

00

SCHENECTADY CHEMICALS, INC.

P.O. Box 1046 • Schenectady, New York 12301

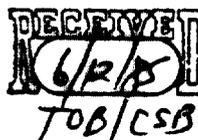
Robert P. Yunick
Vice President - Corporate Technology

~~CONFIDENTIAL~~

FYI-OTS-0685-0402 FLWP
SEQUENCE F

June 3, 1985

Document Control Officer
(ATTN: T. O'Bryan)
Office of Toxic Substances
401 M Street, SW
Washington, D. C. 20460



Dear Mr. O'Bryan:

I am writing in response to Mr. F. D. Kover's letter of April 23, 1985 concerning preparation of a Chemical Hazard Information Profile on 4-Nonylphenol, commonly known commercially as Nonylphenol (NP) or para-Nonylphenol (PNP). Schenectady Chemicals, Inc. is a manufacturer of two grades of PNP: High-Purity Grade and Technical Grade. Their approximate assays are as follows:

	<u>High-Purity</u>	<u>Technical</u>
PNP, % min. .	95	87-88
<u>Ortho</u> -Nonylphenol, %	4+	10-12
Dinonylphenol, % max.	-	2

In 1984, SCI manufactured approximately 18 million pounds of PNP for sale and internal use. In our experience all of our PNP is used as an industrial intermediate. It is reacted or chemically transformed into other derivatives prior to consumer use. We are not aware of any direct consumer use of PNP. Its principle uses are:

Surfactants/Demulsifier
Antioxidant/Stabilizer
Synthetic Resins

In the first case, it is reacted with various alkylene oxides to form monionic surfactants for industrial use. Some of these surfactants are used as demulsifiers in oil well exploration. In the second case it is converted to tris (para-nonylphenyl) phosphite for use as an FDA-approved antioxidant additive to plastics. In the third case it is reacted with formaldehyde to form solid resins for further industrial processing.

SCI has manufactured and used PNP for about 10 years. Since the product is a non-volatile, non-water-soluble, viscous liquid the amount of it exposed in the work place or environment is minimal. As a liquid it is handled in bulk, and pumped through

SCHENECTADY CHEMICALS, INC.

Document Control Officer
(ATTN: T. O'Bryan)
Office of Toxic Substances
Washington, D. C.

-2-

June 3, 1985

closed piping systems. There is no need for workers to handle it as they might handle a solid product in fiber drums or bags.

In our own internal resin making operation where we use PNP, it is not only stored and pumped in closed systems, but it is reacted in closed systems. By-product water streams from this process are first precipitated with flocculating agents. These precipitates are incinerated at high temperature to eliminate environmental release. Following precipitation, the water stream is then passed through a carbon absorption bed to further remove organic contents. The absorbate from the carbon is also incinerated.

In our 10 years of making, handling and using PNP, we have not experienced any employee exposure problems that are attributable to PNP.

In many respects PNP is used similarly to para-tert.-octylphenol (PTOP). PTOP is under study currently by EPA in cooperation with the Octylphenol Program Panel of CMA in Washington. You may want to consult documents filed with EPA by the Panel concerning uses, handling, exposure, etc. of PTOP. Most of this information is applicable to PNP.

Very truly yours,

SCHENECTADY CHEMICALS, INC.



Robert P. Yunick

RPY/cbd

00

Monsanto

MONSANTO INDUSTRIAL CHEMICALS CO.
800 N. Lindbergh Boulevard
St. Louis, Missouri 63167
Phone: (314) 894-1000

June 4, 1985

FYI-OTS-0685-0402 FLWP
SEQUENCE G

1985 JUN 11 PM 10:35

Document Control Officer (Attn: T. O'Bryan)
Information Management Division (TS-793)
Office of Toxic Substances
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

RECEIVED
6/12/85
TBB/CSB

Gentlemen:

This communication is in response to your letter of April 23, 1985 requesting unpublished information on 4-Nonylphenol for preparation of a CHIP document.

Product Description:

Monsanto produces a technical grade of Nonylphenol. The CAS No. is 25154-52-3 which your letter identifies as "mixed" isomers.

Health Effects

Health Effects are listed in the Physiological Effects Summary section of the attached MSDS. If additional details are needed, please let me know.

Environmental Effects

The MSDS lists a 96-hr LC₅₀ for Nonylphenol in fathead minnows. In addition, Monsanto has determined the Environmental Toxicity of Nonylphenol to Daphnia magna. These values are:

24-hr LC ₅₀ <u>Daphnia magna</u>	0.48 mg/l
48-hr LC ₅₀ <u>Daphnia magna</u>	0.44 mg/l
No effect concentration <u>Daphnia magna</u>	0.25 mg/l

Document Control Officer
(Attn: T. O'Bryan)
June 4, 1985
Page 2

Uses

Applications for Nonylphenol are listed in the attached Product Data Sheet.

Worker Exposure

There are a total of twelve (12) employees in the manufacture, storage and shipping areas. Potential exposure is minimal due to the low vapor pressure of Nonylphenol and occurs primarily when sampling and loading product.

Environmental Exposure

Wastewater from the manufacturing area is discharged into the Publicly Owned Treatment Works (POTW).

If you need any other information, please let me know and I will try to furnish it.

Sincerely,


Gilbert J. McEwan
Manager, Product Acceptability

/ku
Enclosure

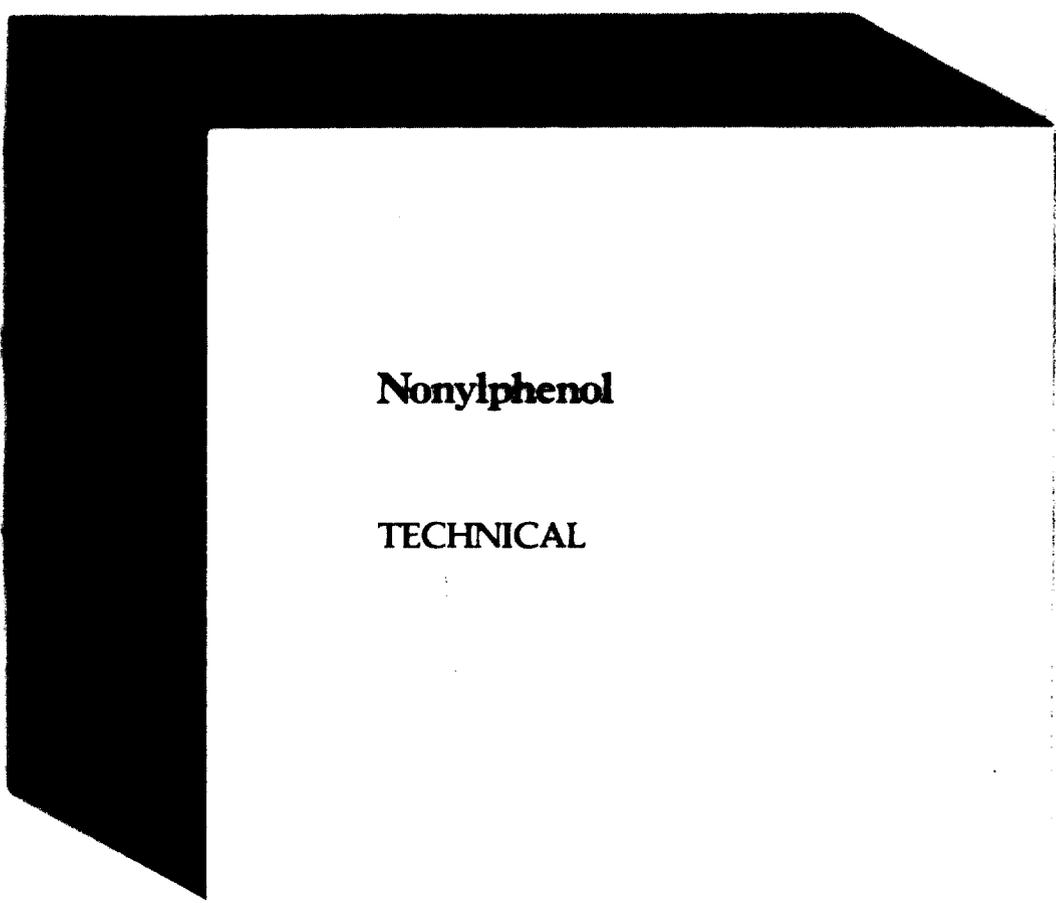
NONYLPHENOL

Monsanto

**Nonylphenol
TECHNICAL**



**Detergent
Materials**



Nonylphenol

TECHNICAL

PRODUCT DATA SHEET

**Date Effective:
October 1983**

MONSANTO PRODUCT NAME

NONYLPHENOLMONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167**Emergency Phone No.**
(Call Collect)
314-694-1000**PRODUCT IDENTIFICATION**

Synonyms: 4-Nonylphenol; NP

Chemical Formula: $C_9H_{19}C_6H_4OH$

CAS No.: 25154-52-3

DOT Proper Shipping Name: ORM-A n.o.s. via Air

DOT Hazard Class/ I.D. No.: ORM-A via Air/NA1693

DOT Label(s): Not Applicable

Hazardous Substance(s)/ RQ(s): Not Applicable

U.S. Surface Freight Classification: Nonylphenol (Chemicals, NOIBN)

WARNING STATEMENTS

WARNING!
CAUSES IRRITATION

PRECAUTIONARY MEASURES

Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

EMERGENCY AND FIRST AID PROCEDURES

FIRST AID: IF IN EYES, immediately flush with plenty of water for at least 15 minutes.
Call a physician.

IF ON SKIN, immediately flush with plenty of water. Remove contaminated clothing.
Wash clothing before reuse.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical safety goggles to prevent eye contact. Have eye baths immediately available where eye contact can occur.

Skin Protection: Wear impervious gloves and protective clothing to prevent skin contact. Wear face shields and impervious aprons when splashing is likely. Remove contaminated clothing promptly and launder before reuse. Provide safety showers at any location where skin contact can occur. Wash hands and contaminated skin thoroughly after handling.

(Occupational Control Procedures Continued On Next Page)

OCCUPATIONAL CONTROL PROCEDURES (Continued)

Respiratory

Protection: Use NIOSH approved equipment with full facepiece when airborne exposure is excessive. Consult respirator manufacturer to determine appropriate type equipment for given application.

Ventilation: Provide ventilation to minimize exposure. Local exhaust ventilation preferred.

Airborne

Exposure Limits: Product: Nonylphenol wt. % ca 90

OSHA PEL/TWA: None Established

ACGIH TLV/TWA: None Established

FIRE PROTECTION INFORMATION

Flash Point: 300°F **Method:** Cleveland Open Cup

Extinguishing Media: Water spray, foam, CO₂ or dry chemical.

Special Firefighting Procedures:

Wear self-contained breathing apparatus when exposure to vapors or products of combustion is possible. Full protective clothing to avoid skin contact should be worn.

REACTIVITY DATA

Materials to Avoid: Keep away from strong oxidizing agents.

Hazardous Decomposition

Products: CO, CO₂, smoke, soot and phenolics can be produced.

Hazardous Polymerization: Does not occur.

PHYSIOLOGICAL EFFECTS SUMMARY

Oral LD₅₀ (Rat): 1,300 mg/kg, Slightly Toxic

Dermal LD₅₀ (Rabbit): >2,000 mg/kg <3,160 mg/kg, Slightly Toxic

Eye Irritation (Rabbit): (FHSA) 58.0 on a scale of 110.0, Severely Irritating

Skin Irritation (Rabbit): (FHSA) 8.0 on a scale of 8.0, Severely Irritating

PHYSICAL DATA

Appearance and Odor: Clear, viscous liquid; characteristic phenolic odor

Boiling Point @ 760 mm Hg: 258°C

Specific Gravity @ 100°C/20°C: 0.930

Viscosity @ 100°C (centistokes): 7.18

Reid Vapor Pressure @ 100°F (lbs.): 0.58

Solubility: Practically insoluble in water (0.00024 g/g H₂O @ 25°C); soluble in most organic solvents

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

NONYLPHENOL

MATERIAL SAFETY DATA

SPILL, LEAK & DISPOSAL INFORMATION

Waste Disposal: Discarded product should be incinerated or placed in an approved landfill in accordance with local, state and federal regulations.

**Spill or Leakage
Procedures:**

Contain spillage and absorb on sawdust or soil. Incinerate or place in an approved landfill in accordance with local, state and federal regulations.

ADDITIONAL COMMENTS

This product can be stored in heresite-lined or stainless steel tanks. Dried air or nitrogen padding may be necessary. For outdoor storage, heating coils and/or insulation may be desirable to maintain fluidity.

Environmental Toxicity Information:

96-hr LC₅₀ Fathead Minnow: 0.3 mg/l, Highly Toxic

DATE: 10/1/83

REVISED: X

SUPERSEDES: 9/78

MSDS NO.: 025154523

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

Product Acceptability Coordinator
Detergent Materials
Monsanto Industrial Chemicals Company
314-694-2096
(A Unit of Monsanto Company)

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

Product: Nonylphenol

Grade: Technical

General Description: A clear, viscous liquid

Code No.: 6500-00

CAS No.: 25154-52-3

Molecular Weight: 220-235

Formula: $C_9H_{19}-\text{C}_6\text{H}_5-\text{OH}$

Specifications:

Appearance	Clear liquid with no foreign matter
Color, APHA (as shipped)	60 Maximum
Odor	No foreign odor; characteristic phenolic
Moisture, Karl Fischer	0.05% Maximum
Hydroxyl Number	240-255
Distillation Range, ASTM D-1078-70:	
1st Drop	288°C Minimum
5%	291°C Minimum
95%	312°C Maximum
Dry Point	319°C Maximum

Typical Values: *(Based on material tested in our laboratories, but variable from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.)*

Appearance	Clear liquid
Color, APHA (as shipped)	45
Moisture, Karl Fischer	0.04%
Ash	0.01%
Active	97.5%
Specific Gravity @ 25°C	0.937
Lbs./gallon	7.87 (approx.)

Note: *Both specifications and typical values are subject to change from time to time. Please write us for our current Data Sheet.*

Production Location: Kearny, NJ

Packaging: 55 gallon metal drums, tank trucks and tank cars
Drums: tare weight-46 lbs.; net weight-415 lbs.; export cube-10.715 ft.³

Labeling Requirements: Product label required by law.

Shipping Classification: Nonylphenol (Chemicals, NOIBN)

Handling Precautions: WARNING! CAUSES IRRITATION. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. FIRST AID: IF IN EYES, immediately flush with plenty of water for at least 15 minutes. Call a physician. IF ON SKIN, immediately flush with plenty of water. Remove contaminated clothing. Wash clothing before reuse.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

Nonylphenol

Key Properties: Nonylphenol is manufactured by the alkylation of phenol with an appropriate olefin. The reactive hydroxyl group permits a multiplicity of reactions. These include ethoxylation, etherification, esterification, halogenation, mercuration, nitration, polymerization, salt formation and sulfonation.

- Applications:**
- Nonionic surfactants
 - Anionic surfactants
 - Dispersants
 - Emulsifiers
 - Souring agents
 - Wetting agents
 - Antioxidants
 - Antisludge agents
 - Biocides
 - Corrosion inhibitors
 - Laminating resins
 - Thermosetting resins
 - Lacquers, Varnishes
 - Styrene copolymers
 - Resin stabilizers
 - Rubber stabilizers
 - Fuel oil stabilizers
 - Leveling agents
 - Oil additives
 - Deemulsifiers
 - Rubber accelerators
 - Printing inks
 - Remoisturable adhesives
 - Epoxy resins

For further information, please contact your nearest Monsanto Detergent Materials Sales Office.

DETERGENT MATERIALS

MONSANTO INDUSTRIAL CHEMICALS CO./800 N. LINDBERGH BLVD./ST. LOUIS, MISSOURI 63167

A UNIT OF MONSANTO COMPANY

NOTICE: Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. Nothing contained herein is to be construed as a recommendation to use any product, process, equipment or formulation in conflict with any patent and Monsanto makes no representation or warranty, express or implied, that the use thereof will not infringe any patent. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

DETERGENT MATERIALS SALES OFFICES

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260 Springside Drive
Montrose Development Park
44313
Tel. (216) 666-4111

ATLANTA, GEORGIA
320 Interstate North Parkway
Suite 500
30339
Tel. (404) 951-7600

BIRMINGHAM, MICHIGAN
30400 Telegraph Road
Suite 460
48010
Tel. (313) 645-5420

CHICAGO, ILLINOIS
9701 West Higgins Rd.
Suite 500
Rosemont, Illinois
60018
Tel. (312) 823-9050

CINCINNATI, OHIO
Whitehall Bldg.
8041 Hosbrook Road
45236
Tel. (513) 984-1100

HOUSTON, TEXAS
1300 Post Oak Tower Bldg.
5051 Westheimer Road
77056
Tel. (713) 877-5999

KENILWORTH, NEW JERSEY
North 8th Street & Monroe Avenue
07033
Tel. (201) 276-2900

LOS ANGELES, CALIFORNIA
1401 Dove Street
Suite 350
Newport Beach, California
92663
Tel. (714) 553-7700

ST. LOUIS, MISSOURI
800 N. Lindbergh Blvd.
63167
Tel. (314) 694-1000
*Toll Free (800) 325-4330

*Customer Order Processing Department



Texaco Chemical Company PO Box 430
Beaumont, TX 77701
713 666 8000

016-24-85

FYI-OTS-0685-0402 FLWP
SEQUENCE I

June 12, 1985

Document Control Officer (Attn: T. O'Bryan)
Information Management Division (TS-793)
Office of Toxic Substances
401 M Street, SW
Washington, DC 20460

RECEIVED
6/26/85
TOB/CSB

Dear Sir:

In response to the call for unpublished studies on nonylphenol (mixed isomers, C.A.S. No. 25154-52-3) for the development of CHIP reports, Texaco Chemical Company is herewith submitting the following:

1. "D.O.T. Skin Corrosivity Study in Rabbits", August 21, 1984. Conducted for Texaco Inc. by Pharmakon Research International, Inc.
2. "Dermal Sensitization Study of Nonylphenol in Albino Guinea Pigs (Modified Buehler Test)", December 19, 1984. Conducted for Texaco Inc. by Food & Drug Research Laboratories, Inc.

We regard both of these studies as important because there has apparently been some confusion over the proper classification of nonylphenol by these skin contact tests. Skin contact is the most likely route of exposure to nonylphenol. It is apparently a borderline case for skin corrosivity by the D.O.T. protocol since some manufacturers classify nonylphenol as "Corrosive" and some do not. However, Texaco Chemical Company considers the enclosed test result to be reliable and therefore classifies nonylphenol as a D.O.T. corrosive material.

Likewise, there may be conflicting reports in the literature as to the skin sensitizing potential for nonylphenol. A sample of commercial grade nonylphenol (mixed isomers) manufactured by Texaco Chemical was tested by the modified Buehler test in albino guinea pigs. As stated in the attached report, under the conditions of the test, nonylphenol did not cause contact dermal sensitization.

Document Control Officer (Attn: T. O'Bryan)
June 12, 1985
Page 2

A current Material Safety Data Sheet for nonylphenol published by Texaco Chemical Company is also enclosed for your information.

We trust that these documents will be of value to you in the development of the CHIP report.

Sincerely,



F. E. Bentley
Coordinator Product Safety

FEB:mc
EHS/y

Enclosure



ESTABLISHED 1802

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

LEGAL DEPARTMENT

June 26, 1985

file with FYI-OTS-0485-0402

Signature

Document Control Officer (TS-793)
Information Management Division
Office of Toxic Substances
401 M Street, SW
Washington, DC 20460

Attention: T. O'Bryan

Dear Mr. O'Bryan:

CHIP Request: 4-Nonylphenol
CAS-25154-52-3

This letter responds to Mr. F. D. Kover's 4/23/85 letter to Du Pont requesting information on the above chemical for EPA's planned Chemical Hazard Information Profile (CHIP). Du Pont has searched its records and has no unpublished health and safety reports on 4-nonylphenol.

Very truly yours,

Mark H. Christman

MHC/paa

07/09/85
RECEIVED

Peter Kover
for
Terry O'Bryan

1985 JUL -5 AM 8:53
EPA
INFO CONTROL BRANCH

→ Jim D.
10 769



file with FYI-0402

July 19, 1985

7/24

Mr. Frank Kover
Office of Toxic Substances
401 M Street, S.W.
Washington D.C. 20460

RECEIVED
7/30/85
TOB/CSB

Dear Mr. Kover:

Regarding the attached letters, please be advised that we have checked our files and we have no unpublished technical bulletins.

Sorry for the delay, but these letters were inadvertently filed.

Sincerely,

Mona Jenne

Mona Jenne
Secretary to L. M. Wiseman

4- Nonylphenol

UU

Monsanto

RECEIVED
7/18/85

TOB/CSB

MONSANTO INDUSTRIAL CHEMICALS CO.
800 N. Lindbergh Boulevard
St. Louis, Missouri 63167
Phone: (314) 894-1000

FYI-OTS-0685-0402 FLWP

June 5, 1985

SEQUENCE H

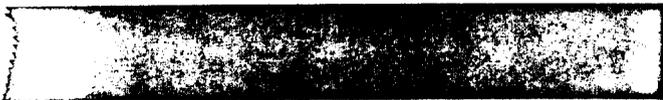
Document Control Officer (Attn: T. O'Bryan)
Information Management Division (TS-793)
Office of Toxic Substances
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

CONTAINS TRADE SECRET OR
OTHERWISE CONFIDENTIAL
INFORMATION OF MONSANTO
COMPANY

Gentlemen:

This letter supplements my letter of June 4, 1985 on information for the CHIP document on 4-Nonylphenol. It contains trade secret or confidential business information of Monsanto Company and is for EPA use only. Such information is exempt from disclosure under Section 552(b)(4) of the Freedom of Information Act. The disclosure by the EPA of such information would result in substantial harm to Monsanto's competitive position.

Current Production Volumes



Sincerely,

Gilbert J. McEwan
Gilbert J. McEwan
Manager, Product Acceptability

/ku

Borg-Warner Chemicals, Inc.



Technical Centre, Washington, W.Va. 26181

Telephone: 304/863-7055 TWX: 710-934-8270 Telex: 86-9423

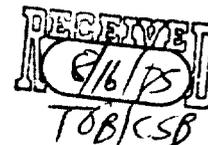
EPA
INFO. CONTROL BRANCH

1985 AUG 14 AM 8:29

August 8, 1985

FXI-OTS-0885-0438 INIT
SEQUENCE A

Document Control Officer (WH 557)
Information Management Division
Office of Toxic Substances
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460



Dear Sir or Madam:

The purpose of this letter is to share with you toxicity findings resulting from exposure of fathead minnows to chemical process effluent waters containing small quantities of phenolic chemical substances. It is our conclusion that these findings do not constitute a TSCA Section 8(e) reportable situation at this time. However, we are sharing this information with you in the spirit of cooperation and free scientific exchange. Should you decide this information reasonably supports a conclusion of substantial risk in accordance with TSCA Section 8(e), then consider this correspondence as the required 8(e) notification.

We manufacture speciality polymer additives and alkyl phenols at our plant near Morgantown, West Virginia. We discharge our treated process effluent into the Monongahela River through NPDES permits No. WV0004740 outfall 001 and WV0022047 outfall 002. The subject toxicity studies were designed and conducted by Donald S. Cherry, Ph.D., Aquatic Ecotoxicologist and Associate Professor of Zoology, University Center for Environmental Studies, Virginia Polytechnical Institute and State University, to increase knowledge of our regulated effluents. The design of the study addressed factors affecting the mortality of fathead minnows during acute static 48 hour LC 50 testing. Data as summarized by Dr. Cherry are included in Attachment I, and we will forward a copy of the final report to you when received.

According to Dr. Cherry, several changes were consistently detectable in liver tissues from surviving fathead minnows exposed to either the LC50 or LC10 levels of diluted effluent. These liver tissues were examined by transmission electron microscopy (TEM) and the following observations made:

- a. an increase in lipid droplets per TEM field occurred in survivors from incubations at LC50 concentrations of effluent,
- b. an increase in nuclear aberrations per TEM field occurred in survivors from incubations at LC50 concentrations of effluent,
- c. the observed pathology included expanded rough endoplasmic reticulum, increased vacuolar and lysosomal population, nuclear evagination and distortion,

- d. observed cellular changes increased with increasing concentrations of effluent, indicating a dose-response effect.

The samples used in this study were collected as grab samples from the effluent discharged before the effluent had reached the Monongahela River. Selected samples were analyzed by gas chromatography/mass spectroscopy and the following phenolic compounds were detected in microgram per liter concentrations: phenol; 4-nonylphenol and other nonylated isomers thereof; tert-butylphenol, in both ortho- and meta-substituted isomers; and multi-butylated phenols including 4-(1,1,3,3-tetramethylbutyl)phenol, 4-(2,2,3,3-tetramethylbutyl)phenol, 2,4-bis(1,1-dimethylethyl)phenol, 2,6-bis(1,1-dimethylethyl)phenol, 2,4,6-tris(1,1-dimethylethyl)phenol; 5-methoxy-2,3,4-trimethylphenol.

The wastewater effluent tested does not come into contact with employees at our plant. The effluent tested is discharged into the Monongahela River at a rate of between 200 and 450 gallons per minute. The river flows on an average of 4,390 cubic feet per second, which substantially dilutes the effluent from that facility. The very low concentrations of phenolics used in our study are extremely high by comparison to the minute concentrations in the river at any one time.

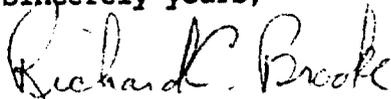
Section V(A) of the EPA guidelines as published in the March 16, 1978 Federal Register states that when environmental effects as opposed to human health effects are evident, as is the case in the facts reported here, the environmental effects "...must involve, or be accompanied by the potential for, significant levels of exposure...". The dilutions described above eliminate the possibility of any significant level of exposure.

Attachment II contains published literature references we have found concerning aquatic species exposed to phenolics. The literature review was completed on July 24, 1985. Although no publication exactly duplicates our study, similar results were found in aquatic species.

Further research is now being planned and will include exposure of fathead minnows to water from the Monongahela River upstream and downstream from our effluent discharge. Dr. Cherry will design the protocol and perform the study. We will be happy to provide results from this further research for your information.

Please feel free to contact me at your convenience should you have questions on this matter.

Sincerely yours,



Richard C. Brooke
Section Manager
Material Sciences and Regulatory Affairs

yes

Table 1. The effect of Borg Warner Effluent on the number of lipid droplets per TEM field for fathead minnows experiencing various aeration strategies and shipment containers. Means \pm S.E. are given.

Description of Treatment	Effluent Concentration	Lipids per field	ANOVA
Morgantown	0	10.8 \pm 1.5 ^a	
Constant Aeration	-LC ₁₀ (20%)	33.8 \pm 1.8 ^b	
No Shipment	-LC ₅₀ (30%)	47.8 \pm 2.5 ^c	86.39 (p<0.0001)
Va. Tech	0	0+0 ^a	
Constant Aeration	-LC ₁₀ (20%)	0+0 ^a	
Glass Container	-LC ₅₀ (30%)	4.2 \pm 0.7 ^b	32.67 (p<0.0001)
Va. Tech	0	2.0 \pm 0.3 ^a	
Constant Aeration	-LC ₁₀ (20%)	17.4 \pm 0.9 ^b	
Bag Container	-LC ₅₀ (30%)	22.8 \pm 0.9 ^b	183.25 (p<0.0001)
Va. Tech	0	0+0 ^a	
Intermittent Aeration	-LC ₁₀ (20%)	0+0 ^a	
Glass Container	-LC ₅₀ (30%)	4.4 \pm 0.4 ^b	121.0 (p<0.0001)
Va. Tech	0	0.2 \pm 0.2 ^a	
Intermittent Aeration	-LC ₁₀ (20%)	0+0 ^a	
Bag Container	-LC ₂₀ (30%)	4.4 \pm 0.4 ^b	92.60 (p<0.0001)

August 8, 1985
Document Control Officer (WH 557)
Page 3

ATTACH ENT I

The attached Tables 1 through 4 are summaries of data prepared by Dr. Cherry. These data include the lipid droplets per TEM field, aberrant nuclei per TEM field, diagnosis of gill tissue, and average percent aberrant nuclei in liver cells. These data are results of research performed by Dr. Cherry, and a final report of this research will be forthcoming soon.

Table 2. The effect of Borg Warner effluent on the number of aberrant nuclei per TEM field and the ratio of aberrant:normal nuclei per TEM field for fathead minnows experiencing various aeration strategies and shipment containers. Means \pm S.E. are given.

Description of Treatment	Effluent Concentration	Aberrant Nuclei	ANOVA	Aberrant/Normal Nuclei	ANOVA
Morgantown Constant Aeration No Shipment	0	0.4 \pm 0.2 ^a		0.015 \pm 0.009 ^a	
	~LC ₁₀	1.2 \pm 0.4 ^b		0.042 \pm 0.014 ^b	
	~LC ₅₀	4.4 \pm 0.7 ^b	20.36 (p<0.001)	0.148 \pm 0.023 ^b	17.85 (p<0.001)
Virginia Tech Constant Aeration Glass Container	0	0 \pm 0 ^a		0 \pm 0 ^a	
	~LC ₁₀	0.8 \pm 0.4 ^{ab}		0.013 \pm 0.006 ^{ab}	
	~LC ₅₀	2.0 \pm 0.7 ^b	4.75 (p<0.0302)	0.033 \pm 0.012 ^b	4.72 (p<0.0334)
Virginia Tech Constant Aeration Bag Container	0	0.4 \pm 0.2 ^a		0.006 \pm 0.004 ^a	
	~LC ₁₀	1.0 \pm 0.3 ^b		0.017 \pm 0.005 ^b	
	~LC ₅₀	5.0 \pm 0.9	19.54 (p<0.0002)	0.092 \pm 0.015 ^b	23.11 (p<0.001)
Virginia Tech Intermittent Aeration Glass Container	0	0.4 \pm 0.2		0.006 \pm 0.004	
	~LC ₁₀	0.8 \pm 0.4		0.015 \pm 0.007	
	~LC ₅₀	1.4 \pm 0.5	1.65 (p<0.20)	0.025 \pm 0.009	1.78 (p<0.20)
Virginia Tech Intermittent Aeration Bag Container	0	0 \pm 0 ^a		0 \pm 0 ^a	
	~LC ₁₀	0.4 \pm 0.2 ^b		0.008 \pm 0.005 ^b	
	~LC ₅₀	1.8 \pm 0.4 ^b	13.40 (p<0.0009)	0.033 \pm 0.006 ^b	16.31 (p<0.0004)

Table 3. Diagnosis of gill tissue from fathead minnows (Pimephales promelas) exposed to Borg-Warner 001 effluent with constant or intermittent aeration and shipped in glass or Borg-Warner bags.

Site/Aeration/Container	Exposure Concentration	Diagnosis
Morgantown Constant Aeration	0	Type II-III - hyperplasia
None	-LC10	Type II - hyperplasia
	-LC50	Type I
Virginia Tech Constant Aeration	0	Type II-III - hyperplasia
Bag	-LC10	Type III - hyperplasia
	-LC50	Type II - hyperplasia
Virginia Tech Constant Aeration	0	Type III - hyperplasia
Glass	-LC10	Type II - hyperplasia, protozoan, parasites
	-LC50	Type II-III - hyperplasia
Virginia Tech Intermittent Aeration	0	Type II - hyperplasia
Bag	-LC10	Type I - telactagnesia
	-LC50	Type I
Virginia Tech Intermittent Aeration	0	Type I
Glass	-LC50	Type II - hyperplasia
	-LC50	Type I - telactagnesia

Table 4. Average Percent Abberant Nuclei in the liver cells of fish used in Borg-Warner bioassays using Duncan's multiple range test ($\alpha = 0.05$).

Location	Aeration	Transport	% Effluent	Mean	Std. Dev.	ANOVA	Duncans
Morgantown	Continuous	None	0%	1.51	1.51		a
	Continuous	None	20%	4.24	3.18		a
	Continuous	None	30%	15.15	4.7	21.41	b
Blacksburg	Intermittent	Bag	0%	0	0		a
	Intermittent	Bag	20%	0.76	1.04		a
	Intermittent	Bag	30%	3.32	1.3	16.31	b
	Intermittent	Glass	0%	0.67	0.92		a
	Intermittent	Glass	20%	1.52	1.65		a
	Intermittent	Glass	30%	2.57	2.01	1.78NS	a
	Continuous	Bag	0%	0.6	0.83		a
	Continuous	Bag	20%	1.71	1.22		a
	Continuous	Bag	30%	9.23	3.45	23.48	b
	Continuous	Glass	0%	0	0		a
	Continuous	Glass	20%	1.37	1.48		a,b
	Continuous	Glass	30%	3.32	2.64	.01	b

ATTACHMENT II

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August 8, 1985

Document Control Officer (WH 557)

Page 5

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JANETTE D. SHERMAN, M.D.
INTERNAL MEDICINE

please reply to:

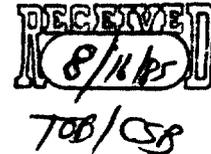
□ 25811 W. 12 MILE ROAD
SOUTHFIELD, MICHIGAN 48034
313 - 358-5830

FYI-OTS-0885-0402P FLWP
SEQUENCE J

□ P O BOX 1239
MAKAWAO, MAUI
HAWAII 96768
808 - 572-1172

August 9, 1985

Dr. ^{Fred} Albert Wiedow, Ph D
Office of Toxic Substances TS778
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460



Dear Al:

Enclosed are my report and bibliography concerning the birth defects in this unfortunate child who was born in Kona, Hawaii. I have censored any identifying data but suggest that if you need further follow up as to specifics, you contact the attorney, William Pickett, who is at Suite 1413 Bank of Kansas City Building, 1125 Grand Avenue, Kansas City, Missouri 64106.

I would appreciate it if you would supply me with additional information about the nonylphenol.

Earlier, I contacted you about the toxicology para tertiary butyl benzoic acid. (ptbba).

I will be back in my Detroit office as of August 19th. Please feel free to contact me if any of this requires additional information and/or clarification.

Kindest regards to you and your wife and to Harry.

Janette
Janette D. Sherman

JDS:bf

Enclosures

JANETTE D. SHERMAN, M.D.
INTERNAL MEDICINE

please reply to:

25811 W. 12 MILE ROAD
SOUTHFIELD, MICHIGAN 48034
313 - 358-5830

P O BOX 1239
MAKAWAO, MAUI
HAWAII 96768
808 - 572-1172

July 22, 1985

The Dow Chemical Toxicology
Research Laboratory
Midland, Michigan

Dear Madams & Sirs:

I would appreciate receiving copies of your reports concerning Acrylonitrile. It is my understanding that there is a 90 day oral toxicity study done by Humiston, C; a two-year study by Norris, J.M.; and an additional study by Quast, J.F., et al.

Thank you for your attention to this request.

Very truly yours,

Janette D. Sherman
Janette D. Sherman, M.D.

JDS:bf

*do you
folks
have this?*



DEAR COLLEAGUE,

WE REGRET WE ARE UNABLE TO FILL YOUR REQUEST FOR A COPY OF
Acrylonitrile reports. These were contract studies

and can be obtained from CMA.

*Al -
Who's that?*

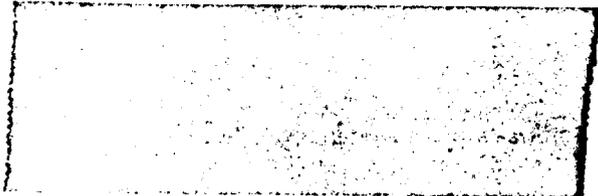
- NO REPRINTS AVAILABLE FROM PUBLISHER.
- REPRINT SUPPLY EXHAUSTED.

THANK YOU FOR YOUR INQUIRY.

TOXICOLOGY INFORMATION SERVICES
1803 BUILDING
THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN 48640

x

May 24, 1985



Re: [redacted] Baby Boy

[redacted] Mother

Kona, Hawaii

Date of Birth: [redacted]

Date of Death: [redacted]

*July
1985*

Dear [redacted]

I have reviewed the medical records which you sent to me in regard to the [redacted] baby.

Without reiterating the entire list, I have reviewed all of the records which you sent to me with your cover letter of April 16, 1985.

Review of these records indicates that the [redacted] baby, a boy, was born on 7/14/81. At the Kona Hospital, immediately after birth, he was found to have the following abnormalities:

- Myelomeningocele
- Deformity of the head
- Deformity of the penis
- Absent anus
- Deformities of the lower limbs

He was transferred to Kapiolani Childrens Hospital in Honolulu, whereupon a more thorough evaluation revealed the following birth defects:

- Low set small ears
- Barrel chest
- Lateral urethra
- Left hydrocele
- Right small testicle
- Meningomyelocele
- Imperforant anus with the colon ending 3 cm. short of the anus
- Rectovesical fistula
- Hypoplasia of the lower extremities
- Small abnormal kidneys
- Short neck

Short upper arm
Dysmorphic facies
Lumbosacral agenesis
Lumbosacral hemangioma

I will not review the entire Kapiolani medical events. However, suffice it to say that despite excellent medical care, attention to the various abnormalities, multiple consultations, and a number of procedures, this unfortunate child died approximately three weeks following his birth.

Review of [redacted] obstetrical record indicates that her last menstrual period was October 2, 1980, and that her estimated date of confinement was 7/7/81. The child was delivered one week later, on 7/14/81.

It is my understanding that a chemical was used in Mrs. [redacted]'s place of employment, in order to install insulation materials. It is my understanding that this product was used between the fifth and sixth week of her gestation. Answers to Interrogatories supplied by the National Cellulose Corporation (Celanese Corporation) reveal the products used in the insulation is as follows:

SK-131A-HIGH Molecular Weight Emulsion Polymer of Ethyl Acrylate, Acrylonitrile, Itaconic acid dispersed in water, using ethylene oxide nonyl phenol adducta non ionic dispersants. Less than 0.1% of formaldehyde and ammonia added for bacterial and pH control.

SK-131-B-High Molecular Weight Emulsion Polymer of Ethyl Acrylate N-methylol acrylamide itaconic acid dispersed in water using ethylene oxide nonyl phenol adducta non ionic dispersants. Less than 0.1% formaldehyde and 0.01% of other bacteriacides (1,2-dibromo-2, 4-dicyanobutane) added for bacteriacidal control.

I assume that the last named chemical is dibromo (not bidromo).

Further Answers to Interrogatories identified the polymers with the following CAS numbers:

35705-21-6
9016-45-9
26428-44-4
51811-79-1

I have done a number of literature searches, and data collections on the various chemicals listed in the Answers to Interrogatories.

I will summarize the information that has been collected in regard to these various chemicals:

Acrylates:

Acrylic resins are produced by the polymerization of acrylamide with partial hydrolysis or the copolymerization of acrylamide with acrylic acid. This family of chemicals has been associated with the production of neuropathy, embryo toxicity, and fetal toxicity.

Acrylonitrile:

Multiple testing has shown this chemical to be toxic by both the inhalation and cutaneous routes. It is mutagenic in micro-organism test systems. When administered to animals it has produced axial skeletal malformation, mesodermal changes, encephalocoel, limb and tail defects, and heart defects.

Ethyl Acrylate:

This chemical has been tested in rats and shown to cause malformations.

Ethylene Oxide:

This chemical is also known as epoxy ethane. It is active by the inhalation, intravenous and dermatological routes. It has been shown to cause teratogenic changes in rats, and has proven to be mutagenic in thirteen species. It binds to DNA in a covalent fashion. In monkeys, ethylene oxide has been shown to cause sister chromatid exchanges, as well as chromosomal aberrations. It has caused increased spontaneous abortions as well as leukemias and mesotheliomas in rats. In summary, this is an extremely biologically active substance shown to have teratogenic, mutagenic, and carcinogenic effects.

Formaldehyde:

This chemical has been associated with the development of mutations since at least 1946, and with carcinogenic effects since 1936. Multiple reports are in the medical literature showing mutagenic effects in *Drosophila*, *Neurospora*, *Salmonella*, grasshoppers, flowering plants, and fungi. Formaldehyde has been shown to cross-link between two amino acids and between nucleic acids in the nucleic acid bases. In cultured human cell test systems, formaldehyde has been shown to be mutagenic. There is a strong association between mutagenicity, carcinogenicity, and teratogenicity.

Itaconic Acid:

This product is also called methylene succinic acid. It has been used in agriculture as a plant growth regulator, as well as promoting ripening and flowering of tomatoes. It has been shown to increase peritoneal macrophages in animal test systems. A look at its chemical structure reveals that it is a highly reactive substance.

Nonyl Phenol:

This chemical is a non-ionic surfactant that is hydrophobic. It increases the penetration of other chemicals and is useful in industry for this. Multiple tests have been done indicating that nonyl phenol causes changes in viral replication, histamine release, and interacts with other chemicals.

Review of additional data indicates membrane damaging effects, a questionable association with the toxic shock syndrome, and a malignant transformation. Testing in animal species has shown birth defects, as well as changes in liver function studies and changes in the metabolism of cholesterol in the liver. Nonyl phenol has been shown to cause changes in the growth of seeds, as well as decreased photosynthesis and decreased growth in aquatic plant systems. When added to pesticidal formulations, nonyl phenol has been shown to result in an increase in the pesticidal properties. It also increases the persistence of xenobiotics, with persistence in sediment. It appears from testing that nonyl phenol is dependent upon bacterial systems for degradation. In aquatic species, it has been shown to be toxic to salmon, shrimp, and Daphnia. The chemical is currently being considered for CHIPS (Chemical Hazard Information Profile).

Computer searches for the CAS numbers of the reacted final products revealed little to no information. I do not know if data ^{has} been submitted to EPA under the Toxic Substance Control Act for registration in regard to these chemicals or not. If these data have been submitted, I would appreciate it if you would obtain them for me.

Appended to this report are the chemical structures of a number of the chemicals. Please note that, by and large, they are highly reactive, and are useful not only in the chemical industry because of their reactivity, but toxicologically active in biological systems because of the same reactivity.

Because of the fat solubility of a number of these chemicals they are retained within biological systems, and so exert their actions longer than the immediate exposure period. This is especially true of substances such as nonyl phenol, designed because it is indeed a hydrophobic (lipophilic).

Review of the Standard Embryological Reference for Human Development, according to age and weeks and body system (Arey Developmental Anatomy, W.B. Saunders Co.) of 13 body systems, the [redacted] child had defects in 7 of them. These are of body form, urogenital system, skeletal system, muscular system, nervous system, and sense organs.

His multiple abnormalities indicate profound interruption of normal development at an early stage of life, which correlates closely with the time of Mrs. Woodbury's exposure. Additionally, because of the multiple abnormalities, it is likely that they resulted from insults from a combination of chemicals, as indicated in the make-up of the Celanese product.

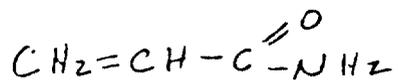
Review of the [redacted] baby's medical records, Mrs. [redacted] prenatal records, the chemical toxicology data, and the times of exposure, indicates to me that within a reasonable degree of medical certainty, the aforementioned chemicals were involved in the teratogenic effects and resulted in this child's death.

If any of this requires additional information and/or clarification, please contact me.

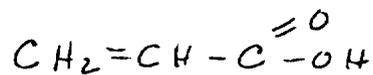
If you wish bibliographic references in regard to these chemicals please let me know and I will supply them.

Very truly yours,

Janette D. Sherman, M.D.



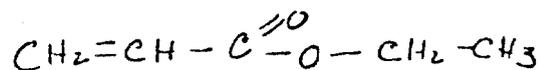
ACRYLAMIDE



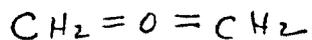
ACRYLIC ACID



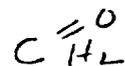
ACRYLONITRILE



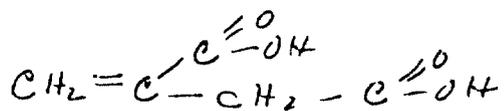
ETHYLENE ACRYLATE



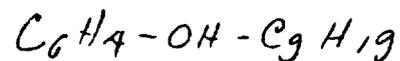
ETHYLENE OXIDE



FORMALDEHYDE



ITACONIC ACID
(Methylene succinic acid)



NONYL PHENOL
2,6, di-methyl 4 heptyl
phenol hydroxide

JANETTE D. SHERMAN, M.D.
INTERNAL MEDICINE

Please reply to:

25811 W 12 MILE ROAD
SOUTHFIELD, MICHIGAN 48034
313-358-5830

P O BOX 1239
MAKAWAO MAUI
HAWAII 96768
908-572-1172

July 22, 1985

Re: [REDACTED] baby boy. Mother [REDACTED]

Hawaii 96740

Date of Birth: 7- [REDACTED] 81 Date of Death: 8- [REDACTED] 81

Dear Mr. [REDACTED]:

Enclosed is the bibliography of teratogenic effects, caused by chemicals involved in the National Cellulose Corporation products. Specifically, the bibliography is in reference to acrylics, acrylonitrile, ethylene oxide, formaldehyde, itaconic acid and nonylphenol.

Please be advised that this bibliography is not all inclusive. It does however, represent the known literature about the teratogenic effects of these chemicals.

Because of the volatile nature of these chemicals, it must be assumed that they would have been absorbed into [REDACTED] body by inhalation. These chemicals are very reactive, and capable of causing a variety of adverse effects, including teratogenicity and mutagenicity. A number are also known proven carcinogens.

Please keep me apprised of the situation. If any of this material requires additional information and/or clarification please contact me.

Very truly yours,

Janette E. Sherman, M.D.

JDS:bf

CHEMICALS AND BIRTH DEFECTS

Abrahams, R.H.

Recent studies on workers exposed to ethylene oxide. In Jarkasky JF (ed): "The Safe Use of Ethylene Oxide." Proc Educational Semin Health Industry Manufacturers Association, Washington DC:

HIMA Report No. 80-4, pp 27-38 and 211-220.

1980

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Methods for Detecting Carcinogens and Mutagens with the Salmonella/Mammalian - Microsome Mutagenicity Test. Mut. Res. 31:347-363

1975

Anon.

Medical Letter on Drugs and Therapeutics 25(642):78-80.

1983

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Formaldehyde, University's effective research
Consumers Research Magazine

Mar 1979

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The health hazards of formaldehyde
The Lancet, p 926 Indian lands in the
Continental United States and Hawaii.

Auerbach, C.

The Mutagenic Mode of Action of Formalin
Science 110:419-20

1949

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Mutation Tests on Drosophila Melanogaster with Aqueous
Solutions of Formaldehyde

Am. Naturalist 86, 330-332

1952

Auerbach, C.; Moutschen-Dahmen, M. and Moutschen, J.
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Related Compounds

Mutat. Res. 39-317-362

1977

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Tumor Incidence and Lethal Mutation Rate in a Tumor Strain
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Cancer Res. 11:555-558
1961

Nonoxynol-9
Fertility and Sterility Vol 37, No. 2
Feb 1982

Chvapil, M.; Eskelson, C.D.; Stiffel, V., Owen, J.A.;
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Studies on Nonoxynol-9. II. Intravaginal Absorption,
Distribution, Metabolism and Excretion in Rats and Rabbits
Contraception 22(3):325-39
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Fertility and Sterility Vol 33, No. 5
May 1980

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Genetic effects of formaldehyde
Food and Cosmetic Toxicology 17(3):300-1
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Chemical Hazards to Human Reproduction
Jan 1981

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The Role of Organic Peroxides in the Induction of Mutations
Nat. Aca. of Sci. of USA Proceedings 35:581-586
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Etylenoxid. Kriteriedokument for Gransvarde
Arbete och Halsu G:1-33. Stockholm Swedish Board of
Occupational Health
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Eiberg, G.S.; Baranowski, E.
Health Implications of Urea-Formaldehyde Foam Insulation
Canadian Journal of Public Health 72(5):335-8
Sep-Oct 1981

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Response to Interagency Testing Committee Recommendations
Federal Register Vol 44, No. 94
May 14, 1979

Ewards, P.M.
The insensitivity of the developing rat foetus to the toxic
effects of acrylamide
Chem Biol' Interact 12(1):13-8
Jan 1976

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Report of the Federal Panel on Formaldehyde
Environ Health Perspect 43:139-68
Feb 1982

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Ethylene oxide: evidence of human chromosome effects
Environ Mutagen 1:375-382
1979

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R.M.
Heritable translocation and dominant-lethal mutation
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Ethylene oxide - spontaneous abortions (Letter to Editor)
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Reproductive-toxicologic assessment of the epoxides ethylene
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Sand j work environ health 9 94-102
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Toxicology of Acrylonitrile (AN)
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Hashimoto, Kazuo
The Toxicity of Acrylamide
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Reproductive Hazards and Plastics Industry
Progress in Clinical and Biological Research 141:79-87
1984

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Spontaneous abortions in hospital staff engaged in
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Pilot research chromosome study of workers at sites where
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Johnson and Johnson Corporate Submittal to OSHA
Mar 30, 1982

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IN THE CIRCUIT COURT OF THE THIRD CIRCUIT
STATE OF HAWAII

	and)	Civil No. 8252
)	
Plaintiffs,)	CELANESE CORPORATION'S
)	SUPPLEMENTAL ANSWERS TO
vs.)	FIRST REQUEST FOR ANSWERS
)	TO INTERROGATORIES
)	
NATIONAL CELLULOSE)	
CORPORATION, et al.,)	
)	
Defendants.)	

CELANESE CORPORATION'S SUPPLEMENTAL ANSWERS
TO FIRST REQUEST FOR ANSWERS TO INTERROGATORIES

Comes now CELANESE CORPORATION, by and through its attorneys, and pursuant to the Order Granting Plaintiffs' Motion to Compel Answers to Interrogatories, supplements its response to Plaintiffs' First Request for Answers to Interrogatories as follows:

8. What are the ingredients that are compounded to produce said product?

NO 200
CAS 8001 40885

ANSWER: SK-131-A--High molecular weight emulsion polymer of ethyl acrylate, acrylonitrile, itaconic acid dispersed in water using ethylene oxide nonyl phenol adduct nonionic dispersants. Less than .1 percent of formaldehyde and ammonia added for bacterial and pH control.

SK-131-B--High molecular weight emulsion polymer of ethyl acrylate, n-methylol acrylamide, itaconic acid dispersed in water using ethylene oxide nonyl phenol adduct nonionic dispersants. Less than .1 percent formaldehyde and .01 percent of other bactericides (1,2-dibromo-2, 4-dicyanobutane) added for bactericidal control.

dibromo

9. State the chemical formula for each such ingredient.

ANSWER: See answer to interrogatory 8.

10. State the common and/or generic name of each such ingredient.

ANSWER: See answer to interrogatory 8.

DATED: Honolulu, Hawaii, January 2, 1985.

Brian Aburano
WILLIAM A. BORDNER
BRIAN ABURANO

Attorneys for Defendant
CELANESE CORPORATION

Itaconic acid
 $CH_2=CH(COOH)CH_2COOH$

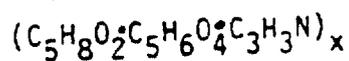
glycerine

9. State the chemical formula for each such ingredient.

SK-131-A

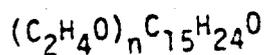
CAS number for polymer is 35705-21-6

Butanedioic acid, methylene-, polymer with ethyl 2-propenoate and 2-propenenitrile



CAS number for dispersant is 9016-45-9

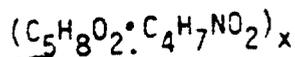
Poly(oxy-1,2-ethanediyl), a-(nonylphenyl)-w-hydroxy-



SK-131-B

CAS number for polymer is 26428-44-4

2-Propenoic acid, ethyl ester, polymer with N-(hydroxymethyl)-2-propenamide



CAS number for dispersant is 51811-79-1

Poly(oxy-1,2-ethanediyl), a-(nonylphenyl)-w-hydroxy-, phosphate

request the structural formula