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MONSANTO COMPANY

Environmental Policy Staff

SPECIAL REPORT
ON
PENTACHLOROPHENOL PRODUCTS/PROCESSES -
INFORMATION FOR USE IN
LITIGATIONS

Report No. MSL-4254

Compiled by: W. B. Bennet
D. R. Dill
H. C. Godt, Jr.
D. K. Lynch
S. H. Vogel

Date: November 30, 1984

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I. Introduction

This report on the history of Monsanto's production and sale of pentachlorophenol products was assembled primarily for use in the Pennsylvania and Georgia litigations. However, it certainly could find use in any future litigations involving the company.

The information gathered includes the chemistry involved in the production of pentachlorophenol basic products; a brief history of their processes; the compositions of the basic products and derived formulations; a product/process chronology of significant events; references dealing with the safety and handling of these products/processes; references to sales reports, sales invoices/purchase orders, and customer contacts/call reports; and organizations related to pentachlorophenol products in which Monsanto participated.

The source of this information was part of the files on pentachlorophenol products, assembled by the Corporate Law Department, and included:

<u>Source</u>	<u>Document Numbers</u>
Toxicity Documents (DMEH Library)	0000001-002892
Toxicity Documents (A/O-Nitro files)	0004319-0004894
Manufacturing Documents (WGK plant)	0010001-0014458
Manufacturing Documents (D.B. Edward's file)	0014459-0015947.01
Design Manual (CED Library)	0015948-0016215
Manufacturing Documents (Coburn, Croft law firm files)	0016216-0018618
Environmental Law Documents (NIOSH files)	0019740
	0019782-0019790
SMPs and Research Reports (R2C Information Center)	0025001-0028105.02
Research Reports (R2C Information Center)	0028106-0029082
Research Documents (A/O-Nitro files)	0029083-0030087
Research Documents (W. B. Bennet's files)	0030088-0030674
General Documents ("Penta Bible", Liebmann and Blase files, technical bulletins from Corp. Distribution)	0035001-0036500
General Documents (L. Meyer and B. Russell files)	0043021-0046219
General Documents (A/O-Nitro files)	0046220-0046583
Sales (Marketing) Documents (PCB litigation files)	0050001-0050698

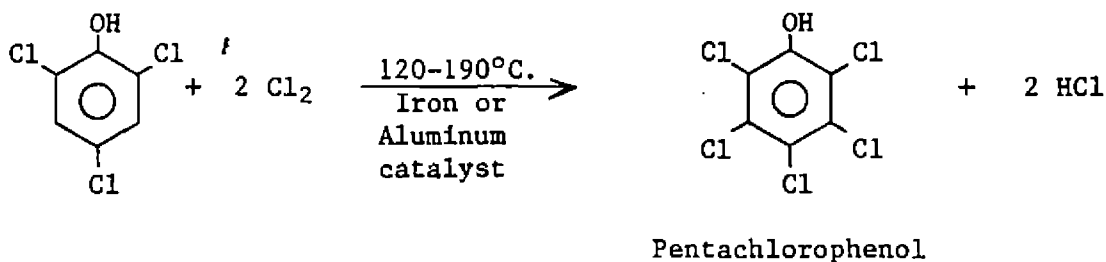
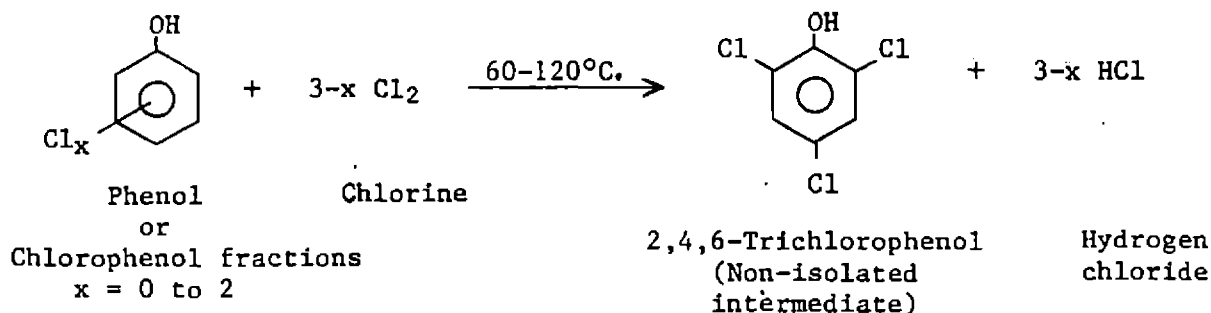
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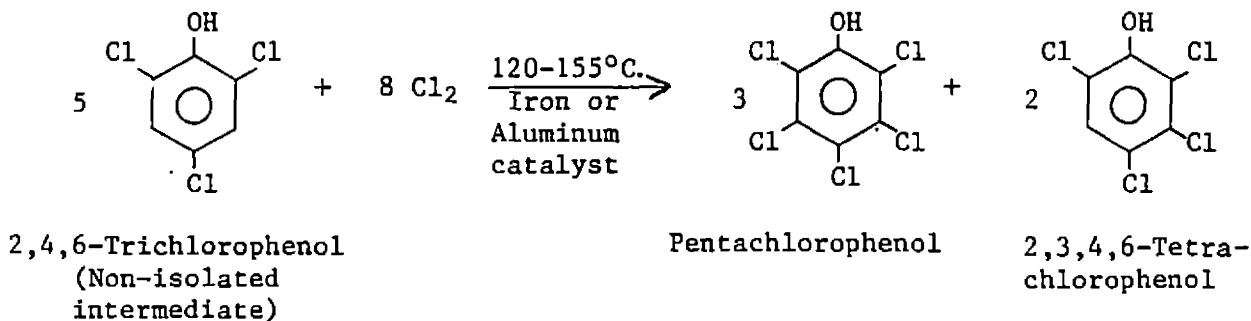
II. Chemistry of Pentachlorophenol Basic Products

A. Pentachlorophenol (Penta)



Note: Monsanto Penta contained about 90% pentachlorophenol and about 10% 2,3,4,6-tetrachlorophenol (refer to Penta 60 chemistry).

B. Penta 60 (60% Pentachlorophenol, 40% 2,3,4,6-Tetrachlorophenol)



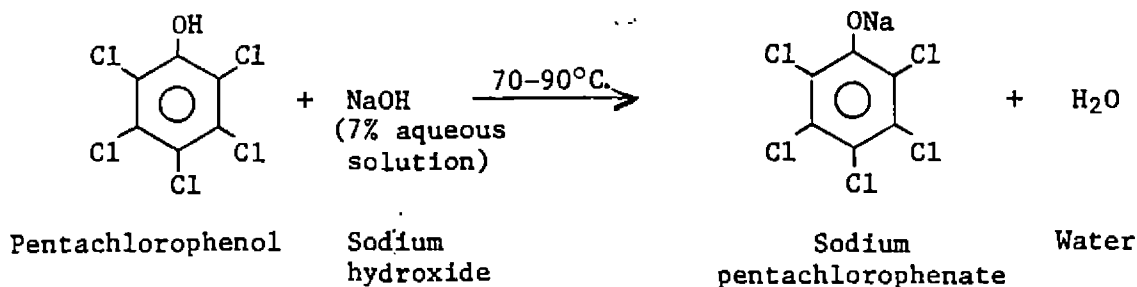
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Hydrogen
chloride

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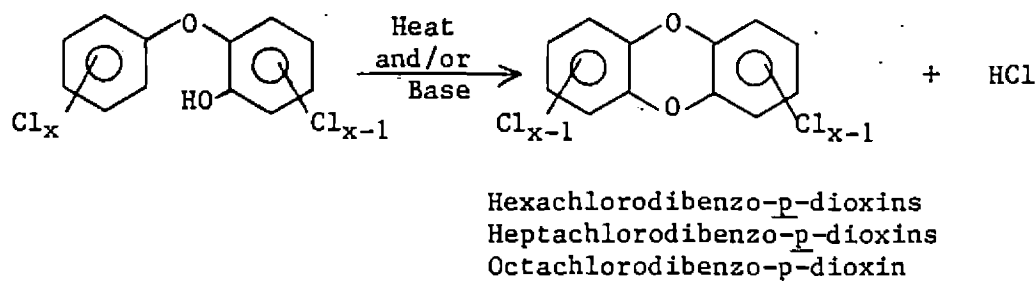
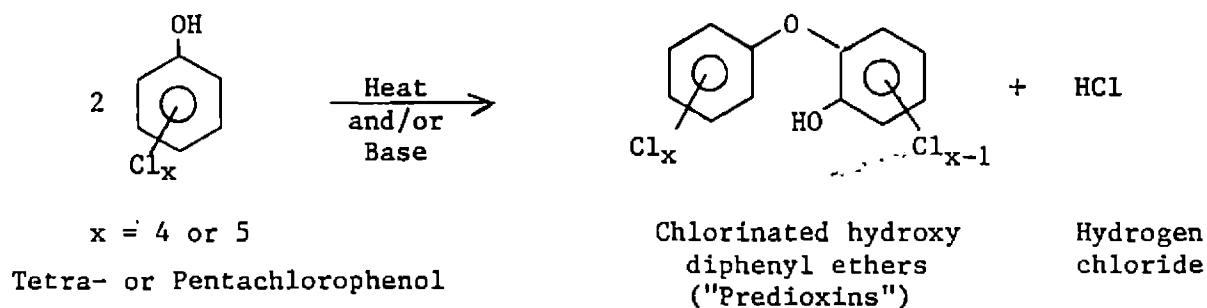
C. Sodium Pentachlorophenate (Santobrite)



Note: Santobrite contains about 90% sodium pentachlorophenate and about 10% sodium 2,3,4,6-tetrachlorophenate.

D. By-products Formed (Alkali Insolubles)

1. Chlorinated Dibenzo-p-dioxins and "Predioxins"

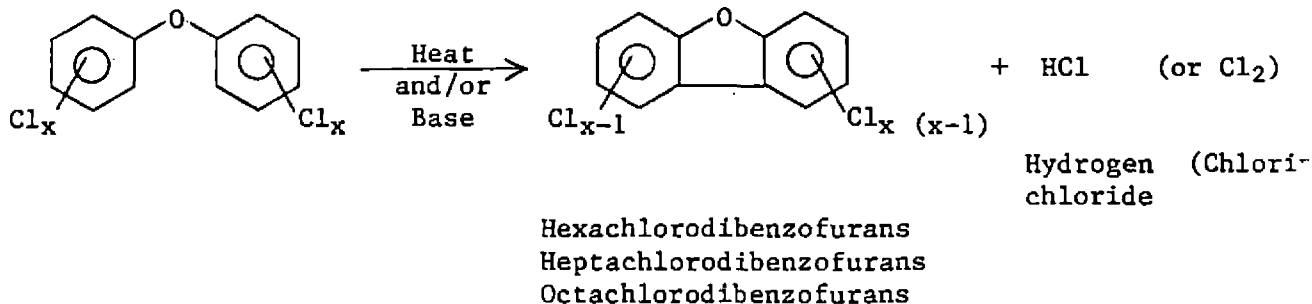
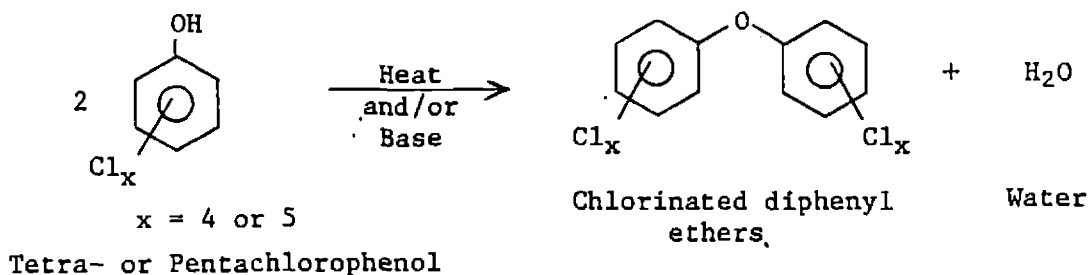


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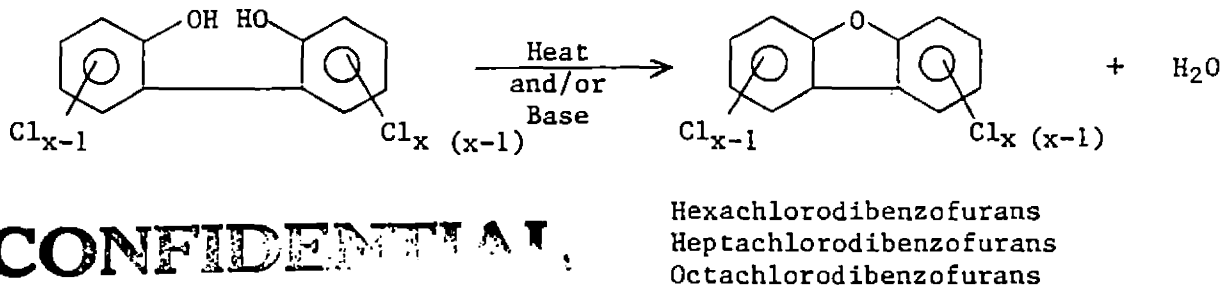
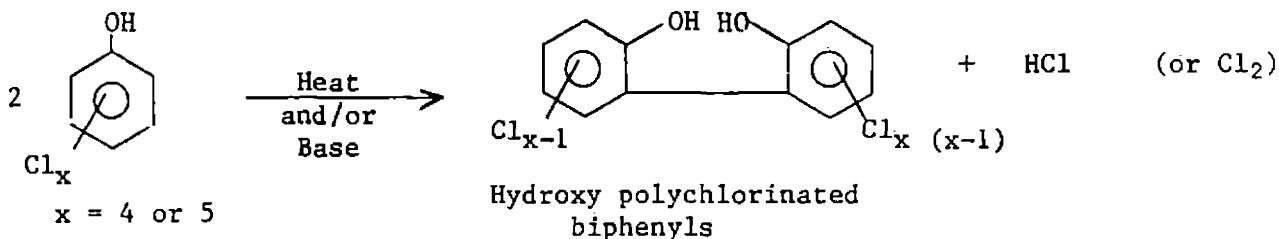
C25292

2. Chlorinated Dibenzofurans, Chlorinated Diphenyl Ethers, and Hydroxy Polychlorinated Biphenyls

Route 1



Route 2



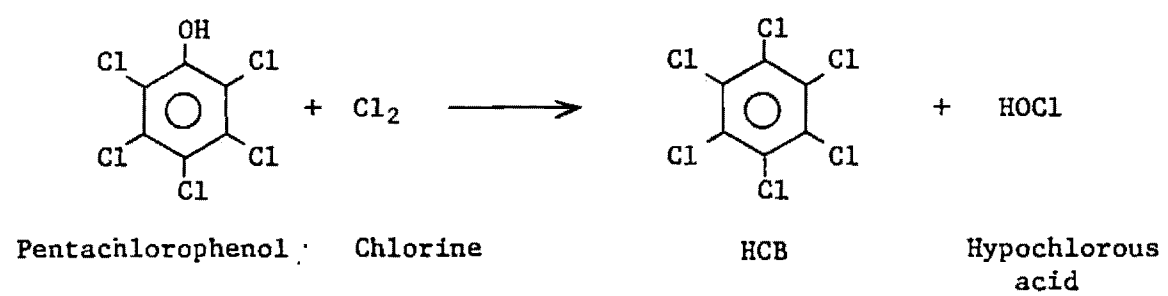
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Hexachlorodibenzofurans
Heptachlorodibenzofurans
Octachlorodibenzofurans

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3. Hexachlorobenzene (HCB)



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III. Brief History of the Penta and Santobrite Processes

Monsanto began the production of pentachlorophenol (Penta) in 1936 probably in the W Building pilot plant of the Queeny plant. In October, 1938, manufacture of Penta and Santobrite began in a newly built full-scale production unit (Building B0) of the Krummrich plant. At that time, Penta was called Santophen 20, and Santobrite was called Santophen 20S. A pine oil/methanol/Penta mixture, called Santophen 20 P.A., was also made.

Penta was marketed in flake form until 1963. Then Penta and later Penta 60 (60% pentachlorophenol, 40% tetrachlorophenol) were offered in prilled form and the flaking operation discontinued. Penta 60 production began in 1968. In 1971, facilities were in-stalled to make 2000 lb. Penta blocks. Production of 1000 lb. Penta blocks began in 1972. Santobrite was produced in powder, briquette, pellet, and 30% aqueous solution forms throughout its history. Over the years, numerous formulations involving Penta and Santobrite were produced and sold.

The chemistry for the production of Penta and Santobrite remained essentially the same throughout the life of these products. Phenol, or chlorophenol fractions from the production of o- and p-chlorophenol or 2,4-dichlorophenol, was progressively chlorinated to the appropriate crystallizing point (for Penta, 174-182°C.; for Penta 60, 145°C.). Iron powder was first used as a catalyst; from 1940, aluminum. Santobrite was simply the neutralization of Penta with sodium hydroxide.

From 1938 to about 1950, Penta and Santobrite were manufactured in Building B0 of the Krummrich plant. It has long since been dismantled. From about 1950 to 1978 when production of Penta ceased (Santobrite production stopped in 1975), these materials were produced in Building BD, just east of the Building B0 site. Building BD was dismantled in 1979. Concerning the equipment, as demand for these products increased, additional equipment was added. Although modernized and in some instances larger, the new equipment operated essentially in the same manner.

With regard to major changes, a jumbo chlorinator (2½ times as large as the other chlorinators) was put in operation in March, 1970. In 1971, 0.4-0.5% triphenyl phosphite (TPPi) and 0.2-0.5% RT-53A [di(t-amylphenyl) acid phosphate] were added to Penta in order to improve the color and solubilize oil insolubles. In 1972, sublimation of the prilled Penta was reduced by addition of Mobil Provalent 4A oil and more effectively by Humble NUSO-38 oil.

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The following gives the Krummrich plant Department Numbers for the various Penta basic products at various points in time.

<u>Product</u>	<u>1938-67</u>	<u>1967-78</u>
Molten Penta	Dept. 236	Dept. 236
Flaked Penta	Dept. 236	--
Prilled Penta (started 10/20/63)	Dept. B-236	Dept. 226*
Penta 60 (started 11/68)	--	Dept. 236
Santobrite Powder, Pellets, Solution	Dept. A-236	Dept. 225*
Santobrite Briquettes	Dept. A-236	Dept. 227*

*Same department as in 1938-67 - just renumbered due to machine accounting installation.

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IV. Composition of Penta Basic Products and Formulations

A. Basic Products

1. Pentachlorophenol, Molten

Internally produced - not sold

Specifications: (Ref. 0025583)

Alkali Insolubles (chlorinated diphenyl ethers, biphenyls, dibenzo-p-dioxins, dibenzofurans and related compounds)	0.6%, max.
Pentachlorophenol (by GLC)	90%, min.
Total chlorinated phenols, calc'd as Pentachlorophenol	97.5%, min.

2. Pentachlorophenol, Technical

Also called:

Santophen 20
Penta
Monsanto Penta

Sold in the following forms:

Flakes
Oiled Flakes (0.5% fuel oil)
Prills
Oiled Prills (0.5% fuel oil)
Blocks (1000 lb., 2000 lb.)

Analysis: (Ref. 0010080-0010478; 0000108)

	<u>Range</u>	<u>Typical</u>
Pentachlorophenol	85-87%	86.5%
Tetrachlorophenol	5-7	6.0
Highboilers (diphenyl ether types)	6.5-8.5	7.5
Total phenols		97.5%
Alkali insolubles		0.6% max.
Penta/hexachlorodibenzo-p-dioxins		700 ppm
Heptachlorodibenzo-p-dioxins		1000 ppm
Octachlorodibenzo-p-dioxins		2700 ppm
Chlorinated dibenzofurans		not quantified
Crystallizing point	178-182°C.	

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Note: "Golden" Penta was Pentachlorophenol, technical, with 0.15% ethylene glycol or water added at the end of the chlorination cycle either in the chlorinator or in the hold tank before start of prilling. This product had a lighter and more uniform prilled appearing color. Such a material was never commercialized.
(Ref. 0026086-91)

3. Penta 60

Mixture of Tetrachlorophenol and Pentachlorophenol

Form: Prills

Analysis: (Ref. 0026167) .

Pentachlorophenol	48%, min.
Tetrachlorophenol	28%, min.
Active ingredients (Chlorophenols)	95%, min.
Alkali insoluble matter (chlorinated diphenyl ethers, biphenyls, dibenzo-p-dioxins, dibenzofurans, and related compounds)	0.15%, max.
Crystallizing point	145°C.

4. Penta L

A lower assay form of Penta. . Also lower alkali insolubles.

Form: Prills

Analysis: (Ref. 0026164)

Same as Penta, prilled except; Pentachlorophenol (by GLC)	82.0%, min.
Crystallizing point	174-177°C.

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5. Sodium Pentachlorophenate, Technical

Also called:

Santophen 20S
Santobrite
Santobrite, Alkaline

Forms:

Briquettes
Pellets
Powder
Solution
Modified Fines

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Analysis: (Ref. 0025676)

Santobrite: (Ref. 0025676)

Sodium Pentachlorophenate	90%, min.
Water	9%, max.
Free Alkali (as NaOH)	0.5-0.9%

Santobrite Solution: (Ref. 0025441)

Sodium Pentachlorophenate	29.5-30.5%
---------------------------	------------

Santobrite, Alkaline: (Ref. 0025676)

Sodium Pentachlorophenate	86.0%, min.
Water	9.0%, max.
Free Alkali (as NaOH)	3.0-4.0%

B. Formulations

Note: "Permasan" is a later tradename for "Permatol"

1. Monsanto Brush Treatment 5 parts wood rosin, 90 parts of 50/50 mix of #2 Fuel Oil and Shell Dione lube oil, 5 parts Santophen 20, and 0.0015 parts of Orange dye.

(Ref. 0026015)

2. Monsanto Penta Crop Desiccant

10% Penta, tech.
3% Armour RD 1990A (emulsifier)
87% Sovacide 544C (aromatic petroleum solvent)

(Ref. 0000956-1000)

3. Penta Concentrate (Koppers Penta Wood Preservative
1-10 Concentrate)

40% Penta, tech

60% WK-60 Solvent (Eastman Chemical)

(Ref. 0046199-215)

4. Penta Solution

40% solution of Penta in
KB-3 oil from Wood Treating
Chemical Co. (Eastman Waste
Oil). Made from precipitated
pentachlorophenol from prill
fumes caustic scrubber.

(Ref. 0012322, 0014268)

5. Permasan

Same as Permatol A Treating
Solution.

6. Permasan 116

	<u>lbs./1000 gal.</u>
Fish oil	702
Pine oil	350
Aroclor 5460	350
Paraffin wax	70
Nuodex	3
Santophen 20	
(Tech. Penta)	368
Solvent	
(Mineral Spirits)	
(800 gal)	5194

(Ref. 0026755)

7. Permasan 116 Concentrate

12.03% Tech. Pentachlorophenol
11.56% Steam distilled pine oil
9.22% Cicoil
4.63% Boiled linseed oil
2.31% Refined paraffin wax
60.25% Mineral spirits

(Ref. 0026698)

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8. Permasan 167

7/25/40

5.19% Tech. Pentachlorophenol
5.00% Steam distilled Pine Oil
5.00% Aroclor 5460
10.00% Falkovar K Fish Oil
1.00% Refined Paraffin
74.00% Mineral Spirits
0.03 Cobalt dryer
(Ref. 0026728-9)

7/17/41

Substitute Cumar 420-S Resin
for Aroclor 5460
(Ref. 0026719-21)

7/28/41

Substitute Piccolyte 100-S
instead of Cumar 420-S.
(Ref. 0026718)

11/27/42

Substitute Cobalt Nuolate for
Cobalt Nephthenate on an
equivalent metal basis.
(Ref. 0026715)

9. Permasan 167 Concentrate

11/2/40

11.20% Tech. Pentachlorophenol
10.79% Steam distilled Pine Oil
21.59% Falkovar K Fish Oil
10.79% Aroclor 5460
2.16% Paraffin wax
43.46% Mineral Spirits
0.03% Cobalt Metal (dryer)
(Ref. 0026710)

8/21/41

Substitute Piccolyte 100-S
for Aroclor 5460
(Ref. 0026702)

11/27/42

Substitute Cobalt Nuolate
for Cobalt Naphthenate
(Ref. 0026701)

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10. Permasan 170

7/25/40

5.19 parts Tech. Pentachloro-
phenol
5.00 parts Steam distilled
Pine Oil
5.00 parts Dehyd. Castor Oil
5.00 parts Aroclor 5460
1.00 parts Refined paraffin
79.00 parts Mineral Spirits
0.03 parts Cobalt as
Cobalt Naphthenate
(Ref. 0026728-9)

7/17/41

Substitute Cumar 420-S for
Araclor 5460 (Ref.
0026719-21)

7/28/41

Substitute Piccolyte 100-S
for Cumar 420-S
(Ref. 0026718)

11/27/42

Substitute Cobalt Nuolate for
Cobalt Naphthenate on
an equivalent metal basis.
(Ref. 0026715)

11. Permasan 200

11.21% Tech. Pentachlorophenol
10.83% Steam distilled Pine
Oil 21.66% Falkovar K Extra
Heavy
Fish Oil
8.66% Aroclor 5460
2.17% Dialuminum Stearate
45.46% Mineral Spirits
0.03% Cobalt metal from
Cobalt Naphthenate
(Ref. 0026675)

12. Permasan 204 Concentrate

11.21% Pentachlorophenol, tech.
10.83% Steam distilled Pine Oil
21.66% Falkovar K Extra Heavy
Fish Oil
8.66% Aroclor 5460
2.17% Dialuminum Stearate
45.46% Mineral Spirits
0.03% Cobalt metal (as Cobalt
drier solution)
(Ref. 0028775)

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13. Permasan 204 Treating
Solution

1 part Permasan 204 Concentrate
1½ parts Mineral Spirits
(Ref. 0028776)

14. Permasan 300

9/18/41

2.08% Tech. Pentachlorophenol
3.00% 2-chloro-o-phenyl phenol
4.00% Piccolyte 100-S resin
4.00% Steam distilled Pine Oil
4.00% Falkovar Extra Heavy
Fish Oil
1.00% Dialuminum Stearate
0.50% Refined paraffin wax
81.5 % Mineral Spirits
0.03% Cobalt (as Cobalt
Naphthenate)
(Ref. 0026689)

11/27/42

Substitute Cobalt Nuolate
for Cobalt Naphthenate on an
equivalent Cobalt basis.
(Ref. 0026680)

15. Permasan 300 Concentrate

11/28/41

4.860% Pentachlorophenol, Tech.
7.010% 2-chloro-o-phenyl phenol
9.348% Piccolyte 100-S resin
9.348% Steam distilled Pine Oil
9.348% Falkovar K Extra Heavy
Fish Oil
2.337% Dialuminum Stearate
1.169% Refined Paraffin wax
56.580% Mineral Spirits
0.03% Cobalt Metal as Cobalt
Naphthenate
(Ref. 0026789)

11/27/42

Substitute Cobalt Nuolate for
Cobalt Naphthenate on an
equivalent cobalt basis.
(Ref. 0026781)

16. Permasan, Reformulated

9/29/41

2.08% Pentachlorophenol, Tech.
3.00% 2-chloro-o-phenylphenol
5.00% Synthetic Copal Ester Gum
90.00% Standard Oil engine
distillate #1.
(Ref. 0026742)

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- | | | |
|-----|---|---|
| 17. | Permatol A Concentrate | Same as Santophen 20 P.A. |
| 18. | Permatol A-PX116
(Permasan 116) | 5.19 parts Tech. Pentachlorophenol
5.00 parts Pine oil
4.00 parts Ciccoil
2.00 parts Boiled linseed oil
1.00 part Paraffin
83.00 parts Mineral Spirits
(Refs. 0026007-8, 0026773-9) |
| 19. | Permatol A Treating
Solution
(Also called Permasan) | <p><u>4/4/38</u>
5 parts Penta (Santophen 20)
90 parts #2 Fuel Oil
5 parts Wood Rosin, Filtered
(Ref. 0026018)</p> <p><u>1/2/45</u>
3.38 parts Penta
1.82 parts Tetrachlorophenol
5.00 parts Synthetic Copal
Ester Gum
90.00 parts Shell Range Oil
(Ref. 0026011)</p> |
| 20. | Preservetex Concentrate | 40% Tech. Pentachlorophenol
40% Pine Oil
20% Triphenyl phosphate
(Ref. 0026650) |
| 21. | Santophen 20 P.A.
(Permatol A Concentrate) | 40% Tech. Pentachlorophenol
30% Pine oil
30% Methanol
(Ref. 0026439) |
| 22. | Timbertox XX | 2.973% Gilsonite
8.920% Refined Linseed Oil
5.08% Tech. Pentachlorophenol
4.373% Synthetic Copal
Ester Gum
78.654% Standard Engine
Distillate #1.
(Ref. 0026658) |
| 23. | Timbertox 10-S | A 5% solution of Monsanto Penta
in a petroleum solvent similar
to fuel oil #1 in volatility.
(Ref. 0028349) |

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.24. Timbertox 12 Concentrate 34.5% Pentachlorophenol, tech.
37.9% Pine Oil 27.6%
Velsicol NR-21 solvent (Ref.
0026667)

Note: Wood Treating Chemicals Co. formulations of
which compositions were not found in the files:

Pole-Treat 15
Pole-Life
Tritox
Wood Treat AA
Woodtox Pre-prime Concentrate
Woodtox Pre-prime Ready-to-use

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V. Product/Process Chronology of Penta Products

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
1936	Monsanto began manufacture of pentachlorophenol by chlorinating phenol in the presence of iron as catalyst (probably in Queeny plant "W" Building).
03/19/37	First process documentation for the production of Santophen 20 (Penta), Santophen 20S (Santobrite), and Santophen 20 P.A. at WGK plant (Plant B). Chlorinated phenol to trichlorophenol and then further chlorination to Penta using iron as catalyst. Reaction of Penta with sodium hydroxide (NaOH) yielded Santobrite. Santophen 20 P.A.= solution of 40% Penta, 30% Pine Oil, and 20% methanol. Santophen 20 = pentachlorophenol, technical - produced in flaked form. Santophen 20S = sodium pentachlorophenate powder.
04/14/37	Santophen 20 (Penta) Data Sheet mentions toxicity.
04/16/37	Santophen 20S (Santobrite) Data Sheet mentions toxicity.
02/25/38	Revision of 1937 process for Santophen 20 and 20S. No major, significant change. Mentions Santophen 20S powder and briquette forms.

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<u>SOURCE</u>	<u>DOCUMENT NOS.</u>
Research Summary Report on Penta, 10/40 (First edition of "Penta Bible")	0017590
Tentative Process for Santophen 20, 20S and 20 P.A.	0026435-56

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Data Sheet on Santophen 20	0035928-40
Data Sheet on Santophen 20S	0035935-37
Tentative Process for Santophen 20 and 20S.	0026225-37

DATEEVENT/SIGNIFICANCE

04/04/38

First process documentation for
Permatol A Treating Solution and
Monsanto Brush Treatment formulations.

Permatol A Treating Solution =
5 parts Penta (Santophen 20)
90 parts #2 fuel oil
5 parts of wood rosin

Monsanto Brush Treatment =
5 parts wood rosin
5 parts Santophen 20
90 parts 50/50 mix of #2 fuel
oil and Shell Dione
lube oil.

This is the same as "Armatol" by
Huttig Sash & Door Co. Monsanto was
vying for their business.

07/29/38

First documented production of
Permatol A Treating Solution.
22,000 gals. prepared in the Queeny
plant "W" Building as stock for sales
development. Experimental in nature.
Product transferred to WCK plant
for subsequent manufacture.

09/26/38

First use of cell gas chlorine in
Penta process. Previously used
revaporized liquid chlorine. Cost
reduction.

09/29/38

Filter change during filtering of
sodium pentachlorophenate solution
prior to making Santobrite Powder.
Reduced time of filtration.

SUBJECT TO PROTECTIVE ORDER

CONFIDENTIAL

C25307

SOURCE

DOCUMENT NOS.

Tentative Process for
Manufacture of Permasan.

0026015-19

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

Final Report - Manufacture of
Permatol A Treating Solution.

0028472-79

Addendum to 1938 Tentative
Process for Santophen 20
and 20S.

0026221

Addendum to 1938 Tentative
Process for Santophen 20
and 20S.

0026219-20

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
10/11/38	Manufacture of Penta began in a newly built scale plant at the WGK plant. A report (10/27/39) documents the process demonstration and standardization of operation in this new plant
01/15/39	Monsanto Sales Development Bulletin on Santobrite mentions toxicity in paper industry.
02/25/39	First documented production of humectant treated Santobrite Powder. Used sulfurated castor oil as humectant. Reduced dusting.
04/03/39	Better control of humectant addition in production of Santobrite Powder, humectant treated.
05/15/39	Documentation of early production of Penta in the "W" Building of the Queeny plant for sales development and for stock in making Santophen 20S, Permatol A Concentrate, and Permatol A Treating Solution.
06/09/39	First full-scale manufacture of Santobrite Briquettes. Made by , compressing, granulating, and recompressing Santobrite Powder to make 1-5/8" diameter briquettes weighing about 1 ounce.
07/12/39	Documentation of production of about 20,000 gals. of Monsanto Brush Treatment for sales development to Huttig Sash and Door Co. Work done in Queeny plant "W" Building (See 04/04/38 entry).

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 SUBJECT TO PROTECTIVE ORDER.

C25309

SOURCEDOCUMENT NOS

Final Report: Pentachlorophenol Demonstration of Process on Large Scale.	0028544-53
Monsanto Sales Development Bulletin No. 10	0036488-98
Addendum to 1938 Tentative Process for Santophen 20 and 20S.	0026216-17
Addendum to 1938 Tentative Process for Santophen 20 and 20S.	0026215
Final Report: Manufacture of Tetrachloro- and Pentachlorophenol for Sales Development.	0028464-71
Addendum to 1938 Tentative Process for Santophen 20 and 20S.	0026212-14
Final Report on Monsanto Brush Treatment.	0028536-43

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
07/28/39	Documentation of early production of Santobrite Powder and Briquettes in the Queeny plant "W" Building for sales development. Also, data for plant design of full-scale production unit at W GK plant was obtained (see 06/09/39 entry).
10/13/39	Documents early production of Santophen 20 P.A. in the "W" Building of the Queeny plant for sales development. (see 03/19/37 entry). Santophen 20 P.A. is the same as Permatol A Concentrate.
01/31/40	Lab work resulting in recommending use of aluminum instead of iron as catalyst for Penta manufacture.
04/01/40 Revised: 8/1/44 2/1/47 4/25/52	Monsanto Technical Bulletins on Santobrite in paper industry mention toxicity, handling instructions, and applications.
04/04/40 : :	First process documentation of Permatol A-PX116 formulation. Later known as Permasan 116. Composed of 5.19 parts of Penta, tech., 4 parts Cicoil, 5 parts Pine Oil, 2 parts boiled linseed oil, 1 part of paraffin, and 83 parts of mineral spirits.
04/23/40	Preparation of test quantities of Santophen 20 P.A.

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 SUBJECT TO PROTECTIVE ORDER

C25309

SOURCEDOCUMENT NOS.

Final Report on Sodium
Pentachlorophenate (Santobrite).

0028453-63

Final Report: Make 10,000 gals.
of Santophen 20 P.A.

0028733-42

Final Report: Penta

0028554-64

Monsanto Technical Bulletin O-5

0036480-87

0036464-71

0036456-63

0036444-9

Tentative Process for
Permatol A-PX116

0026007-8

Final Report: Santophen 20 in
Pine Oil.

0028726-32

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
05/22/40	First process documentation of Permasan 116 Concentrate. Contains 12.03% Penta, tech., 11.56% steam distilled Pine Oil, 9.22% Ciccoil, 4.63% boiled linseed oil, 2.31% refined paraffin wax and 60.25% mineral spirits.
06/11/40	Permasan 116 became new name for Permatol A-PX116 formulation.
06/20/40 Revised: 12/1/45 7/1/46 12/9/48	Monsanto Technical Bulletins on Santobrite in tanning industry mention toxicity, handling instructions, and applications.
07/10/40	Started using ground aluminum ingot instead of iron as catalyst in chlorinating from the trichlorophenol stage to Penta in the process. This catalyst change gave better product (less color and higher crystallizing point).
07/12/40	1000 gals. of Permasan 116 was made in the Queeny plant "W" Building testing a slight change in the formulation to correct a turbidity problem. Followed Tentative Process dated 06/11/40. Again transferred the manufacture of this product back to the W GK plant.
07/18/40	Detailed fomulation procedure for manufacture of Permasan 116.

CONFIDENTIAL
 SUBJECT TO PROTECTIVE ORDER

C25310

SOURCEDOCUMENT NOS.

Tentative Process for Permasan
116 Concentrate.

0026696-99

Tentative Process for
Permasan 116.

0026773-79

Monsanto Technical Bulletin O-19

0036231-36

0036219-23

0036214-18

0036224-30

Amendment to 1938 Tentative
Process for Santophen 20 and 20S.

0026209-11

Final Report: Permasan 116.

0028757-65

Tentative Process for
Permasan 116.

0026761-71

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

07/25/40

First documented processes for water repellent formulations of Penta - Permasan 167 and 170.

Permasan 167 = 5.19% Penta, tech., 5% steam distilled Pine Oil, 5% Aroclor 5460, 10% Falkovar K Extra Heavy Fish oil, 1% refined paraffin, 74% mineral spirits, and 0.03% cobalt metal as cobalt naphthenate.

Permasan 170 = 5.19% Penta, tech., 5% steam distilled Pine Oil, 5% dehydrated castor oil, 5% Aroclor 5460, 1% refined paraffin, 74% mineral spirits, and 0.03% cobalt metal as cobalt naphthenate.

10/02/40

Concentrated form of Permasan 167 produced to permit shipping to West Coast and other distant places and dilution by purchasers, thus keeping cost down.

Permasan 167 Concentrate = 11.2% Penta, tech., 10.79% steam distilled Pine Oil, 21.59% Falkovar K Extra Heavy Fish Oil, 10.79% Aroclor 5460, 2.16% paraffin wax, 43.16% mineral spirits and 0.03% cobalt metal as cobalt naphthenate.

SECRET

C25311

SOURCE

DOCUMENT NOS.

Tentative Process for
Permasan 167 and 170

0026722-34

Tentative Process for
Permasan 167 Concentrate.

0026706-13

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATEEVENT/SIGNIFICANCE

10/03/40

Process for production of a "non-toxic water repellant treatment for wood" formulation. There was a market for such a product. Had to be of such a nature to allow incorporation of Penta. The formulation was Permasan 167 without the Penta added.

Water Repellant Concentrate 202 =
23.81% steam distilled Pine Oil
47.62% Falkovar K Extra Heavy
Fish Oil
23.81% Aroclor 5460
4.76% Paraffin wax
0.03% Cobalt metal as cobalt
Naphthenate

This formulation was to be diluted by the customers with mineral spirits to form the finished treating solution.

10/08/40

Process for an "inexpensive water repellant without toxic" to meet a market need. The material was furnished as a concentrate to be diluted by the customer with mineral spirits.

Water Repellant Concentrate 203 =
45.45% steam distilled Pine Oil,
45.45% Aroclor 5460, and 9.1%
paraffin wax.

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SUBJECT TO PROTECTIVE ORDER.

C25312

SOURCE

DOCUMENT NOS.

Tentative Process for Water
Repellant Concentrate 202.

0026040-47

Tentative Process for Water
Repellant Concentrate 203.

0026032-38

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

01/28/41

EVENT/SIGNIFICANCE

Process documentation for Permasan 300 Concentrate. Contains:

4.86 % Penta, tech.
7.01 % 2-chloro-o-phenylphenol
9.348% Piccolyte Resin S-100
9.348% Steam distilled Pine Oil
9.348% Falkovar K Extra Heavy
Fish Oil
2.337% Dialuminum Stearate
1.189% Refined paraffin wax
56.55% Mineral spirits
0.03% Cobalt Metal (as cobalt
naphthenate)

05/20/41

Preparation of test quantities of Permasan 167, 170, 204 Concentrate and 204 Treating Solution to determine the commercial value of these formulations.

Permasan 204 Concentrate

11.21% Penta, tech.
10.83% Steam distilled Pine Oil
21.66% Falkovar K Extra Heavy
Fish Oil
8.66% Aroclor 5460
2.17% Dialuminum stearate,
45.46% Mineral spirits
0.03% Cobalt Metal (as Cobalt
drier solution).

Permasan 204 Treating Solution

1 part Permasan 204 Concentrate
1½ parts Mineral spirits

Reformulation of Permasan 167 and 170 due to Aroclor 5460 shortage.
Used Cumar 420-S.

07/17/41

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SUBJECT TO PROTECTIVE ORDER.

C25313

SOURCE

DOCUMENT NOS.

Tentative Process for Permasan
300 Concentrate.

0026782-94

Final Report: Permasan 167,
170, 204 Concentrate and 204
Treating Solution.

028766-77

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

Amendment to Tentative Process
for Permasan 167 and 170.

0026719-21

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
07/28/41	Reformulation of Permasan 167 and 170 due to material shortages and performance. Substituted Piccolyte S-100 for Cumar 420-S.
08/08/41	Reformulation of Water Repellant Concentrate 203 because of material shortage of Aroclor 5460. Substituted Piccolyte S-100.
08/21/41	Reformulation of Permasan 167 Concentrate due to shortage of Aroclor 5460. Substituted Piccolyte Resin S-100.
09/18/41	Process documentation of the production of the Water Repellant formulation Permasan 300.

It contained:

2.08% Penta, tech.
 3.0 % 2-chloro-o-phenylphenol
 4.0 % Piccolyte S-100
 4.0 % Steam distilled Pine Oil
 4.0 % Falkovar K Extra Heavy
 Fish Oil
 1.0 % Dialuminum Stearate
 0.5 % Refined paraffin wax
 81.5 % Mineral spirits
 0.03% Cobalt metal (as Cobalt
 Naphthenate).

CONFIDENTIAL
 SUBJECT TO PROTECTIVE ORDER

C25314

SOURCE

DOCUMENT NOS.

Tentative Amendment to Tentative
Process for Permasan 167 and 170.

0026718

Tentative Amendment to Tentative
Process for Water Repellant
Concentrate 203.

0026029-31

Amendment to Tentative Process
for Permasan 167 Concentrate.

0026702

Tentative Process for
Permasan 300.

0026681-94

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE
09/29/41

EVENT/SIGNIFICANCE

Permatol A Treating Solution (Permasan) was reformulated. The product was called Permasan, Reformulated.

It contained:

2.08% Penta, tech.
3.0 % 2-chloro-o-phenylphenol
5.0 % Copal Ester Gum,
synthetic oil
90.0 % Standard Oil Engine
Distillate #1.

10/07/41

Process for Water Repellant Concentrate 400, a Penta-free product.

It contained:

45.45% Steam distilled Pine Oil
45.45% Piccolyte S-100
9.1 % Paraffin Wax

10/21/41

Process for Permasan 200. Used dialuminum stearate in place of paraffin wax to improve paintability. Permasan 200 contains:

11.21% Penta, tech.
10.83% Steam distilled Pine Oil
21.66% Falkovar K Extra Heavy
Fish Oil
8.66% Aroclor 5460
2.17% Dialuminum Stearate
45.46% Mineral Spirits
0.03% Cobalt metal (as cobalt
naphthenate)

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SUBJECT TO PROTECTIVE ORDER.

C25315

SOURCE

DOCUMENT NOS.

Tentative Process for Permasan,
Reformulated.

0026737-47

Tentative Process for Water
Repellant Concentrate 400.

0026021-27

Tentative Process for Permasan
200 Treating Solution.

0026670-78

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

12/31/41

Production of a Penta formulation for Wood Treating Chemical Co. called Timbertox XX. It contained:

2.973% Gilsonite
8.92 % Refined Linseed Oil
5.08 % Penta, tech.
4.373% Synthetic Copal Ester Gum
78.654% Standard Engine Distillate #1.

10/05/42

Process documentation for Timbertox 12 Concentrate; a product for Wood Treating Chemical Co. It contained:

34.5% Penta, tech.
37.9% Steam distilled Pine Oil
27.6% Velsicol NR-21 Solvent

11/27/42

Permasan 167, 167 Concentrate, 300 and 300 Concentrate were reformulated due to poor raw material availability for cobalt naphthenate. Substituted Cobalt Nuolate on an equivalent metal basis.

06/17/43

Manufacturing process documentation of use of ground aluminum ingot instead of iron for the chlorination from the trichlorophenol stage to Penta. The change occurred before this time (see 7/10/40 entry). Gave better product (better color and higher crystallizing point). Also safety-precautions described to reduce worker exposure.

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SUBJECT TO PROTECTIVE ORDER

C25316

SOURCE

DOCUMENT NOS.

Tentative Process for
Timbertox XX.

0026653-59

Tentative Process for Timbertox
12 Concentrate for Wood Treating
Chemical Co.

0026661-68

Amendment for Tentative Process
for Permasan 167, 167 Concentrate,
300 and 300 Concentrate.

0026715

Process Description for
Manufacture of Santophen 20
(Pentachlorophenol, tech.)

0026596-643

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
07/06/43	Process documentation for Preservetex Concentrate. It contained: 40% Penta, tech. 40% Steam distilled Pine Oil 20% Triphenyl phosphate This formulation was for textile treatment.
07/29/43	Documentation of production of Permatol A Concentrate for sales development work from Sept. 1939 to Aug. 1941
11/01/43	Monsanto Technical Bulletins on Penta mention toxicity, handling instructions, and applications.
Revised: 12/1/45	
7/1/46	
10/1/48	
12/15/49	
3/30/50	
3/25/52	
6/55	

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SUBJECT TO PROTECTIVE ORDER.

C25317

SOURCE

DOCUMENT NOS.

Tentative Process for Preservetex Concentrate. 0026645-51

Final Report on Permatol A Concentrate (Santophen 20 P.A.) 0028778-83

Monsanto Technical Bulletin 0-25 0035904-14
0035893-903
0035882-92
0035870-81
0035857-69
0035850-56
0035839-49
0035806-20

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

11/24/43

EVENT/SIGNIFICANCE

Process documentation of Permasan 116 formulation. It contained:

lbs. per
1000 gals.

368	Santophen 20
350	Steam distilled Pine Oil
702	Falkovar K Extra Heavy Fish Oil
70	Refined Paraffin Wax
350	Aroclor 5460
3	Nuodex (Cobalt drier)
5194	Sinclair Solvent (mineral spirits).

After 7/25/40, this product was manufactured under the name of Permasan 116, Permasan 167 and Timbertox XX. (a Wood Treating Chemical Co. name)

Due to the war, Shell #1 Straw Distillate 2201W was not available. Shell Range Oil replaced the above as diluent in the Permasan formulation.

Published the results of experiments on toxicology and dermatology of Penta and Santobrite. "Emphasized very sharply the necessity of careful handling." Gave handling instructions for Penta, Santobrite and several of the formulations.

Manufacture of Santobrite Pellets from Santobrite Flakes. Introduction of a less dusty form of Santobrite.

01/02/45

01/01/48

04/05/49

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SUBJECT TO PROTECTIVE ORDER.

C25318

SOURCE

DOCUMENT NOS.

Manufacturing Process for
Permasan 116 (old 167
formulation)

0026749-58

Revision to Tentative Process
for Manufacture of Permasan
(Permatol A Treating Solution)

0026010-11

"Toxicology and Dermatology
of Pentachlorophenol and
Sodium Pentachlorophenate"
J. D. Fleming (a Monsanto
publication)

0045852-71

Tentative Amendment to Tentative
Process for Santobrite - Manufac-
ture of Santobrite Pellets.

0026205-7

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
07/15/49	First process description for Santobrite separate from the Penta process. Safety procedures described. Covers Santobrite Powder and Briquettes.
10/12/49	Cell gas chlorine authorized to be used during part of the chlorination in the production of Penta.
10/09/53	Revised process for Monsanto Penta. No significant changes from the 1943 process. Safety and Fire Protection discussed.
11/16/53	UV Light was shown to accelerate deposition of sludge in Santobrite Solution. Did not find suitable process change to recommend.
	Suspect that this deposition of sludge is the conversion of "predioxins" or other precursors to chlorinated dioxins.
02/01/54	Revised process description for Monsanto Penta. No significant change in chemistry. Includes formal specifications for raw materials and finished products. Safety precautions given. (0026065)
02/01/54	First detailed process description for Santobrite Pellets. Safety discussed. (025724)

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 SUBJECT TO PROTECTIVE ORDER

C25313

SOURCE

DOCUMENT NOS.

Description of Process for the
Manufacture of Santobrite.

0025665-707

Process Amendment to Description
of Process for the Manufacture
of Santophen 20.

0026599

Description of Process for the
Manufacture of Monsanto Penta.

0026547-95

Final Report: Improvement of
Santobrite Quality.

0028106-15

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

Process Description for the
Manufacture of Monsanto Penta.

0026048-74

Process Description for the
Manufacture of Santobrite Powder,
Pellets, and Briquettes.

0025708-37

DATE

EVENT/SIGNIFICANCE

05/26/54

Orders issued to chlorophenols departments in the WGK plant not to eat or drink beverages in the departments. Diligence in industrial hygiene.

10/04/54

First mention of the chloracne problem in Penta production workers. Employees in this production unit have shown evidence of chloracne for several years. Recommendations made for improving the situation (e.g., improve ventilation, eliminate hand contact with product, etc.)

10/25/54

Concern shown for current chloracne problem. A review of the contemplated replacement of the worn-out dry-type dust collector with a wet-type one. First mention of moving Santobrite Briquetting to Building BD from Building BO. New dust collector should be capable of handling this new installation.

03/17/55

Revised process for Monsanto Penta. No significant, major process changes. Safety precautions given (0026510-11). Also raw material and finished product specifications.

04/01/55

Increased the crystallization point specification for Penta to 178°C., min. This was accomplished by doubling the aluminum catalyst charge. The result: reduced caking tendency.

CONFIDENTIAL
SUBJECT TO PROTECTIVE ORDER

C25320

SOURCE

DOCUMENT NOS.

Memo: H. B. Patrick to
H. O. Hehner

0018133

Memo: J. T. Garrett to
R. S. Wobus

0013411-13

Memo: E. W. Mares to
C. C. Richiusa

0013522

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

Revised Process Description for
the Manufacture of Monsanto Penta.

0026494-520

Amendment #1 to Process
Description for Monsanto Penta.

0026491-93

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
04/01/55	Use of "sniff" cell gas chlorine in chlorination to produce Penta. No significant change in product quality.
04/20/55	Start design of Penta expansion to meet Sales forecasts.
05/06/55	Research work on physical properties, analytical, formulations, and applications for Penta documented. Covers period from Jan. 1947 to April 1955.
07/12/55	Documentation of project to increase Penta production at W GK by 2M lbs./year to be completed in 3 months. Use spare Nitro plant chlorinator. A fourth chlorinator was to be installed later to meet 1957 sales.
04/10/56	Minor revision of the 1954 Santobrite process. No significant change.
04/16/56	Revised process for Monsanto Penta. No significant change.
06/01/56	Research work on preservation and chemical treatment of cellulosic materials documented. Covers period from Jan. 1953 to May 1956. Includes Timbertox 10S formulation which contained 5% Penta, tech. in a petroleum solvent similar to Fuel Oil #1 in volatility.

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 SUBJECT TO PROTECTIVE ORDER.

C25321

<u>SOURCE</u>	<u>DOCUMENT NOS.</u>
Amendment #2 to Process Description for Monsanto Penta.	0026486-90
Job Record, WGK Chem. Engr. Dept.	0016595
Final Report: Application work on Penta and Derivatives.	0028132-341
Memo: R. Peterson/J. Graves to P. G. Marsh	0016599-608
Process Description for Manufacture of Santobrite Powder, Pellets and Briquettes.	0025743-71
Process Description for Manufacture of Monsanto Penta.	0026462-93
Final Report: Application work on Wood Preservatives.	0028342-97

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

03/14/57

Added Dow Corning Antifoam B to water in Schneible scrubbing tower to eliminate foaming. The weak Santobrite solution which developed in the scrubbing tower was used in making Santobrite dissolver batches. This defoamer ended up in Santobrite (no deleterious effect on product).

06/57

Monsanto Technical Bulletin on Santobrite for slime and algae control mentions toxicity and handling instructions.

09/23/57

Recommendation by Medical Dept. that eating in Penta production unit be discontinued. Recommendation implemented.

12/20/57

Addition of aluminum catalyst at a higher chlorination level and addition of oxalic acid as stabilizer. The result was reduced caking tendency and improved color.

12/30/57

Monsanto Penta Crop Desiccant (for onions and potatoes) described.

Composed of:

- 10% Penta, tech.
- 3% Armour RD 1990A (emulsifier)
- 87% Sovacide 544C (aromatic petroleum solvent)

Also safe handling and toxicity of Penta and its salts described. (0000962-81)

CONFIDENTIAL
SUBJECT TO PROTECTIVE ORDER

C25322

SOURCEDOCUMENT NOS.

Tentative Amendment A to SMP for
Santobrite, 4/10/56.

0025741-2

Monsanto Technical Bulletin 0-15

0036093-98

Memo: J. T. Garrett to
E. W. Mares

0018132

Memo: R. Paterson/D. Castle to
Chlorophenol Group
Personnel

0018134

Tentative Amendment A to SMP for
Pentachlorophenol, 4/16/56.

0026459-61

Special Report: Monsanto Penta
Crop Desiccant

0000956-1000

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
04/58	Monsanto Technical Bulletin on Santobrite mentions toxicity and handling instructions.
05/22/58	Revised process for manufacture of Monsanto Penta. No significant changes.
07/25/58	Process documentation of lab work recommending doubling the catalyst charge and raising the crystallization point. Tested in the WGK plant on 7/19/54. (see 4/1/55 entry)
07/58	Monsanto Technical Bulletin on Santobrite and Penta for preservation of paints and water-base additives. Gives toxicity and handling instructions.
10/58 Revised: 12/65	Monsanto Technical Bulletin on Monsanto Penta (pentachlorophenol, technical). Gives toxicity and handling instructions.
11/58	Monsanto Technical Bulletin on Santobrite for Preservation of Cellulose Insulating Materials. Gives toxicity and handling instructions.
05/25/59	Process for Santobrite updated. Only minor revisions.
01/60 Revised: 11/63	Monsanto Technical Bulletins for Santobrite in paper industry. Gives toxicity and handling instructions.

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 SUBJECT TO PROTECTIVE ORDER.

C25323

SOURCEDOCUMENT NOS.

Monsanto Technical
Bulletin SC-1 (Revised)

0036081-92

Process Description for the
Manufacture of Monsanto Penta.

0025876,
0025884-901

Final Report on Penta Caking

0026795-857

Monsanto Technical Bulletin SC-2

0036016-23

Monsanto Technical Bulletin SC-3

0035784-805
0035765-83

Monsanto Technical Bulletin SC-10

0035973-91

Process Description for
Santobrite Powder, Pellets, and
Briquettes.

0025773-98

Monsanto Technical Bulletin SC-4

0036436-43
0036427-35

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
01/60 Revised: 3/63	Monsanto Technical Bulletins on Handling Precautions for Penta and Santobrite. Toxicity given.
01/60	Monsanto Technical on Santobrite in the tanning industry. Gives toxicity and handling instructions.
06/02/60	Use of recovered 2,4-dichlorophenol from 2,4-D production as partial raw material for Penta production. Thus shorter chlorination cycles and increased production. No 2,4-D was in the recovered 2,4-dichlorophenol thus no deleterious effect on Penta quality.
11/60	Data Report on Copper Pentachlorophenate for Preservation of Cellulosic Materials. Gives toxicity and handling instructions. Product never reached full commercialization.
02/09/61 : :	Revision of process documentation for Monsanto Penta. No significant changes.
02/13/61	Routine revision of process documentation of Santobrite process. No significant changes.
06/61	Data Report on Santobrite for Laundry Control of Mold and Mildew. Gives toxicity and handling instructions.
07/13/61	Lab testing on Penta prilling.

CONFIDENTIAL
 SUBJECT TO PROTECTIVE ORDER.

C25324

<u>SOURCE</u>	<u>DOCUMENT NOS.</u>
Monsanto Technical Bulletin SC-9	0035992-6015 0036099-122
Monsanto Technical Bulletin SC-11 (Revised)	0036201-13
Tentative Amendment A to Manufacturing Process for Monsanto Penta, 5/22/58.	0025878-82
Monsanto Chemical Specialties Data Report No. CS-13	0036142-49
Process Description for Monsanto Penta	0025903, 0025922-44
Process Description for Santobrite Powder, Pellets, and Briquettes.	0025800-22
Monsanto Chemical Specialties Data Report No. CS-9	0036158-65
TSD Report	0012066-88

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
07/13/61	Pilot plant testing of prilling Penta in the Inorganic Research Lab (N Bldg.). Tests were successful. Plan to make cost estimate for installation in the WGK Penta production unit.
09/25/61	Incidence of chloracne cases on the rise in the Penta/Santobrite production unit. Recommendations made to help correct problem. "Better housekeeping than has been seen in years."
03/16/62	Lists employees who have received treatment for chloracne in recent months.
03/30/62	Review of the case of chloracne in the WGK chlorophenol group indicated an improvement in the situation and under control.
08/10/62	Issuance of Project Design Manual describing instruments for Penta quality tests and improvement of chlorine delivery. Forerunner of Penta Modernization.
01/15/63	Research recommends prilling and coating Penta. Studies done in a pilot plant prilling tower. Reason: to meet competition--such a product exhibits less sublimation, caking tendencies, and dusting. Coating was done with Armoflo 67.
01/16/63	Issuance of Project Design Manual on basic prilling facilities (Phase I - Penta Modernization).

CONFIDENTIAL
 SUBJECT TO PROTECTIVE ORDER.

C25325

SOURCEDOCUMENT NOS.

TSD Report

0012066-88

Memo: J. T. Garrett to
H. B. Patrick

0013414-15

Memo: H. Patrick to
H. Carder

0013344-45

Memo: H. Carder to
R. E. Soden

0013419

Project Design Manual EA 4-398,
Project 6299

0016025-63

Final Report: Penta process
studies.

0026956-85

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**Project Design Manual EA 4-398,
Project 6724.

0015948-16024

DATE

EVENT/SIGNIFICANCE

02/01/63

Change Penta product form from flakes to prills to eliminate sublimation, dusting and caking tendency. Also started chlorinating to a higher degree to reduce tetrachlorophenol content. Prills were coated with 0.1% Armoflo 67 (an antidusting agent).

02/28/63

Issuance of Project Design Manual to provide necessary facilities to supplement previously installed prilling tower to produce and package prilled Penta. Also modernize electrical facilities. (Phase II - Penta Modernization) Gives outline and purpose of the various parts.

10/20/63

Sales bulletin on Prilled Penta issued. Gives handling precautions.

03/64

Analytical studies on the characterization of the insolubles in Santobrite. The insolubles mainly included materials containing silicon and aluminum. Also polychlorinated aromatics were present. Possible structures were chlorinated dibenzo-p-dioxins and dibenzofurans -- the octachloro derivatives are specifically mentioned (0027043). First documented evidence of such materials in Penta products.

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C25326

SOURCE

DOCUMENT NOS.

Tentative Amendment B to
Manufacturing Process for
Monsanto Penta, 2/6/61

0025917-19

Project Design Manual EA 4-461

0016064-215

Sales Bulletin 7768-100

0046453-5

Final Report on Santobrite
Characterization of Insoluble
Material. .

0027026-73

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
04/07/64	Coating of Santobrite #1 Fines and Santobrite Pellets with propylene glycol and/or monoacetin to reduce dustiness.
04/30/64	Tested the elimination of mechanical agitation during chlorination. No significant changes were noted in the product.
06/30/64	Discontinued mechanical agitation during chlorination in the production of Penta. No apparent effect on quality.
08/17/64	Qualification of Alcoa's aluminum D-OX-IT shot and Reynold's HPS aluminum granules as alternate catalyst supply for Penta production.
01/19/65	Study of catalyst concentration, catalyst addition time, and rate of temperature rise on Penta quality.
06/65	Revised procedure to make all grades of Santobrite except Briquettes in a pelletizer-dryer system described. Contains Safety and Toxicity Data. (0025865)
06/16/65	Process documentation of the allowance of a minimum amount of aluminum catalyst in the range of 2-14 lbs. per batch. This reduced mineral spirits and xylene insolubles prill screen build-up, and did not effect chlorination efficiency.

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 SUBJECT TO PROTECTIVE ORDER.

C25327

SOURCEDOCUMENT NOS.

Tentative Amendment A to
Tentative Process for Santobrite,
2/17/64

0012623-24

Tentative Amendment C to SMP
for Penta, 2/9/61

0025915-16

Tentative Amendment D to SMP
for Penta, 2/9/61.

0025912-14

Tentative Amendment E to SMP
for Penta, 2/9/61

0025910-11

Tentative Amendment F to SMP
for Penta, 2/9/61

0025908-9

SMP for Santobrite

0025823-74

Amendment 1 (Tentative Amend-
ment G) to SMP for Penta, 2/9/61.

0025905-7

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
11/09/65	First SMP describing Prilled Penta production. Contains Safety and Toxicity Data.
07/66	Monsanto Technical Bulletin on Santobrite in paper industry. Gives toxicity and handling instructions. Notes FDA approval.
07/66 Revised: 7/69 6/70	Monsanto Technical Bulletins on Handling Precautions for Penta and Santobrite. Gives toxicity.
07/66	Monsanto Technical Bulletin on Santobrite in the tanning industry. Gives toxicity and handling instructions.
09/01/66	Documentation of lab tests to validate the use of cumene phenol for all phenolic based products at WCK plant.
04/01/67	Sales bulletin on Prilled Penta issued. Gives handling precautions.
04/26/67	Trial of change in catalyst in Penta production to 3:1 aluminum, copper. Should get higher Penta assay (89-91%) and lower high boiler content.
08/67	Toxicity and hazards, effects, First Aid, and protective equipment for Penta and Santobrite documented in Medical Department Bulletin.

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C25323

SOURCE

SMP for Pentachlorophenol	0025946, 0025958- 0026005
Monsanto Technical Bulletin O/PS-2	0036415-26
Monsanto Technical Bulletin O/PS-3	0036279-302 0036376-98 0036353-75
Monsanto Technical Bulletin O/PS-5	0036237-52
TSD Report	0012045-65
Sales Bulletin 7768-100-09-03	0046450-2
Tentative Amendment A to SMP for Penta, 11/9/65.	0025956-57
Medical Department Bulletin on Pentachlorophenol and Sodium Pentachlorophenate	0013286-89

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

10/17/67

Process change to sparge the chlorinator at the end of the chlorination with hydrogen chloride gas to reduce degradation between chlorination and the prilling system.

11/08/67

Plan cited to increase capacity of Penta unit to meet 1970-71 sales forecast. Accomplish by debugging prill tower, increase chlorine flow rate, automate department, and add a new chlorinator. Also quality improvement planned. Monsanto Penta ranked 3rd in quality.

01/08/68

Proposed use of Aluminum-Tellurium as catalyst in the chlorination. Reaction rate is more predictable, and gives higher Penta assay with less impurities.

03/22/68

Proposed use of Salicylaldehyde as stabilizer after the chlorination to prevent product degradation (formation of alkali insolubles and lower Penta assay).

09/16/68

Use of Tellurium-Aluminum catalyst and Salicylaldehyde in a plant test improved Penta quality.

11/01/68

Engineering flow diagram of Penta chlorination.

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SUBJECT TO PROTECTIVE ORDER

C25323

SOURCE

DOCUMENT NOS.

Tentative Amendment B to SMP
for Penta, 11/9/65.

0025953-5

TSD Report

0011565-75

Tentative Amendment C to SMP
for Penta, 11/9/65.

0025951-2

Tentative Amendment D to SMP
for Penta, 11/9/65.

0025949-50

TSD Report on Penta Improved
Quality.

0027166-205

Engineering Diagram Flow

0015497

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

DATE

EVENT/SIGNIFICANCE

11/68

First SMP to indicate the manufacture of Penta 60. In the production of Penta, there was a change in the aluminum catalyst addition. Two additions--one at 90-120°C. at the dichloro stage, and then at the tetrachloro stage. Aluminum-Tellurium catalyst not adopted, HCl sparging not adopted, Salicylaldehyde stabilizer not adopted. More detailed Safety and Toxicity section. GLC assay mentioned.

11/68

Last process documentation to make all forms of Santobrite including briquettes. The pelletizer-dryer system is described. Contains safety and toxicity data (0012006). Good, brief summary of Santobrite production history at W GK plant (0012007-8).

02/13/69

Fume control system on Penta operation was improved and extended each year since installation in 1966. Additional scrubbers have been added where needed.

03/11/69

Approval for plant trial of cumene phenol in place of sulfonation phenol in Santobrite production.

03/11/69

Use of cumene phenol as an acceptable substitute for sulfonation phenol in the Penta process.

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C253330

SOURCE

SMP for Molten Penta, Prilled
Penta and Penta 60.

000000
0026076-79
0026114-201

SMP for Santobrite

0011951-12014

Letter: C. Buckley to
A. M. Telford (Ill.
Pollution Control
Board).

0010596-97

Tentative Amendment A to SMP
for Santobrite, 11/68

0011960-1

Tentative Amendment A for SMP
for Molten Penta, Prilled Penta,
and Penta 60, 11/68.

0026080-82

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

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SUBJECT TO PROTECTIVE ORDER

C253331

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
05/16/69	Documentation of a plant demonstration of the use of cumene phenol as an alternate raw material for Penta. Demonstration successful, but may have a color quality problem in Penta. Santobrite quality and color satisfactory.
06/03/69	Experimental coating of Santobrite Pellets with monoacetin to reduce dustiness.
06/05/69	Eliminate use of Armoflo 67 as coating on Prilled Penta. Customer acceptance of some sublimation ("blooming") of Prilled Penta.
07/69	Monsanto Technical Bulletins on Handling Precautions for Penta and Santobrite. Gives toxicity.
01/70	Documentation of instructions in the operation of the Santobrite department (Dept. 225). Shows diligence and completeness of training. Safety and housekeeping covered.
02/16/70	List of concerns from <u>Field Safety Review</u> and action plans regarding Penta expansion.
3/70	Start up of jumbo chlorinator. Step change in chlorinator size with external heat exchanger.

SOURCEDOCUMENT NOS.

TSD Report

0011685-713

Tentative Amendment B to SMP
for Santobrite, 11/68

0011957-59

Tentative Amendment B for SMP
for Molten Penta, Prilled Penta,
and Penta 60, 11/80.

0026083-85

Monsanto Technical
Bulletin O/PS-3

0036376-98

Training and Reference
Manual for Santobrite

0011715-811

Memo: R. L. Fields to
E. D. Malone, et al.

0013193-95

Background section of SMP for
Molten Penta, Prilled Penta and
Penta 60, 1/30/72.

0025648-9

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

DATEEVENT/SIGNIFICANCE

04/27/70

Recommendation for a plant trial of adding ethylene glycol to lighten color of Penta.

05/27/70

"Golden" Penta process. Proposed addition of 0.1-0.25% by weight of ethylene glycol at the end of the chlorination. This would give a more uniform and lighter color to Prilled Penta.

06/11/70

Installed a chlorine vaporizer system in the Penta production unit to protect against explosive hazard resulting from liquid chlorine.

07/02-08/70

Plant trial of "Golden" Penta process. Gave material of more uniform color and a lighter color.

07/15/70

Installation of Hum-mer Screener to replace Rotex screening in the Santobrite process described. Excessive maintenance cost was the reason for replacement. Replacement completed 1/20/70.

08/05/70

Installed CO₂ purge system for chlorinators.

09/03/70

Addition of 0.1-0.2% by weight of water to the molten Penta before start of prilling. Produced "Golden" Penta with better appearance.

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SUBJECT TO PROTECTIVE ORDER.

C25332

SOURCEDOCUMENT NOS.

TSD Report: "Golden" Penta

0027227-32

Tentative Amendment C for SMP
for Molten Penta, Prilled Penta,
and Penta 60, 11/68.

0026086-88

TSD Report

0011595-607

TSD Report: "Golden" Penta,
9/10/40.

0027240-66

TSD Report on Santobrite

0027408-36

TSD Report: Bulk CO₂ Facilities

0027233-39

Tentative Amendment D to SMP for
Molten Penta, Prilled Penta,
and Penta 60, 11/68

0026089-91

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
10/08/70	Addition of Del De-Foam Non-Silicon Foam Control Solution to control foam in the prilled Penta off-gas scrubber and Central Fume Scrubber. No effect on product.
10/08/70	Use of Del De-foam antifoam added to scrubber solution in Santobrite production to control foaming.
10/09/70	Testing of modification for dust control of Santobrite using various coating systems employing sodium hydroxide, monoacetin and water.
1971	Facilities were installed to make 2000 lb. Penta blocks.
01/18/71 and 03/09/71	Reports on meeting of Penta manufacturers with USDA and FDA (1/15/71) and under auspices of AWPI (American Wood Preservers Institute) (3/5/71). Monsanto people involved: E. P. Benzing, J. A. Mullendore, J. D. Early, E. P. Wheeler and W. R. Richard. Talks about what can be done to lower dioxin content in Penta.
	Table listing dioxin analysis of samples of Penta from several producers. No limit on impurities in Penta were offered to the USDA.

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SUBJECT TO PROTECTIVE ORDER

C253333

SOURCEDOCUMENT NOS.

Tentative Amendment E to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 11/68

0026092-4

Tentative Amendment D to SMP
for Santobrite, 11/68

0011954-56

Tentative Amendment C to SMP
for Santobrite, 11/68

0011962-64

Scope Commitment Meeting on
Upgrading Penta Block Pouring
Facilities, 5/9/77

0017959

Memos by J. A. Mullendore

0001043-45
0001016-22
0001027

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
02/15/71	Process change lowering the temperature in the first part of the chlorination from 90-120°C. to 60°C. Also other temperature/ time changes. Quality of Penta was improved (reduced impurities).
03/23/71	Safety review of addition of triphenyl phosphate and RT-53A additives to Molten Penta. Corrective actions given.
03/24/71	Wood Treating Chemicals Co. Penta formulations Woodtox Pre-Prime Concentrate and Woodtox Pre-Prime Ready-To-Use mentioned. Composition not given.
03/29/71	Addition of a mixture of triphenyl phosphite (TPPi) and RT-53A to the Molten Penta before prilling or pouring into blocks. These additives stabilize Penta reducing buildup of alkali insolubles. Mentions 2000 lb. blocks.
03/31/71	Plant evaluation of use of cumene phenol for Penta production. Found acceptable.
04/12/71	Proposed change - add phenol or lower chlorinated phenols as chlorine scavengers to the Molten Penta before prilling or pouring into blocks. Improve quality of Penta by eliminating excess post chlorination.

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 SUBJECT TO PROTECTIVE ORDER.

C253334

SOURCEDOCUMENT NOS.

Tentative Amendment F to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 11/68

0026095-98

Memo: D. J. Schillinger to
J. Dalton, et al.

0013189

Letter: R. F. Simmons to
W. Lindsay (Monsanto
Canada, Ltd.)

0050654-55

Tentative Amendment G to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 11/68

0026099-102

TSD Report

0012497-519

Tentative Amendment H to SMP
for Molten Penta, Prilled
Penta, and Penta 60, 11/68

0026103-6

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
04/19/71	Wood Treating Chemicals Co. Penta formulations Pole-treat 15, Pole-life, Tritox, and Wood Treat AA mentioned. Compositions not given.
04/28/71	Report showing dioxin levels in Penta as measured by various analytical labs. (Dow, Monsanto, FDA). W. R. Richard suggested testing FDA standard Penta for teratogenicity
06/03/71	Penta blocks turned down by Monsanto Distribution for test permit for shipping by rail.
07/06/71	Safety review of Penta additive facilities. Recommendations made.
09/09/71	Test run for 2000 lb. Penta blocks at W GK plant successful. Construction of permanent facilities in progress to produce blocks at 3.2 M lb./yr. rate.
11/01/71	Testing the addition of coating agents to the Molten Penta prior to prilling to eliminate/reduce sublimation ("Blooming").
11/15/71	Studies and plant test documentation of additives RT-53A and triphenyl phosphite used to stabilize Penta. Covers period from 12/70-11/71.

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 SUBJECT TO PROTECTIVE ORDER

C253335

SOURCEDOCUMENT NOS.

Letter: R. D. Arsenault to W.Hale (Unity Inter- mountain Telephone Co.)	0050630
Letter: FDA from W. R. Richard-- Multi-Method Study of Dioxins in Chlorophenols.	0001080-1106
Memo: D. Westbrook from R. D. Arsenault	0000799-800
Memo: D. J. Schillinger to F. Elliot, et al.	0013188
TSD Report	0012565-72
Tentative Amendment I to SMP for Molten Penta, Prilled Penta and Penta 60, 11/68	0026107-10
Also Tentative Amendment A to SMP for Molten Penta, Prilled Penta, and Penta 60, 1/30/70	
TSD Report - Penta Quality Improvement.	0027338-407

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATEEVENT/SIGNIFICANCE

12/01/71

Sales contract on Penta between Monsanto and Koppers Company.

12/02/71

Material Safety Data Sheet on Penta issued. Give precautions and protection information.

12/09/71

1968 SMP Tentative Amendments reviewed and status indicated. Also accepts HCl and sparge blanket to chlorinator at the end of a chlorination batch (Amendment B of 1965 SMP).

Amendment C to 1965 SMP - Rejected.

1968 SMP Amendments:

- A - accepted
- B - accepted
- C - rejected ("Golden" Penta)
- D - rejected ("Golden" Penta)
- E - accepted
- F - accepted
- G - rejected
- H - accepted (additive package)
- I - in process

12/71

Monsanto Technical Bulletin on Monsanto Penta. Gives labeling, toxicity, and handling instructions.

12/71

Monsanto sold Wood Treating Chemical Co. to Koppers Company.

1972

Started making 1000 lb. Penta blocks in fiberpaks. Done in same facilities as for 2000 lb. blocks.

CONFIDENTIAL
SUBJECT TO PROTECTIVE ORDER.

C25336

SOURCEDOCUMENT NOS.

Sales Contract

0044525-37

Material Safety Data Sheet

0043530-1

Memo: Updating Amendment
Status for SMP for Molten
Penta, Prilled Penta, and
Penta 60, 11/68

0026111-13

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

Monsanto Technical
Bulletin IC/PS-8

0035681-701

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Scope Commitment Meeting on
Upgrading Penta Block Pouring
facilities, 5/9/77

0017959

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
01/12/72	1971 Sales Report by Customer (copy almost illegible).
01/20/72	Penta chlorinator optimization by installation of a new heat exchanger which can operate over entire chlorination range. No significant effect on product quality.
01/30/72	Last SMP for Penta issued. Jumbo chlorinator mentioned - started up in 3/70. No significant change in operation.
02/15/72	Industrial hygiene inspection of Penta and Santobrite production units on 12/20/71 documented. Investigated reported chloracne cases and adequacy of ventilation. Conclusions and recommendations given. Poor housekeeping noted.
2/72	SMP for Santobrite Briquettes and Solution updated. Describes production of 30% Santobrite Solution, and Santobrite Briquettes from Santobrite #1 or #2 fines or Dowcide G Beads or Beads ST.
03/21/72	Description of process corrections which reduced emissions temporarily
03/30/72	Use of nitrogen purge in place of HCl and CO ₂ purge as blanket over Molten Penta at the end of chlorination to avoid product degradation. Accepted for full-time use.

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 SUBJECT TO PROTECTIVE ORDER

C253337

SOURCEDOCUMENT NOS.

MIC Specialty Products
Sales Report

0044634-40

Tentative Amendment B to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 1/30/72

0025531-34

SMP for Molten Penta, Prilled
Penta, and Penta 60.

0025467,
0025535-664

Memo: B. Eley to File

0017803-6

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

SMP for Santobrite Briquettes
and Santobrite Solution

0025415-65

TSD Report: Reduce Santobrite
Air Pollution.

0028105.01

Amendment C to SMP for Molten
Penta, Prilled Penta, and
Penta 60, 1/30/72

0025525-30

DATEEVENT/SIGNIFICANCE

04/04/72

Recommendations for elimination of prill spillage at cooler. Necessary to prevent worker exposure which causes chloracne. States that 50% of workers in the Penta production unit have chloracne.

04/72

Documents process safety and housekeeping rules for Santobrite Briquettes. Discusses Santobrite air scrubbing system.

04/72

Documents process safety and housekeeping instructions for Penta operations. Mentions all workers in chlorophenols departments must bath at the end of their shifts before leaving the plant. Because of the hazardous operations at WGK plant, work rules were established and documented in the Safety Rule Book.

05/02/72

Documents process for production of 30% Santobrite Solution (aqueous) from Scrubber Liquor. Safety and toxicity discussed.

05/72

Process safety and housekeeping instructions for Santobrite Solution.

06/07/72

Loss Prevention and Environmental Control Research Review on Penta purification project (distillation of Penta) to remove chlorinated dioxins. Not implemented at WGK.

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SUBJECT TO PROTECTIVE ORDER

C25333

SOURCEDOCUMENT NOS.

Memo: R. L. Harness to
R. R. Sorrell

0013175-80

Operator Training and Reference
Manual for Santobrite Briquettes

0010787-806

Operator Training and Reference
Manual for Chlorophenols Group.

0010763-82

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

Tentative Process

0014416-40

Operator Training and Reference
Manual for Santobrite Solution

0010807-57

Memo: W. Russell to
D. Wassan

0018429-33

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
06/29/72	Evaluated coating Prilled Penta with Mobil Provalent 4A Oil to retard sublimation. Results satisfactory.
08/02/72	Safety review of Penta Block installation. Alterations of equipment suggested.
08/23/72	Documentation of standard practice of chlorophenols group at WGK to control and clear up chloracne cases.
08/24/72	Distillation process described which would remove the polychlorodibenzo-p-dioxins from Penta. <u>Not</u> put into practice.
08/30/72	Industrial hygiene practice at WGK plant to control chloracne.
09/26/72	Safety review of bulk Penta handling. Recommendations for improvement made.
10/13/72	OSHA tests for excessive chlorine and noise in the Penta/Santobrite production unit. Chlorine results excellent. Noise level may be in violation.
11/06/72	Humble NUSO-38 oil used to spray coat Prilled Penta in place of P4A oil. Cooling reduces sublimation ("blooming"). Accepted for full-time use.
11/30/72	Location Plans for Penta/Santobrite production units. Locates all pieces of equipment.

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 SUBJECT TO PROTECTIVE ORDER.

C253339

SOURCEDOCUMENT NOS.

TSD Report

0012275-80

Memo: D. J. Schillinger to
J. Dalton, et al.

0013187

Memo: R. R. Sorrell to
R. L. Fields

0017160

Process for Engr. Design:
Distillation of Penta to Remove
Polychloro-p-dioxins

0027451-542

Memo: R. R. Sorrell to all
production personnel.

0017796

Memo: D. J. Schillinger to
C. Buehler, et al.

0013174

Memo: D. Rochell to
R. Sorrell

0013154

Memo: Disposition of Tentative
Amendments A and E to SMP
for Molten Penta, Prilled
Penta, and Penta 60,
1/30/72

0025515-19

Drawings

0015500-1

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

11/72

Process safety, housekeeping and handling instructions for Prilled Penta.

01/09/73

1972 Sales Report by Customer.

01/23/73

Reinstate oiling of Prilled Penta with NUSO-38 oil.

01/73

Documentation of Process Safety Audit for Penta operation. Mentions fire hazard from additives. Penta blocking system introduced new personal hazards. Recommendations for improvement made.

02/73

Monsanto issues Application Manual for Penta and Santobrite. Contains handling precautions and toxicological data.

04/11/73

Information on Penta composition, producers, dioxin content and toxicology of dioxins (presentation slides on Dowcide EC-7).

04/15/73

Decreased RT-53A and triphenyl phosphite to 0.2% and 0.4%, respectively, by weight of the Penta batch. Accepted for full-time use.

05/05/73

Revised process for distillation of Penta (see 8/24/72 for original process).

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SUBJECT TO PROTECTIVE ORDER.

C25340

<u>SOURCE</u>	<u>DOCUMENT NOS.</u>
Operator Training and Reference Manual for Prilled Penta.	0011868-97
MIC Specialty Products Sales Report	0045316-23 0045447-524
TSD Report	0012281-83
Safety Audit Report	0013305-43
Application Manual for Santobrite and Monsanto Penta	0044197-256
Letter: L. L. Atkins (Dow) to H. S. Bergen (Monsanto)	0001166-90
Tentative Amendment D to SMP for Molten Penta, Prilled Penta, and Penta 60, 1/30/72.	0025512-14 0025520-23
Process for Engr. Design: Distillation of Penta	0027543-625

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
05/08/73	Air pollution source operating permit issued by Illinois EPA for Penta prilling tower and Venturi scrubber. Expiration date, 4/25/78. Shows compliance with regulations.
06/73	Safety, housekeeping and handling instructions for Molten Penta.
08/15/73	Process description for the use of previously sewered prilled Penta scrubber liquor and scrap Penta to make Santobrite Briquettes (previous Tentative Process P-1682 describes production of Santobrite Solution from the above-mentioned waste streams).
08/24/73	Improvement of Penta quality by reducing by-product formation (insolubles) by employing lower temperature/heat history during chlorination. Better management of process.
01/09/74	1973 Sales Report by Customer.
04/04/74	Another process amendment dealing with improving Penta quality by better chlorination management through lower temperature/heat history during chlorination.

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 SUBJECT TO PROTECTIVE ORDER.

C25341

SOURCEDOCUMENT NOS.

Illinois EPA letter and Permit

0010568-74

Operator Training and Reference
Manual for Molten Penta

0011813-67

Process Outline: Drum drying
and briquetting Santobrite.

0027626-58

Tentative Amendment F to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 1/30/72

0025507-11

MIC Specialty Products Sales
Sales Report

0045310-15

Tentative Amendment H to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 1/30/72

0025484-87

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

DATEEVENT/SIGNIFICANCE

04/10/74

Provision for acceptable means of disposal of Central Fume Scrubber liquor, and scrap and still wash water. Extraction of scrubber liquor with AD-73 oil and sold to Wood Treating Chemical Co. The phenolics in the other streams will be extracted with Santophen I residue and incinerated. Previously all of these streams were landfilled.

04/11/74

Documentation of the process to recover Penta from the Venturi scrubbing liquor in the Penta prilling operation. Involves extracting the liquor with NB-21 or AD-73 solvent producing a Penta 50% oil concentrate. Gives safety and toxicity information.

4th Q/74

EPA Santobrite file for Monsanto (File 524-305). A chronology from 1948 to 1974.

05/14/74

Loss Prevention and Environmental Control report on Penta. Elimination of Solid Waste. Recommendations made on recovery of Penta from Venturi liquor.

06/28/74

Documentation of Research effort on process to recover Penta from prilled Penta scrubber liquor to make a marketable Penta oil solution. Implemented as Tentative Amendment G to SMP for Penta and Penta 60, 1/30/72.

CONFIDENTIAL
SUBJECT TO PROTECTIVE ORDER

C25342

SOURCEDOCUMENT NOS.

Tentative Amendment G to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 1/30/72

0025488-506

Process for Engineering Design
for Recovery of Penta from
Venturi Liquor by Extraction
into AD-73 Oil.

0045768-813

EPA Santobrite File.

0044157-70

Memo: W. W. Russell to
D. R. Dill

0013171-72

Research Report #3882

0016784-862

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

08/06/74

Pilot plant preparation of Penta Solution for sales development.

11/07/74

Documentation of events leading to overchlorinated Penta batch J-9.

12/06/74

Provision for disposal of large quantity of aqueous phenolic waste from Penta operation in storage. Extracted with nitrochlorobenzene "meta fractions" and sent to outside incinerator.

12/09/74

HOE (Heavy Oxo Ends) and AD-73 oil were shown to be suitable substitutes for Del Defoam for Central Fume Scrubber foam control. Amendment I to the SMP for Penta was accepted for full-time use.

12/31/74

1974 Sales Report by Customer

1975

Santobrite production and sale discontinued.

01/22/75

Reduction in the amount of Santophen I residue used to extract aqueous phenolic wastes from Penta process. Reason: less Santophen I residue available.

02/17/75

Penta Solution defined and process documented. It is a 40% solution of Penta in KB-3 Oil (Eastman Waste Oil).

03/26/75

Analysis of Penta shows hexachlorobenzene (HCB) at 35-60 ppm levels.

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C25343

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

SOURCE

DOCUMENT NOS.

TSD Report

0012314-26

Memo: J. Labanosky to
R. L. Fields

0017728-33

Tentative Amendment J to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 1/30/72

0025475-7

Tentative Amendment I to SMP
Molten Penta, Prilled Penta,
and Penta 60, 1/30/72

0025478-83

MIC Specialty Products
Sales Report

0045411-46
0045324-29

"Sources of Product Information",
Monsanto booklet, July, 1984

--

Tentative Amendment K to SMP
for Penta, Prilled Penta, and
Penta 60, 1/30/72

0025471-4

Tentative Amendment I to
Engineering Design Process
for Penta Solution 5/9/74.

0014268

Memo: R. G. Keley to
D. R. Dill

0017490

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
04/07/75 and 05/28/75	2,3,7,8-TCDD not found in Penta samples at detectable limit of 10 ppm. Levels of hexa CDD at 8-15 ppm, hepta CDD at 110-290 ppm, and octa CDD at 870-1980 ppm.
04/11/75	Positive chick adema factor appears to be due to other substances than the hexa CDD present in Penta. Distillation of Penta removes the positive chick adema factor.
04/24/75	Alert to all Monsanto location managers that Penta is on OSHA's hazardous substance list.

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C25344

SOURCE

DOCUMENT NOS.

Special Study by MIC Applied
Sciences Section

0017424-7
0017528

Memo: P. L. Wright to
D. R. Dill

0017546-8

OSHA Memo #31 on Hazardous
Substances

0010858-61

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

10/28/75

EVENT/SIGNIFICANCE

Documentation of the chlorophenol dioxin problem since its onset in 1970. Issued to aid in decision making with respect to future activities. Summary:

1. Hepta- and octachloro dioxins are present in Santobrite and Penta. Formed during the later stages of chlorination and during Molten Penta storage prior to prilling.
2. Tetrachloro dioxins (TCDD) were not detected in Penta; but about 1 ppm of TCDD were detected at the early stages of chlorination.
3. Santobrite contains less dioxin than Penta. Some are removed as insolubles in the cone settler.
4. Dioxins were not detected in any Penta or Santobrite scrubbing streams.
5. Competitive Penta and Santobrite are comparable in dioxin content.
6. Dioxin formation can be reduced by lower temperature chlorination. Penta 60 has only one-fourth as much dioxins.

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C25345

SOURCE

Memo: S. H. Vogel to
D. P. Roman "Chlorophenol
Dioxin History"

DOCUMENT NOS.

0045171-203.02

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

DATE

EVENT/SIGNIFICANCE

1976

WGK plant industrial hygiene practices in chlorophenols group documented.

01/01/76

Conversion agreement with Koppers for Monsanto to make "Penta Concentrate" (Koppers Penta Wood Preservative 1-10 Concentrate).

It contained:

40% Penta, tech.

60% WK-60 Solvent (Eastman Chemical)

01/15/76

Monsanto provided information to EPA advisory panel and stated conclusions:

1. Did not find the two most toxic species of dioxins (tetra- and pentachlorodioxins) in current Monsanto Penta.
2. Hepta- and octachlorodioxins are several orders of magnitude less toxic than the tetra and penta species. No more toxic than Penta itself. Do not represent a significant risk.
3. The level of hexachlorodioxins in Monsanto Penta is sufficiently low not to present a hazard.
4. Our belief is that Penta is a safe product to market for use by professionals in wood treating.

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C25346

SOURCE

DOCUMENT NOS.

Typed table - author unknown

0016904-8

Conversion Agreement

0046199-211

Letter: L. G. Scharpf, Jr. to
R. Ross (EPA Office of
Pesticides)

0017815-24

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

<u>DATE</u>	<u>EVENTS</u>	<u>SIGNIFICANCE</u>
02/13/76	Monsanto Medical Department issues toxicity information on Penta. Gives handling precautions.	
02/23/76	Penta worker health and environmental concerns were addressed at WGK plant. Action plans developed.	
02/25/76	Documents a review of present and past chloracne situation at the WGK plant. "To the best of our knowledge, we have never treated any employee for chloracne who was not a production employee in the Penta department."	
03/19/76	NIEHS (Nat. Inst. of Environ. Health Services) attributed toxic effects of Penta to hexa CDD.	
04/19/76	Distributor Agreement with Koppers.	
06/09/76	Analytical data comparing hexa-, hepta-, and octachloro dioxin and dibenzofuran content in Penta samples from Reichhold, Vulcan and Monsanto Data quite similar.	
06/22/76	Documentation of eruption of a hold tank following overchlorinated batch of Penta.	
08/12/76	EPA Penta File for Monsanto. (EPA Reg. No. 524-5) A chronology from 1948 to 1976.	

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C25347

<u>SOURCE</u>	<u>DOCUMENT NOS.</u>
Monsanto Medical Department Bulletin	0043529
Memo: J. C. Hume to G. E. Hendrikse	0017027
Memo: P. Heisler to J. Metcalf	0015513-15
Memo: P. L. Wright to L. G. Scharpf	0017532
Distributor Agreement	0044973-45029
Handwritten table - author unknown	0017502
Near miss accident report.	0017734-50
EPA Penta File	0044171-75

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

08/18/76

Documentation of research studies on Penta from 1970 to 1976. Includes analyses, potential dioxin suppression, bioassay studies, postulated chemistry of dioxin formation.

09/17/76

AWPI Status Report on EPA's examination of wood preservatives. Describes effort by AWPI to defend Penta against possible suspension or cancellation of Penta registration.

11/10/76

Threshold Limit Value (TLV) Sampling in the Penta production unit. Penta block pouring operation presented a problem (exceeded TLV allowable limit).

11/76

1971-76 Safety record of injuries in Chlorophenols group.

01/14/77

Revised Toxicity Information of Penta issued by Monsanto DMEH. Gives toxicity and handling precautions.

02/03/77

Spill procedure for Penta established. Requested by Koppers to use internally and to forward it to their customers. Monsanto planned to forward it to their customers. Gives precautions in handling.

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C25348

SOURCE

DOCUMENT NOS.

Final Report: Dioxin and
Related Process Maintenance
Studies.

0010050-478

AWPI Status Report

0044002-40

Memo: J. Labanosky to
C. Buckley and E. Burke

0013388

Safety Report

0017727

Monsanto DMEH bulletin

0045581-2

Memo: J. C. McPhillips to
F. A. Provorny

0044519-23

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
02/07/77	Documentation of an increased trend in number of people and severity of chloracne in the Chlorophenols Group at W GK plant. Standard practice to control chloracne is covered.
02/09/77	Chlorophenols Group Safety Meetings planned for 1977 documented.
03/01/77	A report to the EPA Office of Pesticide Programs by a task group of the American Wood Preservers Institute (AWPI) relevant to EPA's reregistration of Penta. Monsanto participated in this study (D. P. Roman). Contains much environmental information.
03/03/77	Discussion of the chemistry of chlorination of phenols and dioxin by-product formation.
03/03/77	Documentation of studies and issues by the American Wood Preservers Institute (AWPI) relevant to reregistration of Penta by the EPA. Conclusion: Penta fits most appropriately into Catagory II (conditional reregistration subject to long term tests).
03/08/77	Disclaimer issued for Penta Spill Procedure. Mentions Monsanto Technical Bulletin IC/PS-3 "Handling Precautions for Penta and Santobrite" (not attached).

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C25349

SOURCEDOCUMENT NOS.

Memo: P. Heisler to
W. E. Scruggs

0015509-12

Memo: J. Labanosky to
J. Starzyk/N. Miller

0018181-2

Memorandum by Environ. Programs
Task Group No. 6, AWPI.

0017109-56

Presentation to EPA Penta
Science Advisory Board by
S. Vogel of Monsanto.

0014987-15009

Memorandum by Subcommittee
of Environ. Programs Task
Group of AWPI.

0014738-85

Memo: F. A. Provorny to
J. C. McPhillips

0015439

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
03/8-9,15-16/77	Corporate Safety Audit held.
03/25/77	Safety and Toxicity information from AWPI. Reishhold, Vulcan and Kopper want Monsanto to join in analytical work.
04/18/77	Documentation of simulated OSHA inspection of Penta facilities (Dept. 236-237). Many industrial hygiene and safety problems showed up.
04/20/77	Penta strategy and contingency plans.

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C253491

SOURCEDOCUMENT NOS.

Memo: D. J. Metherd to C. Buckley et al, 2/15/77	0015404
Memo: R. L. Liss to H. E. Frierstein, 2/28/77	0015426
Memo: D. P. Roman to G. J. McEwan	0000339-96
Memo: J. L. Wolfsberger to D. Metherd/J. Labanosky	0015465-74
Memo: E. Wilcauskas to R. G. Potter	0015378-88

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

DATEEVENT/SIGNIFICANCE

04/22/77

Safety assessment of Penta and the manufacturing operation. Mentions Penta is moderately toxic by ingestion and dermal application. Chloracne among workers when operational practices deteriorate. Principal impurities in Penta are chlorinated hydroxy diphenyl ethers, dibenzo-p-dioxins and dibenzofurans. No 2,3,7,8-TCDD found at detection limit of 0.01 ppm. Hexa, hepta, and octachlorodibenzo-p-dioxins present at 5-20, 200-300 and 500-1000 ppm, respectively. Conclusion: commercial Penta can be handled safely with proper work practices and facilities. The dibenzofuran and diphenylethers contribute to the toxicity of Penta since the known presence and toxicities of dioxins cannot account for it.

Purification method for dioxin removal described - Distillation.

Competitive input given.

04/25/77

Documentation of poor plant conditions in Penta facilities.

04/26/77

MIC authorizes opening a Seattle Penta warehouse. Safety precautions noted. Penta Spill Procedure.

COPIES DESTROYED
SUBJECT TO RECORDS

C25850

SOURCE

DOCUMENT NOS.

Pentachlorophenol Safety
Assessment.

0015370-77

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

Notes for D. E. Munie
(no author)

0015389-91

Memo: R. L. McFarland to
F. H. Kaprive
Memo: J. C. McPhillips to
D. A. Parkey

0015429-30

0015432-35

Penta Spill Procedure.

0015432-35

DATE

EVENT/SIGNIFICANCE

04/26/77

Preliminary recommendations on industrial hygiene concerns which showed up in Safety Audit.

04/27/77

Report on Mid-America Packaging (St. Clair County, Ill.) - a site of Penta shipping. Poor industrial hygiene. Environmental aspects below Monsanto and OSHA standards. Recommendation to correct problems (dust collection) or terminate shipping from this site.

05/05/77

Suspended the loading of bulk Penta via breaking and emptying bags. Can't protect workers.

05/05/77

Report on Detailed Safety Audit of Penta operation conducted 3/8-9, 15-16/77 (see entry). Many bad features. Recommendations for corrections made.

05/09/77

Proposed plan to upgrade Penta block pouring facilities. Purpose: Reduce operator exposure to Penta fumes and the hazards of Molten Penta.

05/12/77

Minutes of meeting on how to upgrade Penta facilities and product. Much to correct.

05/17/77

A review of the Safety Audit of Penta and other Chlorophenols departments. Process problems, exposure problems, and environmental problems listed.

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C2533

SOURCEDOCUMENT NOS.

Memo: R. L. Liss to
O. DeGarmo

0015459

Trip Report by G. Fort

0015307-13

Memo: W. E. Scruggs to
J. C. McPhillips

0015436

Memo: D. E. Munie to
R. G. Potter
(Safety Audit attached)

0015447-56

Scope Commitment Meeting
background information

0017958-69

Memo: T. W. Cummins to
H. E. Blaylock, et al.

0015364-69

Memorandum (unsigned)

0014706-12

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

DATEEVENT/SIGNIFICANCE

05/18/77

Estimates for new facilities to produce Penta and refine it. Current facilities in poor condition.

05/24/77

Plan and program to continue Penta operations over next 2-3 years. Capital estimates. Plant in poor condition and needed major upgrading.

06/01/77

Report on toxicity of Penta and its impurities. Summarizes composition of Penta including dioxin content as well as acute toxicity tests.

06/03/77

Dow visited to discuss possible licensing of their Penta purification procedure. Never executed.

06/07/77

Names of personnel who have at some time during their employment been assigned full time to the WGK Penta production unit. Dates not ascertained.

06/08/77

Discontinued printing and distributing Monsanto Technical Bulletin O/PS-3 on Handling Precautions for Penta and Santobrite, 6/70. It was out-of-date.

06/20/77

Industrial hygiene of Penta operation discussed and actions agreed upon to improve conditions.

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SUBJECT TO PROTECTIVE ORDER

C25352

SOURCEDOCUMENT NOS.

Memo: R. J. Small to
E. F. Wilcauskas

0015343-44

Notes from D. E. Munie to
R. L. Liss

0015345-54

Memo: R. L. Liss to
W. M. Woelzlein
Short Term Capital list -
Chlorophenols.

Memo: D. P. Roman to
P. A. Tierney
(Report attached)

0000192-222

Memo: G.J. McEwan to file

0043363-5

Memo: D. J. Methard to
E. Tillman

0017783-91

Memo: J. C. McPhillips to
R. C. Isham

0036256

Memo: Minutes of meeting on
Chlorophenol Industrial
Hygiene, D. J. Methard to
J. Labanosky, et al.
6/21/77

0015394-95

**ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE**

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
06/21/77	Request for Penta label to be changed to meet current EPA label requirements. Must have sufficient warning to avoid use of Penta on domesticated animals. Eliminate use in "Paint Preservation" - only used in wood treating.
06/27/77	Review of the WGK plant plans for complying with the May Safety Audit recommendations.
07/11/77	Proposed new label for Penta. Gives precautionary statements.
07/15/77	Monsanto was aware of the industrial hygiene problems in removing 2000 lb. Penta block from the mold probably since the date production started. Recommended discontinuing 2000 lb. Penta block production.
08/02/77	Notes Penta exposure to employees during Penta block pouring operation. Phasing out of 2000 lb. Penta blocks mentioned.
08/04/77	Notes again a trend towards an increase in the number of people and severity of chloracne has returned to the levels experienced in 1971-76. Specifically mentions Ralph Jenkins, Joe Stargyk and Roy Purkey. Gives complete list.

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 SUBJECT TO PROTECTIVE ORDER.

C25333

SOURCEDOCUMENT NOS.

Memo: J. C. McPhillips to
M. F. Litteken

0043330

Memo: Minutes of 6/22 "Review
of Safety Audit Recommen-
dations Status and Plant,"
D. J. Methard to
T. Cummins, et al.

0015392-93

"Label change" form

0043324-6

Memo: J. C. McPhillips to
M. E. Blaylock

0017992

Memo: J. L. Wolfsberger to
D. Methard

0013503

Memo: P. E. Heisler to
W. E. Scruggs

0013504-5

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

08/05/77

Production of 2000 lb. Penta blocks will cease in two months because of safety considerations in the plant. Continue to make 1000 lb. blocks.

08/12/77

Documentation that embryonal and fetotoxicity of Penta may prevent reregistration of Penta by the EPA.

08/26/77

Penta determined in ambient air and wipe samples for OSHA compliance.

08/29/77

Cleaning control room with dilute sodium carbonate solution appeared to reduce surface contamination with Penta.

09/28/77

The Detergents & Phosphates business group recommends Penta production be discontinued by 4/1/78. Will go ahead with certain expenditures to correct industrial hygiene problems.

10/03/77

Proposal to dispose of alkali insolubles in the cone bottom separator in Santobrite manufacture by landfilling, rather than sewerage them as currently done. Reason: insolubles contain chlorinated dioxins.

10/05/77

Discussion of a Penta suit by an Ohio farmer (Pickering) who claims damages resulting from barn treated with Penta. Alleged death of 230 head of cattle.

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SUBJECT TO PROTECTIVE ORDER

C25354

SOURCEDOCUMENT NOS.

Memo: E. F. Wilcauskas to File	0044491
Memo: D. P. Roman to G. J. McEwan	0018140
WGK Anal. Lab Work Proposal	0013407-8
Memo: J. R. Pace to D. Metherd, et al.	0013223-24
Memo: M. E. Blaylock to B. Eley	0015457-58
Minutes of Meeting: H. G. Yapp	0016911-14
Memo: R. A. Stohr to G. J. Levinskas, et al.	0035634

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
10/06/77	Industry hygiene improvement project in Penta production. To eliminate fumes in Penta Block pouring area, and find acceptable way of disposing of alkali insolubles.
10/20/77 and 11/01/77	Top-level recommendation and approval to retire and dismantle Penta production unit at W GK plant.
11/04/77	Documentation of industrial hygiene problem in pouring 1000 lb. Penta blocks due to fumes. Removal of the fumes by a ventilation system is proposed.
11/23/77	Penta customer list for Wood Treating Chemicals Dept., Koppers Co.
11/29/77	Medical records of 60 employees who have worked in the Penta production unit were reviewed. There is and has been for some years a problem with chloracne.
11/77	Draft of news release indicating Monsanto will terminate U.S. production of Penta effective 1st Quarter, 1978. Continue to produce at Newport, U.K.
12/13/77	Status report on the short and long term actions being taken to correct problems observed in the Detailed Safety audit of 5/5/77.

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 SUBJECT TO PROTECTIVE ORDER

C253355

SOURCEDOCUMENT NOS.

TSD Work Proposal

0013488

Retirement Request

0018088-90

Memo: M. E. Blaylock to
J. C. McPhillips

0017970

Letter: J. M. Montgomery
(Koppers) to
J. McPhillips
(Monsanto)

0044557-70.02

Memo: E. Tillman to
M. E. Blaylock

0013526-33

News Release Draft

0017330-1

Memo: M. E. Blaylock to
D. E. Munie, et al.

0013479-83

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

DATE

EVENT/SIGNIFICANCE

4th Q/77

Detergents and Phosphates Division recommended to the Corp. Admin. Comm. (CAC) the discontinuance of Penta production by 7/1/78 because of major industrial hygiene concerns.

01/04/78

2000 lb. Penta blocks no longer produced. 1000 lb. blocks continued.

02/02/78

Program outlined for monitoring Penta exposure effects on Penta workers at the WGK plant.

02/03/78

Recommendation of a safe way of handling overchlorinated batches of Penta. Addition of determined amount of p-chlorophenol stabilizes overchlorinated Penta.

02/24/78

Trend towards an increase in the number of people and the severity of chloracne was still present.

02/78

Penta production unit was shut down.

04/78

All Penta operations at the WGK plant were discontinued. All equipment and the building were dismantled by 1st Quarter, 1980.

06/08/78

Penta on the 1977 NIOSH Suspect Carcinogen List.

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SUBJECT TO PROTECTIVE ORDER

C25356

SOURCEDOCUMENT NOS.

Memo: F. J. Fitzgerald to
J. W. Hanley

0014550-55

Letter: J. C. McPhillips
(Monsanto) to
R. Simmons (Koppers)

0044576

"Penta Sampling Program
Strategy"

0017776-7

Interim Report: Overchlorination
of Penta

0028069-79

Memo: P. E. Heisler to
W. E. Scruggs

0017773-5

Mentioned in Tentative
Amendment L to SMP for Molten
Penta, Prilled Penta, and
Penta 60, 1/30/72.

0025469

Letter: P. E. Heisler to
I. B. Suskind (Univ.
of Cincinnati, 7/21/80)

0013420-24

1977 NIOSH Suspect Carcinogen
List.

0010862-74

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
07/31/78	Discussion of interrogatories on the Pickering case. Mentions that Monsanto encloses a copy of the warning of potential danger in handling Penta with every shipment.
08/08/78	Eliminated the use of defoamer agents in the Central Fume Scrubber. Not used because Penta production unit was shut down.
08/17/78	Draft of Contract to sell scrap Penta to Koppers
03/06/79	Continued discussion of the Pickering case. Long term feeding study on Penta suggested. Necropsy reports on cows included. No record that long-term feeding study was ever performed.
03/06/79	Contributors to the Pickering defense fund listed: Reichhold, Monsanto, Olan Belsher, Walker-Williams, Vulcan, Koppers, McArthur Lumber & Post, Dow, and Forshaw.
06/08/79	Monsanto developed an Agreed Position Statement on chlorinated dioxins. Agreed to establish state-of-the-art analytical capabilities in MRC to measure chlorinated dioxin levels in products, process waste streams, air samples, spills and other mishaps. Shows diligence in industrial hygiene for workers and safety of the products.

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0253357

SOURCEDOCUMENT NOS.

Letter: M. M. Liebman to
C. G. Barclay (Porter,
Wright, Morris and
Arthur Law firm) 0035679-80

Tentative Amendment L to SMP
for Molten Penta, Prilled Penta,
and Penta 60, 1/30/72 0025469-70

Letter: Director, Marketing to
J. Hite (Koppers) 0043576-85

Letter: C. D. Barclay to
M. M. Liebman 0035618-33

Letter: C. D. Barclay to
R. Van Zandt (Travelers
Insurance Co.) 0035674-78

Chlorinated Dibenzodioxins
Agreed Position Statement 0046477-8

ATTORNEY WORK PRODUCT
ATTORNEY-CLIENT PRIVILEGE

<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
06/19/79	Status report on Pickering vs. McArthur Lumber and Feucht vs. Morton cases. Mentions LeMunyon case.
10/18/79	Brick rubble from Penta facility dismantling considered refuse and will be buried on site (WGK plant).
10/19/79	Industrial hygiene practices to be observed in dismantling the Penta facilities documented.
10/30/79	Status report on dismantling of Penta facilities at WGK. Completion expected in December, 1979. Estimated dismantling and retirement costs: \$800,000.
04/04/80	Firestone, McConnell, and Schull studies on cattle showed that given the exposure time periods of 70-160 days dioxins do not have serious adverse effects.
05/05/80	Draft interrogatory answers on Penta case: Pickering vs. Monsanto.
07/21/80	Good summary of history of the technical aspects of producing Penta and Santobrite.

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C25358

SOURCEDOCUMENT NOS.

Letter: C. D. Barclay to
I. Comella and
R. Van Zandt

0035610-17

Memo: R. H. Sinise to
D. B. Edwards

0018035

Memo: D. C. Armstrong to
C. Buckley/D. Metherd

0018034

Penta Discontinuation Project
Status: D. B. Edwards

0018038-9

Letter: C. Barclay to
R. Van Zandt

0035668-72

Memo: V. A. Haskins to
D. Dill, et al.

0035635-67

Letter: P. E. Heisler to
I. B. Suskind

0013420-24

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<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>	<u>SOURCE</u>	<u>DOCUMENT NOS.</u>
11/80	Tentative conclusions reached that workers exposed to Penta show greater tendency to higher triglycerides and lower HDL cholesterol and bilirubin levels. Significance not stated. States that 2,3,7,8-TCDD not detected in Penta at 10-15 ppb limit of detection, but the hexachloro, heptachloro and octachloro derivatives were detected (5-10, 25-250 and 1900 ppm, respectively).	A further report on "The Biochemical Study of Pentachlorophenol Workers at Newport," R. A. Baxter (DMEH-Europe)	0000002-48
08/81	The dioxins in Penta are believed to contribute significantly to its toxicity. Mentions several human fatalities. Also chloracne. Two cases of non-Hodgkins lymphoma out of 158 workers. Good review on toxicity of hexa, hepta, and octachloro dioxins. Hexachloro derivatives most toxic. Mentions composition of Penta, tech. 5-10% tetrachlorophenols 0.1% trichlorophenols trace mono- and dichlorophenols (below 30 ppm) Dioxins: no tetrachloro (0.01 ppm detection limit) hexachloro 3-8 ppm heptachloro 25-250 ppm octachloro 200-2000 ppm Small amounts of chlorinated dibenzofurans (not quantified).	"Review of the Toxicity of Pentachlorophenol" R. J. Fielder. Also other documents to be considered by the Health and Safety Executives' Advisory Committee on Toxic Substances on 1/22/82.	0000049-105

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<u>DATE</u>	<u>EVENT/SIGNIFICANCE</u>
09/04/81	Provided process information on Penta and Santobrite to NIOSH. Also gives historical data.
06/09/82	Six-month monitoring results on chloracne. Includes all people who worked in the Penta production unit. There appears to be improvement.

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C25360

SOURCEDOCUMENT NOS

Letter: P. S. Park to
: H. Walderman
(U.S. Dept. of Health
and Human Services)

0019740
0019782-90

Memo: P. E. Heisler to
H. M. Keating

0013448

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VI. Safety and Handling of Penta Products/Processes

<u>Subject</u>	<u>Source</u>	<u>Document Nos.</u>
1. Toxicity and handling instructions	Monsanto Technical Bulletin 0-5 for Santobrite in paper industry, 4/1/40, 8/1/44, 2/1/47, 4/25/52	0036480-87 0036464-71 0036456-63 0036444-49
2. Toxicity and handling instructions	Monsanto Technical Bulletin 0-19 for Santobrite in tanning industry, 6/20/40, 12/1/45, 7/1/46, 12/9/48	0036231-36 0036219-23 0036214-18 0036224-30
3. Safety precautions described	Process Description for Santophen 20, 6/17/43	0026642-43
4. Toxicity and handling instructions	Monsanto Technical Bulletin 0-25 for Penta, 11/1/43, 12/1/45, 7/1/46, 10/1/48, 12/15/49, 3/30/50, 3/25/52, 6/55	0035904-14 0035893-903 0035882-92 0035870-81 0035857-69 0035850-56 0035839-49 0035806-20
5. Toxicology and Dermatology of Penta and Santobrite. Handling instructions for these products and several of the formulations.	"Toxicology and Dermatology of Pentachlorophenol and Santobrite," J. D. Fleming 1/1/48	0045852-71
6. Safety procedures described	Description of Process for the Manufacture of Santobrite 7/15/49	0025665-707
7. Safety and Fire Protection described	Description of Process for the Manufacture of Monsanto Penta 10/9/53	0026547-95

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	<u>Subject</u>	<u>Source</u>	<u>Document Nos.</u>
8.	Safety precautions described	Process Description for the Manufacture of Monsanto Penta, 2/1/54	0026048-74
9.	Safety discussed	Process Description for the Manufacture of Santobrite Powder, Pellets, and Briquettes, 2/1/54	0025708-37
10.	Orders issued to Chlorophenols Depts. at WCK plant not to eat or drink beverages in the departments. Diligence in industrial hygiene.	Memo: H.B. Patrick to H.O. Hehner, 5/26/54	0018133
11.	Safety precautions given	Revised Process Description for the Manufacture of Monsanto Penta, 3/17/55	0026494-520
12.	Safe handling and toxicity of Penta and its salts	Monsanto Technical Bulletin O-100, 3/56	0000962-81
13.	Toxicity and handling instructions	Monsanto Technical Bulletin O-15 for Santobrite for slime and algae control, 6/57	0036093-98
14.	Recommendation by Medical Dept. that eating in the Penta production unit be discontinued was implemented. Diligence in industrial hygiene	Memo: J.T. Garrett to E.W. Mares, 9/23/57 Memo: R. Peterson/ D. Castle to Chlorophenol Group personnel, 9/3/57	0018132 0018134
15.	Toxicity and handling instructions	Monsanto Technical Bulletin SC-1 on Santobrite, 4/58	0036081-92

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	<u>Subject</u>	<u>Source</u>	<u>Document Nos.</u>
16.	Toxicity and handling instructions	Monsanto Technical Bulletin SC-2 on Santobrite and Penta in paints and water-base additives, 7/58	0036016-23
17.	Toxicity and handling instructions	Monsanto Technical Bulletin SC-3 on Penta, 10/58, 12/65	0035784-805 0035765-83
18.	Toxicity and handling instructions	Monsanto Technical Bulletin SC-10 on Santobrite in Cellulose Insulating Materials, 11/58	0035973-91
19.	Toxicity and handling instructions	Monsanto Technical Bulletin SC-11 on Santobrite in the tanning industry, 1/60	0036201-13
20.	Toxicity and handling instructions	Monsanto Technical Bulletin SC-4 for Santobrite in paper industry, 1/60, 11/63	0036436-43 0036427-35
21.	Toxicity and handling instructions	Monsanto Technical Bulletin SC-9 on Handling Precautions for Penta and Santobrite, 1/60, 3/63	0035992-6015 0036099-122
22.	Toxicity and handling	Monsanto Chemical Specialties Data Report No. CS-13 on Copper Pentachlorophenate in cellulosic materials, 11/60	0036142-49
23.	Toxicity and handling instructions	Monsanto Chemical Specialties Data Report No. CS-9 on Santobrite in laundry, 6/61	0036158-65
24.	Safety and Toxicity Data	SMP for Santobrite, 6/65	0025823-74

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	<u>Subject</u>	<u>Source</u>	<u>Document Nos.</u>
25.	Safety, Toxicity Data and Accident Reports	SMP for Penta, 11/9/65	0026005.04
26.	Toxicity and handling instructions	Monsanto Technical Bulletin O/PS-2 on Santobrite in paper industry, 7/66	0036415-26
27.	Toxicity and handling instructions	Monsanto Technical Bulletin O/PS-5 on Santobrite in tanning industry, 7/66	0036237-52
28.	Toxicity and handling instructions	Monsanto Technical Bulletin O/PS-3 on Handling Precautions for Penta and Santobrite, 7/66, 7/69, 6/70	0036279-302 0036376-98 0036353-75
29.	Toxicity and hazards, effects, First Aid, and protective equipment documented for Penta and Santobrite	Medical Dept. Bulletin, 8/67	0013286-89
30.	Detailed Safety and Toxicity section	SMP for Molten Penta, Prilled Penta and Penta 60, 11/68	0026076-79 0026114-201
31.	Safety and Toxicity Data	SMP for Santobrite, 11/68	0012006
32.	Safety and housekeeping covered	Training and Reference Manual, 1/70	0011715-811
33.	Field Safety Review Penta expansion	Memo: R.L. Fields to E.D. Malone, 2/16/70	0013193-95 of
34.	Precautions and protective information on Penta	Material Safety Data Sheet, 12/2/71	0043530-1
35.	Toxicity and handling instructions	Monsanto Technical Bulletin IC/PS-8 on Penta, 12/71	0035681-701

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	<u>Subject</u>	<u>Source</u>	<u>Document Nos.</u>
36.	Safety	SMP for Santobrite Briquettes and Solution, 2/72	0025415-65
37.	Safety and housekeeping rules for Santobrite Briquettes	Operator Training and Reference Manual, 4/72	0010787-806
38.	Safety and housekeeping rules for Penta and other chlorophenols	Operator Training and Reference Manual for Chlorophenol Group, 4/72	0010763-82
39.	Safety and Toxicity of 30% Santobrite Solution	Tentative Process for 30% Santobrite Solution, 5/2/72	0014416-40
40.	Safety and housekeeping instructions for Santobrite Solution	Operator Training and Reference Manual, 5/72	0010807-57
41.	Standard practice of Chlorophenols Group at W GK to control and clear up chloracne cases	Memo: R.R. Sorrell to R.L. Fields, 8/23/72	0017160
42.	Safety, housekeeping and handling instructions for Molten Penta	Operator Training and Reference Manual, 11/72	0011868-97
43.	Process Safety Audit Penta Operation	Process Safety Audit, 1/73	0013305-43 of
44.	Safety, housekeeping and handling instructions for Molten Penta	Operator Training and Reference Manual, 6/73	0011813-67
45.	Safety and toxicity information	Process for Engineering Design for Recovery of Penta from Venturi Liquor, 4/11/74	0045768-813
46.	Toxicity and handling precautions	Monsanto Medical Department Bulletin 2/13/76	0043529

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	<u>Subject</u>	<u>Source</u>	<u>Document Nos.</u>
47.	Penta worker health and environmental concerns addressed and action plans developed	Memo: J.C. Hume to E.E. Hendrickse, 2/23/76	0017027
48.	Toxicity and handling precautions	Monsanto DMEH Bulletin, 1/14/77	0045581-2
49.	Handling precautions	Penta Spill Procedure, 2/3/77	0044519-23
50.	Chlorophenols Group safety meetings planned for 1977 documented	Memo: J. Labanosky to J. Starzyk/ N. Miller, 2/9/77	0018181-2
51.	Industrial hygiene and safety problems	Simulated OSHA inspection, 4/18/77	0015465-74
52.	Safety Assessment of Penta	Penta Safety Assessment, 4/22/77	0015370-77
53.	Preliminary recommendations on industrial hygiene concerns from Safety Audit	Memo: 4/26/77	0015459
54.	Detailed Safety Audit	Memo: 5/5/77 (Safety Audit attached)	0015447-56
55.	Proposed plan to upgrade Penta block pouring facilities. Purpose: Reduce operator exposure to Penta fumes and the hazards of Molten Penta	Scope Committee Meeting background information, 5/9/77	0017958-69
56.	Safety of the Manufacturing Process for Penta.	Memorandum, 5/17/77, unsigned	0014706-12
57.	Industrial hygiene of Penta operations discussed. Actions agreed upon	Memo: 6/21/77	0015394-95

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	<u>Subject</u>	<u>Source</u>	<u>Document Nos.</u>
58.	Review of W GK plans for complying with May, 1977 Safety Audit recommendations	Memo: 6/27/77	0015392-93
59.	Precautional State-ments on Penta	"Label Change" form, 7/11/77	0043324-6
60.	Monsanto agreed to establish state-of-the-art analytical capabilities to measure dioxin levels in products, waste streams, air samples, spills, etc. Shows diligence in industrial hygiene for workers and safety of the products.	Chlorinated Diben-zodioxins Agreed Position Statement, 6/8/79	0046477-8
61.	Safety procedure recom-mended for overchlo-rinated batches of Penta	Interim Report: Overchlorination of Penta, 2/3/78	0028069-79

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VII. References on Sales Reports, Sales Invoices/Purchase Orders,
and Customer Contacts/Call Reports

A. Sales Reports

<u>Description</u>	<u>Document Nos.</u>
1971 Sales Report by Customer, 1/12/72	0044634-40
1972 Sales Report by Customer, 1/9/73	0045316-23
	0045447-524
1973 Sales Report by Customer, 1/9/74	0045310-15
1974 Sales Report by Customer, 12/31/74	0045411-46
	0045324-29

B. Sales Invoices/Purchase Orders

Document Nos.

0011529-47 } Note: In 1978, Monsanto sold Penta products
0011549-64 } to Koppers Co. but shipped the material
directly to their customers.

0044525-37
0050017-42
0050044-56
0050096-102
0050111-16
0050118-69
0050177-82
0050189
0050197
0050204-34
0050236-400
0050431
0050444-5
0050646

C. Call Reports/Customer Contacts

Document Nos.

0050002-16
0050043
0050057-95
0050103-10
0050117
0050170-6
0050183-8
0050190-6
0050198-203
0050235
0050401-30
0050433-43
0050446-645
0050647-98

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VIII. Monsanto Participation in Organizations Related to
Penta Products

1. American Wood Preservers Institute (AWPI)
1651 Old Meadow Road
McLean, Virginia 22101
(703) 893-4005

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C25369

Document Name: " " ...
PENTA PROD CHRON

Requestor's ID:
OPR 84

Author's Name:
h. c. godt

Document Comments:
pentachlorophenol chronology

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C25370

Document Name:
PENTA PROD REPORT

Requestor's ID:
OPR 84

Author's Name:
h. c. godt

Document Comments:
Information for use in litigations; Report No. MSL-4254

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