	95% Mono/5% Multi	180	2.0
	90% Mono/10% Multi	180	4.3
	80% Mono/20% Multi	180	4.0

Table 5: Heat Deflection of Polypropylene Resins and Regrinds of Monolayer and Multilayer Structures

Phase of Study	Structure	Heat Deflection @ 66 psi, °C		
		Homopolymer	Random Copolymer	Impact Copolymer
1	Virgin PP	100	74	97
	Monolayer regrind	105	81	97
	5 wt.% Multilayer regrind	109	94	96
	30 wt.% Multilayer regrind	105	89	100
2	Virgin PP		88	
	100% Monolayer regrind		86	
	100% Multilayer regrind		89	
	97% Mono/3% Multi		88	
	95% Mono/5% Multi		88	
	90% Mono/10% Multi		92	

## Appendix

Table 6: Processability of Polypropylene Resin and Regrinds of Monolayer and Multilayer Structures

Phase of Study	Structure	Spiral Flow, inches		
		@ 400°F	@ 450°F	@ 500°F
1A Homopolymer	Virgin PP	11.7	13.5	15.75
	Monolayer regrind	11.25	13.5	15.25
	5 wt.% Multilayer regrind	11.5	13.0	14.5
	30 wt.% Multilayer regrind	11.5	13.0	14.5
1B Random Copolymer	Virgin PP	9.5	10.75	11.75
	Monolayer regrind	9.1	10.75	12.0
	5 wt.% Multilayer regrind	9.25	10.5	12.0
	30 wt.% Multilayer regrind	9.25	10.25	11.25
1C Impact Copolymer	Virgin PP	10.98	12.75	14.5
	Monolayer regrind	11.25	13.0	14.75
	5 wt.% Multilayer regrind	11.25	12.75	14.2
	30 wt.% Multilayer regrind	10.7	12.9	14.25
2 Multilayer Retort Container Regrind	Virgin PP	11.0	12.75	14.75
	Monolayer regrind	11.25	13.0	14.5
	100% Multilayer regrind	12.5	13.0	14.25
	97% Mono/3% Multi	11.25	13.0	14.5
	95% Mono/5% Multi	11.25	12.75	14.5
	90% Mono/10% Multi	11.25	12.75	14.5
3 Multilayer Ketchup Bottle Scrap Regrind	Virgin PP	10.25		13.5
	100% Multilayer regrind	10.25		13.0
	95% Mono/5% Multi	10.25		12.75
	90% Mono/10% Multi	10.5		13.0
	80% Mono/20% Multi	10.5		13.0

Table 7: Blow Molded Bottle Properties of Multilayer Ketchup Bottle Regrind (bottle weights 24.5-25 g)

Phase of Study	Structure	Column Crush	Top Load ESCR	
		lbs	Hrs	#Failures
	Virgin PP	46.2	130	6
	100% Multilayer regrind	62.1	300	4
	100% Multilayer regrind + 4% GF-20	56.7	290	2

**APPENDIX VIII-D**

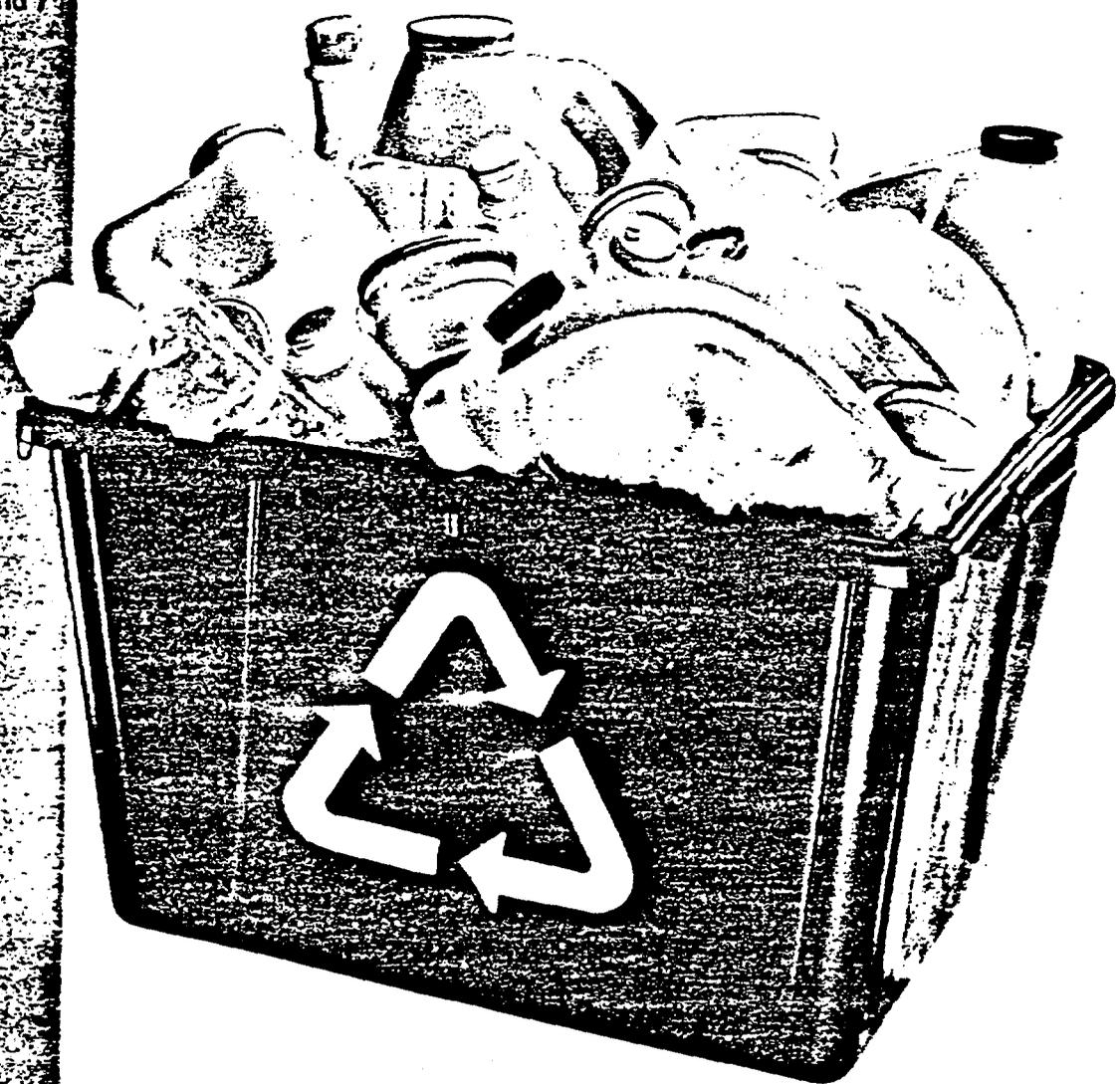
**Recycling Multilayer, Multimaterial Thermoplastic Containers,**

**"Properties Comparisons, Study Phases 4, 5, 6 and 7."**

**EVALGA**

**Recycling Multilayer,  
Multimaterial  
Thermoplastic  
Containers**

**Properties Comparisons  
Study Phases 4, 5, 6 and 7**



000951

# EVALCA

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000952

## Introduction

This publication is the second in a series by EVALCA,\* reporting the results of ongoing studies on the recyclability of multilayer plastic containers with an ethylene vinyl alcohol (EVOH) gas barrier layer. The first three phases of the studies were described in **Recycling Multilayer, Multimaterial Polypropylene Containers - Phases 1, 2, and 3.\*\***

These EVALCA studies add to the growing body of evidence — from the Plastics Bottle Institute of the Society for

the Plastics Industry and elsewhere — supporting the inclusion of multilayer containers in the same recycling stream as the predominant structural layer.

EVALCA has continued its investigation into the properties of recycled multilayer containers. In this report, the effects of including polypropylene, high density polyethylene and polystyrene-based multilayer containers in the recycling streams of virgin resins and post-consumer resins (PCR) are reviewed.

## Common Abbreviations Used in this Study

ASTM - American Society for Testing and Materials (standard testing methods)  
ESCR - Environmental Stress Crack Resistance  
EVALCA - EVAL Company of America  
EVOH - Ethylene Vinyl Alcohol Barrier Resins  
HDPE - High Density Polyethylene  
LDPE - Low Density Polyethylene

LLDPE - Linear Low Density Polyethylene  
KBR - Ketchup Bottle Process Re grind  
PCR - Post Consumer Resin (recycled plastic)  
PP - Polypropylene  
PS - Polystyrene  
STP - Standard Test Procedures (Quantum-developed testing methods)

## Evalca Study Procedures

The tensile strength (ASTM D 638); elongation (ASTM D 638); flexural modulus (ASTM D 790); Izod impact strength (ASTM D 256) and Gardner impact strength (STP 2223) of the test specimens made from the various materials described below were measured. In addition, bottle ESCR and column crush properties were measured on blow molded Boston Round bottles made from blends of virgin HDPE and KBR; HDPE PCR and KBR; and multilayer tray process scrap and HDPE PCR (Phases 4 and 5). Analysis of variance was done for each of the properties in Phases 4 and 5 to determine the statistical significance between each of the blends and the controls. See the Appendix for tables of the actual test results.

Property comparisons were made on the following materials.

Phase 4: *Blends of Ketchup Bottle Process Scrap (KBR) and Virgin HDPE or HDPE PCR*

The KBR was from commercial multilayer bottles used to package name brand ketchup, and was made up of the following:

- 58% virgin random copolymer PP
- 32% process re grind
- 5% EVOH
- 5% tie-layer resin

In this phase of the study, injection molded test specimens and 16 oz. Boston Round bottles containing the following proportions were prepared:

- 100% virgin HDPE
- 100% HDPE PCR
- 2% KBR and 98% virgin HDPE
- 2% KBR and 98% HDPE PCR
- 5% KBR and 95% virgin HDPE
- 5% KBR and 95% HDPE PCR
- 10% KBR and 90% virgin HDPE
- 10% KBR and 90% HDPE PCR
- 25% KBR and 75% virgin HDPE
- 25% KBR and 75% HDPE PCR

Properties of each specimen and bottle were compared to one another.

\*EVAL Company of America is a joint venture of Quantum Chemical Corporation and Kuraray Co., Ltd.

\*\*Published by and available from EVAL Company of America, October, 1990, 1001 Warrenville Rd., Suite 201, Lisle, IL 60532-1359 or Quantum Chemical Corporation, 11500 Northlake Dr., Cincinnati, OH 45249.

**Phase 5: Blends of Multilayer Tray Process Scrap and HDPE PCR**

The scrap came from commercial trays used to package a specific type of brand name convenience food, made up of the following:

- HDPE
- EVOH
- LDPE
- Tie-layer resin

Note: specific proportions are not known

In this phase of the study, injection molded test specimens and 16 oz. Boston Round bottles were prepared with the following proportions:

- 100% HDPE PCR
- 5% multilayer scrap and 95% HDPE PCR
- 10% multilayer scrap and 90% HDPE PCR
- 20% multilayer scrap and 80% HDPE PCR

Properties of each test specimen and bottle were compared to one another.

**Phase 6: Blends of Multilayer Tray Process Scrap and Virgin HDPE**

The scrap came from commercial trays used to package a specific type of brand name convenience food, made up of the following:

- PS
- EVOH
- LDPE
- Tie-layer Resin

Note: specific proportions are unknown

In this phase of the study, injection molded test specimens were prepared with the following components:

- 100% virgin HDPE
- 100% multilayer scrap regrind
- 5% multilayer scrap and 95% virgin HDPE
- 20% multilayer scrap and 80% virgin HDPE

Properties of each test specimen were compared.

**Phase 7: Blends of Multilayer Tray Process Scrap and Virgin PP**

The scrap came from commercial trays used to package a specific type of brand name convenience food, made up of the following:

- PS
- EVOH
- LDPE
- Tie-layer Resin

Note: specific proportions are unknown

In this phase of the study, injection molded test specimens were prepared with the following components:

- 100% virgin PP
- 100% multilayer scrap regrind
- 5% multilayer scrap and 95% virgin PP
- 20% multilayer scrap and 80% virgin PP

Properties of each test specimen were compared.

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## Overall Results

In general, it was found that the inclusion of KBR, containing PP and EVOH, does not significantly affect the final properties of an HDPE PCR stream (Phase 4). KBR could be, according to this study, commingled with the more commonly recycled HDPE, which is then made into a variety of products.

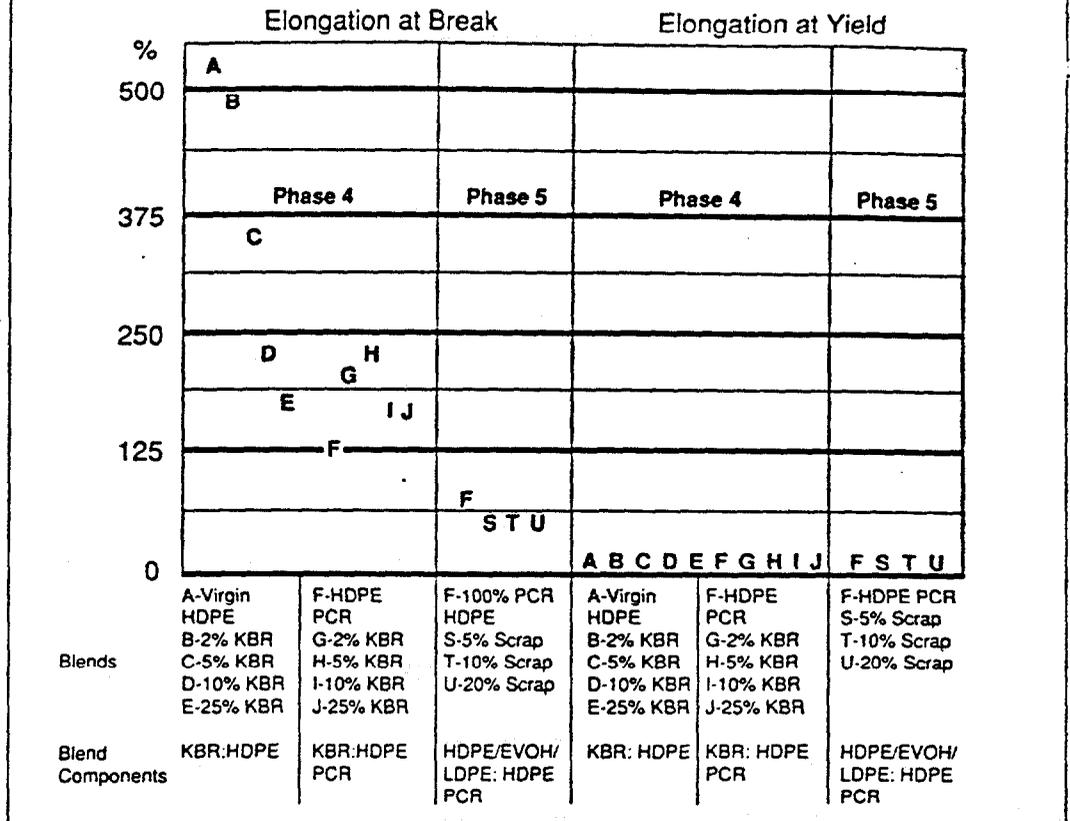
Commingling reground trays with a HDPE/EVOH/LDPE structure with HDPE PCR also results in little or no significant change in most of the properties tested (Phase 5). Since HDPE is the most commonly recycled plastic, food processors concerned with the recyclability of their packaging — particularly since this is a

growing concern among consumers — might investigate further whether a multilayer structure predominantly made from HDPE meets all of their needs.

The addition of reground convenience food packaging trays with a PS/EVOH/LDPE (Phases 6 and 7) structure does however, decrease many properties, particularly elongation and impact strength, when they are commingled with HDPE or PP. This combination is not recommended until further research concerning modifiers and processing aids for improving the extrusion of recycled plastics is completed.



**Figure 2: Elongation at Break and at Yield (ASTM D 638)**

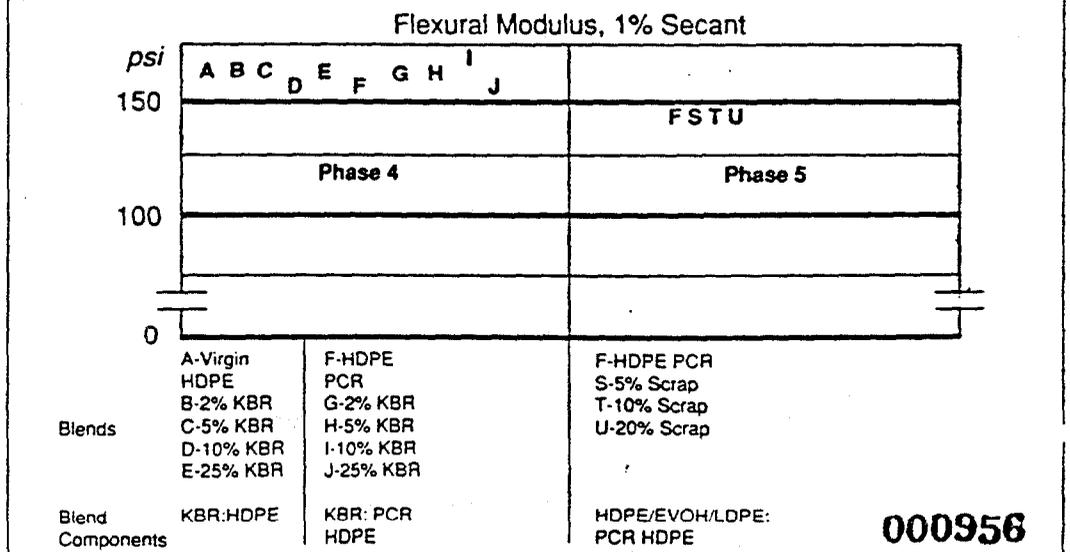


The elongation test measures the increase in the length of a material stretched under tension. The addition of more than 2% KBR to virgin HDPE resulted in significant decreases in elongation at break at the 95% confidence level. Declines ranged from 38% for the 5% KBR blend to 66% for the 20%:80% KBR:virgin HDPE combination. However, elongation at break for the blends of KBR and HDPE PCR showed no significant difference at the 95%

confidence level because of the large standard deviations for those samples. Elongation at yield for all the blends compared to either virgin HDPE or HDPE PCR also exhibited no significant change.

When the HDPE/EVOH/LDPE tray regrind blends were compared to HDPE PCR in Phase 5, there was no significant change in either elongation at break or yield at the 95% confidence level.

**Figure 3: Flexural Modulus, 1% Secant (ASTM D 790)**



000956

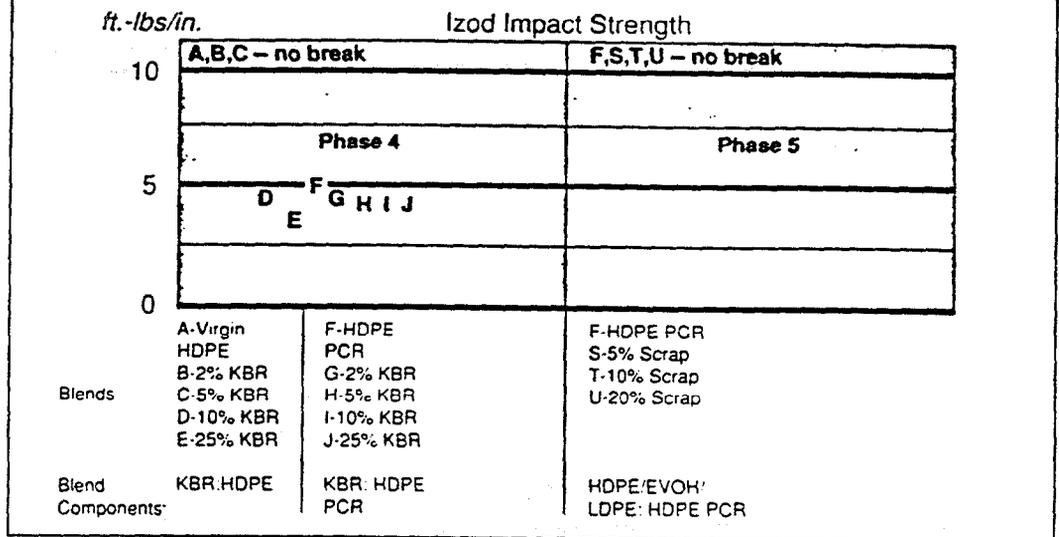
Flexural modulus measures the stiffness of a plastic by determining the force required to deflect or "flex" a test specimen made of a specific grade. Overall, the addition of multilayer material to either virgin HDPE or HDPE PCR resulted in no significant changes in this property.

For example, when KBR (Phase 4) was added to either virgin HDPE or HDPE PCR, the resulting change in flexural modulus (1% secant) values was not

significant at the 95% confidence level. The 10% KBR:90% HDPE PCR blend had a 13% higher flexural modulus than the 100% HDPE PCR, but all other blends varied only 2-4% from the control. When compared to virgin HDPE, the KBR blends varied 0-6% from the control.

Variations in flexural modulus values among the blends of HDPE/EVOH/LDPE tray scrap and both virgin HDPE and HDPE PCR were also considered insignificant at the 95% confidence level.

Figure 4: Izod Impact Strength (ASTM D 256, notched @ 23°C)

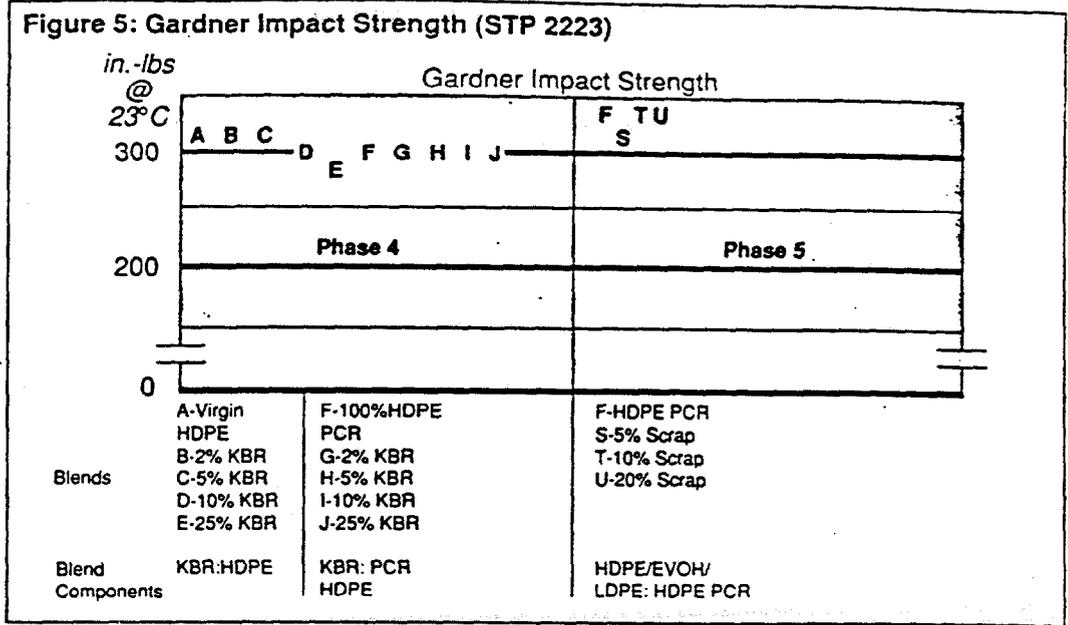


Notched Izod impact strength is a measure of the force needed to crack a test specimen made of a specific polymer resin. For relatively flexible margarine tubs, for example, a low notched Izod might be acceptable. For 5-gallon cement pails, the polymer chosen should have a much higher notched Izod impact strength.

The addition of multilayer KBR regrind to virgin HDPE in relatively small proportions, i.e., 2% and 5% of the total, led to no change in notched Izod values: they and the 100% virgin HDPE all exhibited "no break." The 10% and 25% virgin HDPE blends had Izod values

similar to those of the blends of multilayer KBR with HDPE PCR: 4-5 ft-lb/in. However, despite the small actual differences in notched Izod among the KBR:HDPE PCR blends, these were considered significant at the 95% confidence level. The 2% KBR:HDPE PCR blend had approximately the same Izod value as 100% HDPE PCR. The Izod values of the 5%, 10%, and 25% KBR blends exhibited a 12% decrease in Izod from 100% HDPE PCR.

In Phase 5, no comparison could be made because all KBR:HDPE PCR blend levels exhibited no break.



Because Gardner impact strength, a measure of the force needed to pierce a test specimen made from a specific polymer resin, is determined as the point at which 50% of the samples fail (F50), direct statistical analysis could not be done. Generally, the room temperature (@23°C) Gardner impact strength

remained about the same for all the blends of multilayer KBR and HDPE PCR. The 10% and 25% blends of KBR with virgin HDPE had slight decreases in Gardner impact strength: 4.5% and 9%, respectively. The addition of HDPE/EVOH/LDPE tray scrap to HDPE PCR also led to little variation in Gardner impact strength among the samples (Phase 5).

**Blow Molded Bottle Properties**

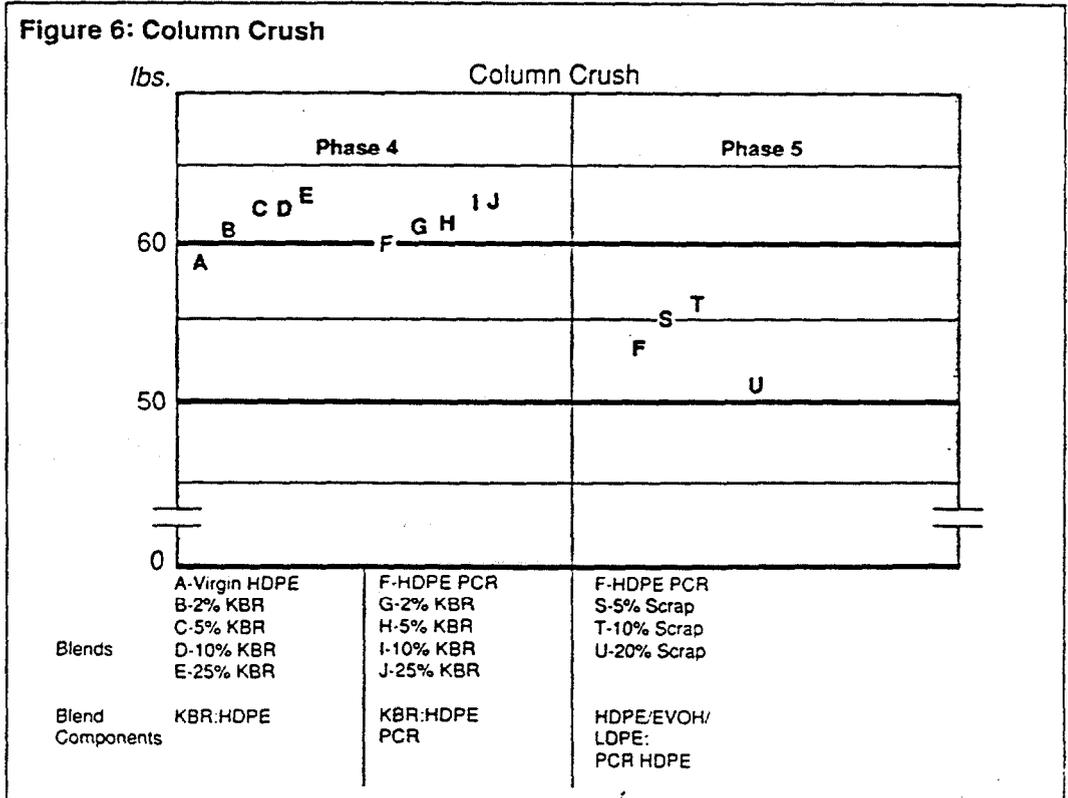
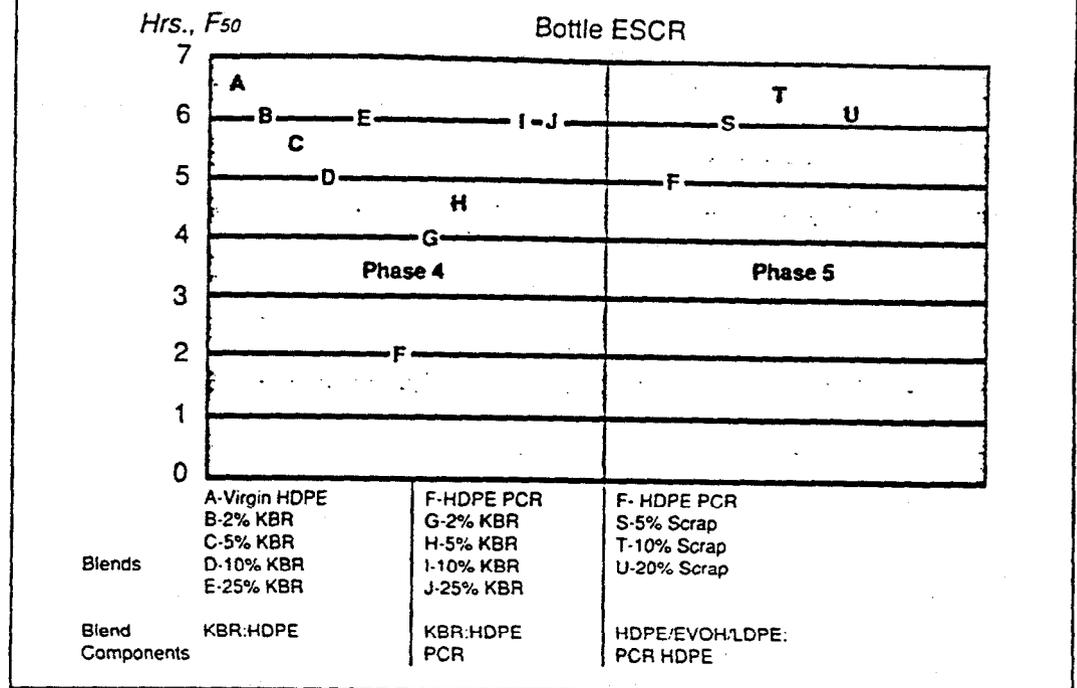


Figure 7: Bottle ESCR (ASTM D 2561)



The column crush test measures the stiffness of a blown bottle; the ESCR test determines the resistance of a material to cracking in the presence of surface active agents, such as detergents and bleaches. To obtain column crush and ESCR data, the blends were blow molded into 16 oz. Boston Round bottles. Because of the multiple polymers in these blends, higher cycle times were necessary to eliminate unmelted particles.

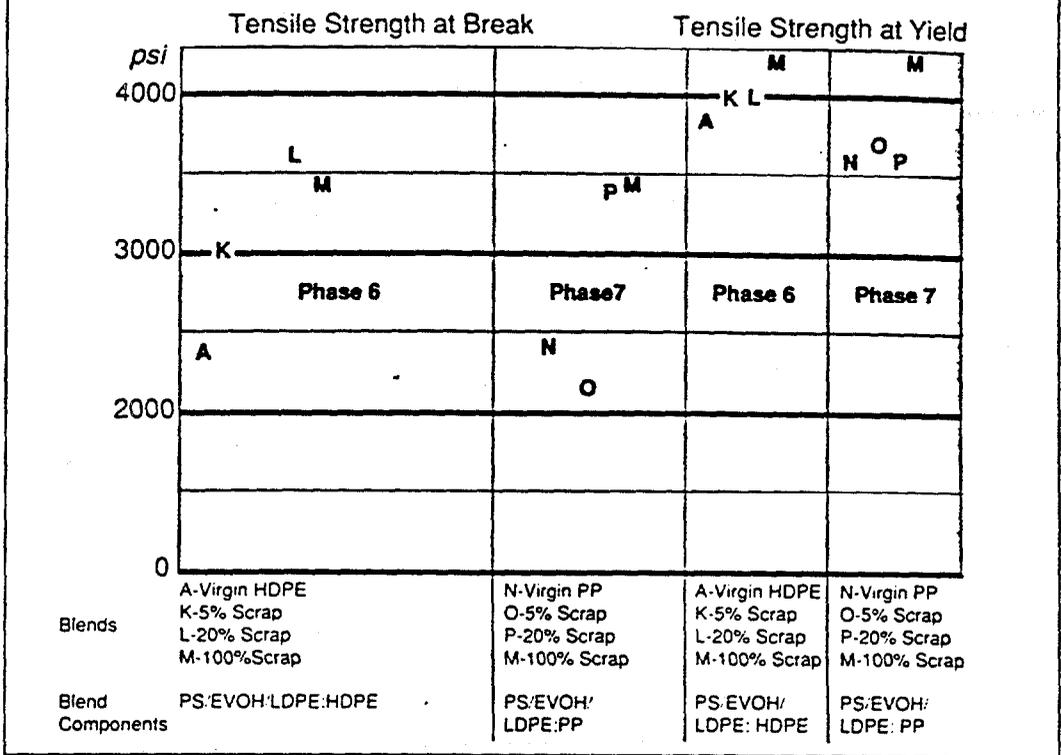
In Phase 4, the addition of multilayer KBR to HDPE PCR resulted in no significant change in column crush at the 95% confidence level. Column crush did increase slightly with increasing levels of KBR blended with virgin HDPE. Bottle ESCR among the HDPE PCR blends did

not change significantly. Again, there was a slight significant difference in the blends of virgin HDPE and KBR. Because of the considerable variability seen in these samples, the general observation is that there is no negative effect on bottle ESCR from the addition of KBR to either HDPE PCR or virgin HDPE.

In Phase 5, the addition of HDPE/EVOH/LDPE tray scrap to the HDPE PCR had no negative effect on bottle ESCR and did not appear to cause any processing problems. However, two separate moldings of the blended polymer bottles did show changes in bottle ESCR, underscoring the variability inherent in PCR resins.

Phase 6: Blends of PS/EVOH/LDPE and HDPE  
 Phase 7: Blends of PS/EVOH/LDPE and PP

Figure 8: Tensile Strength ASTM D 638)



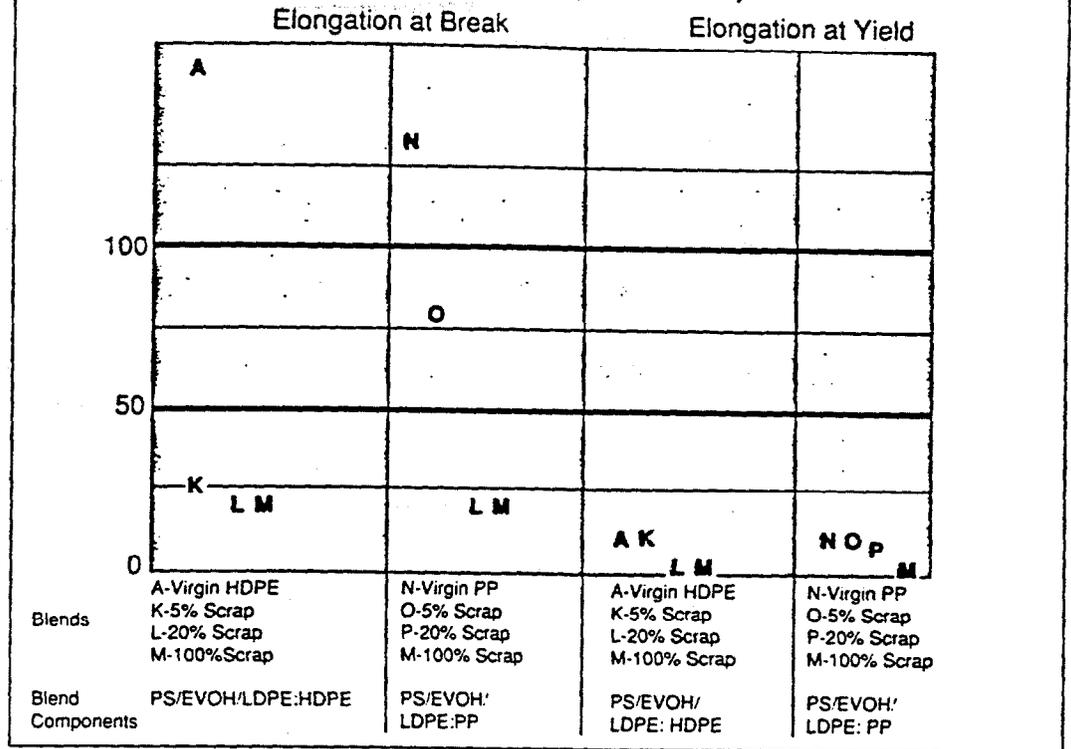
In Phase 6, comparisons were made among various levels of reground PS/EVOH/LDPE multilayer tray scrap blended with virgin HDPE. Tensile strength at break varied from an increase of 27% for the 5% blend to an increase of 58% for the 20% blend compared to the virgin HDPE control.

Tensile strength at yield was virtually unchanged at the 5% and 20% blend levels. There was an increase of 9% in tensile strength at yield at the 100% multilayer level compared to virgin HDPE.

In Phase 7, blends involving the same multilayer tray scrap used in Phase 5 were compared to virgin random copolymer PP. The blend of 5% multilayer tray scrap and 95% PP exhibited a 14% reduction in tensile strength at break. The blend of 20% scrap: 80% virgin PP showed about 40% higher tensile strength at break than the virgin PP, as did test specimens of 100% tray scrap.

Tensile strength at yield was approximately the same for the 5% and 20% blend levels compared to virgin PP. The 100% tray scrap test specimen had tensile strength at yield 19% higher than that of the virgin PP.

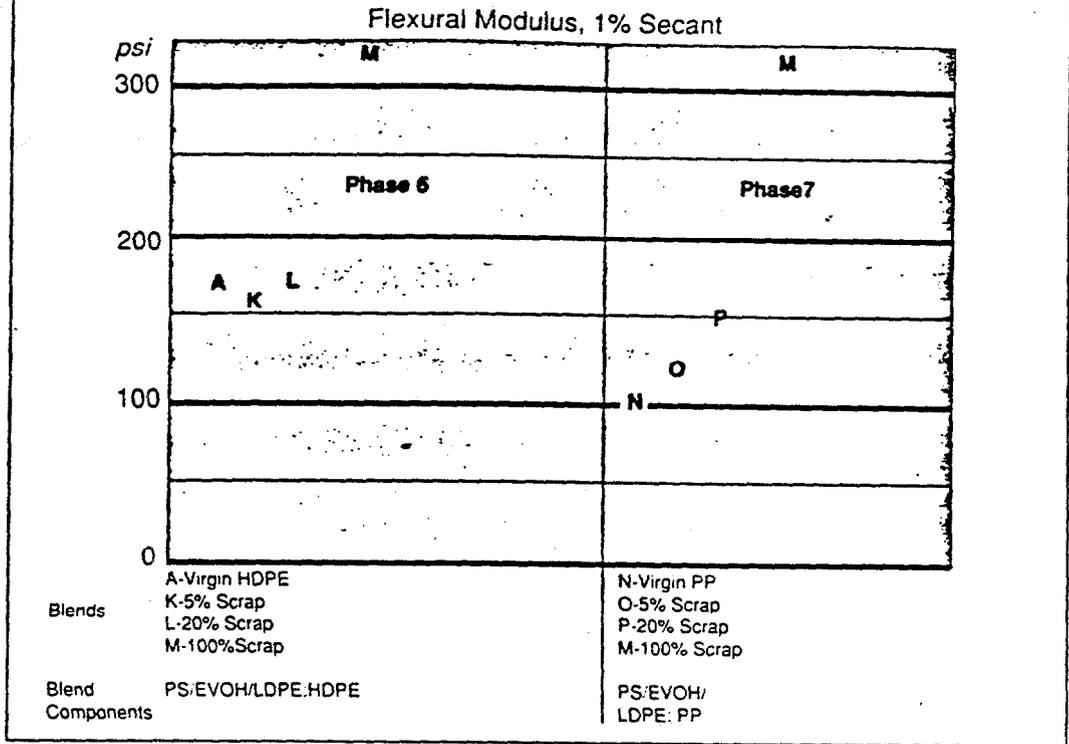
**Figure 9: Elongation at Break and at Yield (ASTM D 638)**



Elongation at break for the blends of the multilayer PS/EVOH/LDPE tray scrap and HDPE were 90% lower than that of virgin HDPE, as were samples of 100% multilayer tray scrap alone (Phase 6). When the tray regrind was added to PP, similar decreases occurred (Phase 7).

Elongation at yield decreased between 12 and 35% for the Phase 6 blends, with the 100% multilayer samples exhibiting an 80% decrease. In Phase 7, the 5% multilayer blend had essentially the same elongation at yield as virgin PP, but the 20% multilayer blend showed a 25% decrease and the 100%, an 85% decline.

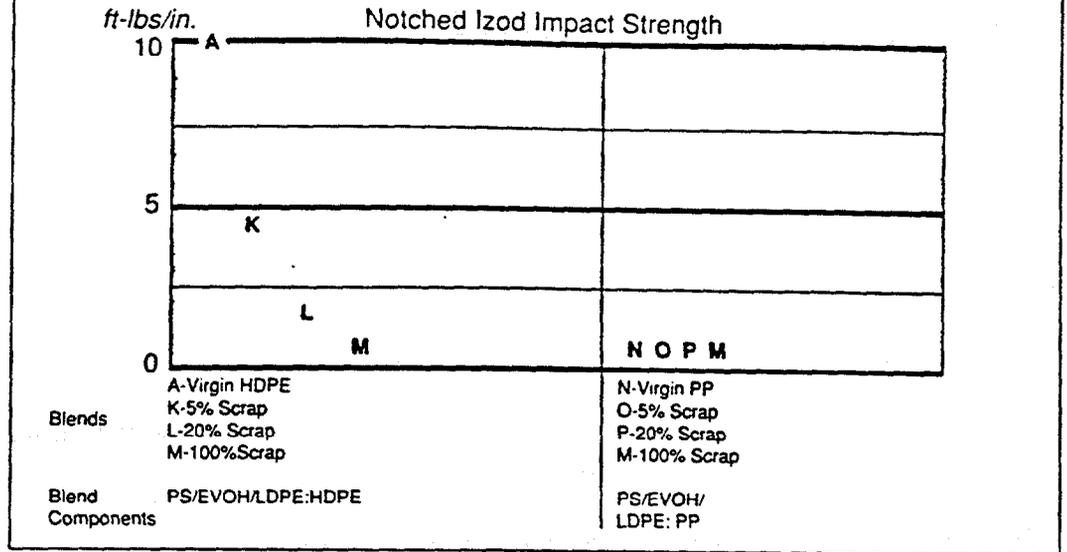
**Figure 10: Flexural Modulus, 1% Secant (ASTM D 790)**



Both 5% and 20% additions of PS/EVOH/LDPE tray scrap to virgin HDPE resulted in no significant change in flexural modulus results, although a sample of 100% of the scrap exhibited a flexural modulus 88% higher than the HDPE control (Phase 6). The same proportions

of tray scrap, when added to PP in Phase 7, resulted in flexural modulus results 12% and 36% higher, respectively. The flexural modulus of the 100% tray scrap test specimen was almost three times that of the virgin PP control.

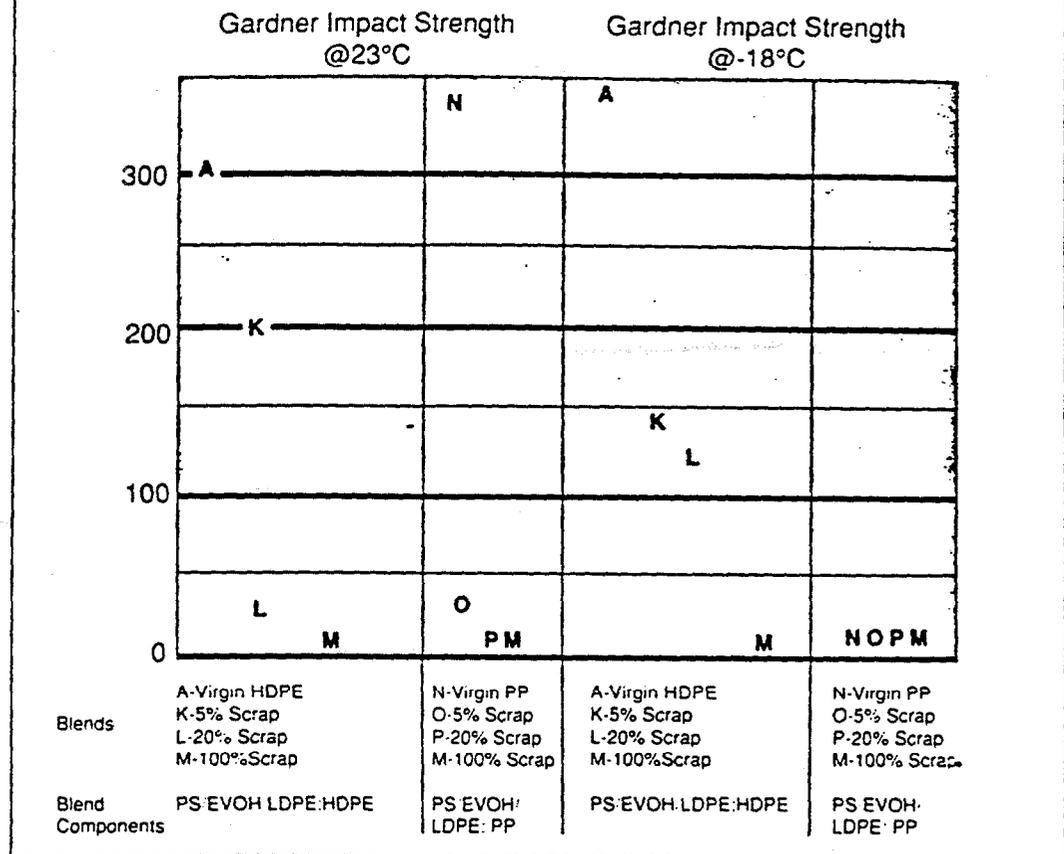
**Figure 11: Notched Izod Impact Strength @ 23°C (ASTM D 256)**



The addition of the PS/EVOH/LDPE tray scrap to virgin HDPE significantly decreased notched Izod values at all levels (Phase 6). The 5% multilayer tray: 95% HDPE blend exhibited a 60% decrease in this property; the 20%: 80% blend showed an 85% decrease. When 100% multilayer tray scrap was tested, its notched Izod was only 1/10 that of 100% virgin HDPE.

When the PS/EVOH/LDPE tray scrap was added to virgin homopolymer PP (Phase 7), notched Izod values for all the blends and 100% multilayer did not vary much from that of the control. All of the samples tested exhibited low Izod levels, which is characteristic of PP homopolymers.

**Figure 12: Gardner Impact Strength (STP 2223)**



The addition of the PS/EVOH/LDPE tray scrap to both virgin HDPE (Phase 6) and virgin homopolymer PP (Phase 7) decreased Gardner impact strength dramatically. Measured at 23°C, the 5% blend level showed a 38% decrease, the 20% blend, a 92% decrease and the

100% scrap, a 99% decrease compared to the virgin HDPE control.

At -18°C, the Gardner impact strength values for all the test specimens in Phase 7 were very low, ranging from 6.6 in.-lbs for the 100% homopolymer PP to 2 in.-lbs for the 5% and 20% blend levels.

## Conclusions

The results of these studies parallel earlier research done by EVALCA on the feasibility of recycling multilayer, EVOH-containing materials along with the recycling stream of the predominant component. The results of the research show that in most cases, multilayer containers can be commingled in the recycling stream of the predominant structural layer with little or no overall change in most of the final properties of the recycled resin.

The Phase 4 study involving blends of multilayer PP/EVOH ketchup bottles and HDPE PCR or virgin HDPE also demonstrates that PP/EVOH multilayer containers can be combined with recycle streams of HDPE. Tensile strength, flexural modulus and room temperature Gardner impact strength were not significantly affected. Only elongation at break was significantly decreased; notched Izod showed significant changes although the actual numeric variations were small. Blow molded bottle ESCR tests of the KBR: virgin HDPE blends showed only slight differences.

Recently, the Plastic Bottle Institute confirmed these findings when it reported the results of a similar study. The PBI report concluded that PP/EVOH multilayer bottles can be effectively recycled in post-consumer HDPE streams when added in levels up to six percent in the production of new HDPE containers.

Results from Phase 6 and Phase 7 showed that blending PS/EVOH/LDPE into either HDPE or PP recycle streams is not a viable approach without using a

modifier of some type. Significant decreases were found in tensile properties, notched Izod and Gardner impact strength.

Commingling HDPE/EVOH/LDPE blends with HDPE PCR (Phase 5) is a viable approach however, and it should be possible to recycle these materials into new HDPE products. Tensile strength was slightly increased by the addition of the multilayer tray scrap while elongation, flexural modulus and impact strength were not significantly changed. The addition of the multilayer scrap had no negative effect on blow molded ESCR, as well.

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Cincinnati, OH 45249  
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1001 Warrenville Road, Suite 201  
Lisle, IL 60532  
(708) 719-4610 / (800) 423-9762

The Council for Solid Waste Solutions  
1275 K Street, NW, Suite 400  
Washington, DC 20005  
(201) 371-5319

Center for Plastics Recycling Research  
Rutgers, the State University of New Jersey  
Busch Campus, Building 3529  
Piscataway, NJ 08855  
(201) 932-3683

**Appendix**

**Table 1: Tensile Strengths of Blends of Multilayer Containers and Virgin or PCR Polymers**

Phase of Study	Structure/Blend	Tensile Strength @ Break, Kpsi	Tensile Strength @ Yield, Kpsi
4	100% Virgin HDPE	2290	3860
	2% KBR: 98% HDPE	2240	3950
	5% KBR: 95% HDPE	2200	3890
	10% KBR: 90% HDPE	2200	3840
	25% KBR: 75% HDPE	2250	3740
4	100% HDPE PCR	2260	3930
	2% KBR: 98% HDPE PCR	2240	3890
	5% KBR: 95% HDPE PCR	2160	3860
	10% KBR: 90% HDPE PCR	2160	3820
	25% KBR: 75% HDPE PCR	2100	3820
5	100% HDPE PCR	2360	3850
	5% HDPE/EVOH/LDPE: 95% HDPE PCR	2570	3980
	10% HDPE/EVOH/LDPE: 90% HDPE PCR	2560	3990
	20% HDPE/EVOH/LDPE: 80% HDPE PCR	2980	4010
6	100% HDPE	2300	3950
	5% PS/EVOH/LDPE: 95% HDPE	2930	4010
	20% PS/EVOH/LDPE: 80% HDPE	3640	4000
	100% PS/EVOH/LDPE	3460	4320
7	100% PP	2410	3640
	5% PS/EVOH/LDPE: 95% PP	2080	3760
	20% PS/EVOH/LDPE: 80% PP	3380	3550
	100% PS/EVOH/LDPE	3460	4320

**Table 2: Elongation of Blends of Multilayer Containers and Virgin or PCR Polymers**

Phase of Study	Structure/Blend	Elongation @Break, %	Elongation @Yield, %
4	100% Virgin HDPE	536	10
	2% KBR: 98% HDPE	470	11
	5% KBR: 95% HDPE	350	10.9
	10% KBR: 90% HDPE	230	10.3
	25% KBR: 75% HDPE	180	11.6
4	100% HDPE PCR	126	10.8
	2% KBR: 98% HDPE PCR	200	10.9
	5% KBR: 95% HDPE PCR	230	10.9
	10% KBR: 90% HDPE PCR	146	10.9
	25% KBR: 75% HDPE PCR	166	11.6
5	100% PCR HDPE	50.2	12.3
	5% HDPE/EVOH/LDPE: 95% HDPE PCR	38.1	12.1
	10% HDPE/EVOH/LDPE: 90% HDPE PCR	34.4	13
	20% HDPE/EVOH/LDPE: 80% HDPE PCR	29.1	11.4
6	100% HDPE	183	9.9
	5% PS/EVOH/LDPE: 95% HDPE	24	8.7
	20% PS/EVOH/LDPE: 80% HDPE	14.7	6.3
	100% PS/EVOH/LDPE	16.8	1.9
7	100% PP	162	13
	5% PS/EVOH/LDPE: 95% PP	76	12.5
	20% PS/EVOH/LDPE: 80% PP	16	9.9
	100% PS/EVOH/LDPE	16	1.9

**Table 3: Flexural Modulus, 1% Secant, of Blends of Multilayer Containers and Virgin or PCR Polymers**

Phase of Study	Structure/Blend	Flexural Modulus, Kpsi
4	100% Virgin HDPE	164
	2% KBR: 98% HDPE	169
	5% KBR: 95% HDPE	163
	10% KBR: 90% HDPE	153
	25% KBR: 75% HDPE	158
4	100% HDPE PCR	155
	2% KBR: 98% HDPE PCR	168
	5% KBR: 95% HDPE PCR	161
	10% KBR: 90% HDPE PCR	176
	25% KBR: 75% HDPE PCR	164
5	100% HDPE PCR	146
	5% HDPE/EVOH/LDPE: 95% HDPE PCR	144
	10% HDPE/EVOH/LDPE: 90% HDPE PCR	142
	20% HDPE/EVOH/LDPE: 80% HDPE PCR	147
6	100% HDPE	172
	5% PS/EVOH/LDPE: 95% HDPE	160
	20% PS/EVOH/LDPE: 80% HDPE	169
	100% PS/EVOH/LDPE	324
7	100% PP	112
	5% PS/EVOH/LDPE: 95% PP	125
	20% PS/EVOH/LDPE: 80% PP	152
	100% PS/EVOH/LDPE	324

**Table 4: Izod Impact Strength (Notched @ 23°C) of Blends of Multilayer Containers and Virgin or PCR Polymers**

Phase of Study	Structure/Blend	Izod Impact Strength, ft-lbs/in.
4	100% Virgin HDPE	no break
	2% KBR: 98% HDPE	no break
	5% KBR: 95% HDPE	no break
	10% KBR: 90% HDPE	4.7
	25% KBR: 75% HDPE	3.7
4	100% HDPE PCR	5.1
	2% KBR: 98% HDPE PCR	4.9
	5% KBR: 95% HDPE PCR	4.6
	10% KBR: 90% HDPE PCR	4.4
	25% KBR: 75% HDPE PCR	4.5
5	100% HDPE PCR	no break
	5% HDPE/EVOH/LDPE: 95% HDPE PCR	no break
	10% HDPE/EVOH/LDPE: 90% HDPE PCR	no break
	20% HDPE/EVOH/LDPE: 80% HDPE PCR	no break
	100% Virgin HDPE	no break
6	100% HDPE	10
	5% PS/EVOH/LDPE: 95% HDPE	4
	20% PS/EVOH/LDPE: 80% HDPE	1.5
	100% PS/EVOH/LDPE	1
7	100% PP	0.94
	5% PS/EVOH/LDPE: 95% PP	1
	20% PS/EVOH/LDPE: 80% PP	1.2
	100% PS/EVOH/LDPE	1

**Table 5: Gardner Impact Strength of Blends of Multilayer Containers and Virgin or PCR Polymers**

Phase of Study	Structure/Blend	Gardner Impact Strength, in.-lbs @23°C	Gardner Impact Strength, in.-lbs @-18°C
4	100% Virgin HDPE	316	N/A
	2% KBR: 98% HDPE	312	N/A
	5% KBR: 95% HDPE	312	N/A
	10% KBR: 90% HDPE	301	N/A
	25% KBR: 75% HDPE	286	N/A
4	100% HDPE PCR	293	N/A
	2% KBR: 98% HDPE PCR	290	N/A
	5% KBR: 95% HDPE PCR	299	N/A
	10% KBR: 90% HDPE PCR	298	N/A
	25% KBR: 75% HDPE PCR	291	N/A
5	100% HDPE PCR	331	360
	5% HDPE/EVOH/LDPE: 95% HDPE PCR	312	368
	10% HDPE/EVOH/LDPE: 90% HDPE PCR	322	386
	20% HDPE/EVOH/LDPE: 80% HDPE PCR	328	376
6	100% HDPE	296	382
	5% PS/EVOH/LDPE: 95% HDPE	183	146
	20% PS/EVOH/LDPE: 80% HDPE	21	133
	100% PS/EVOH/LDPE	4	4
7	100% PP	360	6.6
	5% PS/EVOH/LDPE: 95% PP	39	2
	20% PS/EVOH/LDPE: 80% PP	6	2.1
	100% PS/EVOH/LDPE	4	4.2

**Table 6: Blow Molded Bottle Properties of Blends of Multilayer Containers and Virgin or PCR Polymers**

Phase of Study	Structure/Blend	Column Crush lbs	Bottle ESCR, Hrs., F50
4	100% Virgin HDPE	59.6	6.4
	2% KBR: 98% HDPE	61.3	6.1
	5% KBR: 95% HDPE	63	5.3
	10% KBR: 90% HDPE	63.2	5
	25% KBR: 75% HDPE	63.6	5.8
4	100% HDPE PCR	60.6	2.3
	2% KBR: 98% HDPE PCR	61.7	4.2
	5% KBR: 95% HDPE PCR	62.7	4.5
	10% KBR: 90% HDPE PCR	63.6	5.8
	25% KBR: 75% HDPE PCR	63.6	6
5	100% HDPE PCR	53.7	5.2
	5% HDPE/EVOH/LDPE: 95% HDPE PCR	55.5	5.8
	10% HDPE/EVOH/LDPE: 90% HDPE PCR	57.4	6.4
	20% HDPE/EVOH/LDPE: 80% HDPE PCR	52.9	6.2

# EVALCA

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6853/691

**APPENDIX VIII-E**

**Molecular Weights of EVAL® Resin**

# MOLECULAR WEIGHTS OF EVAL® RESIN

December, 1995  
Kuraray Co., Ltd.

Grade Name	Molecular Weights* <sup>3)</sup>	
	Mw* <sup>1)</sup>	Mn* <sup>2)</sup>
F104	41,800	15,700
L101	49,900	20,400
L104	40,100	15,200

\*1) Mw : Weight Average Molecular Weight

\*2) Mn : Number Average Molecular Weight

\*3) Measurement Method : GPC

\*4) Measurement Conditions :

Apparatus: ALC/GPC-150C (Waters Associates, in U.S.A.)

Column: Shodex Column (Showa Denko Co., in Japan)

HFIP-806P: 8  $\phi$   $\times$  50 mm - one column

HFIP-806M: 8  $\phi$   $\times$  300 mm - one column

Temperature: Column 40 °C, Injector 40 °C

Solvent: HFIP + 20m M Sodium Trifluoroacetate

(HFIP=1,1,1,3,3,3-hexafluoro-2-propanol)

Concentration: 0.05 wt/vol%

Injection Amount: 200  $\mu$ l

Flow Rate: 1.0 ml/min

Detector: RI (Sensitivity= -32, Scale=20)

Standard Polymer: Poly(methyl methacrylate)

**APPENDIX IX-A**

**Material Safety Data Sheets for  
Substances Used in the Production of  
EVOH Copolymers**



QUANTUM CHEMICAL COMPANY

MATERIAL SAFETY DATA SHEET

VINYL ACETATE MONOMER

11 MSDS

MSDS No. 9630  
Issue Date JUN 06, 1995

EMERGENCY NUMBERS:

QUANTUM (713) 479-2873  
CHEMTREC (800) 424-9300

PRODUCT INFORMATION:

PRODUCT APPLICATIONS (800) 543-5900  
REGULATORY (MSDS) (513) 530-4051

DANGER! EXTREMELY FLAMMABLE. CAUSES IRRITATION OF THE EYES, SKIN, AND RESPIRATORY TRACT. Long term exposures to high concentrations in air resulted in respiratory tract tumors in some laboratory animals. Keep away from heat, sparks, flame and all other ignition sources. Avoid contact with eyes, skin, and clothing. Avoid breathing vapor. Use with adequate ventilation. Keep container closed. Wash thoroughly after handling.

SECTION I - IDENTIFICATION

PRODUCT: VAM (TM); Vinyl Acetate Monomer

SYNONYMS: Vinyl Acetate; Ethenyl Acetate; Acetic Acid, Vinyl Ester;  
Vinyl Acetate, Inhibited; Acetic Acid, Ethenyl Ester;  
1-Acetoxyethylene; Ethenyl Ethanoate

FORMULA: CH3COOCHCH2

CHEMICAL FAMILY: Ester

CAS RN: 108-05-4

SECTION II - INGREDIENTS

COMPOSITION	NOMINAL %	PEL/TLV
Vinyl acetate	> 99.9	PEL (See Section IV)

Product No. 9630

VINYL ACETATE MONOMER

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SECTION II - INGREDIENTS (continued)

TLV-TWA: 10 ppm  
TLV-STEL: 15 ppm

Hydroquinone (123-31-9) is added as a polymerization inhibitor at a level of 3-17 ppm, as specified. See Section XII.

---

SECTION III - HEALTH INFORMATION

**INHALATION:** Respiratory irritation may occur above 4 ppm in sensitive individuals and generally above 20 ppm. Other acute effects of overexposure may include headache, dizziness, nausea, weakness and drowsiness. Inhalation of irritants may aggravate existing respiratory disease conditions, such as asthma. Acute inhalation LC50 (4 hours) = 1546 - 4000 ppm (laboratory animals). Studies in rodents indicate that repeated exposures to very high concentrations of vinyl acetate in air, 200-600 ppm for 6 hours per day for 5 days per week, may cause irritative damage to the respiratory tract and tumors after these exposures continue for more than one year. Rodents exposed to 50 ppm for 6 hours per day, 5 days per week for 2 years did not show any evidence of irritative damage, tumors or other harmful effects.

**INGESTION:** Acute oral LD50 = 1.6-2.9 g/kg (laboratory animals). No adverse effects were noted in rats given 1000 ppm or less in drinking water for 3 months. In one study, increased tumor incidence was observed in rats given 1000 ppm or more in drinking water for 100 weeks. These findings were not confirmed in a subsequent study in which no increased tumor incidence was observed in rats given up to 5000 ppm in drinking water daily for two years. A slight decrease in male fertility was noted in rats given 5000 ppm but not 1000 ppm or less in drinking water.

**EYE CONTACT:** Liquid and vapor (at concentrations greater than 20 ppm generally or greater than 4 ppm for sensitive individuals) are irritating.

**SKIN CONTACT:** Liquid is irritating to skin; continued contact may result in severe irritation and blistering. Acute dermal LD50 = 2.3 g/kg (rabbits). Vinyl acetate has been reported to cause allergic skin reactions in some exposed individuals.

**OTHER:** The International Agency for Research on Cancer (IARC) has classified vinyl acetate as a category "2B" carcinogen which indicates that it is "possibly carcinogenic to humans". This IARC classification was based upon limited evidence of carcinogenicity to animals and inadequate evidence of carcinogenicity to humans.

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VINYL ACETATE MONOMER

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SECTION III - HEALTH INFORMATION (continued)

ACGIH has designated vinyl acetate as an "A3-Animal Carcinogen". This designation refers to an agent which is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histological types(s), or by mechanism(s) that are not considered relevant to worker exposure.

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SECTION IV - OCCUPATIONAL EXPOSURE LIMITS

PELs (OSHA Permissible Exposure Limits): Although the 1989 OSHA Air Contaminants Rule (Table Z-1-A) was revoked on 6/30/93, some states continue to enforce the following Z-1-A limits for Vinyl Acetate Monomer.

TWA: 10 ppm  
STEL: 20 ppm

TLVs (ACGIH Threshold Limit Values): See Section II

---

SECTION V - EMERGENCY FIRST AID PROCEDURE

FOR OVEREXPOSURE BY:

**SWALLOWING:** If victim is conscious and able to swallow, quickly have victim drink water or milk to dilute. Do not give sodium bicarbonate, fruit juices or vinegar. Never give anything by mouth if victim is unconscious or having convulsions. CALL PHYSICIAN OR POISON CONTROL CENTER IMMEDIATELY. Do not induce vomiting unless advised by physician or Poison Control Center.

**SKIN CONTACT:** Immediately flush skin with plenty of water while removing contaminated clothing. Wash contaminated clothing before reuse.

**EYE CONTACT:** Immediately flush eyes with plenty of cool water for at least 15 minutes. Do not permit victim to rub eyes. GET MEDICAL ATTENTION IMMEDIATELY.

**INHALATION:** Immediately remove victim to fresh air. If victim has stopped breathing, give artificial respiration, preferably mouth-to-mouth. GET MEDICAL ATTENTION IMMEDIATELY.

Product No. 9630

VINYL ACETATE MONOMER

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SECTION VI - PHYSICAL DATA

BOILING POINT: 162.5 deg F (72.5 deg C)  
MELTING POINT: -135.8 deg F (-93.2 deg C)  
VAPOR PRESSURE: 100 mm Hg @ 21.5 deg C  
SPECIFIC GRAVITY (WATER=1): 0.9338 @ 20 deg/20 deg C  
VAPOR DENSITY (AIR=1): 2.97  
SOLUBILITY IN WATER: 2.3 % by weight @ 20 deg C  
EVAPORATION RATE (BUTYL ACETATE=1): 2.9  
PERCENT, VOLATILE BY VOLUME: 99.9 + %  
APPEARANCE AND ODOR: Clear & colorless liquid with a not unpleasant odor; sweetish smell in small quantities.

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SECTION VII - FIRE AND EXPLOSION HAZARDS

FLASH POINT (Tag Closed Cup): 18 deg F (-8 deg C) ASTM Method D-56  
AUTO-IGNITION TEMPERATURE: 300 deg F (147 deg C)  
FLAMMABLE LIMITS IN AIR (760 mm Hg), % BY VOL. LOWER: 2.6  
UPPER: 13.4  
NFPA RATING: HEALTH ( 2 ) FIRE ( 3 ) REACTIVITY ( 2 )  
(Does not apply to exposure hazards other than during a fire.)

FIRE FIGHTING PROCEDURES: (Note - Individuals should perform only those firefighting procedures for which they have been trained). In advanced or massive fires, fire fighting should be done from a safe distance or from a protected location. Use dry chemical, alcohol-type foam, universal-type foam, or carbon dioxide. Use carbon dioxide or dry chemical for small fires and alcohol-type foam or universal-type foam or water fog for large fires. However, as vinyl acetate is lighter than water and does not effectively mix into water, care must be exercised not to spread burning monomer by a high velocity water stream or through displacement by accumulated fire fighting water since vinyl acetate can float on water and spread fire. Water may be ineffective, but water should be used to keep fire-exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors. If it is necessary to stop a leak, use water spray to protect workers attempting to do so. Water spray may be used to flush spills away from exposures. Vinyl acetate vapors are uninhibited and may form polymers in vents and flame arresters, resulting in stoppage of vents (NFPA 49-1977).

UNUSUAL FIRE & EXPLOSION HAZARDS: Firefighters should wear self-contained breathing apparatus in the positive pressure mode with a full facepiece when there is a possibility of exposure to smoke, fumes, or hazardous decomposition products. Vapor is heavier than air and may travel a considerable distance to a source of ignition and flashback. Vinyl acetate in contact with peroxides

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Product No. 9630

VINYL ACETATE MONOMER

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SECTION VII - FIRE AND EXPLOSION HAZARDS (continued)

may polymerize violently. However, it is usually inhibited with hydroquinone to prevent polymerization. At elevated temperature, such as in fire conditions, polymerization may take place. If the polymerization takes place in a container, there is the possibility of violent rupture of the container. Aqueous solutions of vinyl acetate (containing > 0.5 wt.%) can also be fire hazards.

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SECTION VIII - REACTIVITY

STABILITY: Unstable.

HAZARDOUS POLYMERIZATION: May occur.

CONDITIONS & MATERIALS TO AVOID: Avoid high temperatures and uninhibited monomer. In order to prevent violent reactions from occurring, keep out of contact with peroxides, hydroperoxides, hydrogen peroxides, azo compounds, and other polymerization initiators, as well as strong acids, alkalis or oxidizing agents. Exposure to sunlight, ultra-violet light or x-rays may result in spontaneous polymerization.

HAZARDOUS DECOMPOSITION PRODUCTS: Acetaldehyde and acetic acid may form from hydrolysis. When heated to decomposition, vinyl acetate can produce acetaldehyde and acetic acid fumes. Carbon monoxide can form on incomplete combustion.

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SECTION IX - EMPLOYEE PROTECTION

CONTROL MEASURES: Engineering controls, preferably enclosed systems, should be used whenever feasible to maintain exposures below acceptable criteria (Sections II and IV). When such controls are not feasible, or sufficient to achieve full conformance, other engineering controls such as local exhaust ventilation should be used.

RESPIRATORY PROTECTION: Where engineering controls are not feasible or sufficient to achieve full conformance with acceptable criteria (see Sections II and IV), use NIOSH approved respiratory protection. Respirators should be selected based on the form and concentration of the contaminant in air and in accordance with OSHA requirements (29 CFR 1910.134).

PROTECTIVE CLOTHING: Protective clothing made of chemical- and fire-resistant material must be worn in process areas for the

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VINYL ACETATE MONOMER

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SECTION IX - EMPLOYEE PROTECTION (continued)

duration of anticipated exposure if there is potential for prolonged or repeated skin contact. When these garments become contaminated with vinyl acetate, they must be either cleaned by an industrial cleaning service familiar with these products or disposed of properly.

**EYE PROTECTION:** Wear safety glasses meeting the specifications of ANSI Standard Z87.1 where no contact with the eye is anticipated. Chemical safety goggles meeting the specifications of ANSI Standard Z87.1 should be worn whenever there is the possibility of splashing or other contact with the eyes.

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SECTION X - ENVIRONMENTAL PROTECTION

**ENVIRONMENTAL PRECAUTIONS:** Avoid uncontrolled releases of this material. Where spills are possible, a comprehensive spill response plan should be developed and implemented.

**SPILL OR LEAK PROCEDURES:** Wear appropriate respiratory protection and protective clothing as described in Section IX. Turn off or remove all ignition sources. See Section VII for further information on handling fire and explosion hazards. Contain spilled material. Transfer to secure containers. Where necessary, collect using absorbent media. In the event of an uncontrolled release of this material, the user should determine if the release is reportable under applicable laws and regulations.

**WASTE DISPOSAL:** All recovered material should be packaged, labeled, transported and disposed of or reclaimed in conformance with applicable laws and regulations and in conformance with good engineering practices. Reclaim where possible.

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SECTION XI - REGULATORY CONTROLS

DEPARTMENT OF TRANSPORTATION (DOT):

DOT Hazard Class:	3 (Flammable Liquid)
DOT Proper Shipping Name:	Vinyl Acetate, Inhibited
Other DOT Information:	Identification No. UN1301
	Packing Group II
	Emergency Response Guide No. 26

For further information see Title 49, Code of Federal Regulations, parts 172 and 173.

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Product No. 9630

VINYL ACETATE MONOMER.

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SECTION XI - REGULATORY CONTROLS (continued)

TOXIC SUBSTANCES CONTROL ACT (TSCA):

This product is (or if a mixture, the components of this product are) listed in the TSCA Inventory of Chemical Substances.

SARA TITLE III (SECTIONS 311/312) HAZARD CATEGORIES:

Immediate/Acute Health Hazard:	yes
Delayed/Chronic Health Hazard:	yes
Fire Hazard:	yes
Sudden Release of Pressure:	no
Reactive:	yes

SARA TITLE III (SECTION 313):

Vinyl acetate is subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

NEW JERSEY (NJ), PENNSYLVANIA (PA), & MASSACHUSETTS (MA) RIGHT-TO-KNOW:

Vinyl Acetate - NJ Special & Environmental Hazard; PA Environmental Hazard; MA Extraordinarily Hazardous Substance

CALIFORNIA PROPOSITION 65:

WARNING: This product contains (or may contain) a chemical (or chemicals) known to the State of California to cause cancer, birth defects or other reproductive harm.

Trace amounts of the following chemicals may be present:

Acetaldehyde (CAS RN: 75-07-0) - generally < 100 ppm when manufactured but additional acetaldehyde may form if the product undergoes decomposition or hydrolysis

NOTE: The regulatory information presented here should not necessarily be considered as all-inclusive. Other local, state, federal, and international regulations may also apply.

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SECTION XII - PRECAUTIONS: HANDLING, STORAGE AND USAGE

Protect container against physical damage. Detached or outside storage is preferred. Inside storage should be in an NFPA approved flammable liquids

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Product No. 9630

VINYL ACETATE MONOMER

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SECTION XII - PRECAUTIONS: HANDLING, STORAGE AND USAGE (continued)

storage room or cabinet. All ignition sources should be eliminated. Smoking should be prohibited in storage areas. Vinyl acetate with an inhibitor level of 3-5 ppm hydroquinone should not be stored longer than two months at 70-80 deg F or longer than four months with 14-17 ppm hydroquinone. Electrical installations should be in accordance with Articles 500 and 501 of the National Electrical Code (Class I Group D hazard locations). NFPA 30, Flammable and Combustible Code, should be followed for all storage and handling. Frequent careful leakage inspection should be done. Automatic sprinkler system should be provided. Isolate from oxidizers, caustics and alkalis, chemicals capable of spontaneous heating, materials reacting with air or moisture to liberate heat, ignition sources and explosives. Containers must be bonded and grounded during the transfer of material to avoid static discharge. Consult local fire codes for additional storage information.

Containers can be hazardous when emptied. Since emptied containers retain residual product (vapor or liquid), all precautions described on this MSDS must be observed.

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The information presented herein is believed to be factual as it has been derived from the works and opinions of persons believed to be qualified experts; however, nothing contained in this information is to be taken as a warranty or representation for which Quantum Chemical Company bears legal responsibility. The user should review any recommendations in the specific context of the intended use to determine whether they are appropriate.

PREPARED BY: HSE

ISSUE DATE: JUN 06, 1995

SUPERSEDES: JAN 14, 1994

Regulatory Affairs Group  
Quantum Chemical Company  
11500 Northlake Drive  
P. O. Box 429550  
Cincinnati, OH 45249

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Chemical Group  
Hoechst Celanese Corporation  
P.O. Box 819005 / Dallas, Texas 75381-9005  
Information phone: 214 277 4000  
Emergency phone: 800 424 9300 (CHEMTREC)

CL-1324

Vinyl acetate

Operation

3-21-95 #94

Issued December 11, 1992

## Identification

Product name: Vinyl acetate

Chemical name: Vinyl acetate

Inhibitor: Hydroquinone  
(HQ; CAS no. 123-31-9), 3-5 ppm.

Chemical family: Vinyl monomer  
(acetate ester)

Formula:  $CH_2COOCHCH_3$

Molecular weight: 86

CAS number: 108-05-4

CAS name: Acetic acid, ethenyl ester

Synonyms: VAM; VA; acetic acid vinyl ester; acetic acid ethenyl ester; 1-acetoxyethylene; ethenyl acetate; ethenyl ethanoate.

### Transportation Information

Shipping name: Vinyl Acetate, Inhibited

Hazard class: 3, Flammable Liquid

United Nations no.: UN1301

Packing group: II

\* Emergency Response Guide no.: 26

\* DOT Reportable Quantity: 5000 lb/2270 kg

## Physical data

Boiling point (760 mm Hg): 72.7°C (163°F)

Freezing point: -100°C (-148°F)

Specific gravity ( $H_2O = 1 @ 20/20°C$ ): 0.9338

Vapor pressure (20°C): 88 mm Hg

Vapor density (Air = 1 @ 20°C): 3.0

Solubility in water (% by WT @ 20°C): 2.3

Percent volatiles by volume: 100

Evaporation rate (BuAc = 1): 8.9

Appearance and odor: Clear, colorless, mobile liquid; acrid, ether-like odor.

## Fire and explosion hazard data

Flammable limits in air, % by volume

Upper: 13.4

Lower: 2.6

Flash point (test method):

Tag closed cup (ASTM D56): 16°F (-8°C)

Extinguishing media:

Use  $CO_2$  or dry chemical for small fires.

## Component information (See Glossary at end of MSDS for definitions)

Component, wt. % (CAS number)	Exposure levels			Subject to SARA §313 reporting?
	OSHA PEL TWA; STEL	ACGIH TLV <sup>2</sup> TWA; STEL	IDLH	
* Vinyl acetate, 99.9% (108-05-4)	10 ppm, 20 ppm	10 ppm, 20 ppm	NVE(2)	Yes

(1) All components listed as required by federal, California, New Jersey and Pennsylvania regulators.  
(2) No value established.

alcohol-type aqueous film-forming foam or water spray for large fires. Water may be ineffective but should be used to cool fire-exposed structures and vessels.

### Special fire-fighting procedures:

If potential for exposure to vapors or products of combustion exists, wear complete personal protective equipment, including self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive-pressure mode.

### Unusual fire and explosion hazards:

Rapid, uncontrolled polymerization can cause explosion. Vapor is heavier than air and can travel considerable distance to a source of ignition and flashback. Material creates a special hazard because it floats on water.

## Special hazard designations

	HMIS	NFPA	Key
Health:	2	2	0 = Minimal
Flammability:	3	3	1 = Slight
Reactivity:	2	2	2 = Moderate
Personal protective equipment:	G	—	3 = Serious 4 = Severe

### SARA §311 hazard categories

Acute health:	Yes
Chronic health:	Yes
Fire:	Yes
Sudden release of pressure:	No
Reactive:	Yes

## Reactivity data

Stability:  
Potentially unstable.

### Hazardous polymerization:

Can occur. UNCONTROLLED POLYMERIZATION CAN CAUSE RAPID EVOLUTION OF HEAT AND INCREASED PRESSURE WHICH CAN RESULT IN VIOLENT RUPTURE OF STORAGE VESSELS OR CONTAINERS.

### Conditions to avoid:

Temperatures above 38°C (100°F); sunlight; x-ray or ultra-violet radiation; sparks and flame.

### Materials to avoid:

Peroxides, for example, t-butyl peroxide and hydrogen peroxide; other polymerization initiators; oxidizing agents.

### Hazardous combustion or decomposition products:

Carbon monoxide.

## Health data

### Effects of exposure/toxicity data

#### Acute

**Ingestion (swallowing):** Can cause headache, drowsiness and unconsciousness. Slightly toxic to animals (oral  $LD_{50}$ , rats: 2.9 g/kg).  
**Inhalation (breathing):** Can irritate nasal passages, throat and lungs. Practically non-toxic to animals (inhalation LCLo, rats, 8 hrs: 4000 ppm).  
**Skin contact:** Can cause severe injury (reddening and swelling). Prolonged contact can cause blisters. Sensitization (allergic reaction) can occur. Slightly toxic to animals by absorption (dermal  $LD_{50}$ , rabbits: 2.4 g/kg).  
**Eye contact:** Can cause severe injury — damage reversible.

(continued)

#94

Issued December 11, 1992

**Chronic**

**Mutagenicity:** *In vitro*, suggestive evidence of mutagenicity (Hoechst Celanese data). *In vivo*, not mutagenic (SPI Vinyl Acetate Study Group, 90-day study, micronucleus test).

**Carcinogenicity:** Oral – A two-year drinking water study showed no evidence of treatment-related carcinogenicity (rats, SPI); a second limited drinking water study showed suggestive evidence of treatment-related tumors in the uterus and thyroid (rats, Lijinski). Inhalation – evidence of treatment-related nasal tumors in a two-year study of rats exposed to 600 ppm VA (SPI); suggestion of a treatment-related lung tumor in mice exposed to VA by inhalation at 600 ppm for two years (SPI).

**Reproduction:** No evidence of effects on fetus in VA study by oral or inhalation routes. A suggestion of slight effects on male reproduction in oral study (drinking water, SPI).

**Medical conditions aggravated by exposure:**

Significant exposure to this chemical may adversely affect people with chronic disease of the respiratory system, skin and/or eyes.

**Emergency and first aid procedures**

**Ingestion (swallowing):** Induce vomiting of conscious patient immediately by giving two glasses of water and pressing finger down throat. Contact a physician immediately.

**Inhalation (breathing):** Remove patient from contaminated area. If breathing has stopped, give artificial respiration, then oxygen if needed. Contact a physician immediately.

**Skin contact:** Remove contaminated clothing and wash contaminated skin with large amounts of water. If irritation persists, contact a physician.

**Eye contact:** Flush eyes with water for at least 15 minutes. Contact a physician immediately.

**Spill or leak procedures**

Steps to be taken if material is released or spilled:

Eliminate ignition sources. Caution: Spontaneous polymerization can occur. Avoid eye or skin contact; see "Special protection information" section for respirator information. Place leaking containers in well-ventilated area with spill containment. If fire potential exists, blanket spill with alcohol-type aqueous film-forming foam or use water spray to disperse vapors. Contain spill to facilitate clean-up. Clean-up methods may include absorbent materials, vacuum truck, etc. Avoid runoff into storm sewers and ditches which lead to natural waterways. Call the National Response Center (800 424 8802) if the quantity spilled is equal to or greater than the reportable quantity (5000 lb/day) under CERCLA "Superfund".

**Waste disposal method:**

All notification, clean-up and disposal should be carried out in accordance with federal, state and local regulations. Preferred methods of waste disposal are incineration or biological treatment in federal/state approved facility.

**Hazardous waste (40 CFR 261):**

Yes; hazardous waste code D001.

**Special protection information****Respiratory protection**

Based on contamination level and working limits of the respirator, use a respirator approved by NIOSH/MSHA (the following are the minimum recommended equipment).

For vinyl acetate concentrations of:  
 ≥ 10 ppm and ≤ 100 ppm – Air-purifying respirator with full facepiece respirator with an organic vapor canister or a full facepiece powered air-purifying respirator fitted with organic vapor cartridge(s).  
 > 100 ppm and < 1000 ppm – Positive-pressure full facepiece supplied-air respirator, or continuous-flow full facepiece supplied-air respirator.

≥ 1000 ppm or unknown concentration (such as in emergencies) – Positive-pressure self-contained breathing apparatus with full facepiece. Positive-pressure supplied-air respirator with full facepiece equipped with an auxiliary positive-pressure self-contained breathing apparatus escape system.

**Ventilation**

**Local exhaust:** Recommended when appropriate to control employee exposure.

**Mechanical (general):** Not recommended as the sole means of controlling employee exposure.

**Protective gloves:**

Neoprene or rubber.

**Eye protection:**

Chemical safety goggles.

**Additional protective equipment:**

For operations where spills or splashing can occur, use chemical protective clothing, including gloves and boots. A safety shower and eye bath should be readily available.

**Special precautions****Precautions to be taken in handling and storing:**

Store in a cool, well-ventilated area. Keep away from heat, sparks and flame. Keep containers closed when not in use. Always open containers slowly to allow any excess pressure to vent. Use only DOT-approved containers. Use spark-resistant tools. Do not load into compartments adjacent to heated cargo. When transferring follow proper grounding procedures. Use with adequate ventilation. Avoid breathing vapor. Avoid contact with eyes, skin and clothing. Wash thoroughly with soap and water after handling. Decontaminate soiled clothing thoroughly before re-use. Discard contaminated leather clothing.

\* New or revised information; previous version dated September 15, 1992.

**Glossary for Components information table**

ACGIH – American Conference of Governmental Industrial Hygienists  
 CAS – Chemical Abstracts Service  
 Ceiling – The concentration that should not be exceeded during any part of the working day  
 IDLH – Immediately Dangerous to Life or Health  
 OSHA – Occupational Safety and Health Administration

PEL – Permissible exposure limit  
 SARA – Superfund Amendments and Reauthorization Act  
 Skin – Potential contributor to overall exposure possible via skin absorption  
 STEL – Short-term exposure limit, 15-min. time-weighted average  
 TLV – Threshold limit value  
 TWA – 8-hour time-weighted average

Chemical Group  
 Hoechst Celanese Corporation  
 P.O. Box 819005/Dallas, Texas 75381-9005  
 Information phone: 214 277 4000  
 Emergency phone: 800 424 9300 (CHEMTREC)

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The supplier makes no warranty of any kind, express or implied, concerning the use of this product either singly or in combination with other substances. Effects can be aggravated by other materials. This product may aggravate or add to the effects of other materials. This product may be released from gas, liquid or solid materials made directly or indirectly from it. User assumes all risks incident to its use. User must communicate to its employees and customers, including consumers of its products, all warnings that relate to the potential exposure of each of those persons to the material. In the best of our knowledge, the information contained herein is accurate. However, neither Hoechst Celanese Corporation nor any of its subsidiaries or affiliates assume

Product Name: VINYL ACETATE  
Product Code: 311277  
MSDS Number : 94  
Version Date: 04/21/1995

Page 1 of 11

## Material Safety Data Sheet

Print date - April 12th, 1995 2:24 a.m. 3829 PG1A X0H21001 - 351.1 (2546/2654)

### 1. CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Product Name: ~~VINYL ACETATE~~  
Product Code: 311277  
MSDS Number : 94

SYNONYMS: ACETIC ACID, ETHENYL ESTER  
ACETIC ACID, VINYL ESTER  
ETHENYL ACETATE  
VINYL ACETATE MONOMER  
1-ACETOXYETHYLENE

HOECHST CELANESE CHEMICAL GROUP  
1601 W. LBJ FREEWAY  
PO BOX 819005  
DALLAS, TX 753819005  
USA

TRANSPORTATION EMERGENCY PHONE  
NUMBER (24 HOURS/DAY):  
In USA, call.....800 424 9300.  
Outside USA, call\*....202 483 7617.  
\*collect calls accepted  
In Canada, call.....403 477 8339.  
In Europe, call (31) 10 400 22 64.

### 2. COMPOSITION | INFORMATION on INGREDIENTS

COMPONENT	CAS NUMBER	**
HYDROQUINONE *	123-31-9	
VINYL ACETATE *	108-05-4	99.9%

\* OSHA hazardous according to 29 CFR 1910.1200  
\*\* Hydroquinone is present at 3-17 ppm as an inhibitor.

### 3. HAZARDS IDENTIFICATION

#### EMERGENCY OVERVIEW:

Vinyl acetate is a clear, colorless mobile liquid with a not unpleasant odor in small quantities.

#### DANGER!

Extremely flammable liquid and vapor (fp: 18 F, TCC)  
Vapor may cause flash fire (fp: 25 F, TOC)  
May polymerize explosively if contaminated  
Rapid, uncontrolled polymerization can cause explosion  
Vapor is heavier than air and can travel considerable distance to a source of ignition and flash back  
Material creates a special hazard because it floats on water

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: VINYL ACETATE  
Product Code: 311277  
MSDS Number : 94  
Version Date: 04/21/1995

Print date -- April 12th, 1995 2:24 a.m. 3820 PG1A X0H21001 - 351.2 (2567/3854)

----- 3. HAZARDS IDENTIFICATION (Continued) -----

POTENTIAL HEALTH EFFECTS

ROUTES OF EXPOSURE:

Skin, eyes, inhalation, ingestion.

IMMEDIATE EFFECTS

SKIN:

Can cause severe injury (reddening and swelling). Prolonged contact can cause blisters. Sensitization (allergic reaction) can occur.

EYES:

Can cause severe injury--damage reversible.

INHALATION:

Can irritate nasal passages, throat and lungs.

INGESTION:

Can cause headache, drowsiness and unconsciousness.

DELAYED/LONG TERM EFFECTS

CARCINOGENIC:

Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans; available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure; A3, animal carcinogen, ACGIH.

Possibly carcinogenic to humans (based on inadequate human data and limited animal data); 2B, IARC.

TARGET ORGAN EFFECTS:

Overexposure (or prolonged or repeated exposure) may cause lung damage.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Significant exposure to this chemical may adversely affect people with acute or chronic lung disease.

FOR FURTHER INFORMATION, SEE:

- Section 4 - First Aid Measures
- Section 5 - Fire Fighting Measures
- Section 6 - Accidental Release Measures
- Section 8 - Exposure Controls/Personal Protection
- Section 9 - Physical and Chemical Properties

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
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Product Name: VINYL ACETATE  
Product Code: 311277  
MSDS Number : 94  
Version Date: 04/21/1995

Print date - April 12th, 1995 2:24 a.m. 3820 PG1A X0H21001... - 351.3 (2568/3854)

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: (Continued)**

Section 10 - Stability and Reactivity

----- 4. FIRST AID MEASURES -----

**SKIN:**

Remove contaminated clothing and wash contaminated skin with large amounts of soap and water. If irritation persists, contact a physician.

**EYES:**

Flush eyes with water for at least 15 minutes. Contact a physician immediately.

**INHALATION:**

Remove patient from contaminated area. If breathing has stopped, give artificial respiration, then oxygen if needed. Contact a physician immediately.

**INGESTION:**

Patient should be made to drink large quantities of water. Do not induce vomiting. Contact a physician immediately.

----- 5. FIRE FIGHTING MEASURES -----

NFPA (H, F, R): 2, 3, 2

**FLAMMABLE PROPERTIES**

FLASHPOINT CLOSED CU: 18 F (-8 C)  
FLASHPOINT OPEN CUP : 25 F (-4 C)

AUTOIGNITION TEMP : 800 F (426.9 C)

LOWER FLAMMABLE LMT : 2.6  
Vol. % in air @ 760 mmHg

UPPER FLAMMABLE LMT : 13.4  
Vol. % in air @ 760 mmHg

**HAZARDOUS PRODUCTS OF COMBUSTION:**  
Carbon monoxide.

**EXTINGUISHING MEDIA:**

Use carbon dioxide or dry chemical for small fires; alcohol-type aqueous film-forming foam or water spray for large fires. Water may be ineffective but should be used to cool fire-exposed structures and vessels.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE; 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: VINYL ACETATE  
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## 5. FIRE FIGHTING MEASURES (Continued)

### FIRE FIGHTING INSTRUCTIONS:

If potential for exposure to vapors or products of combustion exists, wear complete personal protective equipment: self-contained breathing apparatus with full facepiece operated in pressure demand or other positive pressure mode. Vapor is heavier than air and can travel considerable distance to a source of ignition and flash back. Material creates a special hazard because it floats on water. Rapid, uncontrolled polymerization can cause explosion.

## 6. ACCIDENTAL RELEASE MEASURES

Caution: Spontaneous polymerization can occur.

Eliminate ignition sources. Avoid eye or skin contact; see "Section 8 - Exposure Controls/Personal Protection" for respirator information. Place leaking containers in well-ventilated area with spill containment. If fire potential exists, blanket spill with alcohol-type aqueous film-forming foam or use water spray to disperse vapors. Contain spill to facilitate clean-up. Clean-up methods may include absorbent materials, vacuum truck, etc.

Call the National Response Center (800 424 8802) if the quantity spilled is equal to or greater than the reportable quantity (RQ) under CERCLA "Superfund": 5000 lb/day.

For more information, see "Section 15 - Regulatory Information".

## 7. HANDLING and STORAGE

TO PREVENT HAZARDOUS POLYMERIZATION: Store in a cool, well-ventilated area. Drums of VA inhibited with 3-5 ppm HQ should be stored at product temperatures not exceeding 30 C (86 F) and for periods not exceeding 6 months. Drums of VA inhibited with 14-17 ppm HQ should be stored at product temperatures not exceeding 30 C (86 F) and for periods not exceeding 1 year. Bulk storage of VA at ambient temperatures is an acceptable practice when there is routine turnover of the tank contents. Inhibitor levels should be monitored if a stability problem is suspected.

Store in a cool, well-ventilated area. Keep away from heat, sparks and flame. Keep containers closed when not in use.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
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----- 7. HANDLING and STORAGE (Continued) -----

Always open containers slowly to allow any excess pressure to vent. Use only DOT-approved containers. When transferring, follow proper grounding procedures. Use with adequate ventilation. Avoid breathing vapor. Avoid contact with eyes, skin and clothing. Wash thoroughly with soap and water after handling. Decontaminate soiled clothing thoroughly. Discard contaminated leather clothing.

Use spark-resistant tools. Do not load into compartments adjacent to heated cargo.

----- 8. EXPOSURE CONTROLS | PERSONAL PROTECTION -----

ENGINEERING CONTROLS:

General or dilution ventilation is frequently insufficient as the sole means of controlling employee exposure. Local ventilation is usually preferred.

PROTECTIVE EQUIPMENT

A safety shower and eye bath should be readily available.

SKIN:

For operations where spills or splashing can occur, use chemical protective clothing, including gloves (neoprene or rubber) and boots.

EYES:

Chemical safety goggles.

INHALATION:

Based on workplace contaminate level and working limits of the respirator, use a respirator approved by NIOSH/MSHA. The following is the minimum recommended equipment for an acceptable level of exposure. To estimate an acceptable level of exposure, see "Section 3 - Hazards Identification", "Section 8 - Exposure Controls/Personal Protection" and "Section 11 - Toxicological Information".

For concentrations  $\geq 1$  and  $\leq 10$  times the acceptable level: Use air-purifying respirator with full facepiece and organic vapor cartridge(s) or air-purifying full facepiece respirator with an organic vapor canister or a full face-piece powered air-purifying respirator fitted with organic vapor cartridge(s).

For concentrations  $> 10$  and the lower of either  $< 100$  times

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## INHALATION: (Continued)

the acceptable level or < the IDLE: Use Type C full face-piece supplied-air respirator operated in pressure-demand or continuous-flow mode.

For concentrations  $\geq$  100 times the acceptable level or IDLE level or unknown concentration (such as in emergencies): Use self-contained breathing apparatus with full facepiece in pressure-demand mode. Type C positive-pressure full facepiece supplied-air respirator with an auxiliary positive-pressure self-contained breathing apparatus escape system.

For escape: Use self-contained breathing apparatus with full facepiece or any respirator specifically approved for escape.

## EXPOSURE GUIDELINES:

VINYL ACETATE (108-05-4)

OSHA PEL	ACGIH TLV
.....	15 PPM (STEL)
.....	10 PPM (TWA)

Hoechst Celanese has adopted the ACGIH TLV.

Immediately Dangerous to Life or Health (IDLE) level:  
No value established.

## -----9. PHYSICAL and CHEMICAL PROPERTIES -----

APPEARANCE	: Clear, colorless, mobile liquid
ODOR	: Not unpleasant, sweetish smell in small quantities.
PHYSICAL STATE	: Liquid
VAPOR PRESSURE	: 89.1 MMEG @ 20 C.
VAPOR DENSITY	: 2.97 Air = 1.
BOILING POINT	: 72.7 C (162.9 F) (760 mmHg)
FREEZING POINT	: -92.8 C (-135.0 F)
SOLUBILITY	: 2.3 % by wt in water @ 20 C
SPECIFIC GRAVITY	: 0.934 20/20 C.
EVAPORATION RATE	: 8.9 BuAc = 1

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----- 10. STABILITY and REACTIVITY -----

CHEMICAL STABILITY:

Stable if stored and handled under recommended conditions.

CONDITIONS TO AVOID:

Drummed product temperatures above 30 C (86 F) (see Section 7 - Handling and Storage); x-ray or ultra-violet radiation; sunlight; sparks and flame.

INCOMPATIBILITY:

Peroxides, for example, t-butyl peroxide and hydrogen peroxide; other polymerization initiators; oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS:

Carbon monoxide.

HAZARDOUS POLYMERIZATION:

Can occur. UNCONTROLLED POLYMERIZATION CAN CAUSE RAPID EVOLUTION OF HEAT AND INCREASED PRESSURE WHICH CAN RESULT IN VIOLENT RUPTURE OF STORAGE VESSELS OR CONTAINERS.

----- 11. TOXICOLOGICAL INFORMATION -----

ACUTE EXPOSURE:

Oral LD50: 2.9-3.7 g/kg (rats); slightly toxic to animals.

Inhalation LC50: 3680-4490 ppm (rats, 4 hrs.); practically nontoxic to animals.

Skin: Slightly irritating to skin; slightly toxic to animals (LD50, rabbits: 2.3-7.5 g/kg); causes skin sensitization in guinea pigs (slight-moderate skin redness in 30% of animals induced with 100% VA and challenged with 25% VA in acetone).

Eye: Slightly to severely irritating to rabbit eyes depending on the quantity administered (0.1 to 0.5 ml).

REPEATED EXPOSURE:

Inhalation exposure (6 hrs./day; 5 days/week) of rats and mice to vapor concentrations of 200 or 600 ppm over a lifetime resulted in irritation of the respiratory tract and decreased body weights. No effect was observed at 50 ppm. Oral exposure of rats to levels of VA in the drinking water

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----- **II. TOXICOLOGICAL INFORMATION (Continued)** -----

up to 5000 ppm over a lifetime did not cause systemic toxicity. Decreases in water/food consumption and body weight gain were noted. The no observed adverse effect level was 1000 ppm. Oral exposure of mice to levels of VA in the drinking water up to 5000 ppm for 13 weeks was without significant effects.

**MUTAGENICITY:** Genotoxic potential was noted in several mammalian cell systems (possibly due to hydrolysis to acetaldehyde), but not in Ames Tests. While genotoxic potential was noted in vivo in several intraperitoneal injection studies, subchronic exposure of rats and mice to VA for 13 weeks orally or via inhalation did not result in genotoxic effects.

**CARCINOGENICITY:** Oral - VA was not carcinogenic in a lifetime drinking water study in rats at concentrations of 200 to 5000 ppm. This study was conducted to help clarify an earlier study of limited quality conducted at lower concentrations and with fewer animals which claimed carcinogenic effects. Inhalation - VA did not cause treatment-related tumors in mice in a lifetime inhalation study at concentrations of 50 to 600 ppm. In rats, treatment-related nasal tumors were reported at 600 ppm, but not at 50 or 200 ppm.

**ACGIE CLASSIFICATION:** A3, Animal Carcinogen (available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure).

**IARC CLASSIFICATION:** 2B, Possibly carcinogenic to humans (based on inadequate human data and limited animal data).

**REPRODUCTIVE/DEVELOPMENTAL EFFECTS:** In a two-generation study, rats were exposed to 200, 1000 or 5000 ppm VA in drinking water. At 5000 ppm, male reproductive parameters were altered slightly; however, responses were inconsistent across generations. The no observed adverse effect level was 1000 ppm. In two separate developmental toxicity studies, rats were given 200, 1000 or 5000 ppm VA in drinking water or exposed 6 hrs./day to 50, 200 or 1000 ppm VA vapors. Results indicate that VA is not uniquely toxic to the developing fetus. The no observed effect level for the mother and the developing fetus was 5000 ppm for the drinking water study and 200 ppm for the inhalation study.

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**IN U.S., CHEMTREC - 24 HRS/DAY**  
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----- 12. ECOLOGICAL INFORMATION -----

**ECOTOXICITY:**

VA exhibits slight acute toxicity to aquatic species. The 24-, 48- and 96-hr. LC50 values for various fish species (bluegill sunfish, fathead minnows, guppies, goldfish, carp, golden orfe) are in the range 14-44 ppm. The 24-hr. EC50 for the water flea is 52 ppm and for brine shrimp is 45 ppm. In the alga *Scenedesmus quadricauda*, cell multiplication was inhibited after eight days exposure to 370 ppm.

**ENVIRONMENTAL FATE/INFORMATION:**

The short atmospheric half-life, the relatively rapid hydrolysis rate in water, the low n-octanol/water partition coefficient and the ability of animals & microorganisms to rapidly biodegrade VA are expected to lead to its rapid removal if released into the environment.

Degradation: Under aerobic conditions, VA is readily bio-degradable. BOD (5-day) values are in the range 42-62% of COD. Biodegradation also occurs under anaerobic conditions. VA was hydrolyzed in studies with samples of soil, sludge and sewage. Water hydrolysis, half-life 7.3 days @ 25 C & pH 7. Atmospheric photochemical degradation, est. half-life 12 hrs. Volatilization half-lives of 4.4 hrs. and 2.2 days have been estimated for a model river and a model pond, respectively.

Bioaccumulation: The n-octanol/water partition coefficients are in the range 0.21-0.73. This suggests that VA has relatively low potential to bioaccumulate.

----- 13. DISPOSAL CONSIDERATIONS -----

All notification, clean-up and disposal should be carried out in accordance with federal, state and local regulations. Preferred methods of waste disposal are incineration or biological treatment in federal/state approved facility.

Hazardous waste (40 CFR 261): Yes; D001.

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----- 14. TRANSPORT INFORMATION -----

DOT proper shipping name : Vinyl Acetate, Inhibited  
DOT hazard class : 3, Flammable Liquid  
UN/NA identification number: UN1301  
Packing group : II  
Reportable quantity (RQ) : 5000 lb/2270 kg  
ER guidebook number : 26  
  
TDG shipping name : Vinyl Acetate, Inhibited  
TDG classification : Flammable Liquid 3.2 (9.2)

----- 15. REGULATORY INFORMATION -----

STATE REGULATIONS

The following chemicals associated with the product are subject to the right-to-know regulations in these states:

VINYL ACETATE (108-05-4): CT, FL, IL, LA, MA, NJ, NY, PA, RI

U.S. FEDERAL REGULATIONS

We certify that all components are either on the TSCA inventory or qualify for an exemption.

SARA 313 : VINYL ACETATE 99.9% (108-05-4)

ENVIRONMENTAL:

CERCLA : VINYL ACETATE 99.9% (108-05-4)

SARA 302 : VINYL ACETATE 99.9% (108-05-4)

SARA 304 : VINYL ACETATE 99.9% (108-05-4)

SARA 311 :

Acute health..... Yes  
Chronic health..... Yes  
Fire..... Yes  
Sudden release of pressure.. No  
Reactive..... Yes

INTERNATIONAL REGULATIONS

Listed on the chemical inventories of the following countries: Australia, Canada, Europe (EINECS), Japan and Korea.

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PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

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----- 15. REGULATORY INFORMATION (Continued) -----

**WHMIS INGREDIENT DISCLOSURE LISTED COMPONENTS:**

WEMIS CLASSIFICATION: Class B, Division 2; Class D, Division 2, Subdivision B and Class F.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

----- 16. OTHER INFORMATION -----

MSDS prepared by: Product Stewardship Department  
Hoechst Celanese Chemical Group

**HAZARD RATINGS**

	HEALTH	FLAMM	REACT	OTHER
NFPA	2	3	2	
HMIS	2	3	2	X

This information is intended solely for the use of individuals trained in the NFPA and HMIS systems.

**REVISION INDICATORS:**

The following sections have been revised:

- SECTION 3: HAZARDS IDENTIFICATION
- COMMENTS CARCINOGENIC
- SECTION 11: TOXICOLOGICAL INFORMATION
- SECTION 12: ECOLOGICAL INFORMATION

**DISCLAIMER:**

The information contained herein is accurate to the best of our knowledge. We do not suggest or guarantee that any hazards listed herein are the only ones which exist. Hoechst Celanese Chemical Group, Inc. makes no warranty of any kind, express or implied, concerning the safe use of this material in your process or in combination with other substances. Effects can be aggravated by other materials and/or this material may aggravate or add to the effects of other materials. This material may be released from gas, liquid, or solid materials made directly or indirectly from it. User has the sole responsibility to determine the suitability of the materials for any use and the manner of use contemplated. User must meet all applicable safety and health standards.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
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PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

001000



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1.0 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: ETHYLENE

MANUFACTURER/SUPPLIER:  
Amoco Chemical Company  
200 East Randolph Drive  
Chicago, Illinois 60601 U.S.A.

EMERGENCY HEALTH INFORMATION:  
1 (800) 447-8735  
EMERGENCY SPILL INFORMATION:  
1 (800) 424-9300 CHEMTREC (USA)  
OTHER PRODUCT SAFETY INFORMATION:  
(312) 856-3907

---

2.0 COMPOSITION/INFORMATION ON INGREDIENTS

<u>Component</u>	<u>CAS#</u>	<u>Range % by Wt.</u>
Ethylene	74-85-1	100

(See Section 8.0, "Exposure Controls/Personal Protection", for exposure guidelines)

---

3.0 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Danger! Extremely flammable. Extremely cold material; can cause burns similar to frostbite. Inhalation causes chemical asphyxiation. Inhalation causes headaches, dizziness, drowsiness, and nausea, and may lead to unconsciousness.

POTENTIAL HEALTH EFFECTS:

EYE CONTACT: Extremely cold material; can cause burns similar to frostbite.

SKIN CONTACT: Liquid can cause burns similar to frostbite.

INHALATION: Inhalation causes chemical asphyxiation. Inhalation causes headaches, dizziness, drowsiness, and nausea, and may lead to unconsciousness.

INGESTION: Ingestion of liquid can cause burns similar to frostbite.

HMIS CODE: (Health:1) (Flammability:4) (Reactivity:0)

NFPA CODE: (Health:1) (Flammability:4) (Reactivity:0)

---

#### 4.0 FIRST AID MEASURES

**EYE:** Immediately flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

**SKIN:** Contact with liquid: Immediately flush in cool water for at least 15 minutes. Get immediate medical attention.

**INHALATION:** If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

**INGESTION:** If swallowed, drink plenty of water, do NOT induce vomiting. Get immediate medical attention.

---

#### 5.0 FIRE FIGHTING MEASURES

**FLASHPOINT:** -213°F(-135°C)

**UEL:** 32.0%

**LEL:** 3.1%

**AUTOIGNITION TEMPERATURE:** 842°F (450°C)

**FLAMMABILITY CLASSIFICATION:** Extremely Flammable Liquid.

**EXTINGUISHING MEDIA:** Agents approved for Class B hazards (e.g., dry chemical, carbon dioxide, foam, steam) or water fog.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Extremely flammable liquid. Vapor may explode if ignited in enclosed area.

**FIRE-FIGHTING EQUIPMENT:** Firefighters should wear full bunker gear, including a positive pressure self-contained breathing apparatus.

**PRECAUTIONS:** Keep away from sources of ignition (e.g., heat and open flames). Keep container closed. Use with adequate ventilation. Do not vent into atmosphere or enclosure unless area is sufficiently ventilated to reduce vapor concentrations below flammable limit.

**HAZARDOUS COMBUSTION PRODUCTS:** Hazardous polymerization possible with catalyst and heat. Incomplete burning can produce carbon monoxide and/or carbon dioxide and other harmful products.

---

#### 6.0 ACCIDENTAL RELEASE MEASURES

Remove or shut off all sources of ignition. Increase ventilation if possible. Wear respirator and spray with water to disperse vapors. Keep out of sewers and waterways.

---

#### 7.0 HANDLING AND STORAGE

**HANDLING:** Keep away from ignition sources (e.g., heat, sparks, or open flames). Do not cut, puncture, or weld on or near this container.

**STORAGE:** Store in flammable liquids storage area. Store away from heat, ignition sources, and open flame in accordance with applicable regulations. Keep container closed.

---

## 8.0 EXPOSURE CONTROLS / PERSONAL PROTECTION

**EYE:** Do not get in eyes. Wear chemical goggles and face shield.

**SKIN:** Avoid skin contact. Wear clothing, gloves and footwear that cannot be penetrated by chemicals or oil.

**INHALATION:** Use with adequate ventilation. If ventilation is inadequate, use supplied- air respirator approved by NIOSH/MSHA.

**ENGINEERING CONTROLS:** Control airborne concentrations below the exposure guidelines.

### EXPOSURE GUIDELINES:

<u>Component</u>	<u>CAS#</u>	<u>Exposure Limits</u>
Ethylene	74-85-1	ACGIH TLV-TWA: simple asphyxiant

---

## 9.0 CHEMICAL AND PHYSICAL PROPERTIES

APPEARANCE AND ODOR:	Gas. Colorless. Odorless.
pH:	Not determined.
VAPOR PRESSURE:	Not determined.
VAPOR DENSITY:	0.98
BOILING POINT:	-154°F(-103°C)
MELTING POINT:	-272°F(-169°C)
SOLUBILITY IN WATER:	Negligible, below 0.1%.
SPECIFIC GRAVITY (WATER = 1):	0.61

---

## 10.0 STABILITY AND REACTIVITY

**STABILITY:** Burning can be started easily.

**CONDITIONS TO AVOID:** Keep away from ignition sources (e.g. heat, sparks, and open flames).

**MATERIALS TO AVOID:** Avoid chlorine, fluorine, and other strong oxidizers.

**HAZARDOUS DECOMPOSITION:** Burning can produce carbon monoxide and/or carbon dioxide and other harmful products.

**HAZARDOUS POLYMERIZATION:** Hazardous polymerization possible with catalyst and heat.

---

## 11.0 TOXICOLOGICAL INFORMATION

### ACUTE TOXICITY DATA:

**EYE IRRITATION:** Testing not conducted. See Other Toxicity Data.

**SKIN IRRITATION:** Testing not conducted. See Other Toxicity Data.

**DERMAL LD50:** Testing not conducted. See Other Toxicity Data.

ORAL LD50: Testing not conducted. See Other Toxicity Data.

INHALATION LC50: Testing not conducted. See Other Toxicity Data.

**OTHER TOXICITY DATA:**

Specific toxicity tests have not been conducted on this product. Our hazard evaluation is based on information from similar products, the ingredients, technical literature, and/or professional experience.

No component of this product present at levels greater than 0.1% is identified as a carcinogen by the U.S. National Toxicology Program, the U.S. Occupational Safety and Health Act, or the International Agency on Research on Cancer (IARC).

---

**12.0 ECOLOGICAL INFORMATION**

Ecological testing has not been conducted on this product.

---

**13.0 DISPOSAL INFORMATION**

Disposal must be in accordance with applicable federal, state, or local regulations.

The container for this product can present explosion or fire hazards, even when emptied! To avoid risk of injury, do not cut, puncture, or weld on or near this container. Since the emptied containers retain product residue, follow label warnings even after container is emptied.

---

**14.0 TRANSPORTATION INFORMATION**

**U.S. DEPT OF TRANSPORTATION**

Shipping Name : Ethylene, Compressed  
Hazard Class : 2.1  
Identification Number : UN1962

**INTERNATIONAL INFORMATION:**

**Sea (IMO/IMDG)**

Shipping Name : Ethylene, Compressed  
Class : 2.1  
UN Number : 1962

**Air (ICAO/IATA)**

Shipping Name : Ethylene, Compressed  
Class : 2.1  
Subsidiary Class : UN1962

**European Road/Rail (ADR/RID)**

Shipping Name : Not determined.

**Canadian Transportation of Dangerous Goods**

Shipping Name : Not determined.

15.0 REGULATORY INFORMATION

CERCLA SECTIONS 102A/103 HAZARDOUS SUBSTANCES (40 CFR PART 302.4): This product is not reportable under 40 CFR Part 302.4.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR PART 355): This product is not regulated under Section 302 of SARA and 40 CFR Part 355.

SARA TITLE III SECTIONS 311/312 HAZARDOUS CATEGORIZATION (40 CFR PART 370): This product is defined as hazardous by OSHA under 29 CFR Part 1910.1200(d).

SARA TITLE III SECTION 313 (40 CFR PART 372): This product contains the following substance(s), which is on the Toxic Chemicals List in 40 CFR Part 372:

Component/CAS Number	Weight Percent
Ethylene 74-85-1	100

U.S. INVENTORY (TSCA): Listed on inventory.

OSHA HAZARD COMMUNICATION STANDARD: Flammable gas. Compressed gas. Contains a component listed by ACGIH.

EC INVENTORY (EINECS/ELINCS): Not determined.

JAPAN INVENTORY (MITI): Not determined.

AUSTRALIA INVENTORY (AICS): Not determined.

KOREA INVENTORY (ECL): Not determined.

CANADA INVENTORY (DSL): Not determined.

PHILIPPINE INVENTORY (PICCS): Not determined.

16.0 OTHER INFORMATION

BY:



Donald M. Barker, Director  
Product Stewardship & Toxicology

Issued: August 26, 1993  
Supersedes: July 30, 1990

*This material Safety Data Sheet conforms to the requirements of ANSI Z400.1.*

*This material safety data sheet and the information it contains is offered to you in good faith as accurate. We have reviewed any information contained in this data sheet which we received from sources outside our company. We believe that information to be correct but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents. No warranty is made, either express or implied.*



Amoco Chemical Company  
200 East Randolph Drive  
Chicago, Illinois 60601 U.S.A.

January 04, 1995

EVAL COMPANY OF AMERICA  
11500 BAY AREA BLVD  
PASADENA TX 77507  
U.S.A.

Attention: Safety Officer

Thank you for your interest in Amoco products. Attached is the current Material Safety Data Sheet (MSDS) for the product(s) purchased by your company.

We are pleased to provide you with the 16-section MSDS. Adopted by the American National Standards Institute (ANSI) as a consensus standard, ANSI Z400.1, the 16-section MSDS creates a uniform MSDS format. The use of standard section titles and layout is intended to provide MSDSs that are significantly easier to use and understand.

The MSDS provides important health and safety information. We suggest that you review this document prior to handling the product. For the MSDS to serve as an effective means of hazard communication, it must be made available to all those who handle and are responsible for operations involving this product. We strongly urge you, and it is your legal responsibility, to distribute an MSDS to all employees, handlers and users of this product. If you resell the product, you are also required to furnish a copy of this MSDS to your customers. The OSHA regulations governing these legal responsibilities are discussed more fully in Volume 52, No. 163 of the Federal Register, August 24, 1987, pp. 31852-86 and Volume 59, No. 27 of the Federal Register, February 9, 1994, pp. 6126-6184.

The Regulatory Information Section contains information to help you meet the requirements of SARA Title III and fulfills our supplier notification obligation under SARA Section 313 (40 CFR 372.45).

It is our policy to automatically distribute an MSDS upon initial purchase of a product, or if a subsequent purchase is made after the MSDS has been significantly revised. This is our way of ensuring that you have current health and safety information on our products.

Spanish MSDSs are available upon request. Please specify the customer reference number located below.

For further health and safety information, please contact me.

Mary P. Mattler  
Coordinator, Client Support  
Amoco Chemical Company  
Mail Code 4903  
Tel: (312) 856-3304  
Fax: (312) 856-7584





# MATERIAL SAFETY DATA SHEET (MSDS)

7/13/95  
Operational

MSDS NUMBER 2001 (REV 7/93)

PAGE 1 OF 4

SECTION I - IDENTIFICATION		SECTION II - HAZARD INFORMATION													
PRODUCT	Methanol	CHEMTREC													
CHEMICAL/ SYNONYMS	Methyl Alcohol Wood Alcohol Carbinol	800-424-9300													
CHEMICAL FAMILY	Alcohol														
GRADE	Technical														
FORMULA	CH3OH														
CAS NO.	67-56-1	Percent: 100													
MANUFACTURER/ DISTRIBUTOR	BMC P.O. Box 20339 Beaumont, TX 77720	409-723-1920													
			<table border="1"> <tr> <td></td> <td>NFPA</td> <td>NPCA</td> </tr> <tr> <td>+ HEALTH</td> <td>1</td> <td>2</td> </tr> <tr> <td>A FIRE</td> <td>3</td> <td>3</td> </tr> <tr> <td>REACTIVITY</td> <td>0</td> <td>0</td> </tr> </table>		NFPA	NPCA	+ HEALTH	1	2	A FIRE	3	3	REACTIVITY	0	0
	NFPA	NPCA													
+ HEALTH	1	2													
A FIRE	3	3													
REACTIVITY	0	0													
		NPCA/EMIS NFPA HAZARD RATING 1 LEAST 0 SLIGHT 1 MODERATE 2 HIGH 3													
		(Personal Protection ratings to be supplied by user depending on use conditions.)													

## SECTION III - PERSONAL PROTECTIVE INFORMATION

### ENGINEERING CONTROLS

Good general ventilation should be provided to keep vapor concentrations below the exposure limits.

### OTHER PROTECTIVE EQUIPMENT

Have available and wear as appropriate: coverall chemical splash goggles; safety spectacles (side shield preferred); full-length face shield; hard hat with brim; flame resistant work clothing; chemical resistant gloves, clothing footwear, and apron; NIOSH/MSHA approved respiratory protection.

## SECTION IV - HEALTH INFORMATION

**SAFETY PRECAUTIONS:** Avoid contact with eyes, skin or clothing. Avoid prolonged or repeated breathing of vapor. Wash thoroughly after handling.

### EXPOSURE LIMITS: METHANOL

OSHA Permissible Exposure Limit (PEL): 200 ppm, 260 mg/m<sup>3</sup> -8 Hr TWA  
 STEL: 250 ppm, 325 mg/m<sup>3</sup> - skin  
 ACGIH Threshold Limit Value (TLV): 200 ppm, 262 mg/m<sup>3</sup> -8 Hr TWA  
 STEL: 250 ppm, 328 mg/m<sup>3</sup> - skin  
 AEL \* (BMC): 200 ppm, -8 & 12 Hr TWA - skin

\*AEL is BMC Acceptable Exposure Limit: Where governmentally imposed occupational exposure limits which are lower than AEL are in effect, such limits shall take precedence.

### \*OTHER APPLICABLE EXPOSURE LIMITS:

All these limits carry a "skin" notation indicating that methanol liquid and vapor can penetrate skin and mucous membrane. Therefore, control of inhalation alone may not be sufficient to prevent an excessive dose. Also, in its "Notice of Intent to Establish", ACGIH lists Biological Exposure Indices for methanol in urine of 15 mg/L (end of shift) and for formic acid in urine of 80 mg/g creatine (before the shift at end of workweek). Harmful if inhaled or absorbed through skin, causes damage to liver, kidney, and nervous system. Causes eye, skin, nose, and throat irritation. May be fatal or cause blindness if swallowed. Cannot be made nonpoisonous.

LISTED AS CARCINOGEN IN: IARC Monographs No: NTP List No: OSHA No

OSHA HEALTH HAZARD CLASSIFICATION  
None

PRIMARY ROUTES OF ENTRY  
Skin/Inhalation

**SYMPTOMS OF OVEREXPOSURE:**

**ACUTE:** Human health effects of overexposure by inhalation, ingestion, or skin or eye contact may include nonspecific discomfort such as nausea, or weakness; temporary nervous system depression with anesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness; or blindness. Higher exposures may lead to abnormal liver function as detected by laboratory tests; abnormal kidney function as detected by laboratory tests; or fatality from gross overexposure. Ingestion of as little as 60 mL may cause blindness or fatality. No evidence of reproductive effects has been reported for humans. Skin permeation can occur in amounts capable of producing systems toxicity.

**CHRONIC:** Individuals with preexisting diseases of the retina or liver may have increased susceptibility to the toxicity of excessive exposures.

**TOXIC DATA:** Inhalation 1-hour LC50: >145,000ppm in rats.  
 Skin Absorption LD50: 15,840 mg/kg in rabbits.  
 Oral LD50: 9100 mg/kg in rats.

The compound is an eye and skin irritant. Toxic effects described in animals from short exposures by inhalation, ingestion, or skin contact include anesthetic effects, liver effects, blindness, and acidosis. Information available on reproductive effects is not sufficient to characterize the reproductive hazard. The compound produced developmental effects in rats exposed by inhalation to 10,000 or 20,000 ppm, but because maternal effects also occurred at these high concentrations, it would conclude that methanol is not a significant hazard to the conceptus. Tests in bacterial or mammalian cell structures demonstrate no mutagenic activity.

**SECTION 4 - EMERGENCIES AND FIRST AID PROCEDURES**

**EYE CONTACT:**

Flush eyes immediately and thoroughly for 15 minutes with water. Get medical attention if irritation persists.

**SKIN CONTACT:**

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash contaminated clothing and shoes before reuse.

**INHALATION:**

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

**INGESTION:**

As little as 60 mL may cause blindness or fatality. Immediately give two glasses of water and induce vomiting. Call physician. Never give anything by mouth to an unconscious person.

**NOTES TO PHYSICIAN:**

Provide standard methanol ingestion treatment. To prepare the antidote, make a solution using 100 mL of 100-proof ethyl alcohol (grain alcohol) in 2000 mL of water and give 1.5 mL/Kg of body weight, or 100 mL for an average adult. Following this, at 2-hour intervals for 4 days, give the antidote (0.5-1.0 mL/Kg of body weight, orally or intravenously to reduce the metabolism of the methanol and to allow time for its excretion. Blood ethanol levels should be 1.0-1.5 mg/mL).

**SECTION 5 - INGREDIENTS**

COMPOSITION	PERCENT (BY WEIGHT)	CAS REGISTRY NO.
Methyl Alcohol	NA	NA

**SECTION VI - PHYSICAL DATA**

BOILING POINT 64.7 deg C (148.4 deg F) at 760 mm Hg.	VAPOR PRESSURE 127 mm Hg at 25 deg C (77 deg F) 238 mm Hg at 37.7 deg C (100 deg F)
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SPECIFIC GRAVITY 0.791 at 20 deg C (68 deg F)	FREEZING POINT -97.7 deg C (-143.8 deg F)	VAPOR DENSITY 1.1 (air=1.0)
SOLUBILITY IN WATER 100 WT %	EVAPORATION RATE (BUTYL ACETATE = (1.0) greater than 1	MOLECULAR WEIGHT 32.04
APPEARANCE AND ODOR: Liquid, Colorless or Clear, Faint alcoholic		
<b>SECTION VII - REACTIVITY</b>		
STABILITY: <input type="checkbox"/> UNSTABLE <input checked="" type="checkbox"/> STABLE	HAZARDOUS POLYMERIZATION	MAY <input type="checkbox"/> OCCUR
WILL NOT <input checked="" type="checkbox"/> OCCUR		
CONDITIONS AND MATERIALS TO AVOID: Do not store or mix with strong oxidizers, chromic anhydride, lead perchlorate, or perchloric acid (reacts vigorously).		
HAZARDOUS DECOMPOSITION PRODUCTS: Occurs from heat and reaction with above stated materials.		
<b>SECTION VIII - FIRE AND EXPLOSION HAZARDS</b>		
FLASH POINT AND METHOD USED 11 deg C (52 deg F) method. (TCC)	FLAMMABLE LIMITS in air % by VOLUME	LEL UEL 6 36
AUTOIGNITION TEMPERATURE: 385 deg C (725 deg F)		
AUTODECOMPOSITION: NA		
AIT: Actual AIT's can be affected by the concentration of vapors and oxygen, vapor/air contact time, pressure, volume, catalytic impurities, etc. Process conditions should be analyzed to determine if the AIT's may be higher or lower.		
EXTINGUISHING MEDIA: Water spray, Dry chemical, CO2, "Alcohol" Foam.		
SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS: Evacuate affected area, stay upwind and avoid smoke and fumes. Use water spray to cool containers. If smoke and fumes cannot be avoided, wear self-contained breathing apparatus.		
UNUSUAL FIRE AND EXPLOSION HAZARDS: Flammable Liquid, Flame is invisible in daylight. Methanol-water mixtures will burn unless very dilute: mixtures with 25% or more methanol are OSHA Class I flammable liquids. Follow appropriate National Fire Protection Association (NFPA) codes.		
<b>SECTION IX - STORAGE AND SPECIAL PRECAUTIONS</b>		
HANDLING AND STORING PRECAUTIONS: Keep away from heat, sparks, and flame. Keep containers tightly closed. Do not store or mix with strong oxidizers, chromic anhydride, lead perchloric, or perchloric acid. Store in adequately ventilated area.		
<b>SECTION X - TRANSPORTATION REQUIREMENTS</b>		
DOT CLASSIFICATION Hazard Class: 3 (Flammable Liquid)	OSHA LABEL REQUIRED NA	REPORTABLE QUANTITY 5000 lbs/2270 Kg
DOT PROPER SHIPPING NAME: Methanol	UN/NA ID NUMBER UN 1230	STCC No. 4909230
DOT PLACARD Flammable	DOT/IMO PROPER SHIPPING NAME: Methanol	DOT/IMO CLASSIFICATION HAZARD CLASS: 3 (Flammable Liquid)

<b>SUBSIDIARY RISK:</b> Poison	<b>SPECIAL INFORMATION</b> Flash Point: 11 Deg C (51 deg F)	<b>SHIPPING CONTAINERS:</b> Tank Cars & Trucks, Barges Reportable quantity: 5000 lbs/2270 kg
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**SECTION 15 - REGULATORY INFORMATION**

**NOTIFICATION**

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.

**HAZARD CATEGORIES**

EHS	ACUTE	CHRONIC	FIRE	PRESSURE	REACTIVE	CERCLA	TOXIC	313
No	Yes	Yes	Yes	No	No	Yes	Yes	Yes

\*CANADIAN WHMIS CLASSIFICATION: B-2, D1A; D2B

**SECTION 16 - EMERGENCY ACTION - SPILL OR LEAK**

**EMERGENCY ACTION:**

Keep unnecessary people away; isolate spill area. **AQUATIC TOXICITY:** The compound has very low toxicity. The 96 hour LC50 for fathead minnows is 28,100 MG/L.

**SPILL, LEAK OR RELEASE: NOTE:** Review Fire and Explosion Hazards and Safety Precautions before proceeding with clean up. Use appropriate **PERSONAL PROTECTION EQUIPMENT** during clean up.

Dike large spills. Flush spill area with plenty of water. **DO NOT** flush to sewer. Comply with Federal, State and Local regulations on reporting releases. The CERCLA Reportable Quantity is 5000 lbs.

**Waste Disposal:** Cleaned up material may be an RCRA Hazardous Waste. The RCRA Hazardous Waste Number for Methanol is U154. Comply with Federal, State and Local regulations on disposal. If approved, incineration, bio-oxidation, subsurface injection, or a licensed disposal contractor may be used.

**FOOTNOTES:**

1. This NFPA rating applies only to short term exposure such as might be encountered under fire or related emergency conditions.
2. Note: NR means Not Rated.
3. NA means Not Applicable.

**DISCLAIMER**

THE INFORMATION AND RECOMMENDATIONS HEREIN ARE TAKEN FROM DATA CONTAINED IN INDEPENDENT, INDUSTRY-RECOGNIZED REFERENCES INCLUDING NIOSH, OSHA, AHS, AND NFPA. THIS BEAUMONT METHANOL CORPORATION MAKES NO GUARANTEE, WARRANTY OR OTHER REPRESENTATION CONCERNING THIS SUBSTANCE SINCE THE CONDITION OF THE AIR IS BEYOND THE CONTROL OF THE COMPANY. BEAUMONT CHEMICAL CORPORATION DISCLAIMS ANY LIABILITY FOR LOSS OR DAMAGE INCURRED IN CONNECTION WITH THE USE OF THIS SUBSTANCE.

METHANOL

MSDS No.  
HCROO1423  
Rev. Date  
03/06/92

**XIII. Label Information**

<b>Manufacturer:</b>	LYONDELL PETROCHEMICAL COMPANY 1221 MCKINNEY AVENUE, SUITE 1600 P.O. BOX 3646 HOUSTON, TEXAS 77253-3646	<b>Telephone Numbers</b> EMERGENCY 800/424-9300 CHEMTREC 800/245-4532 HOT LINE CUSTOMER SERVICE 713/652-7200 INFO ONLY
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**Use Statement** FOR INDUSTRIAL USE ONLY  
KEEP OUT OF REACH OF CHILDREN

**Signal Word:** DANGER

**Physical Hazards:**  
EXTREMELY FLAMMABLE CORROSIVE TO SOME METALS

<b>Health Hazards:</b> HIGH INGESTION HAZARD MAY DAMAGE THE OPTIC NERVE INHALATION HAZARD PROLONGED EXPOSURE MAY DAMAGE THE LUNGS & LIVER MAY CAUSE KIDNEY DAMAGE	HIGH SKIN CONTACT HAZARD SEVERE EYE IRRITANT SKIN IRRITANT - DEFATTING ACTION MUCOUS MEMBRANE IRRITANT MAY CAUSE LONG-TERM ADVERSE HEALTH EFFECTS
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**Precautionary Measures:**  
DO NOT HANDLE NEAR HEAT, SPARKS, OR OPEN FLAME.  
SPILL/LEAK CAN CAUSE FIRE/EXPLOSION.  
KEEP CONTAINER CLOSED WHEN NOT IN USE.  
DO NOT CONTACT WITH OXIDIZABLE MATERIALS.  
USE ONLY WITH ADEQUATE VENTILATION/PERSONAL PROTECTION.  
AVOID PROLONGED OR REPEATED BREATHING OF VAPOR.  
AVOID CONTACT WITH EYES, SKIN, AND CLOTHING.  
WASH THOROUGHLY AFTER HANDLING.  
PREVENT CONTACT WITH FOOD, CHEWING, OR SMOKING MATERIALS.  
DO NOT TASTE/SWALLOW.

**DOT Information:**  
UN/NA ID Number- UN 1230  
Hazard Class- 3 (FLAMMABLE LIQUID, POISON)  
Proper Shipping- METHANOL OR METHYL ALCOHOL (RD-5000/2270)

<b>Instructions:</b> In case of fire, use-	ALCOHOL TYPE FOAM DRY CHEMICAL CO2	HALON FOAM WATERSPRAY
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<b>First Aid</b>	-Inhalation	IMMEDIATELY REMOVE FROM CONTAMINATED AREA TO FRESH AIR. KEEP INDIVIDUAL QUIET. FOR RESPIRATORY DISTRESS, GIVE AIR OR OXYGEN AND/OR ADMINISTER CARDIOPULMONARY RESUSCITATION (CPR). OBTAIN EMERGENCY MEDICAL ATTENTION.
	-Eye Contact	IMMEDIATELY FLUSH EYES WITH PLENTY OF CLEAN LOW-PRESSURE WATER FOR AT LEAST 15 MINUTES. RETRACT EYELIDS OFTEN. OBTAIN EMERGENCY MEDICAL ATTENTION.
	-Skin Contact	IMMEDIATELY REMOVE CONTAMINATED CLOTHING. WASH AFFECTED SKIN THOROUGHLY WITH SOAP AND WATER. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION. WASH CLOTHING BEFORE REUSE; WASH OR DISCARD CONTAMINATED LEATHER SHOES/GLOVES.
	-Ingestion	SEE EMERGENCY MEDICAL TREATMENT PROCEDURES AND SECTION XI. "GENERAL COMMENTS".

**In case of spill.** EXTREMELY FLAMMABLE LIQUID! RELEASE CAUSES AN IMMEDIATE FIRE/EXPLOSION HAZARD. REMOVE ALL IGNITION SOURCES AND SAFELY STOP FLOW OF SPILL. REMOVE ALL NON-ESSENTIAL PERSONNEL. USE PROPER PROTECTIVE EQUIPMENT. CONTAIN OR PREVENT FLOW TO SEWERS OR PUBLIC WATERS. BLANKET WITH AN APPROPRIATE FOAM. RESTRICT WATER USE FOR CLEANUP. IN URBAN AREAS, CLEANUP ASAP. IN NATURAL ENVIRONMENTS, SEEK ADVICE FROM ECOLOGISTS. THIS MATERIAL IS WATER-SOLUBLE AND MAY BIODEGRADE. COMPLY WITH ALL APPLICABLE LAWS. SPILLS MAY NEED TO BE REPORTED TO THE NATIONAL RESPONSE CENTER (800/424-8802). SPILLED MATERIAL AND ANY CONTAMINATED WATER OR SOIL MAY BE HAZARDOUS TO HUMAN OR OTHER LIFE

**Protective Equipment:**  
-Respiratory DO NOT USE AIR-PURIFYING RESPIRATOR. ONLY NIOSH/MSHA APPROVED SUPPLIED AIR OR SELF-CONTAINED BREATHING APPARATUS OPERATED IN POSITIVE PRESSURE MODE  
-Eye EYE PROTECTION SUCH AS CHEMICAL SPLASH GOGGLES AND/OR FACE SHIELD MUST BE WORN WHEN POSSIBILITY EXISTS FOR EYE CONTACT DUE TO SPLASHING OR SPRAYING  
-Skin WHEN SKIN CONTACT IS POSSIBLE, PROTECTIVE CLOTHING INCLUDING GLOVES, APRON, SLEEVES, BOOTS, HEAD AND FACE PROTECTION SHOULD BE WORN.

Material Safety Data Sheet

Page: 1  
Rev. Date  
01/18/94

METHANOL

Enron Operations Corp.  
1400 Smith Street, EB 1108  
P.O. Box 1188  
Houston, TX 77251-1188

Company Contact: Security Department  
Telephone Number: (713)853-6200

Emergency Contact: Chemtrec  
Emergency Phone Number: (800)424-9300

SECTION #1 - IDENTIFICATION

Product: METHANOL

CAS Number: 67-56-1  
Chemical Family: Alcohol  
Chemical Formula: CH<sub>3</sub>OH  
Molecular Weight: 32.05

Hazard Rating - Health: 1 Slight  
- Fire: 3 High  
- Reactivity: 0 Negligible

SECTION #2 - HAZARDOUS CHEMICAL COMPONENTS

Component: METHANOL  
CAS Number: 67-56-1  
Percent of Mixture: <Balance>  
PEL 200 PPM (260 MG/M<sup>3</sup>)  
TLV 200 PPM (260 MG/M<sup>3</sup>)  
STEL 250 PPM (310 MG/M<sup>3</sup>)  
"SKIN" NOTATION

Component: METHYL ALCOHOL  
CAS Number: 67-56-1  
Percent of Mixture: 99.9 to 99.9  
PEL/TLV 200 PPM (260 mg/m<sup>3</sup>)  
STEL 250 PPM (310 mg/m<sup>3</sup>)

SECTION #3 - PHYSICAL DATA

Boiling Point: 148.4°F 64.7°C  
Vapor Pressure: 138@25C  
Vapor Density (Air=1): 1.1  
Specific Gravity: 0.791  
Solubility (H<sub>2</sub>O): 100%  
Percent Volatiles: 100  
Evaporation Rate: >1

SECTION #4 - FIRE FIGHTING & EXPLOSION DATA

Flash Point: 52°F 11°C ICC  
Autoignition: 725°F 385°C

Flammability Class: 3

Lower Explosive Limit (%): 6  
Upper Explosive Limit (%): 36

Fire and Explosion Hazards

Flammable. Flame is invisible in daylight. Methanol-water mixtures will burn unless very dilute. Mixtures with 25% or more Methanol are OSHA Class I Flammable Liquids.

001013

**SECTION #4 - FIRE FIGHTING & EXPLOSION DATA Continued...**Extinguishing Media

Dry chemical, Carbon Dioxide (CO<sub>2</sub>), water spray, "Alcohol" foam.

Special Fire Fighting Instructions

Use water spray to cool tanks or containers. Avoid water streams which may splash and spread flaming liquid. Water spray can be used to reduce the intensity of flames and to dilute spills to non-flammable mixture. Vapors are heavier than air and may flow along surface to distant ignition sources and flash back. Fire fighters should use self-contained breathing equipment and bunker gear.

**SECTION #5 - EXPOSURE EFFECTS and FIRST AID**Route of Exposure - Inhalation

Prolonged inhalation of vapors causes dizziness, nausea, visual impairment, respiratory failure, muscular incoordination and narcosis. Inhalation of high concentrations for prolonged periods has resulted in death. Liver damage has resulted from prolonged or repeated inhalation of vapors.

First Aid - Inhalation

Remove to fresh air. If not breathing, administer CPR. If breathing is difficult, give oxygen. Call a physician.

Route of Exposure - Skin

Essentially non-irritating. Repeated or prolonged contact causes drying, brittleness, cracking and irritation. Slightly toxic to animals by absorption.

First Aid - Skin

Remove contaminated clothing and wash contaminated skin with large amounts of water. If irritation persists, contact a physician.

Route of Exposure - Eyes

May cause eye injury which may persist for several days. Liquid, and vapor in high concentrations, causes irritation, tearing and burning sensation.

First Aid - Eyes

Flush eyes with water for at least 15 minutes. Contact a physician immediately.

Route of Exposure - Ingestion

Poisonous if swallowed. Can affect the optic nerve resulting in blindness. Can cause mental sluggishness, nausea and vomiting leading to severe illness, possibly death (in humans). Practically non-toxic to animals.

First Aid - Ingestion

Induce vomiting of conscious patient immediately by giving two glasses of water and pressing finger down throat. Drink a large amount of water, milk or sodium bicarbonate to dilute material in stomach. Contact a physician immediately.

**SECTION #5 - EXPOSURE EFFECTS and FIRST AID Continued...**Miscellaneous Toxicological Information

Inhalation 1-hour LC50: 145,000ppm in rats.  
Skin Absorption LD50: 15,840 mg/kg in rabbits.  
Oral LD50: 9100 mg/kg in rats.

Health Conditions Aggravated By Exposure

Methanol exposure may aggravate existing eye, skin, kidney and liver disorders. Preplacement and annual medical examinations are recommended for workers who normally handle Methanol with emphasis on neurological, visual, liver and kidney functions.

Monitoring of air in the work place is recommended to maintain Methanol vapors below recommended TLV.

**SECTION #6 - REACTIVITY & POLYMERIZATION**

Stability: Stable

Conditions to Avoid (Stability)

Avoid strong oxidizing agents, excessive heat and ignition sources.

Incompatible Materials

Reacts vigorously with strong oxidizers, chromic anhydride, lead perchlorate, perchloric acids.

Hazardous Decomposition Products

Occurs from heat and reaction with above stated materials.

Conditions to Avoid (Polymerization)

Polymerization will not occur.

Hazardous Polymerization: Will not occur

**SECTION #7 - SPILL, LEAK, & DISPOSAL PROCEDURES**Steps to be Taken in The Event of Spills, Leaks, or Release

Dike large spills. Flush spill area with plenty of water. Do not flush to sewer. Comply with Federal, State, and local regulations on reporting releases.

Waste Disposal Methods

This product when spilled or disposed is a hazardous solid waste. Preferred method is incineration or biological treatment in federal/state approved facility.

SARA Title III Notifications and Information

SARA Title III - Hazard Classes: Acute Health Hazard  
Chronic Health Hazard  
Fire Hazard

**SECTION #7 - SPILL, LEAK, & DISPOSAL PROCEDURES Continued...**SARA Title III Notifications and Information

## SARA Title III - Section 313 Supplier Notification:

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

CAS #	Chemical Name	Percent of Mixture
67-56-1	METHANOL	99.9
67-56-1	METHYL ALCOHOL	99.9 - 99.9

This information must be included on all MSDSs that are copied and distributed for this material.

Other Environmental Information

Aquatic Toxicity Rating - TLM 96: Over 1000 ppm

Spills of 5000 lbs. or more must be reported to the National Response Center (1-800-424-8802).

**SECTION #8 - SPECIAL PROTECTIVE MEASURES**Ventilation

Provide adequate ventilation or exhaust to meet TLV/PEL requirements. Supplied air or self-contained breathing equipment recommended for exposures above the PEL. Organic vapor cartridge respirators not recommended for methanol vapor exposures.

Eye Protection

Have available and wear as appropriate coverall chemical splash goggles or safety spectacles (side shields preferred).

Skin Protection

Rubber gloves and protective aprons or clothing should be used to prevent skin contact. For operations where spills or splashing can occur, use impervious body covering and boots. A safety shower and eye bath should be available.

Respiratory Protection

Provide adequate ventilation or exhaust to meet RLV/PEL requirements. Supplied air or self-contained breathing equipment recommended for exposures above PEL. Organic vapor cartridge respirators not recommended for methanol vapor exposures.

Other Protection

Eye wash and safety shower recommended in area of use. Wash with soap and water immediately after skin contact.

Work/Hygienic Practices

Monitoring of air in the workplace is recommended to maintain methanol vapors below recommended TLV.

## SECTION #9 - SPECIAL PRECAUTIONS - STORAGE &amp; HANDLING

## Storage &amp; Handling Conditions

Store in a cool, well-ventilated area. Do not expose to temperatures above 120°F. Keep away from heat, sparks and flame. Keep containers closed. Use only DOT-approved containers. Use spark-resistant tools. Do not load into compartments adjacent to heated cargo. When transferring, follow proper grounding procedures. Use with adequate ventilation. Provide emergency exhaust. Avoid breathing vapor. Avoid contact with eyes, skin and clothing. Wash thoroughly with soap and water after handling. Wash contaminated clothing thoroughly before reuse.

## SECTION #10 - SHIPPING INFORMATION

Proper Shipping Name: Methanol or Methyl Alcohol

Packing Group: 2

Hazard Class: 3

DOT Identification Number: UN1230

DOT Shipping Label: Flammable Liquid, Poison

## SECTION #11 - OTHER INFORMATION

Regulated by Food and Drug Administration under 21 CFR 175 and 176, for use in adhesives and articles in contact with food items.

Consumer Product Safety Commission requires materials containing methanol to be labeled:

Danger: Poison. Flammable. Vapor Harmful. May be fatal or cause blindness if swallowed. Cannot be made non-poisonous.  
Contains \_\_\_\_\_ % methanol.

Methanol is subject to Section 313 reporting under EPCRA.

## DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

This information relates only to the material designed and may not be valid for such material used in combination with any other materials or in any process. Such information is to the best of this Company's knowledge believed to be accurate and reliable as of the date indicated. However, no representation, warranty or guarantee is made as to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use.

Product Name: METHANOL  
Product Code: 214311  
MSDS Number : 56  
Version Date: 02/01/1995

Material Safety Data Sheet

Print date -- July 27th, 1995 3:59 a.m. 3820 PG1A XOH21001 - 18.1 (104/174)

1. CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Product Name: METHANOL  
Product Code: 214311  
MSDS Number : 56

SYNONYMS: CARBINOL  
METHYL ALCOHOL  
METHYL HYDROXIDE  
MONOHYDROXYMETHANE

HOECHST CELANESE CHEMICAL GROUP  
1601 W. LBJ FREEWAY  
PO BOX 819005  
DALLAS, TX 753819005  
USA

TRANSPORTATION EMERGENCY PHONE  
NUMBER (24 HOURS/DAY):  
In USA, call.....800 424 9300.  
Outside USA, call\*....202 483 7617.  
\*collect calls accepted  
In Canada, call.....403 477 8339.

TRANSPORTATION EMERGENCY PHONE  
(24 HOURS/DAY):  
In USA, call.....800 424 9300.  
Outside USA, call.....202 483 7617.  
In Canada, call.....403 477 8339.

2. COMPOSITION / INFORMATION on INGREDIENTS

COMPONENT	CAS NUMBER	
METHANOL *	67-56-1	99.5 - 99.95%

\*OSHA hazardous according to 29 CFR 1910.1200

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

Methanol is a clear, colorless, mobile liquid with a mild alcohol odor.

DANGER!

Flammable (flash point: TCC, 60 F; TCC, 54 F)  
Vapor is heavier than air and can travel considerable distance to a source of ignition and flash back.  
Material can burn with little or no visible flame.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(200) 835 5233  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
Product Code: 214311  
MSDS Number : 56  
Version Date: 02/01/1995

Print date - July 27th, 1995 3:09 a.m. 3820 PG1A X0H21001 -- 18.2 (105/174)

----- 3. HAZARDS IDENTIFICATION (Continued) -----

POTENTIAL HEALTH EFFECTS

ROUTES OF EXPOSURE:

Skin, eyes, inhalation, ingestion.

IMMEDIATE EFFECTS

SKIN:

Repeated or prolonged contact causes drying, brittleness, cracking and irritation. Prolonged and repeated skin contact with methanol-soaked material has produced toxic effects including vision effects and death.

EYES:

May cause eye injury which may persist for several days. Liquid (and vapor in high concentrations) causes irritation, tearing and a burning sensation.

INHALATION:

Extremely high levels cause stupor, headache, nausea, dizziness, unconsciousness and may produce adverse effects on vision.

INGESTION:

Poisonous or fatal if swallowed. A small amount (usually two or more ounces) can cause mental sluggishness, nausea and vomiting leading to severe illness, and may produce adverse effects on vision with possible blindness or death if treatment is not received.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Significant exposure to this chemical may adversely affect people with chronic disease of the central nervous system, skin, gastrointestinal tract and/or eyes.

FOR FURTHER INFORMATION, SEE:

- Section 4 - First Aid Measures
- Section 5 - Fire Fighting Measures
- Section 6 - Accidental Release Measures
- Section 8 - Exposure Controls/Personal Protection
- Section 9 - Physical and Chemical Properties
- Section 10 - Stability and Reactivity

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
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MSDS Number : 56  
Version Date: 02/01/1995

Print date - July 27th, 1995 3:09 a.m. 3820 PG1A X0H21001 -- 19.3 (106/174)

----- 4. FIRST AID MEASURES -----

SKIN:

Remove contaminated clothing and wash contaminated skin with large amounts of soap and water. If irritation persists, contact a physician.

EYES:

Flush eyes with water for at least 15 minutes. Contact a physician immediately.

INHALATION:

Remove patient from contaminated area. If breathing has stopped, give artificial respiration, then oxygen if needed. Contact a physician immediately.

INGESTION:

Induce vomiting of conscious patient immediately by giving two glasses of water and pressing finger down throat. Contact a physician immediately.

NOTE TO PHYSICIANS:

When plasma methanol concentrations are higher than 20 mg/deciliter, when ingested doses are greater than 30 milliliters, and when there is evidence of acidosis or visual abnormalities, a 10% solution of ethanol in 5% aqueous dextrose, administered intravenously, is a safe effective antidote (Western Journal of Medicine, March 1985, p. 337).

----- 5. FIRE FIGHTING MEASURES -----

NFPA (H, F, R): 1, 3, 0

FLAMMABLE PROPERTIES

FLASHPOINT CLOSED CU: 60.0 F (15.6 C)

FLASHPOINT OPEN CUP : 54.0 F (12.2 C)

UPPER EXPLOSIVE LMT : 36.5 %  
In air by volume.

LOWER EXPLOSIVE LMT : 5.5 %  
In air by volume.

HAZARDOUS PRODUCTS OF COMBUSTION:

Carbon monoxide.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
Product Code: 214311  
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Version Date: 02/01/1995

Print date -- July 27th, 1995 3 09 a.m. 3829 PG:1A XCH21G01 -- 19.4 (107/174)

----- 5. FIRE FIGHTING MEASURES (Continued) -----

EXTINGUISHING MEDIA:

Use carbon dioxide or dry chemical for small fires; alcohol-type aqueous film-forming foam or water spray for large fires. Water may be ineffective but should be used to cool fire-exposed structures and vessels.

FIRE FIGHTING INSTRUCTIONS:

If potential for exposure to vapors or products of combustion exists, wear complete personal protective equipment, including self-contained breathing apparatus with full face-piece operated in pressure demand or other positive pressure mode. Water spray can be used to reduce intensity of flames and to dilute spills to nonflammable mixture. Vapor is heavier than air and can travel considerable distance to a source of ignition and flash back. Material can burn with little or no visible flame.

----- 6. ACCIDENTAL RELEASE MEASURES -----

Eliminate ignition sources. Avoid eye or skin contact; see "Section 8 - Exposure Controls/Personal Protection" for respirator information. Place leaking containers in well-ventilated area with spill containment. If fire potential exists, blanket spill with alcohol-type aqueous film-forming foam or use water spray to disperse vapors. Contain spill to facilitate clean-up. Clean-up methods may include absorbent materials, vacuum truck, etc. Avoid runoff into storm sewers and ditches which lead to natural waterways.

Call the National Response Center (800 424 8302) if the quantity (of any component) spilled is equal to or greater than the reportable quantity (RQ) under CERCLA "Superfund": 5000 lb/day.

For more information, see "Section 15 - Regulatory Information".

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
Product Code: 214311  
MSDS Number : 56  
Version Date: 02/01/1995

Print date -- July 27th, 1995 3:09 a.m. 3920 PG1A X0H21001 -- 18.5 (108/174)

----- 7. HANDLING and STORAGE -----

HANDLING:

Use with adequate ventilation. Keep containers closed when not in use. Always open containers slowly to allow any excess pressure to vent. Avoid breathing vapor. Avoid contact with eyes, skin or clothing. Wash thoroughly with soap and water after handling. Decontaminate soiled clothing thoroughly before re-use. Destroy contaminated leather clothing.

Do not expose to temperatures above 49 C (120 F). Use spark-resistant tools. Do not load into compartments adjacent to heated cargo. Provide emergency exhaust.

STORAGE:

Keep all containers tightly closed when not in use. Store out of direct sunlight and on an impermeable floor.

Do not store with incompatible materials; see "Section 10 - Stability and Reactivity".

----- 8. EXPOSURE CONTROLS | PERSONAL PROTECTION -----

ENGINEERING CONTROLS:

General or dilution ventilation is frequently insufficient as the sole means of controlling employee exposure. Local ventilation is usually preferred.

Explosion-proof equipment (for example, fans, switches, grounded ducts) should be used in mechanical ventilation systems.

PROTECTIVE EQUIPMENT

A safety shower and eye bath should be readily available.

SKIN:

Wear impervious clothing and gloves to prevent repeated or prolonged contact. The recommended material of construction is:  
Butyl rubber.

EYES:

Wear chemical goggles when there is a reasonable chance of eye contact.

TRANSPORTATION EMERGENCY:..... (800) 424 9300  
PRODUCT EMERGENCY:..... (800) 835 5235  
PRODUCT INFORMATION:..... (214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
Product Code: 214311  
MSDS Number : 56  
Version Date: 02/01/1995

----- 8. EXPOSURE CONTROLS | PERSONAL PROTECTION (Continued) -----

INHALATION:

Based on workplace contaminate level and working limits of the respirator, use a respirator approved by NIOSH/MSHA. The following is the minimum recommended equipment for an acceptable level of exposure. To estimate an acceptable level of exposure, see "Section 3 - Hazards Identification", "Section 8 - Exposure Controls/Personal Protection" and "Section 11 - Toxicological Information".

For concentrations  $\geq 1$  and  $\leq 100$  times the acceptable level: Use Type C full facepiece supplied-air respirator operated in pressure-demand or continuous-flow mode. positive-pressure self-contained breathing apparatus escape system.

For concentrations  $\geq 100$  times the acceptable level or IDLH level or unknown concentration (such as in emergencies): Use self-contained breathing apparatus with full facepiece in pressure-demand mode. Type C positive-pressure full facepiece supplied-air respirator with an auxiliary positive-pressure self-contained breathing apparatus escape system.

For escape: Use self-contained breathing apparatus with full facepiece or any respirator specifically approved for escape.

EXPOSURE GUIDELINES:

METHANOL (67-56-1)

OSHA PEL                      ACGIH TLV  
200 PPM (TWA)              250 PPM (STEL)

.....                      200 PPM (TWA)

ACGIH has given this substance a skin designation.

Hoechst Celanese has adopted the ACGIH TLV.

Immediately Dangerous to Life or Health (IDLH) level:  
25,000 ppm.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
Product Code: 214311  
MSDS Number : 56  
Version Date: 02/01/1995

----- 9. PHYSICAL and CHEMICAL PROPERTIES -----

APPEARANCE : Clear, colorless, mobile liquid.  
ODOR : Mild alcohol odor.  
PHYSICAL STATE : Liquid  
VAPOR PRESSURE : 95.0 HG  
(20 C)  
VAPOR DENSITY : 1.11  
Air = 1 at 20 C  
BOILING POINT : 64.6 C (148.3 F)  
(760 mm Hg)  
FREEZING POINT : -97.8 C (-144.0 F)  
SOLUBILITY : Complete in water.  
SPECIFIC GRAVITY : 0.792  
H2O = 1 @ 20/20 C  
EVAPORATION RATE : 2.0  
BuAc = 1  
% VOLATILES : 100.0  
MOLECULAR WEIGHT : 32.0

----- 10. STABILITY and REACTIVITY -----

CHEMICAL STABILITY:  
Stable.

CONDITIONS TO AVOID:  
Heat, sparks, flame.

INCOMPATIBILITY:  
Sulfuric acid; oxidizing agents such as hydrogen peroxide,  
nitric acid, perchloric acid and chromium trioxide.

HAZARDOUS DECOMPOSITION PRODUCTS:  
Carbon monoxide.

HAZARDOUS POLYMERIZATION:  
Will not occur.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
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Version Date: 02/01/1995

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----- 11. TOXICOLOGICAL INFORMATION -----

Oral LD50 : 7.5 g/kg (rats); practically non-toxic to rats.

Dermal : minimum lethal dose, 1.6 g/kg (monkeys); low toxicity to animals by skin contact.

Inhalation LC50 : 64,000 ppm (rats, 4 hrs) practically non-toxic in rats. Repeated exposure of monkeys to 5000 ppm, 6 hrs/day, 5 days/wk for 4 weeks caused no toxic response or effects on vision.

Mutagenicity : In vitro, limited evidence of mutagenicity (mouse lymphoma forward mutation assay). In vivo, no information.

Carcinogenicity : No evidence of carcinogenic potential in limited animal studies in which methanol was given orally or applied to the skin.

Reproduction : Reported to cause birth defects in rats exposed to very high levels of vapors (20,000 ppm).

----- 12. ECOLOGICAL INFORMATION -----

This information is being researched.

----- 13. DISPOSAL CONSIDERATIONS -----

All notification, clean-up and disposal should be carried out in accordance with federal, state and local regulations. Preferred methods of waste disposal are incineration or biological treatment in federal/state approved facility.

Hazardous waste (40 CFR 261): Yes; U154, D001.

TRANSPORTATION EMERGENCY:.....(800) 424 9300 IN U.S., CHEMTREC - 24 HRS/DAY  
PRODUCT EMERGENCY:.....(800) 835 5235 HOECHST CELANESE, 24 HRS/DAY  
PRODUCT INFORMATION:.....(214) 277 4000 (7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
Product Code: 214311  
MSDS Number : 56  
Version Date: 02/01/1995

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----- 14. TRANSPORT INFORMATION -----

DOT proper shipping name : Methanol  
DOT hazard class : 3, Flammable Liquid  
UN/NA identification number: UN1230  
Packing group : II  
ER guidebook number : 28  
Reportable quantity (RQ) : 5000 lb/2270 kg

Canadian Transportation of Dangerous Goods  
Classification : Flammable Liquid 3 (6.1)

----- 15. REGULATORY INFORMATION -----

RECIPIENT MUST COMMUNICATE ALL PERTINENT INFORMATION HEREIN  
TO EMPLOYEES AND CUSTOMERS.

STATE REGULATIONS

The following chemicals associated with the product are  
subject to the right-to-know regulations in these states:

METHANOL (67-56-1): CT, FL, IL, LA, MA, NJ, NY, PA, RI

U.S. FEDERAL REGULATIONS

We certify that all components are either on the TSCA  
inventory or qualify for an exemption.

SARA 313 : METHANOL 99.85% (67-56-1)

ENVIRONMENTAL:

CERCLA : METHANOL 99.85% (67-56-1)

SARA 304 : METHANOL 99.35% (67-56-1)

SARA 311 :

Acute health..... Yes  
Chronic health..... Yes  
Fire..... Yes  
Sudden release of pressure.. No  
Reactive..... No

INTERNATIONAL REGULATIONS

Listed on the chemical inventories of the following  
countries: Australia, Canada, Europe (EINECS), Japan and  
Korea.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 835 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
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Product Name: METHANOL  
Product Code: 214311  
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----- 15. REGULATORY INFORMATION (Continued) -----

WHMIS INGREDIENT DISCLOSURE LISTED COMPONENTS:

WHMIS CLASSIFICATION: Class B, Division 2; Class D,  
Division 1, Subdivision A.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

----- 16. OTHER INFORMATION -----

MSDS prepared by: Product Stewardship Department  
Hoechst Celanese Chemical Group

HAZARD RATINGS

	HEALTH	FLAMM	REACT	OTHER
NFPA	1	3	0	
HMIS	3	3	0	X

This information is intended solely for the use of individuals trained in the NFPA and HMIS systems.

REVISION INDICATORS:

The following sections have been revised:

- SECTION 7: HANDLING AND STORAGE
  - HANDLING
- SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION
  - ENGINEERING CONTROLS
  - SKIN
  - INHALATION
  - EXPOSURE GUIDELINES
- SECTION 16: OTHER INFORMATION
  - HAZARD RATINGS

DISCLAIMER:

The information contained herein is accurate to the best of our knowledge. We do not suggest or guarantee that any hazards listed herein are the only ones which exist. Hoechst Celanese Chemical Group, Inc. makes no warranty of any kind, express or implied, concerning the safe use of this material in your process or in combination with other substances. Effects can be aggravated by other materials and/or this material may aggravate or add to the effects of other materials. This material may be released from gas, liquid, or solid materials made directly or indirectly from it. User has the sole responsibility to determine the

TRANSPORTATION EMERGENCY:.....(800) 424 9300	IN U.S., CHEMTREC - 24 HRS/DAY
PRODUCT EMERGENCY:.....(800) 835 5235	HOECHST CELANESE, 24 HRS/DAY
PRODUCT INFORMATION:.....(214) 277 4000	(7:30 AM TO 4:15 PM, CST)

Product Name: METHANOL  
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DISCLAIMER: (Continued)

suitability of the materials for any use and the manner of use contemplated. User must meet all applicable safety and health standards.

TRANSPORTATION EMERGENCY:.....(800) 424 9300  
PRODUCT EMERGENCY:.....(800) 935 5235  
PRODUCT INFORMATION:.....(214) 277 4000

IN U.S., CHEMTREC - 24 HRS/DAY  
HOECHST CELANESE, 24 HRS/DAY  
(7:30 AM TO 4:15 PM, CST)

001029

**Wako**

*operations*  
8/31/94

## MATERIAL SAFETY DATA SHEET

PRODUCT IDENTITY/TRADENAME: **V-70**

### 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MANUFACTURER'S NAME: Wako Pure Chemical Industries, Ltd.  
ADDRESS: 1-2, Doshomachi 3-Chome, Chuo-ku, Osaka,

541, Japan (Wako Chemicals USA, Inc., 1600  
Bellwood Road, Richmond, VA 23237, U.S.A.)

TELEPHONE NUMBER FOR INFORMATION: (804)271-7677 (Wako Chemicals USA, Inc.)

EMERGENCY TELEPHONE NUMBER: (800) 424-9300 (CHEMTREC)

### 2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAME: 2,2'-Azobis(2,4-dimethyl-4-methoxy valeronitrile)  
SYNONYMS: 2,2'-Azodi(4-methoxy-2,4-dimethylvaleronitrile)  
CAS NUMBER: 15545-97-8

### 3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: White to slightly brown crystalline powder, slightly characteristic odor. Combustible. Irritating and highly toxic gas may be generated by thermal decomposition or combustion. Irritation of eyes and skin. Harmful if inhaled and ingested. It can be absorbed through skin and cause harmful effects.

#### POTENTIAL HEALTH EFFECTS

ROUTE OF ENTRY: Inhalation: Yes; Skin: Yes; Ingestion: Yes.

EYE CONTACT: If dusting occurs, it may cause irritation of eyes.

SKIN CONTACT: Hypersensitive individuals may experience allergic reactions and dermatological reactions such as rash and hives.

**SKIN ABSORPTION:** It can penetrate the skin causing effects similar to those identified under acute symptoms.

**INHALATION:** Dust is irritating to the eyes, nose, throat, and lungs. It may also cause headaches and dizziness. It may cause symptoms of exposure similar to those identified under ingestion symptoms.

**INGESTION:** May cause anorexia, headaches, bellyache, diarrhea, nausea, vomiting and fever. Prolonged exposure may cause shock symptoms, narcosis and death.

**CARCINOGENICITY:** NTP; Not listed, IARC; Not listed, OSHA; Not listed

---

#### 4. FIRST AID

**EYE CONTACT:** Remove any contact lenses at once. Flush eyes well with flooding amounts of running water for at least 15 minutes. Assure adequate flushing by separating the eyelids with sterile fingers. If irritation persists, transport to a hospital immediately.

**SKIN CONTACT:** Remove contaminated clothes and shoes, rinse skin with plenty of water or shower. Use soap to help assure removal. If irritation persists, transport to a hospital immediately.

**INHALATION:** Move victim to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, administer artificial respiration. Maintain normal body temperature with a blanket. If irritation persists, transport to a hospital immediately.

**INGESTION:** Rinse mouth, give plenty of water or milk to dilute the substance and induce vomiting. Never give anything by mouth to an unconscious person. Transport to a hospital immediately.

---

#### 5. FIRE FIGHTING MEASURES

**FLASH POINT:** Not available.

**FLAMMABLE (EXPLOSIVE) LIMITS:** Minimum Explosive Concentration of a dust: 20mg/L

**EXTINGUISHING MEDIA:** Carbon dioxide, dry chemical powder, foam, water.

**FIRE & EXPLOSION HAZARDS:** Hazardous, toxic and irritating dust or smoke may be emitted. May erupt if exposed heat or fire. Dust form an explosive mixture with air.

**FIRE FIGHTING INSTRUCTIONS:** Firemen should wear normal protective equipment (full bunker gear) and positive-pressure self-contained breathing apparatus. Fight fire from maximum distance. Use extreme caution, as heat may decompose material and rupture containers.

---

## 6. ACCIDENTAL RELEASE MEASURES

Do not touch spilled material without suitable protection. After material is completely picked up, wash the spill site with soap and water and ventilate the area. During the cleanup, wear protective clothes, gloves and goggles. Put all wastes in a plastic bag for eventual disposal (do not seal it tightly). Remove, clean, or dispose of contaminated clothing.

---

## 7. HANDLING AND STORAGE

Avoid contact with eyes, skin and clothing. Avoid prolonged or repeated exposure. Handle material with suitable protection away from source of heat or ignition and use non-sparking type tools. Avoid a strong impact and handle with care. This material is unstable to heat and causes violent exothermal decomposition (SADT: 30°C/86°F). This material is capable of creating a dust explosion in low concentration by static electricity or sparks. Store away from sunlight in a cold (< -10°C/14°F) well-ventilated dry place. Because thermal composition releases nitrogen gas and causes the increase of the internal pressure in a closed container, the container should not be sealed tightly. Also refer to the label for handling information.

---

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**ENGINEERING CONTROLS:** Use exhaust ventilation to keep airborne concentrations below exposure limits. Use only with adequate ventilation.

**VENTILATION:** Local Exhaust: Necessary;  
Mechanical Exhaust: Necessary.  
(A closed system is recommended.)

**PERSONAL PROTECTION:** Safety glasses (goggles), Chemical resistant gloves, Protective clothing, NIOSH/MSHA approved respirator.

**EXPOSURE GUIDELINE(S)**  
**OSHA Final Limits, ACGIH TLV(s):** None established.

---

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**APPEARANCE AND ODOR:** Almost white crystalline powder.  
Slightly characteristic odor.

**MELTING POINT:** 50-96°C/122-205°F (Decomposition)

BOILING POINT: Not applicable.  
SPECIFIC GRAVITY: Not available.  
SOLUBILITY IN WATER: Insoluble.

---

## 10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: This material is unstable at temperatures above  $-10^{\circ}\text{C}/14^{\circ}\text{F}$ .  
CONDITIONS TO AVOID: Sunlight, heat, pressure, high temperature, friction, static electrical charges, sparks and dusty condition  
INCOMPATIBILITY (MATERIALS TO AVOID): Oxidizers (Nitric acid etc.), strong acids.  
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, nitrogen oxides, nitrogen gas, cyanide compounds and hydrogen cyanide gas may be formed.  
HAZARDOUS POLYMERIZATION: Will not occur.

---

## 11. TOXICOLOGICAL INFORMATION

RTECS NUMBER: Not listed.  
ACUTE TOXICITY DATA:  $\text{LD}_{50}$  (oral, mouse $\delta$ ): 2028mg/kg.  
 $\text{LD}_{50}$  (oral, mouse $\text{♀}$ ): 2900mg/kg.  
IRRITATION DATA: Not available (Not listed in RTECS).  
MUTATION DATA: Not available (Not listed in RTECS).  
REPRODUCTIVE EFFECTS DATA: Not available (Not listed in RTECS).  
TUMORIGENIC DATA: Not available (Not listed in RTECS).

---

## 12. ECOLOGICAL INFORMATION

Not available.

---

## 13. DISPOSAL CONSIDERATION

Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber in accordance with all applicable regulations. Any disposal must be in compliance with local, state, and federal laws and regulations (contact local or state environmental agency for specific regulations).

---

## 14. TRANSPORTATION INFORMATION (US DOT)

PROPER SHIPPING NAME: 2,2'-Azodi(2,4-dimethyl-4-methoxyvaleronitrile)  
HAZARD CLASS: Flammable solid (Class 4.1)  
IDENTIFICATION NUMBER: UN 2955

---

## 15. REGULATORY INFORMATION

EPA: CERCLA RQ, TPQ = Not listed  
OSHA: TQ = Not listed

New Jersey RTK Hazardous Substance List  
Listed, EPA TSCA Chemical Inventory; EINECS Number: 2395938

---

## 16. OTHER INFORMATION

No specific notes.

---

*This product is a chemical substance and is intended to be used by persons having chemical knowledge and skill, at their own discretion and risk. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Wako shall not be held liable for any damage resulting from handling or from contact with the above material.*



## INITIAL/EMERGENCY RESPONSE GUIDELINES

### PRODUCT: WAKO V-70 INITIATOR

2,2'-AZODI(2,4 DIMETHYL-4-METHOXYVALERONITRILE)

CAS # 15545-97-8

DOT UN #2955

Information Reproduced from 1993 Emergency Response Guidebook  
Guide #70

---

### POTENTIAL HAZARDS

#### FIRE OR EXPLOSION

Extremely flammable.

May ignite itself if control temperature is exceeded.

May explode from heat or loss of temperature control.

#### HEALTH HAZARDS

Contact may cause burns to skin and eyes.

Fire may produce irritating or poisonous gases.

Runoff from fire control or dilution water may cause pollution.

---

### EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry.

Stay upwind; keep out of low areas.

Positive pressure self-contained breathing apparatus (SCBA) and structural firefighter's protective clothing will provide limited protection.

**CALL** Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, **CALL CHEMTREC**

**AT 1-800-424-9300.**

If waterpollution occurs, notify the appropriate authorities.

#### LOSS OF COOLING

Specified control temperature of material must be maintained. Obtain liquid nitrogen, dry ice or ice for cooling. If none can be obtained, evacuate area.

(continued on back)

**001035**

## **FIRE**

**Small Fires:** Dry chemical, CO<sub>2</sub>, Halon, water spray or regular foam.

**Large Fires:** Flood fire area with water.

For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

If fire can be controlled, cool container with water from unmanned hose holder or monitor nozzles until well after fire is out.

## **SPILL OR LEAK**

Shut off ignition sources; no flares, smoking or flames in hazard area.

Do not touch or walk through spilled material.

**Spills:** Moisten material with water and place it into loosely-covered plastic or fiberboard containers for later disposal.

## **FIRST AID**

Move victim to fresh air.

In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water.

Remove and isolate contaminated clothing and shoes at the site.

Keep victim quiet and maintain normal body temperature.



## EMERGENCY CONTACT NUMBERS

(A) SHIPPER: Wako Chemicals USA, Inc.  
1-800-992-9256 or 1-804-271-7677  
Mr. Jim Engel (home): 1-804-745-3356  
Mr. Tokutaro Isobe (home): 1-804-739-8042

(B) CONSIGNEE(S): EVALCA  
11500 Bay Area Blvd  
Pasadena, TX 77507  
Tel# 1-713-474-1504

(C) CHEMTREC (Chemical Transportation Emergency Center)  
1-800-424-9300 (U.S., Hawaii, or Canada)  
From the State of Alaska, call collect: 1-202-483-7616  
In the District of Columbia call: 1-202-483-7616

(D) THE NATIONAL RESPONSE CENTER  
1-800-424-8802

[In the Washington, D.C. calling area, the number is 1-202-267-2675]



1030 Crooked Hill Road  
(717) 233-7000

Harrisburg, PA 17110  
Fax: (717) 233-7000

FAX COVER SHEET

TO: Jim Engel

DATE: 8-26-94

FROM: Sharon

NO. OF PAGES: 6

RE:

Here is list of Day Ice  
houses for Pasadena, Ren.

THANK YOU

"SPECIALIZING IN TRUCKLOAD AND OCEAN CONTAINER TRAFFIC"

Waco Chemical

origin: Richmond, VA

destination: Pasadena, TX

Routing: VA - 95S. to 85S.

NC - 85S.

SC - 85S.

GA - 85S.

AL - 85S. to 65S. to 10W

MS - 10W

LA - 10W to 12W to 10W

TX - 10W

Dry Ice House list for  
emergencies as follows.

①

## Dry Ice Houses

NC

Carbonic Industries 919/544-8250  
 2810 S. Miami Blvd James Brasley  
 Durham, NC home# 919/528-2278

Sunox 910/996-3832  
 Sandy Ridge Rd. Calvin Conrad  
 Greensboro, NC

Carbonic Industries 704/332-4943  
 N. Davidson + 25<sup>th</sup> St Ron Patterson  
 Charlotte, NC pager# 704/565-7310

SC

Sunox 803/288-6010  
 226 Pelham + Davis Circle Charles Conrad  
 Greenville, SC emerg# 800/868-778

GA

Goree Ice 404/451-2765  
 5425 Buford Hwy Steve Daves  
 Doraville, GA home# 404/343-9393  
 pager# 404/890-7681

Triple A Dry Ice 404/434-5816  
 1715 B. Boswell St Tracey  
 Smyrna, GA answering svc. after hrs

Attaway Carbonic 404/521-2594  
 810 Marcus St. Rod Attaway  
 Atlanta, GA answering svc after hrs

AL

Brendbe Inc. 205/262-0505  
 433 N. Decatur St Mike Yates  
 Montgomery, AL home# 205/272-1581  
 205/271-4105 m2. B

Actic Ice 205/471-3583  
 3200 Old Shelle Rd Susan  
 Mobile, AL answering svc after hrs

Loop Ice Co. 205/479-5759  
 410 Dauphin Isle Pkwy Bob White 001041

③

MS

Bay Ice  
1413 30<sup>th</sup> Ave  
Gulfport, MS

601/863-0981  
Tim Sunzell  
home # 601/863-4841

LA

Oleans Carbonic  
1540 St Louis St  
New Orleans, LA

504/523-3433  
Dennis Hartegen  
home # 504/649-4975  
home # 504/242-2074

Corbin Dioxide Sales  
5207 Storey St.  
Harahan, LA

504/835-7291  
Pete Hershey  
home # 504/766-5748

Party Time Ice  
1140 Mettel Ave  
Baton Rouge, LA

504/383-6841  
Vince Starns  
answering svc after h

Capital Welding  
1101 Choctaw Dr  
Baton Rouge, LA

504/383-3717  
Donald Tuernage  
answering svc after h

(4)

LA

Southern Seafood + Produce 318/235-4255

1812 W. Pinhook

Mike Vrisco

Lafayette, LA

home # 318/981-1956  
beeper # 318/266-3091

Fire + Safety

318/433-5744

130 N. Ryan St.

Russel Gridley

Lake Charles, LA

answering svc after hrs

TX

Debes Ice

409/835-4431

3460 Hollywood St.

Sam Debes

Beaumont, TX

home # 409/899-3521

Dry Ice Inc.

713/471-4259

11900 Strang Rd.

Eddie Whitehead

La Poete, TX

home # 713/481-2407

pager # 713/262-6709

Aire Products

713/479-6003

10202 Strang Rd.

24 hrs 7 Days

La Poete, TX

Liquid Nitrogen



## Wako V-70 Initiator Shipping Instruction Summary Checklist

The following items are to be initialled to indicate that they are understood and/or completed. If there are any questions, they need to be answered before leaving the Wako Chemicals facility.

### BOTH THE WAKO WAREHOUSEMAN AND DRIVER TO INITIAL:

1. P.B. The transit temperature  $-15^{\circ}\text{C} (\leq +5^{\circ}\text{F})$  of the trailer is to be reached and maintained for one hour before the V-70 is loaded into the trailer.
2. P.B. Verify that the V-70 drums have FLAMMABLE labelling.
3. P.B. Verify that the PLACARDS are placed properly on the trailer.
4. P.B. Verify the drum count (DRUM COUNT: 60).
5. P.B. Verify that the drums are secured in the trailer.
6. P.B. Confirm that the Instruction packet includes a copy of the Transit Temperature Log, the DOT Special Approval letter, the Material Safety Data Sheet, the Emergency Response Guidelines, the Wako Emergency Contact Telephone Numbers, and the Summary of Dry Ice Locations.

### THE DRIVER TO INITIAL:

1. P.B. It is understood that V-70 becomes very unstable and hazardous if its temperature exceeds  $-5^{\circ}\text{C} (+23^{\circ}\text{F})$ . The transit temperature is set at  $-15^{\circ}\text{C} (+5^{\circ}\text{F})$  to provide a safety margin. Also, it is safe to store V-70 at temperatures less than  $-15^{\circ}\text{C} (+5^{\circ}\text{F})$ .
2. P.B. It is understood that Wako's requirements call for the operation of the refrigeration unit to be checked at least every two (2) hours, with the temperature being taken manually and recorded in the log. The initial (loading) and final (when the trailer seal is broken) time and temperatures must be recorded. Any differences ( $\pm 5^{\circ}\text{F}$ ) between the "manual" temperature and the continuous temperature display must be noted.
3. P.B. It is understood that once the trailer is sealed, it is to be opened only according to the specific instructions of the designated person at Evalca. The refrigeration unit is to remain on at all times, when the V-70 is in the trailer.  
  
The designated person for this shipment is: SUPERVISOR
4. P.B. It is understood that your dispatch is to be contacted immediately should there be any malfunction of the refrigeration unit.
5. P.B. It is understood that your dispatch is to be contacted immediately if there are any other delays or problems encountered during transit.
6. P.B. The procedures describing when and how to obtain emergency cooling and/or dry ice in the event of a malfunction in the refrigeration unit have been reviewed and are understood.
7. P.B. Receiving hours at Evalca are 07:30 - 12:00 & 12:30 - 16:00.

P. Biley  
Driver's Signature

8-29-94  
Date

**Wako**

## Dry Ice Locations

Dallas: Fire Protection 358-3593  
(Distributor for Liquid Carbonic 637-2577)

American Ice 748-9396

The Following Cities Have Dry Ice Facilities:  
(If alternate route is taken, check major cities along route for dry ice facilities.)

Memphis, Tennessee  
Knoxville, Tennessee  
Chattanooga, Tennessee

Washington, D.C.

CARDOX  
Borger, TX

Automatic Fire Control  
Oklahoma City, Oklahoma

NOTE: DRY ICE MAY BE PURCHASED AT MOST TRUCK STOPS AND OR  
COLD STORAGE WAREHOUSE LOCATIONS.

001045



# MALLINCKRODT

## Material Safety Data Sheet

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

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Emergency Telephone Number: 314-982-5000

### SODIUM HYDROXIDE 5.0 AND 10.0 NORMAL VOLUMETRIC SOLUTIONS

#### PRODUCT IDENTIFICATION:

Synonyms: Caustic soda solution; sodium hydroxide liquid

Formula CAS No.: 1310-73-2

Molecular Weight: 40.00

Chemical Formula: NaOH (solutions, 10-40%)

Hazardous Ingredients: Not applicable.

#### PRECAUTIONARY MEASURES

**DANGER! MAY BE FATAL IF SWALLOWED.  
CAUSES SEVERE BURNS.**

Do not get in eyes, on skin, or on clothing.

Avoid breathing mist.

Keep container closed.

Wash thoroughly after handling.

Use with adequate ventilation.

This substance is classified as a POISON under the Federal Caustic Poison Act.

#### EMERGENCY/FIRST AID

If swallowed, do NOT induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. In all cases call a physician.

SEE SECTION 5.

DOT Hazard Class: Corrosive Material

#### SECTION 1 Physical Data

Appearance: Clear, colorless solution.

Odor: Odorless.

Solubility: Miscible with water.

Boiling Point: Not applicable.

Melting Point: Not applicable.

Specific Gravity: 1.1-1.2

Vapor Density (Air=1): No information found.

Vapor Pressure (mm Hg): No information found.

Evaporation Rate: No information found.

#### SECTION 2 Fire and Explosion Information

**Fire:**

Not considered to be a fire hazard.

**Explosion:**

Not considered to be an explosion hazard. May cause fire and explosions when in contact with incompatible materials.

**Fire Extinguishing Media:**

Use any means suitable for extinguishing surrounding fire.

Adding water to caustic solution generates large amounts of heat.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool.

#### SECTION 3 Reactivity Data

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

Sodium oxide at high temperatures.

**Hazardous Polymerization:**

This substance does not polymerize.

**Incompatibilities:**

Acids, aluminium, tin and zinc metals

#### SECTION 4 Leak/Spill Disposal Information

Caution! Floor and other surfaces may be slippery. Ventilate area of leak or spill. Clean-up personnel require protective clothing. Contain and recover liquid when possible. Larger Spills: absorb with vermiculite, dry sand, earth, or similar material for disposal as hazardous waste in a RCRA approved facility. Small spills can be neutralized with dilute acid and disposed of as non-hazardous waste. Reportable quantity (RQ) (CWA Sec. 311): 1000 lbs. sodium hydroxide.

Ensure compliance with local, state and federal regulations.

**SECTION 5 Health Hazard Information****A. EXPOSURE / HEALTH EFFECTS****Inhalation:**

Effects from inhalation of mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Severe pneumonitis may occur.

**Ingestion:**

Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result.

**Skin Contact:**

Corrosive! Contact of skin can cause irritation or severe burns and scarring with greater exposures.

**Eye Contact:**

Corrosive! May cause irritation of eyes, and with greater exposures, severe burns with possibly blindness resulting.

**Chronic Exposure:**

Prolonged contact with solutions or mist has a destructive effect upon tissues.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

**B. FIRST AID****Inhalation:**

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

**Ingestion:**

**DO NOT INDUCE VOMITING!** Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**Skin Exposure:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.

**Eye Exposure:**

Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

**C. TOXICITY DATA (RTECS, 1986)**

Sodium hydroxide: Irritation data: Skin, rabbit: 50 mg/24H Severe Eye, rabbit: 50 mg/24 H Severe

**SECTION 6 Occupational Control Measures****Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):  
Sodium hydroxide: 2 mg/m<sup>3</sup> Ceiling

**-ACGIH Threshold Limit Value (TLV):**

Sodium hydroxide: 2 mg/m<sup>3</sup> Ceiling

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

**Personal Respirators: (NIOSH Approved)**

If the TLV is exceeded, a dust/mist respirator with chemical goggles may be worn, in general, up to ten times the TLV. Consult respirator supplier for limitations. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

**SECTION 7 Storage and Special Information**

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse.

.....  
DROXI

# MALLINCKRODT

## Material Safety Data Sheet

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

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Emergency Telephone Number: 314-982-5000

001049

### Addendum to Material Safety Data Sheet

#### REGULATORY STATUS

#### This Addendum Must Not Be

#### Detached from the MSDS

#### Identifies SARA 313 substance(s)

#### Any copying or redistribution of the MSDS

#### must include a copy of this addendum

(Chem.Key: DROXI)

#### Hazard Categories for SARA

#### Section 311/312 Reporting

Acute Chronic Fire Pressure Reactive

X

Product or Components  
of Product:

SARA EHS Sect. 302  
RQ (lbs.) TPQ (lbs.)

SARA Section 313 Chemicals  
Name List Chemical Category

CERCLA Sec.103  
RQ (lbs.)

RCRA  
Sec. 261.33

SODIUM HYDROXIDE 5.0 AND 10.0 NORMAL  
VOLUMETRIC SOLUTIONS codes: H382 H369 H385

The following percentages correspond one to  
one with the product codes given here.

Sodium hydroxide (1310-73-2) 10%, 20%, 40%

No

No

Yes

No

1000

No

SARA Section 302 EHS RQ: Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.

SARA Section 302 EHS TPQ: Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (\*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.

SARA Section 313 Chemicals: Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.

CERCLA Sec. 103: Comprehensive Environmental Response, Compensation and Liability Act (Superfund). Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4

RCRA: Resource Conservation and Reclamation Act. Commercial chemical product wastes designated as acute hazards and toxic under 40 CFR 261.33



# Mallinckrodt

## Material Safety Data

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Emergency Phone Number: 314-539-1600

Mallinckrodt, Inc., Science Products Division, P.O. Box 800, Paris, KY 40362.

### POTASSIUM PHOSPHATE MONOBASIC

#### PRODUCT IDENTIFICATION:

Synonyms: Phosphoric acid, monopotassium salt; potassium dihydrogen phosphate

Formula CAS No.: 7778-77-0

Molecular Weight: 136.09

Chemical Formula:  $KH_2PO_4$

Hazardous Ingredients: Not applicable.

#### PRECAUTIONARY MEASURES

As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.

#### EMERGENCY/FIRST AID

SEE SECTION 5.

DOT Hazard Class: Not Regulated

#### SECTION 1 Physical Data

Appearance: White granular powder.

Odor: Odorless.

Solubility: 22 g in 100 g of water.

Boiling Point: Not applicable.

Melting Point: Decomposes @ 400°C (252°F).

Specific Density: 2.34

Vapor Density (Air = 1): No information found.

Vapor Pressure (mm Hg): No information found.

Evaporation Rate: No information found.

#### SECTION 2 Fire and Explosion Information

Fire:

Not considered to be a fire hazard.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

Use protective clothing and breathing equipment appropriate for the surrounding fire.

#### SECTION 3 Reactivity Data

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Possibly oxides of phosphorous or potassium at high temperatures.

Hazardous Polymerization:

This substance does not polymerize.

Incompatibilities:

No incompatibility data found.

#### SECTION 4 Leak/Spill Disposal Information

Ventilate area or leak or spill. Clean-up personnel may require protective clothing and respiratory protection from dust.

Spills: Sweep up and containerize for reclamation or disposal.

Avoid dust dispersal. Trace residue may be flushed to sewer with large amounts of water. Disposal: Whatever cannot be saved for reclamation may be disposed in an approved waste disposal facility.

Ensure compliance with local, state and federal regulations.

001051

# Mallinckrodt

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Emergency Phone Number: 314-539-1600

Mallinckrodt, Inc., Science Products Division, P.O. Box 100, Paris, KY 40362.

### SECTION 5 Health Hazard Information

#### A. EXPOSURE / HEALTH EFFECTS

##### Inhalation:

Dust may have a slightly acidic irritating effect on the nasal and respiratory passages.

##### Ingestion:

Not considered particularly toxic but may cause gastro-intestinal upset, possible vomiting and diarrhea if large amounts are ingested. Can sequester calcium in the body.

##### Skin Contact:

No adverse effects expected.

##### Eye Contact:

Mild irritant effects due to its acidic nature.

##### Chronic Exposure:

Potassium phosphate may sequester calcium and cause calcium phosphate deposits in the kidneys.

##### Aggravation of Pre-existing Conditions:

Persons with impaired kidney function may be more susceptible to the effects of the substance.

#### B. FIRST AID

##### Inhalation:

Remove to fresh air. Get medical attention for any breathing difficulty.

##### Ingestion:

Give several glasses of water to drink to dilute. If large amounts were swallowed, get medical advice.

##### Skin Exposure:

Wash exposed area with soap and water. Get medical advice if irritation develops.

##### Eye Exposure:

Wash eyes with plenty of water for at least 15 minutes. If irritation develops, get medical attention.

#### C. TOXICITY DATA (RTECS, 1991)

No LD50/LC50 information found relating to normal routes of occupational exposure.

#### SECTION 6 Occupational Control Measures

##### Airborne Exposure Limits:

None established.

##### Ventilation System:

In general, dilution ventilation is a satisfactory health hazard control for this substance. However, if conditions of use create discomfort to the worker, a local exhaust system should be considered.

**Personal Respirators:** (NIOSH Approved)  
For conditions of use where exposure to the dust is apparent, a dust/mist respirator may be worn. For emergencies, a self-contained breathing apparatus may be necessary.

##### Skin Protection:

Wear protective gloves and clean body-covering clothing

##### Eye Protection:

Safety glasses. Maintain eye wash fountain and quick-drench facilities in work area.

#### SECTION 7 Storage and Special Information

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage.

POPJIM



# MALLINCKRODT

## Material Safety Data Sheet

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

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Emergency Telephone Number: 314-982-5000

## ACETIC ACID GLACIAL

### PRODUCT IDENTIFICATION:

Synonyms: Acetic acid, methane carboxylic acid

Formula CAS No.: 64-19-7

Molecular Weight: 60.05

Chemical Formula: CH<sub>3</sub>COOH

Hazardous Ingredients: Acetic Acid Glacial

### PRECAUTIONARY MEASURES

**DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE. COMBUSTIBLE.**

Do not get in eyes, on skin, or on clothing.

Avoid breathing vapor.

Keep container closed.

Use with adequate ventilation.

Wash thoroughly after handling.

Keep away from heat and flame.

This substance is classified as a POISON under the Federal Caustic Poison Act.

### EMERGENCY/FIRST AID

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING!

Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician.

SEE SECTION 5.

DOT Hazard Class: Corrosive Material

001054

### SECTION 1 Physical Data

Appearance: Clear, colorless liquid.

Odor: Strong, vinegar-like.

Solubility: Infinite in water.

Boiling Point: 118°C (244°F).

Melting Point: 16.6°C (62°F).

Density: 1.05

Vapor Density (Air = 1): 2.1

Vapor Pressure (mm Hg): 11 @ 20°C (68°F).

Evaporation Rate: 0.97

### SECTION 2 Fire and Explosion Information

Fire:

Combustible. Flashpoint: 40°C (104°F) (closed cup).

Autoignition temperature: 427°C (800°F).

Flammable limits, in air, % by volume at 100°C (212°F): lcl: 5.4; ucl: 16.0.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

Fire Extinguishing Media:

Water, dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures. Vapors can flow along surfaces to distant ignition source and flash back. Water diluted acid can react with metals to form hydrogen gas.

### SECTION 3 Reactivity Data

Stability:

Stable under ordinary conditions of use and storage. Heat and sunlight can contribute to instability.

Hazardous Decomposition Products:

When heated to decomposition may emit toxic gases and vapors such as carbon monoxide.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Oxidizers, chromic acid, sodium peroxide, nitric acid, strong caustics, heat, flame.

### SECTION 4 Leak/Spill Disposal Information

Ventilate and evacuate area. Clean-up personnel require protective clothing and respiratory protection from vapors. Allow only qualified personnel to handle the spill. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect men attempting to stop leak. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures. Contain and recover liquid when possible. Absorb with vermiculite, dry sand, earth, or similar material. Scoop up with non-sparking tools and place in a closed container, and dispose in a RCRA approved facility. Do not flush to the sewer.

Reportable Quantity (RQ)(CWA/CE/RCLA) : 5000 lbs.

Insure compliance with local, state and federal regulations.

NFPA Ratings: Health: 2 Flammability: 2 Reactivity: 1

ACETIC ACID GLACIAL

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:

Inhalation of concentrated vapors may cause serious damage to the lining of the nose, throat, and lungs. Breathing difficulties may occur. Neither odor nor degree of irritation are adequate to indicate vapor concentration.

Ingestion:

Swallowing can cause severe injury leading to death. Symptoms include sore throat, vomiting, diarrhea. Ingestion of as little as 1.0 ml has resulted in perforation of the esophagus.

Skin Contact:

Contact with concentrated solution may cause serious damage to the skin. Effects may include redness, pain, skin burns. High vapor concentrations may cause skin sensitization.

Eye Contact:

Eye contact with concentrated solutions may cause severe eye damage followed by loss of sight. Exposure to vapor may cause intense watering and irritation to eyes.

Chronic Exposure:

Repeated or prolonged exposures may cause darkening of the skin, erosion of exposed front teeth, and chronic inflammation of the nose, throat, and bronchial tubes.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems, or impaired respiratory function may be more susceptible to the effects of this substance.

B. FIRST AID

Inhalation:

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

Ingestion:

**DO NOT INDUCE VOMITING!** Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.

Eye Exposure:

Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1986)

Oral rat LD50: 3310 mg/kg. Dermal rabbit LD50: 1.06g/Kg. Mutation references cited.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL): 10 ppm (TWA).
- ACGIH Threshold Limit Value (TLV): 10 ppm (TWA); 15 ppm (STEL).

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)

If the TLV is exceeded a full facepiece chemical cartridge respirator may be worn, in general, up to 100 times the TLV or the maximum use concentration specified by the respirator supplier, whichever is less. Alternatively, a supplied air full facepiece respirator or airtight hood may be worn.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances.

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Delta

American International Chemical  
17 Strathmore Road  
Natick, MA 01760

## MATERIAL SAFETY DATA SHEET

### COPPER ACETATE MONOHYDRATE

#### SECTION I - GENERAL INFORMATION

AIC Product Codes: COPACE, COPACS

Revision Date: November 11, 1993

Emergency Number: Chemtrec 800-424-9300

Information Number: 800-238-0001

Synonyms: Cupric Acetate, Crystals of Venus

CAS #: 142-71-2

OSHA Hazardous Substance: Yes, moderately toxic

DOT Hazard Class:

Copper Based Pesticide, Solid 6.1  
UN # 2775, PK Group III  
Keep away from food

#### SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Copper Acetate, monohydrate 99%

#### SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: Decomposes at 240°C

Vapor Pressure (MM Hg): N/A

Vapor Density (AIR=1): N/A

Specific Gravity (H<sub>2</sub>O=1): 1.9

Percent Volatile by Volume(%):

Melting Point: 115° C

Evaporation Rate (Butyl Acetate=1): Not Applicable

Solubility in Water: 70g/L

Appearance and Odor: Blue green fine crystals with a sour (acetic) odor.

pH: Solutions are acidic.

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

Flash Point: Not Applicable

Flammable Limits: Not Applicable

Extinguishing Media: Use media that is appropriate to treat surrounding fire.

Special Fire Fighting Procedures:

Use firefighting procedure that is appropriate to treat surrounding fire.

Unusual Fire Explosion Hazard: None Known

Auto Ignition Temperature: Not Applicable

#### SECTION V - REACTIVITY DATA

Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: High heat, reducing agents

Hazardous Polymerization: Will not occur under normal conditions

Hazardous Decomposition Products:

Decomposes @ 230° C with formation of carbon monoxide (CO) and acetic acid.

#### SECTION VI - HEALTH HAZARD DATA

Route(s) of Entry: Inhalation: Yes      Skin: Yes      Ingestion: Yes      Eye: Yes

Health Hazards: Acute, LD - 50, Oral in rats - 0.71 g/kg

Carcinogenicity:

Listed by ACGIH - \*Yes \*As copper (Cu)    IARC - No    NTP - No    OSHA - No

Signs - Symptoms of Exposure: May cause irritation to eyes, skin, and throat on contact.

Medical Conditions Aggravated by Exposure: None Known

Emergency First Aid Procedures:

**INHALATION:** Remove individual from site of exposure to fresh air immediately. Observe breathing, seek medical advice.

**INGESTION:** Drink water, do not induce vomiting. Consult a physician and show this data sheet.

**EYES:** Flush immediately with eyelids retracted with large quantities of water (for at least 15 minutes) - Consult a physician.

**SKIN:** Wash off with soap and water.

## SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

### Steps to be Taken in Case Material is Released or Spilled:

Review control measures first. Contain, sweep, or vacuum up taking care not to spread or raise dust.

Waste Disposal Method: Dispose of in accordance to local, state and federal regulations.

### Precautions to be Taken in Handling and Storage:

Avoid contact with skin, eyes, and clothing. Avoid breathing dust or mist. Use normal personal hygiene and housekeeping. Store in cool dry area away from other incompatible materials.

## SECTION VIII - CONTROL MEASURES

Respiratory Protection Type: Wear NIOSH/MSHA approved respirator

### Ventilation Requirements:

Ventilate as necessary to eliminate dust from work area.

### Protective Gloves, Clothing or Equipment Requirements:

Use rubber or neoprene gloves, protect face with chemical goggles. Normal work clothing adequate to protect from contact with skin.

### Work, Hygienic Practices:

Keep away from food and drinks. When using do not eat, drink or smoke. Dispose of contaminated clothing and wash all points of contact after using.

This information is given without any warranty or representation. It is believed to be correct but does not claim to be all inclusive and shall be used only as a guide. American International Chemical, Inc., shall not be held liable for any damage resulting from handling or for contact with the above product. It is offered solely for your consideration, investigation and verification.



# MATERIAL SAFETY DATA SHEET

SECTION I - IDENTIFICATION OF PRODUCT		
<b>SUPPLIER'S NAME</b> THE HALL CHEMICAL COMPANY	<b>EMERGENCY TELEPHONE NUMBER</b> CHEMTREC: 800/424-9300 HALL CHEMICAL: 216/944-2500	
<b>ADDRESS</b> 28960 LAKELAND BOULEVARD WICKLIFFE, OH 44092-0200		
<b>CHEMICAL NAME AND SYNONYMS</b> Manganese Acetate Tetrahydrate	<b>TRADE NAMES AND SYNONYMS</b> Manganese Acetate	
<b>HAZARDOUS MATERIAL DESCRIPTION &amp; PROPER SHIPPING NAME (49CFR 172.101)</b> N/A	<b>HAZARD CLASS (49CFR 172.101)</b> N/A	
<b>CHEMICAL FAMILY</b> Organo Metallic Salts	<b>FORMULA</b> $Mn(C_2H_3O_2)_2 \cdot 4H_2O$	
<b>DATE THIS FORM PREPARED</b> September 24, 1993	<b>PREPARED BY</b> J. GANDHI	<b>CAS NUMBER</b> 6156-76-1 for Mn-Acetate Tetrahy. or 638-58-0 for Mn Acetate
SECTION II - HAZARDOUS INGREDIENTS		
<b>MATERIAL OR COMPONENT</b> Contains approx. 22.5% Manganese as Manganese Acetate Tetrahydrate	<b>OCCUPATIONAL EXPOSURE LIMITS</b> OSHA PEL - 5 mg/m <sup>3</sup> as Manganese ACGIH TWA - 5 mg/m <sup>3</sup> as Mn for dust and compounds (1992-93)	
SECTION III - PHYSICAL DATA		
<b>BOILING POINT (°F)</b> N/A	<b>VAPOR PRESSURE (mm Hg)</b> N/A	<b>VAPOR DENSITY (AIR=1)</b> N/A
<b>SOLUBILITY IN WATER</b> Soluble	<b>SPECIFIC GRAVITY (WATER=1)</b> 1.589 gm/cc @20°C	<b>% VOLATILE BY VOLUME</b> N/A
<b>APPEARANCE AND ODOR</b> Pale pink crystals, slight vinegar-like odor		<b>EVAPORATION RATE</b> N/A
SECTION IV - FIRE AND EXPLOSIVE DATA		
<b>FLASH POINT (METHOD USED)</b> Non-flammable	<b>FLAMMABLE LIMITS</b> N/A	<b>LEL</b> N/A
<b>EXTINGUISHING MEDIA</b> Dry Chemical, CO <sub>2</sub> , Water Spray		
<b>SPECIAL FIRE FIGHTING PROCEDURES</b> Not a fire hazard, wear self-contained breathing apparatus when large quantities are involved.		
<b>UNUSUAL FIRE AND EXPLOSION HAZARDS</b> None expected		
SECTION V - HEALTH HAZARD DATA		
<b>OCCUPATIONAL EXPOSURE LIMITS</b> See Section II		
<b>EFFECT OF OVEREXPOSURE</b> Eye - Key cause irritation.  Skin - Prolonged or repeated skin contact may result in local contact dermatitis.  Inhalation - On acute exposure may cause mild irritation of upper respiratory tract. For detail please see Section IX, Additional Information.  Ingestion - Low order of toxicity by this route.		
<b>EMERGENCY AND FIRST AID PROCEDURES</b> Eye contact - Irrigate with water at least 15 minutes. Consult physician.  Skin contact - Remove contaminated clothing. Wash skin thoroughly with soap and water. Consult physician.  Inhalation - Remove to fresh air. May give oxygen. Consult physician.  Accidental ingestion - Induce vomiting if conscious. Consult physician.		

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## SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE	CONDITIONS TO AVOID: Do not evaporate to dryness.
	STABLE - STABLE UNDER NORMAL TEMPERATURE AND PRESSURE	
INCOMPATIBILITY (MATERIALS TO AVOID) None expected		
HAZARD DECOMPOSITION PRODUCTS Toxic fumes and metal oxides may be present during decomposition.		
HAZARDOUS	MAY OCCUR	CONDITIONS TO AVOID
	POLYMERIZATION	
	WILL NOT OCCUR Not known to occur.	

## SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED  
Contain the spill. Pick up the spill in an approved container for disposal.

WASTE DISPOSAL METHOD  
Dispose in accordance with federal, State and Local laws.

## SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFIC TYPE)  
Use NIOSH approved respiratory protection where airborne level exceeds appropriate occupational exposure limit.

VENTILATION	LOCAL EXHAUST	X	SPECIAL
	MECHANICAL (GENERAL)	X	OTHER Adequate to maintain below exposure limit.
PROTECTIVE GLOVES	Wear rubber gloves to avoid skin contact.		EYE PROTECTION Wear goggles where eye contact may occur.

OTHER PROTECTIVE EQUIPMENT  
Wear protective coverall as appropriate to avoid skin contact.  
Safety showers and eyewash stations should be present in work area.

## SECTION IX - SPECIAL PRECAUTIONS

PRECAUTION TO BE TAKEN IN HANDLING AND STORING  
Keep container closed. Protect against physical damage. Avoid contact with skin, eyes and clothing.

OTHER PRECAUTIONS  
Avoid breathing and use only with adequate ventilation. Wash thoroughly after handling. No food or beverage should be consumed in work area.

## ADDITIONAL INFORMATION

Long term exposure to insoluble forms of Manganese compounds may produce damage to central nervous system similar to Parkinson's disease. However, cases of central nervous system damage have not been demonstrated in workers exposed to soluble salts of Manganese.

The following toxicity data is from the Registry of Toxic Effects of Chemical Substances (1981-82):

Oral Rat - LD<sub>50</sub> 3730 mg/kg

LD<sub>50</sub> = Lethal dose 50, that dose most likely to cause death of 50% of experimental animals.

This product contains "MANGANESE COMPOUNDS" toxic chemical subject to the reporting requirements of Superfund Amendment and Reauthorization Act (SARA) of 1986, Section 313 of the Emergency Planning and Community Right to Know Act and of 40 CFR, Part 372.

This substance is listed on the Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

MSHA Hazard Ratings: HEALTH 2, FIRE 0, REACTIVITY 0

Information presented herein has been compiled from sources considered to be dependable and is accurate and reliable to the best of the knowledge and belief of The Hall Chemical Co., but is not guaranteed to be so. The Company makes no representations or warranties, express or implied. Customers are encouraged to conduct their own tests.

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**MATERIAL SAFETY DATA SHEET**

**CALCIUM ACETATE**

be used to comply with OSHA's  
Hazard Communication Standard,  
29CFR 1910.1200. Standard must be  
consulted for specific regulations.

Quick Identifier  
Common Name (used on  
and list)

**SECTION I - GENERAL INFORMATION**

Manufacturer's Name - ARCHER INDUSTRIES, INC.  
Address - 114 WILSON AVENUE  
NEWARK, NJ 07105  
Emergency Telephone # - (201) 344-0600 Secondary Tel# - CHEMTREC  
Other Information: Calls - (201) 344-0600 (800) 424-2300  
24 Hours a Day  
Date Prepared - December 1, 1992

**SECTION II - HAZARDOUS INGREDIENTS/IDENTITY**

Hazardous component(s) (chemical & common names) -

: Calcium Acetate is non hazardous

OSHA PEL	ACGIH TLV	Other Exposure Limits	% (Optional)	CAS Number
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\*not established. : : 62-54-4

: HMIS H-1, F-0, R-0, P-3  
: \* Consider ACGIH TWA of 10mg/m<sup>3</sup> for particulates not otherwise classified

**SECTION III - PHYSICAL & CHEMICAL CHARACTERISTICS**

Boiling Point : Decomposes at 160 degrees C  
Specific Gravity (H<sub>2</sub>O=1) : 1.5  
Vapor Density (Air=1) : Unknown Vapor Pressure (mmHg) : N/A  
Solubility in Water : Appreciable  
Reactivity in water : N/A  
Appearance & Odor : White granules or powder  
Melting Point : Decomposes at 160 degrees C

**SECTION IV - FIRE & EXPLOSION DATA**

Flash Point : N/A Method Used : N/A

Flammable Limits: LEL UEL  
in Air by Volume Lower : N/A Upper : N/A

Ignition Temperature : N/A Extinguisher Media : Water

Special Fire Fighting Procedures : Cool Containers

Unusual Fire & Explosive Hazards : Decomposes to acetone and calcium carbonate

**001064**



**MATERIAL SAFETY DATA SHEET**

**: CALCIUM ACETATE**

May be used to comply with OSHA's Hazard Communication Standard, 29CFR 1910.1200. Standard must be consulted for specific regulations.

Quick Identifier  
Common Name (used on label and list)

**SECTION I - GENERAL INFORMATION**

Manufacturer's Name - JARCHEM INDUSTRIES, INC.  
 Address - 414 WILSON AVENUE  
 NEWARK, NJ 07105  
 Emergency Telephone# - (201) 344-0600 Secondary Tel# - CHEMTREC  
 Other Information Calls - (201) 344-0600 (800) 424-9300  
 24 Hours a Day  
 Date Prepared - December 1, 1992

**SECTION II - HAZARDOUS INGREDIENTS/IDENTITY**

Hazardous component(s) (chemical & common names)-

: Calcium Acetate is non hazardous

OSHA PEL	ACGIH TLV	Other Exposure Limits	% (Optional)	CAS Number
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: \*not established : : : 62-54-4

: HMIS H-1, F-0, R-0, P-2  
 : \* Consider ACGIH TWA of 10mg/m<sup>3</sup> for particulates not otherwise classified

**SECTION III - PHYSICAL & CHEMICAL CHARACTERISTICS**

Boiling Point : Decomposes at 160 degrees C  
 Specific Gravity (H<sub>2</sub>O=1) : 1.5  
 Vapor Density (Air=1) : Unknown Vapor Pressure (mmHg) : N/A  
 Solubility in Water : Appreciable  
 Reactivity in water : N/A  
 Appearance & Odor : White granules or powder  
 Melting Point : Decomposes at 160 degrees C

**SECTION IV - FIRE & EXPLOSION DATA**

Flash Point : N/A Method Used : N/A

Flammable Limits in Air by Volume LEL Lower : N/A UEL Upper : N/A

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Self-Ignition Temperature : N/A Extinguisher : None

Special Fire Fighting Procedures

Unusual Fire

