S/C/738/89

IN THE COURT OF QUEEN'S BENCH OF NEW BRUNSWICK

TRIAL DIVISION

JUDICIAL DISTRICT OF SAINT JOHN

BETWEEN: CLARENCE AGNEW AND OTHERS,

Plaintiffs

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./ UNIROYAL CHEMICAL LTEE.,

Defendants

AND

BETWEEN: JEAN VIVIAN AGNEW AND OTHERS,

Plaintiffs

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./ UNIROYAL CHEMICAL LTEE.,

Defendants

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Plaintiffs

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

RECORD ON MOTION

William B. Richards, Esq.
Clark, Drummie & Company
Barristers & Solicitors
40 Wellington Row
Saint John, N.B.
Telephone: 633-3800
Solicitors for the Plaintiffs

David M. Norman, Esq., Q.C.
Hanson, Hashey
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Solicitors for the Defendants

Douglas A.M. Evans, Esq., Q.C.
Gilbert, McGloan, Gillis
Barristers & Solicitors
133 Prince William Street
Saint John, N.B.
Telephone: 634-3600
Solicitors for the Defendant
Chipman Inc.

Thomas O'Neil, Esq., Q.C.
Barry & O'Neil
Barristers & Solicitors
85 Charlotte Street
Saint John, N.B.
Telephone: 633-4226
Solicitors for the Defendants
The Dow Chemical Company and
Dow Chemical Canada Inc.

I N D E X

S/C/738/89

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THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

AFFIDAVIT OF SERVICE
(FORM 18B)

I, W. Andrew LeMesurier, of the City of Saint John, in the County of Saint John and Province of New Brunswick, MAKE OATH AND SAY AS FOLLOWS:

1. On the 8th day of January, 1993, I served the defendant, Chipman Inc. with the attached document marked "A" by leaving a copy with Douglas A.M. Evans, Q.C., at Gilbert, McGloan, Gillis, Solicitors for the defendant, Chipman Inc., at 133 Prince William Street, Saint John, N.B.

2. I was able to identify the person served by means of the fact that he is known to me.

SWORN TO at the City of Saint John, in the County of Saint John, in the Province of New Brunswick, this 14th day of January, A.D., 1993. BEFORE ME: ______________________ Commissioner of Oaths Being a Solicitor **JOHN C. WARNER**	______________________ W. Andrew LeMesurier

S/C/738/89

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TRIAL DIVISION

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BETWEEN: CLARENCE AGNEW AND OTHERS,

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Defendants

AND

BETWEEN: JEAN VIVIAN AGNEW AND OTHERS,

Plaintiffs

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

AFFIDAVIT OF SERVICE
(FORM 18B)

I, W. Andrew LeMesurier, of the City of Saint John, in the County of Saint John and Province of New Brunswick, MAKE OATH AND SAY AS FOLLOWS:

1. On the 8th day of January, 1993, I served the defendant, The Dow Chemical Company and Dow Chemical Canada Inc. with the attached document marked "A" by leaving a copy with Marilyn Patstone, Receptionist, at Barry & O'Neil, Solicitors for the defendants, The Dow Chemical Company and Dow Chemical Canada Inc., at 85 Charlotte Street, Saint John, N.B.

2. I was able to identify the person served by means of the fact that she identified herself to me.

SWORN TO at the City of Saint John, in the County of Saint John, in the Province of New Brunswick, this 14th day of January, A.D., 1993.

BEFORE ME:

Commissioner of Oaths
Being a Solicitor
JOHN C. WARNER

W. Andrew LeMesurier

S/C/738/89

IN THE COURT OF QUEEN'S BENCH OF NEW BRUNSWICK

TRIAL DIVISION

JUDICIAL DISTRICT OF SAINT JOHN

BETWEEN: CLARENCE AGNEW AND OTHERS,

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- and -

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Defendants

AND

BETWEEN: JEAN VIVIAN AGNEW AND OTHERS,

Plaintiffs

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

AFFIDAVIT OF SERVICE
(FORM 18B)

I, W. Andrew LeMesurier, of the City of Saint John, in the County of Saint John and Province of New Brunswick, MAKE OATH AND SAY AS FOLLOWS:

1. On the 8th day of January, 1993, I served the defendant, Uniroyal Chemical Ltd./Uniroyal Chemical Ltee. with the attached document marked "A" by leaving a copy with David Norman, Q.C., at Hanson Hashey, Solicitors for the defendant Uniroyal, at 400 Phoenix Square, Fredericton, N.B.

2. I was able to identify the person served by means of the fact that he identified himself to me.

SWORN TO at the City of Saint John, in the County of Saint John, in the Province of New Brunswick, this 14th day of January, A.D., 1993.

BEFORE ME:

Commissioner of Oaths
Being a Solicitor
JOHN G. WARNER

W. Andrew LeMesurier

S/C/738/89

IN THE COURT OF QUEEN'S BENCH OF NEW BRUNSWICK

TRIAL DIVISION

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Defendants

AND

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Plaintiffs

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./ UNIROYAL CHEMICAL LTEE.,

Defendants

NOTICE OF MOTION (FORM 37A)

TO: The Defendants

The Plaintiffs will apply to the Court of Queen's Bench of New Brunswick at the Provincial Building at 110 Charlotte Street, 4th Floor, Saint John, N.B., on the 18th day of January, 1993, at 1:30 p.m. for an order that the

AVIS DE MOTION (FORMULE 37A)

DESTINATAIRE:

Le demandeur (ou selon le cas) demandera à la Cour a (lieu précis) , le , 19 , à h , d'ordonner :

Statement of Claim be amended as set out in the affidavit of Jerry K. White, pursuant to Rule 27.10 of the Rules of Court.

Upon the hearing of the motion the following affidavits or other documentary evidence will be presented:

(a) Affidavit of Jerry K. White, sworn to on the 8th day of January, 1993.

You are advised that:

(a) you are entitled to issue documents and present evidence at the hearing in English or French or both;

(b) the plaintiffs intend to proceed in the English language; and

(c) if you intend to proceed in the other official language, an interpreter may be required and you must so advise the clerk at least 5 days before the hearing.

DATED at Saint John, NB, this day of January, 1993.

Solicitor for Plaintiffs,
William B. Richards,
Clark, Drummie & Company

A l'audition de la motion, les affidavits ou les authres preves litterales suivantes seront présentées:

Sachez que:

(a) vous avez le droit d'émettre des documents et de présenter votre preuve à l'audience en français, en anglais ou dans les deux langues;

(b) le demandeur (ou selon le cas) l'intention d'utiliser la langue ; et

(c) si vous avez l'intention d'utiliser l'autre langue officielle, les services d'un interprète pourront être requis et vous devrez en aviser le greffier au moins 5 jours avant l'audience.

FAIT à le
19 .

Avocat du demandeur

S/C/738/89

IN THE COURT OF QUEEN'S BENCH OF NEW BRUNSWICK
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JUDICIAL DISTRICT OF SAINT JOHN

BETWEEN: CLARENCE AGNEW AND OTHERS,

Plaintiffs,

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THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

AND

BETWEEN: JEAN VIVIAN AGNEW AND OTHERS,

Plaintiffs,

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

A F F I D A V I T

I, Jerry K. White, of the City of Fredericton, in the County of York and Province of New Brunswick, MAKE OATH AND SAY AS FOLLOWS:

1. I am a plaintiff in the above noted action and as such I have personal knowledge of the facts herein deposed to unless otherwise stated.

2. I am Executive Director of the Sprayers of Dioxin Association Health and Environment Inc. ("S.O.D.A."), an association originally organized in 1984 for the purpose of investigating the health effects of phenoxy herbicides on employees of New Brunswick Electric Power Commission who sprayed herbicidal formulations for N.B. Power during the 1950s and 1960s.

3. As Executive Director of S.O.D.A., and as a plaintiff in the above action, I also have acted as agent for the plaintiffs in the prosecution of this action, making all decisions in relation to hiring lawyers, and experts, negotiating with New Brunswick Electric Power Commission (now New Brunswick Power Corporation) in an attempt to settle the plaintiffs' claim against N.B. Power in a related action to this one. As well, I made all other necessary decisions in the case against Dow and Others. I have so acted as agent for the plaintiffs since 1984.

4. The pleadings in this case, which are substantial in volume, have been filed with the court.

5. This affidavit is for the purpose of supporting the plaintiffs' motion to amend their pleadings with respect to fraud as well as to plead res ipsa loquitor.

6. In November 1991 the plaintiffs applied to court for production of Dow Chemical's documents as set out in its Affidavit of Documents. The documents began to arrive in January 1992 as undertaken by Mr. O'Neil on behalf of Dow. At the present time Dow still has not made available to the plaintiffs all of its Schedule "A" documents, although the plaintiffs have requested them several times, and Dow had undertaken to produce them as of January 1992. In fact there are still what I estimate to be 1200-1400 documents not made available as set out in Appendix "D" of Schedule "A" of Dow's affidavit.

7. The plaintiffs have received from Dow's Affidavit of Documents copies of 80 rolls of microfilm. Each roll has approximately 4000 documents on it. We have fully reviewed and hard copied about 25 rolls.

8. On January 27th, 1992, about two weeks before discovery of the plaintiffs began, the plaintiffs asked to delay discovery until they had a chance to review Dow's documents. the defendants objected and on motion the court refused the adjournment.

9. The plaintiffs made a request for copies of Chipman's Affidavit of Documents in June of 1992. The copies were not delivered until July 1992.

10. Uniroyal was served with a request for an Affidavit of Documents in May 1992. To date there has been no Affidavit forthcoming from that defendant. Attached hereto and marked as Exhibit "A" is a letter dated November 27, 1992 from Clark, Drummie & Company to Hanson, Hashey. I am informed by William B. Richards and I verily believe it to be true, that Uniroyal is to file their Affidavit of Documents in January 1993. Attached hereto and marked as Exhibit "B" is a letter from David Norman, Q.C. to Mr. Richards inviting Mr. Richards to review the documents before the actual preparation of the Affdiavit.

11. As a result of the above, and as a result of the fact that several hundreds of further documents have been received from N.B. Power within the same time frame as described above, the plaintiffs were not previously in a position to properly and fully advance allegations in respect of fraud.

12. Attached hereto and marked as Exhibit "C" is a copy of the proposed amendments to the Statement of Claim wherein fraud is alleged against the defendants as particularly set out therein and which allegations I verily believe to be true.

13. In respect of the proposed amendments the following documents are, I verily believe, evidence of the defendants' fraud as set out in the proposed amended claim:

1. Two letters to William B. Richards from Dr. Alastair Hay re PCBs, dated 3 November 1992 and November 10, 1992 along with attached C.V. The letters express an opinion in respect of the hazards of chemicals used in the spray program and the non-disclosure by the defendants of those hazards.

2. Pages 8 and 9 of deposition of V.K. Rowe, former Director of Toxicology for Dow Chemical Company and Assistant Director of Dow's Biochemical Research Laboratory. The testimony acknowledges Dow's early knowledge of chlorinated di or bi phenyls (P.C.B.s) and their toxicity. The testimony was taken in the case of Keister v. Dow, U.S. District Court, Eastern District of Arkansas, July 18, 1990.

3. Paper entitled Chloracne - Dow Experience. This paper traces in chronological order Dow's history of chloracne, along with the chemical agents in question. (Dow document 1289).

4. Report of Biochemical Research Laboratory, The Dow Chemical Company re Toxicity of 2,4,5 Trichlorophenoxy Acetic Acid, dated August 25, 1945 (Dow document 1172).

5. Two pages from Dow Brochure entitled Application Methods and Dosage for Dow Weed and Brush Killer Formulations in which Dow proposes the use of oil as a carrier. This is on N.B. Power microfilm files and in part reads as follows:

Basal Bark Treatment

2nd paragraph

Spray Mix: Use 4 gallons of Esteron 245 for every 95 gallons of fuel or kerosene or similar oil. Transformer oil has been used satisfactorily. Do not use water or oil-water emulsions for basal bark treatment. Used transformer oil may be used if available.

Esteron Brushkiller

<u>bottom of page, 1st column and top of page, 2nd column</u>

Fuel oil may be used....it is questionable whether oil adds to the effectiveness of Esteron Brushkiller. In certain cases when application is made during the summer season with particular emphasis on wetting the stems and bark rather than the foliage, good results have been obtained.

6. Letter to Mr. J.E. Guerette, New Brunswick Electric Power Commission from W.A. Stearman, Chipman Chemicals Limited dated 28 November 1956 proposing use of oil as carrier (N.B. Power files).

7. Letter to James M. Cruickshank, Naugatuck Chemicals from P.C. Levesque, The New Brunswick Electric Power Commission, dated June 20, 1951 re use of oil in spray program.

8. Letter to P.C. Levesque, The New Brunswick Electric Power Commission from James Cruickshank, Naugatuck Chemicals (owned by and defending this action as Uniroyal Chemical Ltd.), dated June 29, 1951 regarding the use of oil in spray program.

9. Document prepared by The Dow Chemical Company entitled Brush and Weed Control on Railroad Rights of Way by Use of 2,4-D and 2,4,5-T, dated January 26, 1953 indicating safety of product.

10. Document entitled The New Brunswick Electric Power Commission Transmission Line R-O-W Maintenance Chemical Control Operation Instruction to Foremen indicating safety of product and mixture of herbicide with stove fuel or waste transformer oil.

11. Page 14 from report of N.B. Power Herbicide Use (1955-64) prepared in 1984 re the sale of Brushkill (2,4-D and 2,4,5-T) by the defendants to N.B. Power.

12. Letter to Dr. Andrew G. Goesl, Texarkana, Arkansas-Texas from V.K. Rowe, The Dow Chemical Company dated July 12, 1955 indicating Dow's knowledge of extent of exposure by sprayers.

13. Letter to Dr. Knecht, Boehringer Co. from Dr. Schmidt dated 14 November 1955 re hazards of 2,4,5-T (Dow document 1549).

14. Letter to L.L. Coulter, The Dow Chemical Company from V.K. Rowe, Biochemical Research Department, dated February 13, 1956 re hazards of oil as used in herbicide spray to human health.

15. Letter to Mark Wolf, Biochem Research Lab, The Dow Chemical Company from L.L. Coulter, Agricultural Chemicals Development, The Dow Chemical Company, dated March 20, 1959 requesting information on the toxicity of oil used in Brushkiller formulations.

16. Letter to L.L. Coulter, Agricultural Chemical Development, The Dow Chemical Company from Mark A. Wolf, Biochemical Research Laboratory, The Dow Chemical Company, dated July 6, 1959 re effects of fuel oil in response to above referenced request.

17. Memorandum to Mr. George Gagnon from J.E. Guerette, The New Brunswick Electric Power Commission re: Transformer Waste Oil and Oil Drums for use in spray program, dated October 28, 1959.

18. Letter to Dow Chemical Company from German based C.H. Boehringer Sohn re <u>The chlorakne. Preparation of Trichlorophenol</u>, dated February 11, 1957 (Dow document 1750). The letter purports to assist Dow Chemical in solving its chloracne problem.

19. Letter to Brigadier General Fred J. Delmor, U.S. Army Munitions, Army Chemical Centre, Maryland, from G.E. Lynn, Director of Registration Bioproducts Department, The Dow Chemical Company re Dow's stated position that 2,4-D and 2,4,5-T are non-toxic, dated April 22, 1963 (Dow document 1362)

20. Letter to Dow Chemicals Company from C.H. Boehringer Sohn re chloracne, dated December 15, 1964 (Dow document 1286). The shared information was to be kept strictly confidential. (See attached english translation by W.B. Trapp, Dow Chemical Company).

21. Letter to Dr. Hans Merz, C.H. Boehringer Sohn from Walter B.N. Trapp, The Dow Chemical Company, dated January 28, 1965 re dangers of trichlorophenol and secrecy agreemetn between Dow Chemical and Boehringer.

22. Memorandum L.G. Silverstein, The Dow Chemical Company, Industrial Hygienist re Hazard of Monsanto T Acid, dated March 10, 1965. This memo indicates that the final product used as 2,4,5-T spray can be contaminated.

23. Letter to Mr. John Stephens from Dr. R. Emmet Kelly (medical director at Monsanto Chemical Company) dated March 17, 1965 re extreme toxicity of dioxin received

from Dow Chemical.

24. Letter from V.K. Rowe, Biochemical Research Laboratory, The Dow Chemical Company to Dr. Emmet Kelly and others dated March 19, 1965 re meeting of chemical companies.

25. Letter to Mr. Paul Hoffman from Dr. R. Emmet Kelly dated March 30, 1965 re 2,4,5-T problem.

26. Report on the Chloracne Problem Meeting on 3/24/65 from L.G. Silverstein dated March 29, 1965.

27. Letter to Ross Mulholland, Dow Chemical of Canada from V.K. Rowe, Biochemical Research Laboratory, The Dow Chemical Company dated June 24, 1965 re meeting of chemical companies.

28. Document entitled The Chloracne Problem - Biochem's Contribution dated 3/11/65. This is a brief history of Dow's experience with the toxic effects of its trichlorophenol process (Dow document 2868).

29. Internal memo re trichlorophenol summary from J.D. Doedens, Chemicals Department, cc. V.K. Rowe, re chemical companies handling of trichlorophenol problems and Dow's secrecy agreement with Boehringer.

30. Letter to C.A. Highhill, 2,4,-D Plant from L.G. Silverstein, Biochemical Research Laboratory, The Dow Chemical Company, dated August 16, 1966 re testing for chloracne.

31. Letter to K.E. Coulter, Midland Division Research & Development from Alex Widiger, Benzene Research Laboratory, The Dow Chemical Company, dated April 25, 1967 re chloracne research program. The document indicates the slow progress being made in identifying the chloracnegens. It also indicates that chloracne is just cosmetic evidence of serious systemic injury.

32. Letter to W.J. McCoy, Bioproducts Sales, from V.K. Rowe, Biochemical Research Laboratory, The Dow Chemical Company, dated July 25, 1967.

33. Document prepared by Biochemical Research Laboratory, The Dow Chemical Company entitled Chloracne Problem at Fort Saskatchewan Plant, Dow Chemical of Canada, dated 3/21/69.

34. Dow document entitled Distribution of Reported Adverse Effects Following Exposure of Field Workers and Applicators to 2,4-D Formulations, prepared circa 1978 (Dow document 5716).

35. Paper entitled A Dow Canada Backgrounder re The Risk in Spraying 2,4,5-T Herbicide dated June 30, 1982.

36. Pages 22 and 23 of a Cohort Mortality Study prepared by Sobeco Ernst & Young, on behalf of the plaintiffs, dated October 1992 indicating excess deaths in cohort. The study has been served upon the defendants.

14. Attached hereto and marked as Exhibit "D" are copies of the documents described above.

15. I make this affidavit for the purpose of requesting this Honourable Court to permit the proposed amendments to the plaintiff's claim as referenced.

SWORN to at the City of)
Fredericton, in the County)
of York, in the Province of)
New Brunswick, this 8th day)
of January, 1993.)
)
BEFORE ME:)
)
---------------------------)

Commissioner of Oaths
Being a Solicitor
W. Andrew LeMesurier

Jerry K White

Jerry K White

"A" [illegible]

CLARK, DRUMMIE & COMPANY

BARRISTERS AND SOLICITORS

40 WELLINGTON ROW

SAINT JOHN, N.B.

CANADA

THOMAS B. DRUMMIE, Q.C.
DONALD F. MACGOWAN, Q.C.
WILLARD M. JENKINS
BARRY R. MORRISON
FRANK P. HAMM
WILLIAM B. RICHARDS
NORMAN J. BOSSE
W. ANDREW LEMESURIER
SHERRIE R. BOYD
J. GEORGE BYRNE
TIMOTHY M. HOPKINS
M. LISE ALLAIN
DENO P. PAPPAS, Q.C.
WALLACE S. TURNBULL, Q.C.
M. ROBERT JETTE
TERRENCE W. HUTCHINSON
PATRICK J. P. ERVIN
L. PAUL ZED
FREDERICK A. WELSFORD
JOHN M. McNAIR
DONALD J. HIGGINS
KAREN M. COLPITTS
JOHN C. WARNER
MICHAEL J. COMEAU

COUNSEL
RICHARD W. BIRD

MAILING ADDRESS: P.O. BOX 6850
STATION A
SAINT JOHN, N.B.
E2L 4S3

TELEPHONE: (506) 633-3800

TELECOPIER: (506) 633-3811

PLEASE REFER TO:

OUR FILE No.

YOUR FILE No.

November 27, 1992

Messrs. Hanson, Hashey
Barristers & Solicitors
Suite 400, Phoenix Square
P.O. Box 310
Fredericton, N.B.
E3B 4Y9

Attention: David M. Norman, Esq., Q.C.

Dear Sirs:

RE: Agnew and Others v. Dow Chemical and Others

Further to our attendance in court I am calling upon you to deliver your client's Affidavit of Documents forthwith.

In my view the affidavit should contain any and all marketing information and data which your client possesses vis-a-vis N.B. Power. It should contain any and all toxicological studies carried out by your client or in its possession in respect of the herbicides in question, dioxins and any toxicological studies in respect of the various recommended oils to be used as a carrier for the herbicide spray, including kerosene, fuel and diesel oil and transformer oil (PCBs).

Uniroyal's affidavit should also contain reference to any correspondence with other chemical companies, governmental agencies and departments, private companies or individuals in respect of the manufacture, marketing and/or use of 2,4-D and 2,4,5-T as well as any of the related chemicals or chemical compounds involved in the manufacturing process of the referenced herbicides. Customer complaints are also absolutely relevant.

The above documents would include not just letters and correspondence but all internal corporate memos as well as laboratory notes, production logs and any other written, microfilmed, microfiched or computerized data.

As well, the plaintiffs demand that this information not be restricted by the years of exposure. In other words, the plaintiffs are entitled to information which predates 1950 or which was produced after 1967 if in any way it relates to the issues between the parties. One of those issues which is of prime importance is the development of Uniroyal's knowledge and information in respect of the chemicals in question.

I believe that Uniroyal has had more than sufficient time to search its records and prepare the affidavit of documents. I would point out that Dow's affidavit of documents was filed in only a matter of several weeks after the Request was served upon Mr. O'Neil. In my mind Uniroyal has had an excessive amount of time to comply with the request.

Yours truly,

CLARK, DRUMMIE & COMPANY

William B. Richards

WBR/nrg

"B" ult

HANSON, HASHEY

BARRISTERS & SOLICITORS

P. O. BOX 310

SUITE 400. PHOENIX SQUARE

FREDERICTON. NEW BRUNSWICK

E3B 4Y9

TELEPHONE (506) 453-7771
FAX (506) 453-9600

PLEASE REFER TO
OUR FILE NO

910983

December 24, 1992

William B. Richards
Clark, Drummie & Company
Barristers and Solicitors
P.O. Box 6850, Station "A"
Saint John, New Brunswick
E2L 4S3

Dear Mr. Richards:

Re: Agnew and Others v. Dow Chemical and Others

Further to your letter dated December 22, it is entirely up to you when you take advantage of our invitation to see our documents. The purpose of our invitation was to save expense and delay in preparation of an Affidavit of Documents. Therefore, the earlier you meet with me the better.

Yours truly

HANSON, HASHEY

David M. Norman

DMN/te

OFFICES IN FREDERICTON AND SAINT JOHN, NEW BRUNSWICK

"C"
URC

S/C/738/89

IN THE COURT OF QUEEN'S BENCH OF NEW BRUNSWICK
TRIAL DIVISION
JUDICIAL DISTRICT OF SAINT JOHN

BETWEEN: CLARENCE AGNEW AND OTHERS,

Plaintiffs,

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

AND

BETWEEN: JEAN VIVIAN AGNEW AND OTHERS,

Plaintiffs,

- and -

THE DOW CHEMICAL COMPANY, DOW CHEMICAL CANADA INC., CHIPMAN INC., AND UNIROYAL CHEMICAL LTD./UNIROYAL CHEMICAL LTEE.,

Defendants

PROPOSED AMENDED STATEMENT OF CLAIM

THIRD AMENDED STATEMENT OF CLAIM

1. The plaintiffs are individuals with the capacity to sue and variously reside at the municipalities as referenced in Schedules "A" and "B" annexed hereto.

2. The plaintiffs' actions having cause number F/C/373/89 have been consolidated with the actions having cause number S/C/738/89 pursuant to an order of the Court of Queen's Bench on December 10, 1991.

3. The plaintiffs severally bring their actions in this proceeding pursuant to Rule 5.03 of the Rules of Court.

4. The defendant, The Dow Chemical Company, (hereinafter called "Dow Chem"), is a duly incorporated company having its head office in the City of Midland, in the State of Michigan, in the United States of America.

5. The defendant, Dow Chemical Canada Inc., (hereinafter called "Dow Can"), is a duly incorporated company having its head office in the City of Sarnia, in the Province of Ontario and at all times material was a subsidiary of Dow Chem.

6. The defendant, Chipman Inc., is a duly incorporated company having its head office at the City of Stoney Creek, in the Province of Ontario.

7. The defendant Uniroyal Chemical Ltd./Uniroyal Chemical Ltee. (Uniroyal) is a duly incorporated company having its head office in Elmira, Ontario and is joined as a defendant pursuant to an order of the Court of Queen's Bench dated December 10, 1991.

8. Between the years 1950 and 1967 the defendants manufactured, synthesized, produced, distributed and/or sold to the New Brunswick Electric Power Commission herbicides, chemicals or chemical compounds of 2,4-dichlorophenoxy acetic acid (2,4-D) and 2,4,5-trichlorophenoxy acetic acid (2,4,5-T) which contained 2,3,7,8 Tetrachlorodibenzo-p-dioxin ("TCDD").

9. "TCDD" is a highly toxic impurity which is produced in the manufacture of the 2,4,5-T herbicide which was sold to the New Brunswick Electric Power Commission as "Brushkiller" or "Silvex", and as a result of containing

"TCDD" were rendered highly toxic and known to be so by the defendants.

10. Several of the plaintiffs and those individuals whose estates are represented by some of the named plaintiffs (collectively "the users"), whose names are set out in Schedule "A", were employed by the New Brunswick Electric Power Commission variously between the years 1950 and 1967 as herbicide sprayers whose responsibility it was to directly handle and apply the herbicides referenced in paragraph 7 to destroy brush on property owned or controlled by the New Brunswick Electric Power Commission.

11. The defendants had actual knowledge of the method of application of the herbicide chemical and knowledge of the manner of exposure of the plaintiffs to the herbicide.

12. The defendants knew but fraudulently did not warn the users of the high toxicity and likely severe and detrimental health affects which could be contracted or experienced by those who came into physical contact with the herbicides, including respiratory and cardiovascular disorders, liver disease, as well as an increased risk of cancer, diabetes, fatigue, impotency, skin disorders such as chloracne and nervous disorders, as well as death by chemical intoxication.

13. The users, not being warned of the potential hazards of the herbicides, failed to take precautions to avoid either the direct or indirect application to their persons, or ingestion of the herbicides.

14. As a result of their direct contact with the herbicides as described, the users were caused serious and debilitating personal injury or death.

15. As a result of the injurious toxicity of the herbicides the users have suffered significant special and general damages both pecuniary and non-pecuniary.

16. Several other plaintiffs, whose names are set out in Schedule "B", are variously the spouses or children or legal representatives of deceased spouses or children (hereinafter called "Relatives") of the said users of the herbicide applied by New Brunswick Electric Power Commission.

17. The defendants took no precautions, nor made any attempt to safeguard, warn or protect the Relatives from serious injury or death, being the likely consequences to those who used or had more than a casual contact with the said herbicides.

18. The defendant Dow Chem and Dow Can fraudulently misled the public in respect of the toxicity of its herbicide product to human health, and as a result of such fraud kept critical data verifying herbicide toxicity from the plaintiffs to whom they owed a duty of care.

19. The particulars of Dow Chem's fraudulent behaviour referenced above are as follows:

(a) by 1941 Dow Chem knew that highly chlorinated hydrocarbons, including polychlorinated biphenols, posed a potential serious health risk to humans such as referenced in paragraph 12 above, of which skin disorders such as chloracne were but symptomatic.

(b) Dow Chem knew in the 1934-1936 time frame that Dow Chem employees producing Dowicide P contracted severe chloracne. This was a trichlorophenol based product.

(c) Dow Chem knew that in the mid 1940s some of its customers complained to Dow Chem about contracting dermatitis or chloracne from the use of Dow Chem's Dowicide 3 product, a closely related compound to trichlorophenol based products.

(d) Dow Chem knew that at its research lab at 172 Building 2,4,5 trichlorophenol residues caused some worker chloracne during or before 1955.

(e) Dow Chem knew that at its 199 Building the 2,4,5-Trichlorophenol process caused serious chloracne amongst its workers in 1964.

(f) Dow Chem knew that it had a prevailing chloracne problem amongst its workers in the Dowicide plants in the 1950s and 1960s and began research in 1966 on the problem. Dowicides were produced from polychlorinated hydrocarbons.

(g) Dow Chem knew by 1957 that production temperature for trichlorophenol should not be raised above 150°C. To increase production Dow Chem raised production temperature in 1963 in 199 Building which led to the formation of increased levels of dioxin in Dow Chem's 2,4,5-T herbicide.

(h) Dow Chem's 2,4-D and 2,4,5-T, sold to N.B. Power, were produced from chlorophenols and Dow Chem knew that the toxic characteristics of the trichlorophenol process was passed on to the 2,4,5-T herbicide.

(i) By 1957 Dow Chem knew that unwanted chemical compounds being produced in the manufacturing process of 2,4,5-T were extremely toxic and that these compounds were dioxins; and Dow Chem knew that dioxins, especially TCDD could cause serious health risks to humans, including chloracne and liver disorders.

(j) Dow Chem's 2,4-D and 2,4,5-T were oil based. Dow Chem knew by 1956 that these oils were potential health risks to those who sprayed, were exposed to, and breathed the oil mists, and that such oils could cause disease or health conditions such as respiratory ailments, chloracne, liver disease and cardiovascular disease.

(k) Dow Chem organized and hosted a meeting of other chemical companies including Hooker Chemical Corporation, Diamond Alkali Company and Hercules Powder Company in March 1965 for the purpose of promoting private self regulation in the production standards of 2,4,5-T and to forestall government regulation which Dow Chem feared due to the threat to human health of dioxin contained in 2,4,5-T herbicide.

(l) Deliberately and with reckless disregard for the plaintiffs' health Dow Chem did not publicly or in any other manner disclose its experience, knowledge or information as referenced above to the plaintiffs, did not warn the plaintiffs of serious potential health risks from exposure to its herbicide products, and continued to produce and market its products during the 1950s and 1960s to N.B. Power.

20. The particulars of Dow Can's fraudulent behaviour as referenced above are as follows:

(a) Despite having actual knowledge to the contrary Dow Can fraudulently maintained publicly, and to N.B. Power, as recently as August 18th and 19th, 1982, that 2,4,5-T poses no serious risk to human health as set out in letters to The Daily News, a Halifax, Nova Scotia newspaper and to N.B. Power.

(b) Dow Can had the same or similar knowledge as Dow Chem in respect to the toxicity of polychlorinated hydrocarbons, generally, and polychlorinated biphenyls, 2,4,5-T and dioxin specifically, but did not warn the plaintiffs in respect of the toxicity of these products as it had a duty to do.

21. By reason of the foregoing Dow Chem and Dow Can committed fraud against the plaintiffs in producing and/or marketing highly toxic chemicals to N.B. Power for use in its herbicide spray program, and in not warning the plaintiffs about the attendant hazards to ensure their safety, and by never warning them as such, which they had a duty to do.

22. Such failure to warn the plaintiffs denied them the knowledge or information necessary to avoid exposure to the herbicide spray and oils, or having been exposed before 1967, it denied them the knowledge or information to seek proper medical assistance after the fact of exposure, thereby causing them death and injury as referenced.

23. The defendants Dow Chem, Chipman Inc. and Uniroyal individually recommended to N.B. Power with reckless disregard for the plaintiffs' health, the use of either transformer oil, kerosene, fuel or diesel oil as a herbicide carrier in its spray program. Such proposals were made in 1952 by Dow Chem, 1951 and 1956 by Chipman Inc. and 1951 by Uniroyal.

24. The above referenced defendants knew that such oils were potentially extremely hazardous to human health and could cause respiratory and cardiovascular disorders, liver disease, as well as an increased risk of cancer, diabetes, fatigue, impotency, skin disorders such as chloracne and nervous disorders, as well as death by chemical intoxication.

25. Except for experimental purposes dating back to 1951, N.B. Power used such oils as recommended, at various times from 1959 in its spray program.

26. The defendants committed fraud upon the plaintiffs by deliberately and recklessly not warning them or disclosing to them the human health risk of exposure to these oils, and by never disclosing to or warning the plaintiffs as such which they had a duty to do.

27. Such failure to warn the plaintiffs denied them the knowledge or information necessary to avoid exposure to the herbicide spray and oils, or having been exposed before 1967, it denied them the knowledge or information to seek proper medical assistance after the fact of exposure, thereby causing them death and injury as referenced.

28. As a result of the defendants' fraud the plaintiffs became exposed to the herbicides and oils referenced. They died or suffered serious injury to their health, the particulars of which have been provided to the defendants.

29. As well, as a result of the defendants' fraud the plaintiffs could not have reasonably discovered their individual causes of action until sometime after June 30, 1985 which was approximately three months after a preliminary mortality study was completed for the plaintiffs.

30. As a result of their family relationship with the users as described, the Relatives also had significant and regular contact with the herbicides and, as a result, suffered serious and debilitating personal injury or death, the particulars of which will be delivered to the defendants upon request.

31. Furthermore, as a result of the negligence and fraud of the defendants, and the injurious toxicity of the herbicides and oils used, the Relatives have suffered special and general damages, both pecuniary and non-pecuniary.

32. The plaintiffs, therefore, severally claim against the defendants, in negligence and fraud both jointly and severally, as follows:

(a) general damages for personal injury caused by the herbicides containing "TCDD";

(b) special damages, the particulars of which will be delivered to the defendants at or before trial;

(c) special and general damages for loss of past and future income;

(d) in respect of those plaintiffs representing the named estates, damages for wrongful death and for that purpose the plaintiffs rely on Sections 2(1), 3(1), and (2) of the Fatal Accidents Act, R.S.N.B., c. F-7, and amendments thereto;

(e) damages, including punitive and exemplary damages for perpetrating fraud on the plaintiffs.

(f) the plaintiffs also claim damages pursuant to Section 10 of the Medical Services Payment Act, R.S.N.B. c. M-7 and amendments thereto and the Hospital Services Act, R.S.N.B., c. H-9 and amendments thereto;

(g) costs on a solicitor/client basis;

(h) interest and such other relief as this Honourable Court deems just.

33. The plaintiffs plead and rely upon Section 2 of the Contributory Negligence Act, R.S.N.B. c. C-19, and amendments thereto, and further plead the doctrine of res ipsa loquitur in respect of the defendants' negligence.

34. As well, the plaintiffs seek a declaratory order from the court pursuant to Rule 27.06(11) of the Rules of Court that notwithstanding the limitations period set out in the Fatal Accidents Act or the Limitation of Actions Act, that the plaintiffs' claims are not barred as a result of the fraud of the defendants, or any of them.

DATED at Saint John, N.B. this 21st day of December, 1992.	FAIT a le 19
W.B. Richards	
William B. Richards	Avocat du demandeur
Name of Lawyer for plaintiff:	Nom de l'avocat du demandeur:
William B. Richards	

Name of firm: Raison sociale (s'il y a lieu)

Clark, Drummie & Company

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"D" [illegible]

INDEX OF EXHIBITS

1. Two letters to William B. Richards from Dr. Alastair Hay re PCBs, dated 3 November 1992 and November 10, 1992 along with attached C.V. The letters express an opinion in respect of the hazards of chemicals used in the spray program and the non-disclosure by the defendants of those hazards. 36-64

2. Pages 8 and 9 of deposition of V.K. Rowe, former Director of Toxicology for Dow Chemical Company and Assistant Director of Dow's Biochemical Research Laboratory. The testimony acknowledges Dow's early knowledge of chlorinated di or bi phenyls (P.C.B.s) and their toxicity. The testimony was taken in the case of Keister v. Dow, U.S. District Court, Eastern District of Arkansas, July 18, 1990. 65-66

3. Paper entitled Chloracne - Dow Experience. This paper traces in chronological order Dow's history of chloracne, along with the chemical agents in question. (Dow document 1289). 67-97

4. Report of Biochemical Research Laboratory, The Dow Chemical Company re Toxicity of 2,4,5 Trichlorophenoxy Acetic Acid, dated August 25, 1945 (Dow document 1172). 70-98

5. Two pages from Dow Brochure entitled Application Methods and Dosage for Dow Weed and Brush Killer Formulations in which Dow proposes the use of oil as a carrier. This is on N.B. Power microfilm files and in part reads as follows: 99-100 (poor copy)

   Basal Bark Treatment

   2nd paragraph

   Spray Mix: Use 4 gallons of Esteron 245 for every 95 gallons of fuel or kerosene or similar oil. Transformer oil has been used satisfactorily. Do not use water or oil-water emulsions for basal bark treatment. Used transformer oil may be used if available.

Esteron Brushkiller

<u>bottom of page, 1st column
and top of page, 2nd column</u>

Fuel oil may be used....it is questionable whether oil adds to the effectiveness of Esteron Brushkiller. In certain cases when application is made during the summer season with particular emphasis on wetting the stems and bark rather than the foliage, good results have been obtained.

6. Letter to Mr. J.E. Guerette, New Brunswick Electric Power Commission from W.A. Stearman, Chipman Chemicals Limited dated 28 November 1956 proposing use of oil as carrier (N.B. Power files). 101-103

7. Letter to James M. Cruickshank, Naugatuck Chemicals from P.C. Levesque, The New Brunswick Electric Power Commission, dated June 20, 1951 re use of oil in spray program. -105

8. Letter to P.C. Levesque, The New Brunswick Electric Power Commission from James Cruickshank, Naugatuck Chemicals (owned by and defending this action as Uniroyal Chemical Ltd.), dated June 29, 1951 regarding the use of oil in spray program. 106-111

9. Document prepared by The Dow Chemical Company entitled Brush and Weed Control on Railroad Rights of Way by Use of 2,4-D and 2,4,5-T, dated January 26, 1953 indicating safety of product. 112-122

10. Document entitled The New Brunswick Electric Power Commission Transmission Line R-O-W Maintenance Chemical Control Operation Instruction to Foremen indicating safety of product and mixture of herbicide with stove fuel or waste transformer oil. 123-128

11. Page 14 from report of N.B. Power Herbicide Use (1955-64) prepared in 1984 re the sale of Brushkill (2,4-D and 2,4,5-T) by the defendants to N.B. Power. 129

12. Letter to Dr. Andrew G. Goesl, Texarkana, Arkansas-Texas from V.K. Rowe, The Dow Chemical Company dated July 12, 1955 indicating Dow's knowledge of extent of exposure by sprayers. 13

13. Letter to Dr. Knecht, Boehringer Co. from Dr. Schmidt dated 14 November 1955 re hazards of 2,4,5-T (Dow document 1549). -134

14. Letter to L.L. Coulter, The Dow Chemical Company from V.K. Rowe, Biochemical Research Department, dated February 13, 1956 re hazards of oil as used in herbicide spray to human health. 135

15. Letter to Mark Wolf, Biochem Research Lab, The Dow Chemical Company from L.L. Coulter, Agricultural Chemicals Development, The Dow Chemical Company, dated March 20, 1959 requesting information on the toxicity of oil used in Brushkiller formulations. 136-137

16. Letter to L.L. Coulter, Agricultural Chemical Development, The Dow Chemical Company from Mark A. Wolf, Biochemical Research Laboratory, The Dow Chemical Company, dated July 6, 1959 re effects of fuel oil in response to above referenced request. 138-139

17. Memorandum to Mr. George Gagnon from J.E. Guerette, The New Brunswick Electric Power Commission re: Transformer Waste Oil and Oil Drums for use in spray program, dated October 28, 1959. 140-141

18. Letter to Dow Chemical Company from German based C.H. Boehringer Sohn re <u>The chlorakne. Preparation of Trichlorophenol</u>, dated February 11, 1957 (Dow document 1750). The letter purports to assist Dow Chemical in solving its chloracne problem.

19. Letter to Brigadier General Fred J. Delmor, U.S. Army Munitions, Army Chemical Centre, Maryland, from G.E. Lynn, Director of Registration Bioproducts Department, The Dow Chemical Company re Dow's stated position that 2,4-D and 2,4,5-T are non-toxic, dated April 22, 1963 (Dow document 1362) 143-144

20. Letter to Dow Chemicals Company from C.H. Boehringer Sohn re chloracne, dated December 15, 1964 (Dow document 1286). The shared information was to be kept strictly confidential. (See attached english translation by W.B. Trapp, Dow Chemical Company). 145-146

21. Letter to Dr. Hans Merz, C.H. Boehringer Sohn from Walter B.N. Trapp, The Dow Chemical Company, dated January 28, 1965 re dangers of trichlorophenol and secrecy agreemetn between Dow Chemical and Boehringer. 1[illegible]-149

22. Memorandum L.G. Silverstein, The Dow Chemical Company, Industrial Hygienist re Hazard of Monsanto T Acid, dated March 10, 1965. This memo indicates that the final product used as 2,4,5-T spray can be contaminated. 150-161

23. Letter to Mr. John Stephens from Dr. R. Emmet Kelly (medical director at Monsanto Chemical Company) dated March 17, 1965 re extreme toxicity of dioxin received from Dow Chemical. 152

24. Letter from V.K. Rowe, Biochemical Research Laboratory, The Dow Chemical Company to Dr. Emmet Kelly and others dated March 19, 1965 re meeting of chemical companies. 153-154

25. Letter to Mr. Paul Hoffman from Dr. R. Emmet Kelly dated March 30, 1965 re 2,4,5-T problem. 155

26. Report on the Chloracne Problem Meeting on 3/24/65 from L.G. Silverstein dated March 29, 1965. 156-161

27. Letter to Ross Mulholland, Dow Chemical of Canada from V.K. Rowe, Biochemical Research Laboratory, The Dow Chemical Company dated June 24, 1965 re meeting of chemical companies.

28. Document entitled The Chloracne Problem - Biochem's Contribution dated 3/11/65. This is a brief history of Dow's experience with the toxic effects of its trichlorophenol process (Dow document 2868). 164-180

29. Internal memo re trichlorophenol summary from J.D. Doedens, Chemicals Department, cc. V.K. Rowe, re chemical companies handling of trichlorophenol problems and Dow's secrecy agreement with Boehringer.

30. Letter to C.A. Highhill, 2,4,-D Plant from L.G. Silverstein, Biochemical Research Laboratory, The Dow Chemical Company, dated August 16, 1966 re testing for chloracne.

31. Letter to K.E. Coulter, Midland Division Research & Development from Alex Widiger, Benzene Research Laboratory, The Dow Chemical Company, dated April 25, 1967 re chloracne research program. The document indicates the slow progress being made in identifying the chloracnegens. It also indicates that chloracne is just cosmetic evidence of serious systemic injury. 184-187

32. Letter to W.J. McCoy, Bioproducts Sales, from V.K. Rowe, Biochemical Research Laboratory, The Dow Chemical Company, dated July 25, 1967.

33. Document prepared by Biochemical Research Laboratory, The Dow Chemical Company entitled

Chloracne Problem at Fort Saskatchewan Plant, Dow Chemical of Canada, dated 3/21/69.

34. Dow document entitled Distribution of Reported Adverse Effects Following Exposure of Field Workers and Applicators to 2,4-D Formulations, prepared circa 1978 (Dow document 5716). 197-213

35. Paper entitled A Dow Canada Backgrounder re The Risk in Spraying 2,4,5-T Herbicide dated June 30, 1982.

36. Pages 22 and 23 of a Cohort Mortality Study prepared by Sobeco Ernst & Young, on behalf of the plaintiffs, dated October 1992 indicating excess deaths in cohort. The study has been served upon the defendants. 215-219

u / n

WML

School House
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Mr William B Richards
Clark Drummie & Co
40 Wellington Row
Saint John
New Brunswick
Canada

3 November 1992

Dear Bill

Re:PCBs

I have found the literature that I would recommend we use at trial and it is very helpful. It May be more useful if I set it out in sections.

Chlorinated naphthalenes

The first fatal cases of jaundice after exposure to chlorinated naphthalenes were reported in 1937 (Drinker et. al J Industrial Hygiene and Toxicology : Vol 19, page 283 (1937). More extensive reports of the cases were provided in a paper by Greenberg et al (J Ind Hyg & Tox. 21:29 (1939) where it was noted that skin eruptions occurred before the liver disease. The skin eruptions were said to be "characteristic of the dermatitis caused by chlorinated naphthalenes, and until recently was the only disturbance attributed to them". This skin disease is now recognised to be chloracne.

More cases of chloracne following exposure to chlorinated naphthalenes were reported in 1943 (Collier , The Lancet I;72, 1943)and 1944 (Cotter , J Am Med Assoc.125:273 (1944)- one of these cases also had liver disease).

Other cases of jaundice caused by chlorinated naphthalenes, both fatal were reported in 1942 (McLetchie & Robertson, Br Med J. I:691(1942)) and 1946 (Dwyer ,Med J Aust.page 783 (1946).

As a result of these cases above it was recognised that if someone had chloracne they might also have systemic injury as well which had been caused by the naphthalenes. In some cases the liver disease occurred in the absence of skin eruptions.

Animal tests

The first 3 cases of jaundice prompted the manufacturers to ask Cecil Drinker at Harvard Medical School to investigate the toxicity of the chlorinated naphthalenes in animals. Drinker showed that the higher chlorinated congeners were the most toxic and that they caused marked liver damage.(Bennett et al J Ind Hyg & Tox J 20:97 (1938)). More importantly, Drinker and his colleagues also looked at PCBs in these animal tests and they reported that of the"various chlorinated hydrocarbons tested, chlorinated diphenyl(another word for PCB) gave evidence of being the most toxic"(Page 121 same ref). In another papagraph the authors say :"thus, a mixture of trichlornaphthalenes (chlorine content 49.4 per cent) proved to be the least toxic of any of the compounds tested,whereas Chlorinated diphenyl (chlorine content 65.0 per cent) was highly toxic even in low concentrations."

The paper I have quoted from which discusses the animal tests could not be misinterpreted. The evidence was clear. PCBs were more toxic than chlorinated naphthalenes in rats.

Asca result of their work in animals Drinker and his colleagues recommended some occupational exposure standards for PCBs. The same values were suggested for the penta and hexa chlorinated naphthalenes based on animal feeding and inhalation studies. The recommendations were for exposures were 0.5 mg per cubic metre. (Drinker, J Ind Hyg & Tox 21:155(1939)

PCBs

The first and extremely useful PCB publication was by Schwartz (Am J Public Health 26:586 (1936)) in which he pointed out that : "In addition to these skin lesions[chloracne], symptoms of systemic poisoning have occurred among workers inhaling these fumes[PCBs]. Those working with the chloro diphenyls haave complained of digestive disturbances, burning of the eyes,impotence " and he then refers to symptoms caused by different chemicals. So PCBs caused skin and internal problems and this was known in 1936!

Hygiene

In a later paper Schwartz and Peck (NY State J Med 43:1711(1943)) say that the "most potent of these chemicals,as far as their acne-forming properties are concerned, are the chlornaphthalenes,chlordiphenyls[PCBs],and chlordiphenyloxides." To prevent occupational acnem workers should not be exposed to their fumes and therefore processes should be "totally enclosed". In addition the "workers should be provided with clean Cloveralls and underclothes daily. These should be laundered at the plant and cleaned in such a way that no chlorinated hydrocarbons remain on them". Schwartz and Peck also say that shower baths should be compulsory, there should be sufficient facilities so that workers do not have to wait too long for a shower, and suitable cleansers should be provided to remove chemicals from the skin.

I think that this should about cover it!

With best wishes

03 NOV '92 18:43

Alastair Hay
Senior Lecturer in Chemical Pathology

Ulf

School House
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Arthington
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England

Mr William B Richards
Clark Drummie & Co
40 Wellington Row
Saint John
New Brunswick
Canada

10 November 1992

Dear Bill

Re: Agnew *et al* vs Dow and others

As a result of reading the documents of the chemical companies in this case I am prepared to state the following:

PCBs

All 3 chemical companies recommended the formulation of their herbicides in transformer oil. Naugatuck recommended this practice in 1951; Chipman made a similar recommendation in 1957, and Dow also advocated the use of transformer oil in one of its brochures, which would appear to have been written in the 1950's. Transformer oil contains polychlorinated biphenyls (PCBs) and it was well known in the late 1930's that these products were harmful. By 1936 it was clear that these chemicals not only caused the skin disease chloracne, but that they were also the cause of systemic illness as well. By 1938 it was known that the PCBs would damage the liver of experimental rats and that they were more toxic to the liver than the chlorinated naphthalenes. Chlorinated naphthalenes were known at that time to have been responsible for the deaths of 3 workers.

Chloracne and dioxin

Dow had a chloracne problem for many years. Between 1934-6 severe outbreaks occurred amongst employees producing Dowicide P. The chemicals involved in this process were Sodium tetrachlorophenate and o-chloropoenylphenol.

In the 1930's there was one laboratory case following exposure to a chlorinated dibenzofuran.

A case of what would appear to have been chloracne (sometimes referred to as Dowicide bumps) was reported in a sawmill worker in 1936. The chemicals responsible were reported to be Dowicides (possibly Dowicide H - sodium tetrachlorophenoxide).

In the 1940's Dow customers are reported to have contracted chloracne from Dowicide 3 , a mixture of 4- and 6- chloro-2-phenylphenol.

A severe case of chloracne occurred in the benzene research laboratory in 1942 when someone recycled a trichlorophenol residue in a glycol solvent.

Cases of the skin disease also occurred in workers employed on Dow 6X production in the 1950's and 1960's. At least one severe and several mild cases are reported to have been detected.

Cases of chloracne also occurred at the Boehringer Company in West Germany in 1954/55 and the company was put in touch with Dow to get help. Boehringer was also making 2,4,5-trichlorophenol. On 11 February 1957 Boehringer wrote to Dow to explain where the chloracne producing agent was formed in the 2,4,5-trichlorophenol process. The chloracnegen was identified as 2,3,7,8-tetrachlorodibenzodioxin(dioxin) in 1957. Boehringer also informed Dow about the need to keep the temperature low in the trichlorophenol process. Higher temperatures would lead to the formation of more of the dioxin. The contents of this letter appear to have been ignored. Had the information been noted, Dow would not have tried to increase the production of trichlorophenol in 1964 by raising the temperature of the process.

Dow's trichlorophenol process was known to produce materials capable of causing chloracne as far back as 1944. Samples from the trichlorophenol process were tested for their potential to cause chloracne in the sensitive rabbit-ear test in 1944, and again in 1957. The samples gave a positive response indicating that they had the potential to cause chloracne in man. These samples would have been contaminated with dioxin.

It was not until some of Dow's own employees working on the trichlorophenol process developed chloracne in 1964 that Dow took steps to remedy the situation. The main reason for the outbreak of chloracne was a change in the trichlorophenol manufacturing procedure designed to increase production.

In 1965 Dow convened a secret meeting of the various manufacturers of trichlorophenol -and the 2,4,5-T herbicide made from it- to inform them about the dioxin problem. Dow scientists explained that the dioxin would be carried over from the trichlorophenol process into the finished 2,4,5-T herbicide which was on sale. Dow was anxious to avoid chloracne occurring in members of the public, fearing that if this happened, the whole 2,4,5-T industry would be hit and restrictive legislation banning the herbicide,or severely controlling it, would follow. Dow said that the dioxin contamination of the herbicide should not exceed 1 part per million(ppm). Many 2,4,5-T formulations on the market in 1965 had dioxin concentrations exceeding this level. Dow purchased 2,4,5-T acid from other manufacturers and one batch of 100,000 lb from Monsanto had a dioxin level of between 3-7 ppm (according to an internal memo of 25 February 1965). Dow was concerned about the quality of the Monsanto product but allowed the 100,000 lb to be used because the chemical was already in packages, and already in the pipeline.

Some 10 cases of chloracne are reported to have occurred at Dow Canada in 1966. The cases were at Fort Saskatchewan and the people involved were making Dowicides, possibly Dowicide G.

The meeting of the manufacturers remained an internal matter. And the serious consequences of dioxin contamination of 2,4,5-T did not become public knowledge until 1970. In 1969 the Bionetics Research Laboratory report noting that 2,4,5-T caused malformations in rodents, was published. The following year it was suggested that the teratogen capable of causing these malformations was dioxin. There had been no restrictions on the sale of 2,4,5-T, nor any suggestions that it posed a health risk, before this.

It is my view, based on the documents I have read, that Dow had ample warning of the dangers of dioxin in its trichlorophenol process, but did nothing about it until 1964/5. Dow had received clear guidance from Boehringer in 1957 about the problem areas in the trichlorophenol process. It also knew (as far back as 1944)that samples from the process could cause chloracne. The cause of the Boehringer problems was identified in 1957 and the information openly published. Dow also knew that chloracne might not be the only consequence of exposure to dioxin, but that internal injuries (particularly to the liver) might also occur. German doctors documented the consequences of dioxin exposure in papers published in 1957. The earlier history of the chlorinated napthalenes also indicated that chloracne might be but a warning of other, internal, injuries.

Yours sincerely

Alastair Hay

Alastair Hay,Ph.D.
Senior Lecturer in Chemical Pathology
University of Leeds.

CURRICULUM VITAE

Name:	Alastair Watt Macintyre Hay
DOB:	21st April 1947
Place of birth:	Glasgow, Scotland
Nationality:	British
Degrees:	BSc (Hons), Chemistry IIA - London 1969 PhD, Biochemistry, London 1973
Work Address:	Department of Chemical Pathology Old Medical School University of Leeds Leeds LS2 9NL England
Present Appointment:	University Lecturer in Chemical Pathology since April 1979 (University of Leeds) Leeds, England
Former Appointments:	Research Fellow - Zoological Soc. of London September 1972 - November 1977 Research Fellow - University of Leeds Department of Animal Physiology and Nutrition December 1977 - March 1979
Societies:	Biochemical Society British Pharmacological Society Association of Clinical Biochemists Bone and Tooth Society British Toxicology Department
Marital Status:	Married - wife - Wendy One son - Tom - D.O.B. 7.1.80

Scholarships

1977 - Scientific Journal Nature: Travelling Scholarship

Membership of UK Government Committees

(i) Medical & Toxicology Panel. Ministry of Agriculture Fisheries and Food. 1987 - date.

(ii) Advisory Committee on Recycling. Department of Trade and Industry Sept 1989-March 1990.

(iii) Working Group on the Assessment of Toxic Chemicals (WATCH) - Health and Safety Executive Sept 1989-date.

(iv) Colloquium for UK Members of the Ad-Hoc Group of Scientific on Limit Values. Health & Safety Executive June 1990-date.

(v) Working Group to Review the Indicative Criteria for Occupational Exposure Limits. Health and Safety Executive. Dec 1990-Jan 1991.

Other Committees

(vi) Working Party on Health Effects of Hazardous Waste. British Medical Association. Dec 1989-Jan 1991. Report published June 1991. Hazardous Waste and Human Health, Oxford University Press 1991.

Fellowship

Invited to become Fellow of Collegium Ramazzini June 1991

Consultancies

Participant in World Health Organisation/International Agency for Research on Cancer - Workshop on Health Risks of Exposure to Chlorinated Dibenzodioxins and Chlorinated Dibenzofurans (January 1978).

Consultant to United States Environmental Protection Agency - on Health Risks of Chlorinated Dioxins - Cincinnatti July 1983.

Consultant to United States Environmental Protection Agency on Health Risks of Chlorinated Dibenzofurans - Cincinnatti May 1986.

Other Consultancies

(i) Expert witness for Royal Commission on the use and Effects of Chemical Agents on Australian Personnel in Vietnam. Sydney, Australia - July 1984.

(ii) Expert Witness on behalf of Vietnam Veterans in Agent Orange lawsuit in New York March/April 1984.

(iii) Expert Witness on behalf of former Monsanto employees in lawsuit against Monsanto - Charleston/West Virginia, United States - July 1984.

Grant Reviewing

i) National Environmental Research Council

ii) The Wellcome Trust

iii) Greenpeace Environmental Trust

Journal Reviewing

i) Nature

ii) Annals of Clinical Biochemistry

iii) Disasters

iv) Clinical Science

v) British Journal of Industrial Medicine

Collaboration with Industrial Companies

i) Sterling Winthrop. Investigation of the role of Danazol in the treatment of Osteoporosis 1988-89.
£34,000 grant with D Purdie.

ii) Upjohn. Investigation of the effect of Provera on Bone Mineral Turnover. 1989-90.
£24,000 grant with D Purdie.

iii) Schering Health Care: Investigation of role of combined oestrogen/progestagen on bone mineral turnover. 1989-90.
£29,000 grant with D Purdie.

iv) Schering Health Care: 2 year investigation of the efficacy of a combined oestrogen/progestagen on treatment of osteoporosis. Dec 1991-June 1993.
£186,000 grant with Prof J Dette.

Current Research Students

2 full-time PhD students.

(i) Investigation of effect of heavy metals on immune function Financed by Association of Commonwealth Universities. Oct 1989-Sept 1992.

(ii) Investigation of the effect of toxins on immune function in seals. Financed by Greenpeace Environmental Trust. Oct 1990-Sept 1993.

1 Part-time PhD student

The effect of myocardial infarction and antibiotics on the renal tubule. Oct 1984-date

Previous Research Students

2 awarded PhDs.

2 completed 3 year research period but failed to write up in time allotted

3 students undertaking research projects for Fellowship of Medical Laboratory Sciences.

Research Grant Awards

Previous

Leeds Western Health Authority 3 year 1982-5; MRC Studentship. 1986-89.

Current

Greenpeace Scientific Trust - Effect of Toxins on Immune function in seals.
£12,500 Oct 90-Sept 91
£13,000 Oct 91-Sept 92
Collaborative project with Dr S Evans.

Gulbenkian Foundation
Public Attitudes to Recycling
£7,000 - Dec 1990

See also - industrial collaboration.

Grant Applications submitted

Application to MRC for 3 year (£86,000) grant to set up a pharmacokinetic model to predict methadone concentrations in plasma after a single dose of the drug, and to investigate the pharmacological/psychological factors which may contribute to addicts remaining addicted to opiates following treatment with methadone.

Other Responsibilities

(i) Responsibility for Departmental Toxicology Service for Leeds General Infirmary (since September 1984).

(ii) Member of Leeds District Health Authority Drugs Advisory Committee. 1987-90.

(iii) Member Leeds City Council Waste Research Group Sept 89-

(iv) Member Leeds City Council Advisory Committee Reducing Hazardous Waste discharges from domestic sources.

Invitations to Speak at International Conferences/Workshops

1. 5th Parathyroid Conference. Oxford 1975. Paper presented: Comparative Aspects of Vitamin D transport.

2 2nd International Workshop on Calcified Tissues, Israel March 1986. Paper presented. 'A Possible role for vitamin D in vertebrate evolution'.

3. 3rd Workshop on Vitamin D. Asilomar California 1977. Paper presented. Evolution of vitamin D serum transport proteins'

4. International Agency for Research on Canecer. Member of Working Group to assess the carcinogenicity of polychlorinated dibenzodioxins & dibenzofurans. Lyons,France. January 1978.

5. 3rd International Workshop on Calcified Tissues. Israel March 1988. Paper presented: Vitamin D Metabolism in New World Primates'.

6. Health Effects of Halogenated Aromatic Hydrocarbons. Conference Organised by New York Academy of Sciences May 1978. Paper presented. 'Accidents in Trichlorophenol plants: a need for realistic surveys to ascertain risks to health'.

7. Chlorinated Dioxins and Related Compounds: Impact on the Environment. Rome, October 1980 Paper presented 'Exposure to TCDD: the health risks'

8 Human and Environmental Risks of Chlorinated Dioxins and Related Compounds. Arlington, Virginia October 1981. Member of panel to assess human epidemiology and to write the report on 'Human Observations'.

9. Symposium on the Biochemistry of Vitamin D Function Biochemical Society London 1981. Paper Presented 'The role of membrane lipids in the expression of vitamin D function in the intestinal mucosal cell'.

10. Royal Society of Chemistry Symposiun on Chemistry and Society. Leeds 1981. Paper presented 'The social consequences of producing and using the herbicide 2,4,5-T'.

11. Herbicides in War: The long-term Ecological and Human Consequences, Ho Chi Minh City, Vietnam January 1983. Paper presented on 'Experimental Toxicology and Cytogenetics'.

12. United States Environmental Protection Agency. Member of Working Group to Produce 'Health Assessment Document for Polychlorinated Dibenzo-p-dioxins' Cincinnati. July 1983.

13. American Chemical Society Symposium on Chlorinated Dioxins and Dibenzofurans in the Total Environment. Washington D.C. August 1983. Paper presented 'The mutagenic properties of 2,3,7,8-Tetrachloridibenzo-p dioxin'.

14. Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel in Vietnam. Expert testimony presented at 3-day hearing in Sydney, Australia July 1984.

15. United States Environmental Protection Agency. Member of Working Group to produce report 'Health Assessment Document for Polychlorinated Dibenzofurans'. Cincinnati, May 1986.

16. Royal Society of Chemistry Downland Lecture. University of Sussex. November 1986. Paper presented 'Chemical Warfare in the 1980's: a return to trenches'.

17. International Symposium on Chemical Warfare. Sorbonne, Paris. January 1989. Paper presented on 'Toxicology of chemical warfare agents'.

18. International Conference of Cocoa Workers. Sponsored by Oxfam Ilheus, Brazil, May 1989. Paper presented: 'Toxicology of Pesticides used in cocoa production'.

19. Institution of Occupational Safety and Health, Selby/Leeds, October 1989, Paper presented: 'Exposure limits for worker protection: fact or fiction.

20. Science and the Total Environment/British Council. Dundee April 1990. Paper presented: ' A recent assessment of cocoa and pesticides in Brazil: an unhealthy blend for plantation workers'

21. United Nations Environment Programme (UNEP). Member of small working group to produce report for UNEP Secretary General on 'Chemical Weapons and the Human Environment'. Geneva July 1990.

22. 5th International Environmental Impact Seminar: Environmental Monitoring and Control. October 1990. organised by Industry and Environment Associates. Paper presented: 'Toxicology in the Workplace and Surrounding Waste Disposal Sites'.

23. United States Senate Foreign Relations Committee. Invitation to present expert testimony at International Parliamentary Consultation Conference on Kurdish Human Rights. Washington D.C. March 1991. Paper presented: 'Chemical Warfare and the Kurds'.

24. Symposium : Science and the Citizen. Nuffield Foundation. Manchester, June 1991. Paper presented: 'A Working Scientist's Perspective'.

25. International Workshop on Dioxin Standards, Raleigh, North Carolina. September 1991. Paper presented: 'Exposure to dioxins in industry'.

Also:

Presentations/Posters to Nutrition Society/Endocrine Society/Bone & Tooth Society/Association of Clinical Biochemists.

Seminars to Depts of Chemistry/Biochemistry/Medicine at Universities of Edinburgh/Heriot Watt (2x)/Manchester/Sussex/Bradford/Royal Holloway College (London)/Kings College.

Seminars at Hope Hospital Manchester/Highlands Hospital, Enfield/Pontefract Hospital-Pontefract/Leeds Infirmary/Trent Polytechnic Dept of Chemistry (2x)/Northern College (Barnsley).

PUBLICATIONS

Books

1) Alastair Hay. 'The Chemical Scythe: Lessons of 2,4,5-T and dioxin'. 265pp. N.Y. & London. Plenum Press. August 1982. Reprinted 1985. **

2 a) *Sean Murphy. *Alastair Hay and Steven Rose. 'No Fire, No Thunder'. The threat of chemical and biological warfare. ** 135pp. London. Pluto Press. February 1984.

b) United States. Monthly Review Press. New York. November 1984.

c) Japanese translation - - The English Agency (Japan Ltd) August 1985.

3) *Peter Hurst. *Alastair Hay, Nigel Dudley. The Pesticide Handbook. 358pp. London. Journeyman August 1991 **

Parts of Books

1. Hay, A.W.M. Comparative aspects of vitamin D transport. In: Calcium Regulating Hormones. The Proceedings of the 5th Parathyroid Conference. pp 405-407. Amsterdam. Exerpta Medica (1975).

2. *Hay, A.W.M. & Watson, G. Evolution of vitamin D serum transport proteins in vitamin D: Biochemical, Chemical and Clinical Aspects related to Calcium Metabolism (Ed. by Norman, A.W. et al) pp 483-489. Berlin and New York. Walter de Gruyter, (1977).

3. *Hay, A.W.M., Hassam, A.G., Crawford, M.A., Stevens, P.A., Mawer, E.B. & Cane, L. The ability of 1a, 25-dihydroxycholecalcifero to alter the fatty acid composition of phosphoglycerides in rat intestinal mucosa and smooth muscle in Vitamin D Basic Research and its Clinical Application (Ed. by Norman, A.W., et al). 1031-4. Berlin & New York. Walter de Gruyter,(1979).

4. Halogenated hydrocarbons. *Hay A.W.M. in 1981 EST Yearbook of Science & Technology. McGraw-Hill pp 198-200.

5. *Hay, A.W.M. Exposure to TCDD: the health risks in chlorinated dioxins and related compounds. Impact on the Environment. Edit. byO. Hutzinger, et al. pp 589-600. Oxford. Pergamon Press,(1982).

6. *Hay, A.W.M., Mawer, E.B., Hassan, A.G., Crawford, M.A. & Stevens, P.A. The role of essential fatty acids in vitamin D dependent calcium absorption in the intestine/ Proc. of 5th vitamin D workshop. Vitamin D: chemical biochemical and clinical endocrinology of calcium metabolism. pp 309-311. Berlin & N.Y. Walter de Gruyter (1982)

7. *Hay, Alastair. Experimental toxicology and cytogenetics: an overview in Herbicides in War, the long term human and ecological consequences. Ed. by A.H. Westing. pp 161-166. London & Philadelphia. Taylor & Francis 1984.

8. Cung, Binh Trung, Hay A.W.M. et al. Experimental toxicology and cytogenetics: Symposium summary in Herbicides in War, the long term human and ecological consequences. Ed. A.H. Westing. pp 153-155. London & Philadelphia. Taylor & Francis 1984.

9. Hay, Alastair. 'Biological Weapons' in Sci.Tech. Report. Current issues in Science & Technology. Edit. by John Turney. pp. 162-164. Pluto Press. London & Sydney. (1984).

10. Hay, Alastair. 'Yellow Rain' in Sci.Tech.Report. Current issues in Science & Technology. Edit. by John Turney. pp. 164-166. London & Sydney. Pluto Press. 1984.

11. *Hay, Alastair. 'The Mutagenic properties of 2,3,7,8-Tetra-chlorobenzo-p-dioxin' in 'Chlorinated Dioxins and Dibenzofurans in the Total Environment - II'. Edit. by L.H. Keith, G. Choudhary & C. Rappe. Butterworth Publishers 1984. pp.297-307.

12. Hullin, R.P., Morgan, D.B., Antonis, A.H., Clegg, C., Dodds, T., Hay, A.W.M., Holtan, J., Penney, M., Schorah, C.J., Sheltawy, M. & D.P. Srinivasan. The biochemical and nutritional state of 1200 patients in a mental hospital. In Biological Psychiatry - Recent Studies (Ed. by G.D. Burrows, T.R. Norman & K.P. Maguire) London John Libbey & Co Ltd., pp 240-252. (1985)

13. *Alastair Hay. Environmental Pollution. Review article for B.B.C. Domesday Project, November 1986.

14. Hay, A. Chemical Warfare and the Kurds. A paper presented at the International Parliamentary Consultation Conference on Kurdish human rights, Washington DC 27 February 1991. (in press)

Full Papers in Refereed Journals

1. *Hay, A.W.M., Sinclair, A.J. & Ray, W.G. Some useful techniques in thin layer chromatography. Journal of Laboratory Practice 23, 403-404, (1974).

2. *Hay, A.W.M. & Ray, W.G. A simple macrotome. Journal of Laboratory Practice. 24, 35 (1975).

3. *Hay, A.W.M. & Watson, G. Binding of 25-hydroxyvitamin D_2 to plasma protein in New World monkeys. Nature 258, 150 (1975).

4. *Hay, A.M.W. The transport of 25-hydroxycholecalciferol in a New World monkey. Biochemical Journal 151, 193-196 (1975).

5. *Hay, A.W.M. & Watson, G. The plasma transport proteins of 25-hydroxycholecalciferol in mammals. Comparative Biochemistry and Physiology. 53B, 163-166 (1976).

6. *Hay, A.W.M. & Watson, G. The plasma transport protein of 25-hydroxycholecalciferol in fish, amphibia, reptiles and birds. Comparative Biochemistry and Physiology. 53B, 167-172 (1976).

7. *Hay, A.W.M. & Watson, G. The binding of 25-hydroxycholecalciferol and 25-hydroxyergocalciferol to tissue binding proteins in a New World and an Old World primate. Comparative Biochemistry and Physiology. 56B, 131-134 (1977).

8 *Hay, A.W.M. & Watson, G. Vitamin D_2 in vertebrate evolution. Comparative Biochemistry and Physiology. 56B, 374-380 (1977).

9. *Hay, A.W.M. & Watson, G. Binding properties of serum vitamin D transport proteins in vertebrates for 24R, 25-hydroxycholecalciferol and 24S, 25-hydroxycholecalciferol in vitro. Comparative biochemistry and Physiology. 58B, 42-48 (1977).

10. *Hay, A.W.M. & Jones, G. The elution profile of vitamin D_2 metabolites on Sephadex LH20. Clinical Chemistry.25, 473-475 (1979).

11. *Hay, A.W.M. Accidents in trichlorophenol plants: a need for realistic surveys to ascertain risk to health. Proceedings of the New York Academy of Sciences. 320, 321-324 (1979).

12. *Hay, A.W.M., Hassam, A.G., Crawford, M.A., Stevens, P.A., Mawer, E.M. and F. Sutherland Jones. Essential fatty acid restriction inhibits vitamin D dependent calcium absorption. Lipids. 15, 251-4 (1980).

13. =Fleming, J., Cooper, E.H., Hay, A.W.M., Morgan, D.B. & Parapia, L. Tubuloproteinuria in Cancer Chemotherapy. La Riceroa Clinica Laboratoire. 10, 135-141 (1980).

14. =Fleming, J.J., Child, J.A., Cooper, E.H., Hay. A.W.M., Morgan, D.B. & Parapid, L. Renal tubular damage without glomerular damage after cytotoxic dugs and aminoglycoside. Biomedicine, 33. 251-254 (1980).

15. =Christine Emery, Russell M. Young, D. Brian Morgan, Alestair W.M. Hay, David Tete-Donkor & Jill Rubython. Tubular damage in patients with hypokalaemia. Clinica Chimica Acta 140, 231-238 (1984).

16. *Sheltawy, M., Newton, H., *Hay, A., Morgan, D.B. & Hullin, R.P. The contribution of dietary vitamin D and sunlight to the plasma 25-hydroxy vitamin D in the elderly. Clinical Nutrition, Human Nutrition 38C, 191-194 (1984).

17. =Gillies, D.R.N., Hay, A., Sheltawy, M. & P.J.Congdon. Effect of phototherapy on plasma 25 (OH)- vitamin D in neonates. Biology of the Neonate. 45, 225-227 (1984).

18. Newton, H.M.V., Sheltawy, M., *Hay, A.W.M. & D.B. Morgan. The relations between vitamin D_2, and D_3 in the diet and plasma 25 OHD_2 and 25 OHD_3 in elderly women in Britain. American Journal Clinical Nutrition 41, 760-764 (1985).

19. *Hay, A. Cremation and the Environment. Pharos International Journal of the Cremation Society of Great Britain. 52, 16-25 (1986)

20 =Price, D.E., Mehta, A., Pak, B.K., Hay, A. and M.P. Feely. Effect of low-dose phenobarbitone on 3 indices of hepatic microsomal enzyme ** induction. British Journal of Clinical Pharmacology. 22, 744-747 (1986).

21. + *Nadkarni, S., Faye, S., A.W.M. *Hay Experience with the use of the Toxi-Lab TLC System in screening for morphine/heroin abuse. Annals of Clinical Biochemistry. 24, 211-212 (1987).

22. *Purdie, D., *Hay, A., Abbas, S. Effects of Danol on mineral homeostasis in normal postmenopausal women. Journal of the Royal Society of Medicine 80, 681-2 (1987).

23. +*Nadkarni, S., *Hay, A.W.M., Faye, S. and P.J. Congdon. Theophylline and caffeine in neonates. Annals of Clinical Biochemistry 25, 408-410 (1988).

24. =Pullar, T., Birtwell, A.J., Wiles, P.G., Hay, A. & M.P. Feely. Use of a pharmacological indicator to compare compliance with tablets prescribed ** to be taken once, twice or three times daily. Clinical Pharmacology and Therapeutics. 44, 540-545 (1988).

25. =Wolff, K., Sanderson, M. and Hay, A.W.M. A rapid horizontal method for detecting drugs of abuse. Annals of Clinical Biochemistry 27, 482- ** 488 (1990).

26. =Wolff, K., Shanab, M.A., Sanderson M. and Hay, A.W.M Screening for drugs of abuse: The effect of heat treating urine for the safe handling ** of samples from Aids. Clinical Chemistry 36(6) 908-910 (1990).

27. *Wolff, K., Sanderson, M., Hay*, A. W.M*. & Raistrick, D. Methadone concentrations in plasma and their relationship to drug dosage. Clinical ** Chemistry 37 (2) 205-209 (1991).

28. =Wolff, K., Hay, A. & Raistrick, D. Methadone in Saliva. Clinical Chemistry 37(7) 1297-8 (1991)

29. =Wolff, K., Hay, A. & Raistrick, D. High dose methadone & the need for plasma drug measurements. ** Clinical Chemistry (Case Report) (in press)

30. +Wolff, K., Hay, A*., Raistrick, D*., Calvert, R. & Feely, M. Measuring compliance in methadone maintenance patients: use of a pharamacological indicator to estimate methadone plasma levels. Clinical ** Pharmacology & Therapeutics 50, 199-207 (1991)

31. = Lloyd, O., et al ,Lloyd, D.L.L., Lloyd, M.M., Williams F.L.R., McKenzie, A. & A. Hay. Toxicity from Ragwort and Fat Cow Syndrome, or from industrial chemicals: the value of epidemiological analysis for interpreting clinicopathological findings. The Science of The Total Environment 106, 83-96 (1991).

32 Hay, A. A recent assessment of Cocoa and Pesticides in Brazil: An unhealthy blend for Plantation Workers. The Science of the Total Environment 106, 97-109 (1991).

33 Wolff, K., Hay, A.W.M. and Raistrick, J. Plasma methadone measurement and their role in methadone detoxification programmes. Clinical Chemistry (in press).

34 =Purdie, D., Hay, A. & Everett, M. Effects of SHD 386L on mineral metabolism in the human menopause. Maturitas (in press).

Editorials, Conference Reports, Reviews in Scientific Journals

1. Hay, A.W.M. Vitamin D at Asilomar. Report of 3rd workshop on Vitamin D. Nature 266, 17-18 (1977).

2. Hay, A.W.M. Combatting rickets. Nature 270, 289 (1977).

3. Hay, A.W.M. Tetrachlorodibenzo-p-dioxin release at Seveso. Disasters 1(4), 289-308 (1977).

4. Hay, A.W.M. Identifying carcinogens. Nature, 269, 468-470 (1977)

5. Hay, A.W.M. Halogenated Hydrocarbon Effects. Nature, 274, 533-534 (1978).

6. Hay, Alastair, Dioxin workshop. Nature, 276, 304 (1978).

7. Hay, Alastair. Seveso: No answers yet. Disasters, 2, 163-168 (1978)

8. Hay, A, Complexities of vitamin D metabolism still increasing. Nature, 278, 509-510 (1979).

9. Hay, Alastair. Skin toxicology. Nature, 279, 375 (1979)

10 Hay, Alastair. Dioxin and 2,4,5,-T: what are the risks? Nature, 284, 111 (1980).

11. Hay, Alastair. New pathways for chlorinated dioxins. Nature. 294, 514-515 (1981).

12. Hay, Alastair. Vitamin D: sunlight and precursors. Nature, 297, 364 (1982).

13. Hay, A. It kills weeds, but what about people? New Scientist, 98, No. 1314 pp 158-161 (1982).

14. Hay, A., Murphy, S., Robinson, J.P. & Rose, S. The poison cloud hanging over Europe. New Scientist 93, No.1296 pp. 630-635 (1982).

15. Hay, Alastair. At war with chemistry. New Scientist 101, 12-18 (1984).

16. Alastair Hay. How the chemical industry could clean up its act. New Scientist 12 February 1987, vol. 113. p. 63-64.

17. Alastair Hay. How to identify a carcinogen. Nature 332. 782-783 (1988).

18. Alastair Hay. Recycling in Wastes Management. Vol. 80 (2) 130-132 (1990).

19. Alastair Hay. Testing Time for the tests. Nature 350, 555-556 (1991).

Pamphlets/Reports

1 =Robinson, J.P., Murphy, S., Hay, A.W.M., & Rose, S. The threat of chemical weapons. Spokesman Pamphlet, 38pp (1982)

2. =Alastair Hay & Geoff Wright. One is not enough. The Case for recycling. Friends of the Earth. 46pp (1989).

3 ≈Jane Forshaw, Alastair Hay & Geoff Wright.
Fashionable Waste: The Make-up of a Recycler.
Save Waste and Prosper, Leeds. 46pp (1990).

4. ≈Westing, A, Ezz, E.A., Goldblat, J. Hay, A.W.M. et al.
Chemical Weapons and the Human Environment. Report to the Secretary General of the UN Environment Programme. July 1990 (in press).

Scientific Abstracts and Letters to Journals

32

Other Scientific Articles/Book Reviews

111 contributions, principally to Nature.

Radio/Television Scripts

2 scripts written by me for programmes I presented.

LIST OF PUBLICATIONS

Books

1) Alastair Hay. 'The Chemical Scythe: Lessons of 2,4,5-T and dioxin'. Plenum Press. N.Y. & London. 265pp. Published August 1982. Reprinted 1985.

2a) *Sean Murphy. *Alastair Hay and Steven Rose.
'No Fire, No Thunder'. The threat of chemical and biological warfare. Pluto Press. London 135pp. Published February 1984.

b) United States. Publishers - Monthly Review Press. New Press. New York. November 1984.

c) Japanese translation - Publisher - The English Agency (Japan Ltd) August 1985.

3) =Peter Hirst, Alastair Hay, Nigel Dudley.
Dare We Spray: A Pesticide Handbook. Pluto Press (1991) in press.

Pamphlets/Reports

1. Robinson, J.P., Murphy, S., Hay, A.W.M., & Rose, S. The threat of chemical weapons. Spokesman Pamphlet. 38pp (1982)

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Chemical Weapons and the Human Environment. Report to the Secretary General of the UN Environment Programme. July 1990 (in press).

Scientific Abstracts and Letters to Journals

1. =Sinclair, A.J., Fiennes, R.N.T.W., Hay, A.W.M., Watson, G., Crawford, M.A., & Hart, M.G. Linolenic acid deprivation in Capuchin monkeys. Proc.Nutr.Sc., 33, 49A (1974).

2. Hay, A.W.M. The transport of vitamin D in the Giant Panda, Trans.Zool.Soc.Lond., 33, 139-140 (1976).

3. Hay, A.W.M. Vitamin D transport in vertebrates. Proc.Anat. Soc.J.Anat. 122. 195 (1976).

4. Hay, A.W.M. A possible role for vitamin D in vertebrate evolution. Proc. of the 2nd International Workshop on Calcified Tissues. (Abstract). Isr.J.Med.Sci. 12, 31-32 (1976).

5. Hay, A.W.M. Vitamin D_2 metabolism in New World primates. Proc. of the 3rd International Workshop on Calcified Tissues. Israel 6-9th March 1978.

6. *Hay, A.W.M., Darling, M. & Watson, G. Rickets and vitamin D metabolism in primates. Proc.Nutr.Soc. 37. 42A (1978)

7. Hay, Alastair. Vitamin A assay in UNICEF. Foodmix Disasters. 2, 82-84 (1978). (Letter).

8. =Rivers, J.P.W., Frankel, T.L.L. Juttla, S & Hay, A.W.M. Vitamin D in the nutrition of the Cat. Proc.Nutr.Soc. 38, 36A (1979).

9. =Care, A.D., Pickard, D.W., Ross, R., Hay, A.W.M., Garel, J.M. & Redel, J. A comparison of the effects of 25,26- dihydorxycholecal - ciferol (25,26-DHCC) and 24,25-DHCC on calcitonin secretion rate in vitamin D depleted pigs. J Endocrinology 85 (2), 54-55 (1980).

10. *Hay, A.M.W., Mawer, E.B., Hassam, A.G., Crawford, M.A. & P.A. Stewart. Intestinal, 1,25-dihydroxycholecalciferol-dependent calcium absorption inhibited by essential fatty acid restriction. Proceedings of Nutri.Soc. 39, 89A, (1980).

For your files we enclose data sheets covering our herbicides and current prices on Brushkill and 2,4,5-T, but suggest you enquire for our best price when your total requirements are known.

I trust the enclosed information will enable you to overcome some of your problems. I have heard many complimentary remarks about your paper at the Eastern Weed Meeting last month in Quebec City. It was apparently very well received. If you require any further information please let us know and we will try to help you out.

Yours very truly,

CHIPMAN CHEMICALS LIMITED.

W. A. Stearman

WAS/ie

enc.

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"7"
WAC

Fredericton, N. B.

June 20th, 1951.

Naugatuck Chemicals,
Elmira, Ontario.

Attention: Mr. James M. Cruickshank, Sales Manager,
Agricultural Chemicals, Eastern Division

Dear Sir:

We wish to thank you for your letter of May 22nd.

We will be pleased to experiment with your Brush Bane Amine and your Brush Bane Low Volatile, which have both been received.

The crew has been in the field for the past two weeks and has been engaged in mapping the growth on the eight and one half acre experimental plots which have been set up in our Saint John District. It is hoped that spraying may be started this week.

As you no doubt remember, we are intending to try four different sprays using water as a carrier and then repeat these sprays using oil as a carrier.

We would appreciate any information you could supply on the concentration to be used when preparing ten gallon quantities of spray solution. (i.e. using 2, 4-D, 2, 4, 5-T and brush bane) with oil as a carrier.

Our water solution is made up of one pint of chemical to ten gallons of water.

It appears that we may wish to purchase a slide viewer at a later date and we wish to thank you for your interest in this matter.

Yours very truly,

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

P. C. Levesque,
Superintendent of District Operations.

PWH/bks

~8" with

The following is a transcript of Document # 2484-2485, from the N.B. Power Affidavit of Documents
92.

Naugatuck Chemicals
Division of Dominion Rubber Company Limited

Letter to: (The New Brunswick Electric Power Commission)
Fredericton, New Brunswick.

Attention: Mr. P.C. Levesque, Superintendent of District Operations

Gentlemen:

Thank you for your letter of June 20th ----- ------- the use of brush control Herbicides.

In your letter you ask for information -- of materials to ---- when preparing ten gallon quantities of spray solution with oil as a carrier. This will depend to a ----ester (?) --- coverage that you can obtain from the nozzle with(out) ---- ---- equipped. I believe we mentioned in an earlier letter (that the) Shawinigan Water & Power, when using waste transformer oil were able to ---- coverage with 10 gallons per acre of brush. However, when -------- ------ of fuel oil, the same nozzle applied -- ----- gallons of oil mixture per acre of brush.

We would suggest that you first (determine) ----- large an area can be covered with -- gallons of oil, for determining how many gallons would be required for (an acre). (When this) determination has been made, you would then be able to (tell) ---- ---- to mix in the quantity of oil to cover one acre, ---- recommendation of ---- 1/2 to 1 gallon of (transformer) will find that ---- ---- quantity of oil ---- --- and that you will have to (add) from 1 quart to two quarts ---- 10 gallon amount of oil.

With regard to the (waste transformer) ---- experimental quantity, we should (point) out (that) ------ oil and therefore can be tested only in a water (carrier).

You mention that your water ------ of chemical to 10 gallons of water, and that a --- ---- (10) gallons of the solution is applied to an acre and that ---- apply one gallon of brush - bane to the acre. In a ------- of carrier does not have too much influence on the resulting ------ and the important factor is the amount of 2,4-D or 2,4,5-T ---- two that is applied over a certain area, since the water, or the ------- matter is simply a carrying agent to aid in dispersing the ----- evenly over the area. Where the foliage is dense, naturally (you would be) --- required to

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Naugatuck Chemicals Continued June 29, 1951

assure proper wetting and penetration into the (inside) leaves ---- brush being sprayed. When using a water spray on 8 to 10 foot tall brush (it is) usually necessary to employ from 100 to 150 gallons of water to adequately cover one acre of brush, when using oil it is possible to cover one acre ----.

---- with
---- particles
(drums or dump) of brush.

------ (certain)
---.

(Yours very truly,)

NAUGATUCK CHEMICALS

(James A. Cruickshank)
(Sales Manager - Agricultural Chemicals
Eastern Division)

Jam. A. Cruickshank/dgh

The above was deciphered by Alastair Hay 16th August 1992.

Naugatuck Chemicals

Gentlemen; Attention of Mr P.C. Levesque, June 29 1955.

Thank you for your letter of June 20th . . the use of brush control Herbicides

In your letter you ask for information . . of materials to . . . when preparing ten gallon quantities of spray solution with oil as a carrier. This will depend to a . . . coverage that you can obtain from the nozzle with . . . equipped. I believe we ~~same~~ mentioned in an earlier letter (. . .) Shawinigan Water & Power, when using waste transformer oil . . . able to . . . coverage with 10 gallons per acre of brush. However . . . of fuel oil, the same nozzle ~~application~~ applied . . . . . . gallons of oil mixture per acre of brush

We would suggest that you first (b . . .) large an area can be covered with . . gallons of oil, for determining how many gallons would be required for (an acre). . . . determination has been made, you would then be able to (tell) . . . . to mix in the quantity of oil to . . . recommendation of . . . ½ to 1 gallon of . . . will find that . . . quantity of oil . . . and that you will have to (add) from 1 ~~pint~~ quart to two quarts . . . 10 gallon amount of oil.

With regard to the (. . .) . . . experimental quantity, . . . oil and therefore can be tested only in a water (? carrier).

You mention that your water . . . of chemical to 10 gallons of water, and that a . . . (? 10) gallons of the solution is applied to an acre and that . . apply one gallon of brush - . . . to the acre. In a . . . of carrier does not have too much influence on the ? resulting . . . and the important factor is the amount of 2,4-D or 2,4,5-T . . . two that is applied over a certain area, since the water, or the . . . matter is simply a carrying agent to aid in dispersing the . . . evenly over the area. Where the foliage is dense, naturally (? you would be) required to assure proper wetting and penetration into the (inside) leaves brush being sprayed. When using a water spray on 8 to 10 foot tall brush (? it is) usually necessary to employ from 100 to 150 gallons of water to adequately cover one acre of brush. When using oil it is possible to cover one acre ..

Page 2

. . . with

(clump) of brush.
particles

- - - - -

. . . . (carbon)

. . .

(Yours very truly)
NAUGATUCK CHEMICAL

John A. [illegible]/dgh

(Sales Manager - Agriculture
- Eastern Division)

deciphered by Alastair Hay 16 August 92.

(6)

Naugatuck Chemicals

Division of Dominion Rubber Company Limited

June 29 1951

[illegible]

Attention: Mr. [illegible]

Gentlemen:

Thank you for [illegible] letter of June [illegible] the use of brush control herbicides.

In [illegible] letter you ask for information [illegible] materials [illegible] used when preparing [illegible] quantities [illegible] with oil as a carrier. This will depend [illegible] coverage that you can obtain from the nozzle [illegible] equipped. I believe we mentioned in an earlier letter that [illegible] Water & Power, when using waste transformer oil [illegible] coverage with 10 gallons per acre of brush. However, when [illegible] fuel oil, the same nozzle [illegible] gallons of [illegible] per acre of brush.

[illegible] large an area can be covered with one gallon of [illegible] for determining how many gallons would be required [illegible] determination has been made, you would then be able to [illegible] to mix in the quantity of oil [illegible] recommendation of [illegible] 1 gallon of [illegible] will find that [illegible] quantity of oil [illegible] and that you will have to [illegible] 10 gallon amount of oil.

With regard [illegible] experimental quantity, we should [illegible] oil and therefore can be tested [illegible] in a water carrier.

[illegible] that your [illegible] of chemical to 10 gallons [illegible] water, and [illegible] 10 gallons of the solution [illegible] acre [illegible] apply one gallon of brush-[illegible] acre. [illegible] of carrier does [illegible] have too much influence on the results [illegible] and the important factor is the amount of 2,4-D [illegible] that is applied over a certain area, since the water, or [illegible] matter is simply a carrying agent to aid in dispersing the [illegible] evenly over the area. Where the foliage is dense, naturally more [illegible] required to assure proper wetting and penetration into the inside leaves [illegible] brush being sprayed. When using a water spray on 8 to 10 foot tall brush, it is usually necessary to employ from 100 to 150 gallons of water to adequately cover one acre of brush. When using oil, it is possible to cover one a[illegible]

[illegible]

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~9"
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1206

BRUSH AND WEED CONTROL ON RAILROAD RIGHTS OF WAY

BY USE OF 2,4-D AND 2,4,5-T

PAPER PRESENTED BEFORE THE TORONTO RAILWAY CLUB

TORONTO, CANADA

January 26, 1953.

Hillard L. Smith
The Dow Chemical Company
Midland, Michigan

INTRODUCTION

Chemicals have been used on the ballast section for weed and grass control for about 40 years in the U.S. and Canada. A large percentage of the chemicals that have been used for this purpose have been applied with on-track equipment, either by the railroads themselves or by the companies in the business of rendering weed control service to the railroads.

Two selective herbicides, 2,4-D and 2,4,5-T have been used for brush and weed control on rights of way for several years. It is this phase of vegetation control which the speaker will discuss with you this evening.

SELECTIVE HERBICIDES USED FOR WEED CONTROL IN AGRICULTURAL CROPS ALSO PROVE TO BE USEFUL FOR THE RAILROADS

It has been known for about 15 years that some organic chemicals act as plant growth regulants. More recently it was found that some of these compounds produced metabolic disturbances in some kinds of weeds which caused them to die. Earlier work was centered around herbaceous weed control. An early published article on the use of 2,4 Dichlorophenoxyacetic Acid (2,4-D) appeared in an August 1944 issue of "Science."

Various research groups found that 2,4-D could be used for controlling broadleaved weeds in wheat, oats, rye, barley, corn, flax and certain other agricultural crops. About this same time it was found that 2,4-D would also control certain woody plants or brush. Various formulations of 2,4-D were used for brush control on utility rights of way in 1945-1946. Observations of the results of brush control with 2,4-D showed that some woody plants were not controlled. Another selective herbicide, 2,4,5-Trichlorophenoxyacetic Acid (2,4,5-T) was then found to control some of the 2,4-D resistant woody plants. This herbicide was used on a small scale in 1947 and on a limited commercial basis in 1948. Various formulations containing mixtures of 2,4-D and 2,4,5-T were used for brush control in 1947-1948. In 1949 commercial preparations were on the market containing mixtures of 2,4-D and 2,4,5-T for brush control on rights of way.

The speaker has followed the use of 2,4-D and 2,4,5-T on railroad rights of way since 1947. The first work was done with knapsack sprayers on a small scale in 1947. In 1948 the Delaware, Lackawanna & Western and the Seaboard Air Line Railroads used some on-track spray equipment for spraying brush. During the 1949 season more roads wanted to try out this new method of brush and weed control. About this same time various Canadian Railroad groups started testing programs of their own. In 1951 a weed control service organization, working in cooperation with the Canadian National Railroad personnel used on-track equipment for spraying brush and weeds on rights of way. The results of this spraying in 1951 were so encouraging that a rather extensive program was planned and carried out in 1952; also the Canadian Pacific Railroad carried out extensive tests in widely separated areas in 1952. During 1952 more than 25 different roads in the U. S. had rather extensive brush control programs with 2,4-D and 2,4,5-T. It is anticipated that there will be a considerable increase in the use of 2,4-D and 2,4,5-T by the railroads in Canada and the U.S. in 1953.

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CHEMISTRY OF SELECTIVE HERBICIDES - 2,4-D AND 2,4,5-T

Chemicals used in the manufacture of 2,4-D and 2,4,5-T are: benzene, phenol, tetrachlorobenzene, 2,4-Dichlorophenol, chlorine and mono-chloroacetic acid.

In order to use these herbicides the acids of 2,4-D and 2,4,5-T must be reacted further to form salts (sodium, amine) and esters (methyl, ethyl, iso-propyl, butyl, amyl, iso-octyl, propylene glycol butyl ether, etc.). Early work by various investigators showed the esters of 2,4-D and 2,4,5-T to be more effective than the salts for brush control.

The following esters of 2,4-D and 2,4,5-T are considered to be highly volatile: methyl, ethyl, iso-propyl, butyl and amyl (pentyl). Low volatile esters, such as the propylene glycol butyl ether esters have been on the market since 1950. In addition to the low volatility, the effectiveness of the esters on woody vegetation is of utmost importance. Low volatility does not necessarily mean high effectiveness. Some esters are low in volatility and yet are low in activity. Storage characteristics of the formulation must also be considered in Canada and northern United States.

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HOW 2,4-D AND 2,4,5-T CONTROLS WOODY PLANTS

2,4-D and 2,4,5-T kill by upsetting normal plant metabolism and plant growth processes. Speed of action varies with the physiological condition of the plant and also with the rate of growth as influenced by environment.

When applied to foliage these compounds penetrate the waxy covering of the leaves and reach living cells and are then translocated through the conductive tissue associated with carbohydrates. Best movement occurs when leaves are manufacturing excessed of carbohydrates which are being moved downward to stems and roots.

When applied to bark as in basal or stump treatment most of the movement is, as a solution in the oil carrier, downward to the crown buds. That is why it is important in basal and stump treatment to apply the chemical in a liberal volume of oil.

than 2,4-D or a mixture of 2,4-D - 2,4,5-T for basal bark spraying. Basal bark spraying has been done the year around. Some disagreement as to the best time to apply a basal spray has been reported. Some woody plants that are fairly resistant to foliage sprays are very susceptible to a basal spray. Good examples of this are red and sugar maple. A basal spray with oil does not lend itself to on-track equipment. The spray may be applied with a knapsack or off-track power equipment. Basal bark treatment is an aid in spraying in areas of sensitive crops. Spraying can be done after the crop has been harvested or before planting.

C. Stump Treatment

Tall brush or brush in areas of sensitive crops may be cut and the stumps treated at the time of cutting. 2,4,5-T generally speaking gives better results than a mixture of 2,4-D and 2,4,5-T or 2,4-D alone. Oil is used as a carrier and the spray may be applied with a knapsack sprayer or off-track power equipment. The bark and any exposed roots are thoroughly wet with the spray. An oil soluble dye may be used as a marker. Thorough coverage and adequate volume is of utmost importance. This method of brush control can be used any time of the year, but does not lend itself to on-track equipment.

<u>HANDLING AND SPRAYING 2,4-D AND 2,4,5-T FORMULATIONS</u>

As ordinarily handled, these products are not likely to cause skin irritation, eye irritation or skin sensitation.

METHODS OF BRUSH CONTROL WITH 2,4-D AND 2,4,5-T

A. Foliage and Stem Spraying

This method of brush control is done during the growing season and is by far the most widely used by the railroads, telephone, power, pipeline, roadside and various other groups. Water is used as a carrier of the esters of 2,4-D and 2,4,5-T. Spraying can be done after the leaves of the woody vegetation are fully expanded until a few weeks before frost. In southern Ontario this period is usually about June 1 to August 15. The spraying period in other parts of Canada will depend upon the length of growing season and must be considered when working out a brush spraying program. A foliage and stem spray not only controls the woody vegetation but also controls the broadleaved weeds and vines on the rights of way. The selective herbicides, 2,4-D and 2,4,5-T do not kill established grasses when used in recommended concentrations. This leaves the grasses on the right of way to prevent erosion. Foliage and stem spraying lends itself very well to on-track spray equipment.

B. Basal Bark Spraying

This method of brush control involves spraying uncut standing brush using oil (#2 fuel or diesel) as a carrier of the herbicides. The brush is sprayed from the ground line to a height of 12 - 15 inches. Thorough wetting at the ground line, completely encircling the woody plant, is of utmost importance. Best results are obtained on brush that has a diameter of two inches or more. Generally speaking 2,4,5-T is more effective

They are not absorbed through the skin to any appreciable extent, and in the amounts likely to be inhaled, are not hazardous. The ingestion of harmful amounts is not likely.

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During the last five years there have been numerous reports of injury or death of livestock and wildlife supposedly from eating crops, weeds, and woody plants treated with 2,4-D and 2,4,5-T.

At a recent weed meeting in New York City, S. N. Fertig, Department Agronomy - Cornell University, Ithaca, New York, has the following to say on this subject:

> "There are no known cases of actual herbicidal poisoning from field application of presently used herbicides marketed as non-poisonous. All cases of herbicidal poisoning of livestock and wildlife that have been definitely diagnosed have been caused by one of the following: (1) lead, (2) arsenic, (3) 'hardware disease', (4) poisonous plants, (5) old age, (6) parasites, (7) drowning, (8) poor marksmanship ('hot' lead), (9) contaminated feed or (10) injection or oral dosage of some medicine or drug. In all cases which have been carefully surveyed, even though the herbicide has been associated with the trouble, it has in no case been directly or indirectly related to the deaths reported."

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ON-TRACK EQUIPMENT FOR APPLYING 2,4-D AND 2,4,5-T AS A FOLIAGE AND STEM SPRAY

Since this method of brush and weed control lends itself very well to on-track equipment, it will be discussed more fully. Results obtained using these selective herbicides are dependent upon several factors, one of the most important of which is proper application equipment. Since 1948 practically all the service companies and some of the railroads have designed equipment for applying these products to the right of way.

Several unique pieces of equipment have been designed to apply the spray. The spray is applied at a speed variation of 6 to 12 miles per hour. In some instances, an entire 200 foot right of way (usually the ballast section is not sprayed) may be sprayed in one operation. This represents about 20 acres per mile of track. Orchard type guns, fire and off-center nozzles are usually used in applying the chemical. By using large orifices and relatively low pressures (50 - 150 psi) the spray is literally rained on the vegetation at volumes often exceeding 200 gallons per acres, depending upon the height and density of vegetation, the proper application equipment and the experience of the indifidual making the application.

SPRAY CONCENTRATION AND WHAT TO EXPECT IN RESULTS OBTAINED

Water is used in diluting the brush killer formulation, usually 1 gallon of formulation (highly effective, low volatility esters containing 2 pounds 2,4-D and 2 pounds of

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2,4,5-T Acid equivalent) per 100 - 150 gallons of water. Most species of brush and weeds can be controlled with this mixture. A sufficient amount of spray is applied to give thorough wetting of the leaves and stems. One application per season is sufficient to control brush. A second application may be necessary the second or third year, depending upon the degree of control obtained the first year. Don't expect to get 100% kill the first year. The degree of control will depend upon many factors such as; species of woody plants present, moisture conditions of the soil soil type, root system of the brush, method of application, coverage obtained, etc. Generally speaking one good foliage spray will control 60% to 90% of the woody vegetation as well as a large percentage of the weeds present. The amount of root kill is less than top kill or reduction in the number of stems present. However, it should be pointed out that even though top kill may not be obtained, there is very little growth of the brush the first or even the second growing season after spraying. Some of the oaks behave in this manner.

ECONOMICS OF THE USE OF 2,4-D AND 2,4,5-T FOR BRUSH AND WEED CONTROL

According to one of the railway magazines, wage rates rose more than 350% between 1933 and 1950. This explains why it costs so much to cut a mile of railroad right of way today. Cutting brush by hand or mechanical methods is like a man getting a hair cut; it has to be done again in a short period of time. On-track equipment application of 2,4-D and 2,4,5-T for brush and weed control can be accomplished at a saving of 40 to 80% on labour. One piece of properly designed spray equipment can spray 30 miles or more per day. If a width of 40 feet is sprayed on each side of the ballast section, this means that 300 acres of brush and weeds are sprayed per day. It would take many days for a section gang to cut the same 30 miles of brush.

Off-track power equipment is used extensively for brush control on telephone and power line rights of way in Canada and United States. The cost of spraying brush by this method is broken down into about one-third for chemical and two-thirds for application. The savings by spraying over cutting is about 25 to 60%. The cost of using on-track equipment for brush control is broken down into one-third for application cost and two-thirds for chemical cost which is just opposite that for off-track equipment.

A

CHEMICAL GROWTH CONTROL

INTRODUCTION:

In recent years many large utilities both in Canada and the United States, as well as far off Australia, have experimented with certain types of chemicals which curtail and eradicate all or most types of woody growth found on transmission line rights-of-way. Most of the utilities found that by use of this chemical treatment they could, over a period of a few years, almost completely stamp out all woody growth on their rights-of-way.

The chemical as opposed to mechanical skirting or cutting kills the trees, plants and bushes to and including the roots, thus there is no regrowth. This means that the right-of-way does not have to be periodically reskirted.

On the basis of the above information the Commission carried out an experimental programme of their own during the late spring, summer and early fall of 1950 and 1951. Results obtained were encouraging and the Commission has now embarked on a small scale spraying programme.

PROCEDURE:

Crew Complement: An average crew should be made up as follows :

1 - Foreman
1 - Truck driver
3 - Utility men (Mixers, relief sprayers, water carriers)
6 - Spray-men

The Foreman and truck driver should be temporary or permanent Commission employees. The other men are to be casual or local labor.

EQUIPMENT:

7 - knapsack pressure tank type sprayers with brass or copper tanks. (Most suitable of the types tried to date has been the Dobbins Sprayer).

A supply of rubber replacement parts for these sprayers should be carried as well as one or two spraying wands and several disc type nozzles and a considerable length of rubber hose.

1 - Large galvanized garbage can (to be used for preparing the mix).

6 - 5 gallon containers (for carrying water or oil).

4 - Water buckets.

3 to 4 - 45 gallon drums, with taps.

6 - Single bitted axes (for cutting large trees).

2 - Large funnels.

1 - 50' metallic tape.

400 to 500' - Aluminum tie wire.

1 - Large thermos jug.

1 - 1 pint measure.

SPRAYING MATERIALS:

2,4-D	(liquid)	-	5 gallon cans
2,4-D + 2,4,5-T	(liquid)	-	5 gallon cans
Ammate	(powder)	-	25 lb. packages

2,4-D: To be used for normal growth excluding the following species- all evergreens, maple and some brambles.

2,4-D + 2,4,5-T: To be used where large number of evergreens, maple or brambles are encountered.

Ammate: To be used for treating (in the powdered form) any newly cut stumps.

MIXTURE

One pint of 2,4-D to 10 gallons of water.
One pint of 2,4-D + 2,4,5-T to 10 gallons of water.
Ammate used dry or 1/4 lb. to 1 gallon water.

One pint of 2,4-D to 10 gallons of stove or fuel oil.
One pint of 2,4-D + 2,4,5-T to 10 gallons of stove or fuel oil.

Ammate not soluble in oil.

CHEMICAL GROWTH CONTROL

EFFECTS OF RAIN:

Permissible to spray reasonably dry growth one hour after rain.

Chemical will be effective on all growth sprayed one hour prior to rainfall. All growth not sprayed one hour prior to rainfall must be resprayed.

WATER AND OIL MIXES:

Any reasonably clean water may be used in preparing the mix. If dirty water is used it will be found to clog the nozzles and other parts of the sprayer. If water is not available on the right-of-way it may be trucked to the nearest spot accessible to the right-of-way in 45 gallon drums and carried to the mixing point in the 5 gallon containers. If a stout stick is available the 5 gallon containers can be hung from the stick and with the ends of the stick carried on the shoulders of two men the water can easily be carried over rough terrain.

If it is not felt to be economical to transport water to the mixing point oil may be used in the mix. A greater coverage can be obtained with a smaller amount of oil than can be obtained with water, using the same amount of chemical. Using water coverage can usually (depending on density of growth) be obtained with 7 pints of the chemical. With oil the same coverage can be obtained using 4 pints of the chemical. For general use however the cost of the oil is prohibitive. Any type of light oil can be used including waste transformer oil.

MIXING POINT:

The mixing point is simply any location on the right-of-way where the chemical spray is mixed and should be located so that the men spraying can refill their sprayers with a minimum loss of time.

USE OF TIE WIRE:

The tie wire is cut in lengths sufficiently long to span the width of the right-of-way and is then strung across the right-of-way at 30 or 40 foot intervals to sub divide it. One or two sprayers then work in each sub-division and are thus enabled to give their area a complete coverage, i.e. they work from one limit to another and then move the rear wire ahead.

SPRAYING:

The Sprayers are carried on the back and the pump handle agitated until it "pumps hard". At this point the pressure is sufficiently built up to give a fine heavy spray. The pressure will stay up for several seconds and a few pumps of the handle will usually be sufficient to bring it up again when the pressure falls off.

Care should be taken to saturate all the leafy part of the growth and any large stem areas. From these areas the plant carries the chemical to it's roots where the actual kill takes place.

Caution: Should a large amount of the concentrated spray come in contact with the skin it should immediately be washed off. Extreme care should be exercised to make sure that neither concentrated spray nor mix gets in the eyes.

USE OF AMMATE:

If any large trees are cut the stumps should be liberally spread with ammate.

DRIFT:

The fine spray has a tendency to drift and extreme care should be used in spraying near farm crops and ornamental shade trees as the spray can be injurious and even if it is not the public is quick to blame something unknown to them for a crop or tree blight.

STREAMS:

Large quantities of spray in brooks, streams or irrigation ditches can do harm some distance from the spraying operation.

TOXIC AFFECTS:

Cattle or other animals that might feed on vegetation which has been sprayed will suffer no ill effects from it, nor is it harmful to fish.

FOLLOW UP:

The first years spraying will not and is not expected to give a 100% kill. This is due to many factors the most prominent of which is the sheltering of one bush or plant by another. For this reason and others, it is necessary to do a spot treatment follow-up during perhaps the next two years.

SPRAYING:

The Sprayers are carried [illegible] and the pump handle agitated until it "pumps hard", at [illegible] the pressure is sufficiently built up [illegible] heavy spray. The pressure will stay up for several [illegible] a few pumps of the handle will [illegible] be sufficient to bring it up again when the pressure falls off.

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This consists simply of [illegible] spraying [illegible] spraying. [illegible] full crew.

CARE OF SPRAYERS.

The chemicals used are [illegible] do deteriorate the rubber parts of the sprayers, [illegible] these parts are not too expensive [illegible] to obtain. It is therefore imperative that the sprayers be thoroughly flushed out with water after every [illegible]

HEIGHT OF GROWTH:

It is not economical to spray rights-of-way on which the average height of the growth exceeds four and one-half (4½) to five (5) feet.

ESTIMATES OF AMOUNT AND VALUE OF HERBICIDE USED AND CONFIRMED AND POSSIBLE SUPPLIERS (1955-1964)

YEAR	ACRES	ESTIMATED POUNDS OF ACTIVE INGREDIENT	ESTIMATED GALLONS OF CONCENTRATE	ESTIMATED COST OF MATERIAL USED	Sherwin Williams	(CIL) GREEN CROSS	PURCHASES CHIPMAN	DOW	NAUGATUCK	TOTAL	
1955	830	4,500	563	$ 4,700	6,100	-	-	-	-		6100
1956	4208	23,100	2,888	24,200	12,330	-	11,400[1]	-	1,800	13,200	25,500
1957	4011	22,100	2,763	23,200	10,012	5,900	9,500	-	1,000	16,400	20,500
1958*	3435	18,900	2,363	19,800	—	4,300	200	16,200[1]	130	20,830	16,500
1959	1678	9,200	1,150	9,600	3733	3,400	360	-	2,100	5,860	6200
1960	1173	6,500	813	6,800	—	-	170	8,900	-	9,070	9000
1961	1493	8,200	1,025	8,600	—	-	400	1,500	1,500	3,400	3400
1962	1264	7,000	875	7,300	—	3,300	1,500	5,300	3,700	13,800	10500
1963	1401	7,700	963	8,100	—	6,200	6,700	1,600	200	14,700	8500
1964	2396	13,200	1,688	14,100	—	11,000	14,000	5,300	1,200	31,500	20.500
				Total $126,400							$126,700

1. Confirmed purchases of Brushkill. All other figures represent purchases from companies, but not confirmed purchases of Brushkill.

* 19 1/3 (870 gal) carried over to 1959

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THE DOW CHEMICAL COMPANY

MIDLAND MICHIGAN

July 12, 1955

Dr. Andrew G. Goesl
Daniel-Harrell Clinic
Medical Arts Building
317 State Line Avenue
Texarkana, Arkansas-Texas

Dear Dr. Goesl:

Mr. R. A. Crandall of our Agricultural Chemical Division at St. Louis has asked me to reply to your letter of June 25th addressed to that office.

I am very sorry to hear that you have a patient who is suffering from mild hepatitis following use of our Esteron 245. Our studies of the toxicology of this material have been conducted on laboratory animals and livestock, and while mild hepatic symptoms have occurred, the dosages in all cases have been rather massive and by the oral route. Furthermore, effects upon the hepatic or renal systems seemed to appear only after rather large doses were given and after other more drastic effects such as myotonia, anorexia, and gastritis were experienced. Thus, if the patient had swallowed the material in substantial amounts, it would not be unreasonable to expect some transient hepatic and perhaps kidney injury to follow other primary symptoms.

It is recognized, of course, that such experimental work is suggestive but not conclusive as far as human subjects are concerned.

As you are probably aware, we have manufactured and sold Esteron 245 and related materials for several years. Millions of gallons have been used and many people have been exposed. To our knowledge, there has never been a case of systemic toxicity attributed to these materials except perhaps where it has been swallowed accidentally or with suicidal intent. An occasional case of dermatitis has been reported, but in most of these cases, the diluent oil (fuel oil or kerosene) has been shown to be the causative agent.

The significance of this plant and field experience is not appreciated until one realizes that there are many custom spraying firms in this country and abroad whose employees do little

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else but apply these materials. It is not unusual for these men to have their clothing wet with the material for hours a day, day after day. We, of course, do not recommend such practice and do our best to discourage it, but nevertheless, it does occur.

In view of our laboratory findings and the experience we have had, we doubt very much if the application of Esteron 245 by your patient could have been in any way related to his hepatitis.

I am sending a copy of your letter together with a copy of this reply to Dr. H. H. Gay, Director of our Medical Department, and thereby will ask him to contact you directly with his opinions in the matter.

If we can be of any further assistance, please do not hesitate to contact us.

Sincerely yours,

VKR

V. K. Rowe
Biochemical Research Department
2-280 Building

VKR/bb

enc.

P.S. I am enclosing a reprint entitled, "Summary of Toxicological Information on 2,4-D and 2,4,5-T Type Herbicides and Evaluation of Their Hazards to Livestock Associated with Their Use." Recognizing that this information does not apply directly to human beings, we believe it is indicative of the type of thing which can be expected.

V.K.R.

cc: Dr. H. H. Gay
R. A. Crandall
H. L. Smith
G. J. Williams

"13"
UAL

1549

Municipal Hospital Kassel
Medical Department

Kassel, 14 Nov 1955

2 Years after
Test Exposure

MN117354

Dr. Knecht
Boehringer Co
Ingelheim

COPY

A summary of our observations of the six cases of trichlorophenol intoxication we examined, reveals the following:

All cases did not come immediately, but only after considerable time after the toxic effect, to our attention. Therefore, acute damage to the liver could no longer be observed or evaluated. The observed changes in the liver was completely identical in all patients and there is no doubt that there was a certain amount of liver damage induced by the toxin, although apparently minor and with good prognosis. Al to the prognosis, however, it must be cautioned that the time of observation was too short to form a definite opinion.

The present late pictures after 2,4,5-T poisoning show increased pigment deposits in the liver cells, whereby the pigment is primarily iron free and there is a reaction of the Kupfer cells. There are only minor fibrotic changes in the liver, that is only a slight thickening of the normally present periportal tissues, but not of the type of tissue growth typical of the chronic hepatitis or beginning cirrhosis. Cell damage was only found in the described case (Hammer). However, in the case of Exel, there was a viral hepatitis, possibly because of decreased resistance of the organ towards invading viruses. To completely evaluate the pigment, it must be mentioned that we found in the case of Cleres, during later examination, that a part of the previously iron-free pigment now contained iron. This confirms our

DOW 1520544

earlier belief about the nature of the pigment, namely that there is a case of masked protein-iron binding, i.e. a precursor of hemosiderosis. Due to the identity of the pictures in all six patients, we definitely conclude that there is an effect of 2,4,5-T on the liver. We can therefore admit new patients from your company for observation only if you definitely insist. However, we do think it advisable to perform a liver biopsy on one or two of the examined cases in about ~~3~~-4 months, in order to observe the course of the condition.

With best colleagual greetings

s/Dr. Wildhirt

Dr. Schmidt

DOW 1520545

Stadtkrankenhaus Kassel
Medizinische Abteilung

Kassel, den 14.11.55

Herrn
Dr. Knecht-Fa. Boehringer
Ingelheim

Abschrift

Wenn wir somit einmal zusammenfassen, was wir bei den bisher untersuchten 6 Fällen mit Trichlorphenolintoxikation gesehen haben, so ergibt sich folgendes:
Sämtliche Fälle kamen nicht unmittelbar, sondern erst nach längerem Intervall nach der Toxineinwirkung zu uns. Infolgedessen waren akute Schädigungen der Leber nicht mehr zu sehen und auch nicht zu erwarten. Die beobachtete Veränderung der Leber war bei allen Patienten völlig identisch und lässt garkeinen Zweifel darüber aufkommen, daß es tatsächlich zu einer gewissen Schädigung der Leber durch die Toxineinwirkung gekommen ist, allerdings von offensichtlich nur geringem Umfang und günstiger Prognose. Allerdings muß hinsichtlich der Prognose noch die Einschränkung zur Vorsicht gemacht werden, daß die Beobachtungszeiten noch zu kurz sind, um ein endgültiges Urteil abgeben zu können. Die jetzigen Spätbilder nach Trichlorphenolvergiftung zeichnen sich durch eine Vermehrte Pigmentablagerung in den Leberzellen aus, wobei das Pigment vorwiegend Eisenfrei ist und ausserdemdurch eine Reaktion der Kupfferschen Sternzellen. Dabei sind immernur geringfügige fibrotische Veränderungen inder Leber, d.h. nur eine ganz leichte Verstärkung des schon normalerweise vorhandenen periportalen Bindegewebes vorhanden, aber nicht von der Art einer Bindegewebsvermehrung, wie sie zur chronischen Hepatitis oder zur beginnenden Cirrhose gehört. Eine Zellschädigung hat sich nur in dem jetzt hier oben beschriebenen Fall (Fall Hammer) gefunden. Allerdings ist es ja bei Fall Exel intercurrent zu einer aufgepfropften Hepatitis gekommen, möglicherweise durch eine gewisse Resistenzminderung des Organs gegenüber einem Virusbefall. Schliesslich ist noch für die Einschätzung des Pigments wichtig daß wir beim Fall Cleres bei der Nachpunktion gefunden haben, daß jetzt ein Teil des vorher eisenfreien Pigmentes eisenhaltig ist. Dies bestärkt unsere schon frühere Auffassung über die Natur dieses Pigments, dass es sich dabei um eine maskierte Eiseneiweissverbindung, also um eine Vorstufe von Haemosiderien handelt.
Infolge der Indentität der Bilder bei allen 6 Patienten scheint uns von unserer Seite her die Bedeutung der Trichlorphenoleinwirkung auf die Leber geklärt. Wir würden daher neue Patienten aus Ihrem Betrieb nur dann noch zur Beobachtung aufnehmen, wenn Sie ganz speziellen Wert darauf legen. Dagegen erscheint es uns zwechmässig, wenn in etwa 3-4 Monaten nochmals der eine oder der andere der bisher untersuchten Fälle zu einer neuerlichen Kontrolle und Leberbiopsie hierher kommen könnte, damit wir den weiteren Verlauf dieser Dinge beobachten können.

Mit bester kollegialer Empfehlung
gez.

Dr. Wildhirt

Dr. Schmidt

134

T2.30-6-20   T2.30-13-20.   w/4" wr

THE DOW CHEMICAL COMPANY

MIDLAND MICHIGAN 1415

UUW 1 551515

February 13, 195[illegible]

L. L. Coulter
Agricultural Chemicals Development
American Legion Building

cc: F. [illegible]. Fletcher

In your letter of January 26th you report that at the meeting of the Weed Society of America, New York City, January 4 and 5 it was disclosed that Esteron Brush Killer and Esteron 245 are being applied to vegetation using orchard guns operating at pressures in the range of 150 to 400 p.s.i., and that the composition applied consists generally of 4 to 6 quarts of the active agents plus 10 to 20 gallons of oil emulsified with 80 to 90 gallons of water.

We have no information relative to the health hazards associated to such applications, but certainly the possibility and possible consequences of inhaling these fine droplets of this composition should be considered. We do know that certain oils can, when inhaled as a mist, cause serious respiratory embarrassment. Whether this will be a factor in application of a material such as that described above is unknown to us. If this were strictly an application of oil alone we would be particularly concerned and would suggest that persons applying such material employ a respirator designed for the removal of such mists. I question, however, whether this will be necessary in view of the large volume of water being applied. There is no doubt, however, that the operators should be instructed to avoid breathing this mist. I believe, however, that this method of application should be carefully watched to see whether any adverse effects occur in individuals making such applications. For the time being then, it is my recommendation that we do not recommend this manner of application, but keep our eyes open and ask firms applying material in this way to watch for any evidence of respiratory difficulties. If such appear, then I believe that we should take a positive approach and recommend the wearing of appropriate respiratory protection.

I regret that I cannot be more specific at this time with respect to this hazard.

135

V. K. Rowe
Biochemical Research Department
12-534 Building
Phone - 8991

"15" wr

THE DOW CHEMICAL COMPANY 001185

DOW 1551627

MN073280

MIDLAND
March 20, 1959

RECEIVED
MAR 23 1959
Biochem, Res. Lab.

Mark Wolf
Biochem Research Lab
634 Building

Dear Mark:

By review of our conversation this morning (March 18) regarding the relative toxicity of 1 1/2 to 2 gallons of Forron 245 in 100 gallons of water or Forron Brushkiller at the same concentration in water, as compared with Esteron Brushkiller O.S. in an oil-water emulsion, we would like to outline the field situation and our needs as we see it.

It is a common practice on the utility right-of-ways to use 1 gallon of Esteron Brushkiller O.S. or Esteron 245 O.S. plus 10 galons of oil; this oil could be either No. 1 or 2 fuel oil or kerosene in 89 gallons of water for a total of 100 gallons of mix. This mixture is used because it gives quick, uniform knockdown, does a little better job on conifers and actually has been promoted by some companies because it is dramatic enough that it is easy to sell. Nonetheless it is being used very commonly and our products are used in this manner when the customers decide they want to use oil. The use of this oil has a number of problems; in the first place it costs money, it is difficult to mix with Esteron O.S. and water, it is messy to handle, it is hard to obtain, and it requires additional trucking facilities to handle the large volume of raw material to be imported. We have been shooting at a formulation which would essentially give the early uniform brown-out and kill of the oil-Esteron Brushkiller mix without having all of the disadvantages and handling problems of oil. These formulations which Chem Engineering Lab has come up with are Forron Brushkiller and Forron 245.

You have indicated to us that Forron formulations used in this manner are somewhat more toxic to the handler than the Esteron 245 or Esteron Brushkiller formulations and the question naturally comes up as to what is the relative hazard of the Forron formulations with the oil-water

DOW 1 551628

combinations. Specifically, we would like to know what the relative handling hazards are of 1 1/2 or 2 gallons of Forron 245 or Forron Brushkiller per 100 gallons of water or as compared with 1 gallon Esteron Brushkiller O.S. or Esteron 245 O.S. plus 10 gallons of one of the above oils, plus 89 gallons of water. This should, of course, include skin irritation, eye irritation, possibly inhalation and any other tests which you think might be pertinent.

This information can be important to us in furthering our Forron program and in counseling our customers properly in the use of oil-water mixtures with our present brushkiller formulations. We would appreciate your checking this out for us.

Yours very truly,

L. L. Coulter

L. L. Coulter
Agricultural Chemicals Development

wb

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ubh

1956

MIDLAND
July 6, 1959

L. L. Coulter
Agricultural Chemical Development
Abbott Road Building

DOW 750638

The following compositions were tested on rabbits. They were applied as received and were as follows:

Composition		Reference Number
Esteron Brush Killer	1 gal.	3-24-59 D
Fuel Oil	10 gal.	R. E. V.
Water	89 gal.	
Esteron Brush Killer	1 gal.	3-24-59 F
Water	99 gal.	
Forron Brush Killer	2 gal.	3-24-59 B
Water	100 gal.	R. E. V.
Esteron 2,4,5 OS	1 gal.	3-24-59 C
Fuel Oil	10 gal.	R. E. V.
Water	89 gal.	
Esteron 245 OS	1 gal.	3-24-59 E
Water	99 gal.	R. E. V.
Forron 245	2 gal.	3-24-59 A
Water	98 gal.	R. E. V.

The test rabbits were shaved 5 to 7 days prior to test initiation. Each rabbit had bandaged onto the shaven and healed skin, a fresh sample of three of the compositions in as widely separated locations as possible each day, five days a week for one to ten applications. At the time of the application, the skin response was observed and recorded. To facilitate the comparison, the first three compositions were tested on two rabbits and the last three on two other rabbits.

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DOW 750639

The results show that Esteron Brush Killer and Esteron 2,4,5 OS, when diluted with water only, were the least irritating of the test materials. In these tests, these materials caused essentially no irritation.

Forron Brush Killer and Forron 2,4,5 when diluted with water were shown to be slightly more irritating than the Esteron materials diluted with water. The response was that of mild irritation accompanied by mild scaliness when repeated prolonged contact occurred.

On the other hand, the Esteron Brush Killer and the Esteron 2,4,5 OS, diluted with water and fuel oil, were shown to be markedly irritating and damaging on prolonged or repeated contact. These materials caused a burn upon 24 hour skin contact on rabbits.

Thus it is apparent that the Esteron formulations to which was added fuel oil must be considered much more irritating than either the Forron or Esteron formulations diluted with water.

If you have any questions concerning the above, I shall be glad to discuss them with you.

- Mark A. Wolf -

Mark A. Wolf
Biochemical Research Laboratory
634 Building
Phone ME 6-2776

MAW/jd

4/7a WR

October 28, 1959

Memorandum to Mr. George Gagnon

Re: Waste Oil and Oil Drums

Oil Drums

A part of the stores yard on Hughes Street, Devon, has been set aside for the movements of oil drums. These have been marked by painted signs attached to the yard fence.

The first pile of drums on the left hand side of the main gate is marked "UNCONTAMINATED TRANSFORMER OIL DRUMS". These are drums which have no refund value but which have at one time contained good transformer oil. These should not be used for any other purpose except to handle good or salvageable transformer oil. Salvageable transformer oil means oil that can be filtered. These drums should not be contaminated unnecessarily because they are at a premium and extremely useful when planning power transformer moves or maintenance jobs. These drums should be returned when borrowed for such jobs.

The second pile of drums is marked "CONTAMINATED OIL DRUMS". These drums have no refund value and have been contaminated by material which is detrimental to good transformer oil. These may be used only for the purpose of storing waste oil.

The third pile of drums is marked "WASTE OIL". These contain waste oils which is intended for use in the chemical control operation. Any type of waste oil (cleaning oil, dumped transformer oil, old lubricating) is worth saving for this purpose. Such waste oil may be put in front of this pile, on skids, bung side up. From time to time the filter press operator will visit the site and pump the waste oil from any refundable drums he will

continued..........

find there into non-refundable drums from the pile marked contaminated oil drum, thus retaining a refundable drum for circulation. Once empty, these refundable drums shall be left at the site for stores personnel to pick up and return to the supplier for refunds.

Waste Oil

Waste oil is well worth saving for the chemical control operation. It is recommended that people who have waste oil to dispose of should pick up empty drums from the pile marked "CONTAMINATED DRUMS" to collect it. Arrangements could be made with the store's personnel to have any waste oil transported to this site.

Waste oil for this purpose may include:

(1) Transformer oil which is not considered worth filtering.

(2) Residual cleaning fluids such as varsol, etc.

(3) Oil engine lubrication oil.

Uncontaminated transformer oil which can be filtered should not be brought to this site, but must be kept in some other location until reconditioned by the filter press operator.

J.E. GUERRETTE,
Transmission Maintenance Engineer.

JEG/am

c.c. P.C. Levesque
L.M. Dargavel
C.J. McKinley
G. Lawlor
R. Thomas
N. Grandy
R. Heatherington
. Trask
D. Knight

1750

161

C. H. Boehringer Sohn
22b Ingelheim am Rhein
Germany

Dow Chemical Company
1714 Eastman Rd.
Midland, Michigan
USA

Attention Leonard Rivkin

February 11, 1957

DOW 1131841

Our ref: Dr. Wey/B

Re: The chlorakne. Preparation of Trichlorophenol

Gentlemen!

We hereby refer to our 1955 correspondence on the above subject. At that time you were kind enough to share your experience with us.

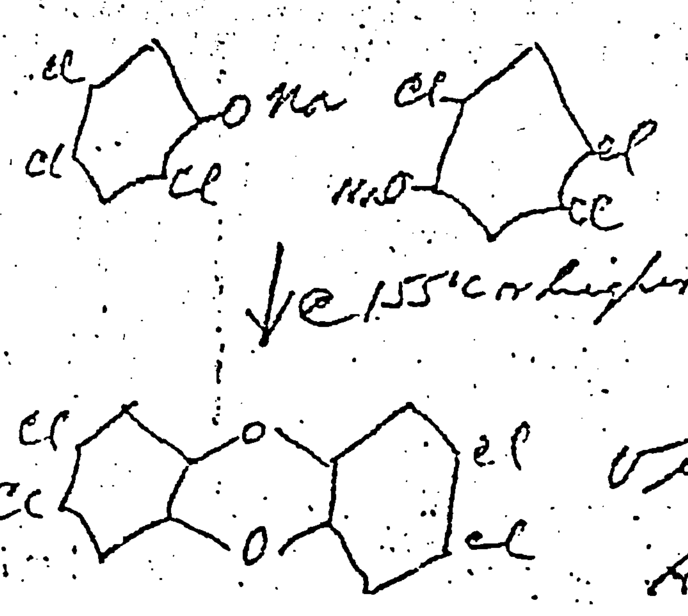
Since our own work on avoiding chlorakne exciters has come to a type of conclusion, we should like to make the results available to you and are accomplishing that by attaching a short description.

We hope that we have been able to give you, by means of this explanation, a contribution to the assurance of the synthesis of trichlorophenoxy acetic acid and assume that the contribution will also be of interest to you.

Sincerely

attch.

5-8-57



Very very toxic
Attacks Liver

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Information sent as attached to and file copy (Action)

Action 1302

DOW 5J4540

April 22, 1963

Brigadier General Fred J. Delmor (3)
U. S. Army Munitions Command
Chemical-Biological-Radiological Agency
Office of the Commanding General
U. S. Department of Defense
Army Chemical Center, Maryland

Dear General Delmor:

At the request of Dr. Warren C. Shaw, Agricultural Research Service, United States Department of Agriculture, we are supplying herewith three copies of the information available to us concerning the toxicity of 2,4-D (2,4-dichlorophenoxy acetic acid) and 2,4,5-T (2,4,5-trichlorophenoxy acetic acid).

This information was prepared by Dow for a petition to the Food and Drug Administration requesting a tolerance for 2,4-D in asparagus. (Incidentally, the tolerance of 5 ppm as requested was established by the FDA). Included in this information are references 8 and 9 which give data on the toxicity of 2,4,5-T.

In addition to this information, we would like to also mention that we have been manufacturing 2,4-D and 2,4,5-T for over ten years. To the best of our knowledge, none of the workmen in these factories have shown any ill effects as a result of working with these chemicals.

Further, many millions of pounds of these chemicals have been used here and abroad without causing a single proven case of illness to livestock.

There have been very few complaints and alleged illnesses in humans due to 2,4-D, however, we have never been convinced that these instances were in fact caused by the chemical. In view of the low toxicity observed in other mammalian species, our toxicologists believe these cases have been related to 2,4-D by coincidence.

Knowing that these products are used by all sorts of people under varied circumstances, we consider the few number of alleged injuries to be phenomenal when related to the large quantities of product manufactured and sold.

We are glad to have this opportunity to serve you, and trust the information we have provided will be of assistance.

Sincerely,

C. E. Lynn
Director of Registration
Bioproducts Department

JOG

cc: Dr. Warren G. Shaw, A.R.S., U.S.D.A.

bc: W. W. Sunderland
V. K. Rowe (No Enclosure)

DOW 534541

144

1386

MN012332

C. H. BOEHRINGER SOHN

CHEMISCHE FABRIK

Postanschrift: C.H. Boehringer Sohn, 6507 Ingelheim am Rhein

Ingelheim 7111
bei Selbstwahl 06132-7111
Boehringer Ingelheimrhein
Fernschreiber 4-17777
Alle Codes in Gebrauch
Landeszentralbank Mainz 48/61
Conrad Hinrich Donner, Hamburg 1
Deutsche Bank AG, Filiale Mainz
Deutsche Bank AG, Filiale Frankfurt (Main)
Kreissparkasse Ingelheim am Rhein Nr. 550
Postscheckkonto: Frankfurt (Main) Nr. 1633

DOW Chemicals Company

Midland / Michigan

U.S.A.

Ihre Zeichen	Ihre Nachricht vom	Unsere Nachricht vom	Unsere Zeichen	
			Dr.Mz/Oe	6507 Ingelheim am Rhein den 15.12.1964

Betrifft

Sehr geehrte Herren,

während eines kürzlichen Besuches Ihrer Herren Dr. Trapp, Lueck und Silverstein erwähnten wir einen wissenschaftlichen Bericht, in welchem die Isolierung des chlorakneaktiven Wirkstoffs sowie die Folgerungen für die betriebliche Arbeitsweise ausführlich beschrieben sind. Herr Silverstein zeigte daraufhin Interesse an der Überlassung eines Exemplars dieses Berichtes.

Bis heute haben wir den Inhalt dieses Berichtes ausserhalb unseres Hauses niemandem zur Kenntnis gegeben, da wir besonderen Wert darauf legten, die ausserordentliche Gefährlichkeit des Tetrachlorbenzodioxin nicht allgemein bekannt werden zu lassen. Da Sie aber den gleichen Wirkstoff aus den Nebenprodukten Ihrer Trichlorphenol-Produktion isolieren konnten, haben wir uns entschlossen, Ihnen diesen Bericht zu überlassen. Wir möchten Sie aber bitten, diesen ebenso wie die übrigen, Ihnen bereits übergebenen Verfahrensunterlagen streng vertraulich zu behandeln und ausserhalb Ihrer Firma niemandem zur Kenntnis zu bringen.

Wir hoffen, dass der beiliegende Bericht (Versuche zur Auffindung des bei der 2,4,5-T-Säure-Herstellung auftretenden Chlorakne-Erregers) vom 12.9.1956 Ihnen bei der Lösung Ihres Chlorakneproblems nützlich sein wird und verbleiben

mit freundlichen Grüssen
C.H. BOEHRINGER SOHN
ppa.

(Dr. Kudszus) (Dr. Merz)

Anlage

December 15, 1964

MN012332

Dow Chemical Company
Midland, Michigan
U.S.A.

Honored Gentlemen:

During a brief visit with your messers. Dr. Trapp, Lueck and Silverstein we mentioned a scientific report, in which the isolation of chloracne active substances as well as conclusions concerning operating procedures are fully described. Mr. Silverstein showed an interest in this and asked for a copy of this report.

Until now we have disclosed the content of this report to no one outside of our company, as we attach a special value thereto, because the extraordinary danger of the tetrachlorobenzodioxin is not generally known. However, since you have isolated the same material from the by-products (oil) of your Trichlorophenol process we have chosen to turn this report over to you. We would ask you, however, that you commit yourselves to a management policy of strict confidence with respect to this information and that you would disclose it to no one outside of your firm.

DOW 1568605

We hope that the enclosed report (Experiments on the determination (isolation) of chloracne exciters in the production of 2,4,5-T acid) of Dec. 9, 1956 will be of use to you in the solution of your chloracne problem and we remain

with friendly greetings

C. H. BOEHRINGER SOHN

Signed by

Dr. Kudszus Dr. Merz

Attached papers

Translated by: W.A. Trapp

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WMC

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THE DOW CHEMICAL COMPANY

MIDLAND DIVISION
MIDLAND, MICHIGAN

January 28, 1965

MN012332

DOW 1568535

CONFIDENTIAL

Herrn Dr. Hans Merz
Director of Production
C. H. Boehringer Sohn
Ingelheim am Rhein
West Germany

Dear Dr. Merz:

We very much appreciated the opportunity to talk with you yesterday and I have summarized below our understanding of the essential elements of our conversation, as you suggested.

##

At the outset I explained to you that there were four Dow people on three telephones here. I then introduced Mr. Silverstein, Dr. Henry Tolkmith, who would be on hand to handle any necessary translation, and finally, Mr. Dylewski, an engineer concerned with the development of a new process for 2,4,5-Trichlorophenol. We then began with a series of medical questions posed by Mr. Silverstein.

Silverstein:

1. We have isolated and identified a symmetrical and an unsymmetrical isomer of tetrachlorodibenzodioxin. The symmetrical isomer is "2,3,6,7" (German notation) and the unsymmetrical is "2,3,6,8". Limited animal experimentation indicates that the unsymmetrical isomer is much less active. Have you any information on the relative activity of these two isomers?
   Answer: "No, we stopped research - it was too dangerous".

2. Do you have any liver biopsy specimens available for our M.D.'s to study?
   Answer: "No, since we have had no new cases for seven years.

3. Have the liver function tests or kidney function tests used on your chloracne cases been published anywhere?
   Answer: "Do not know".

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4. Did you note any increased incidence of diabetes in your chloracne patients, or did any diabetics with chloracne suffer aggravation of their diabetic condition?
Answer: "No cases of diabetes were found".

5. Did you study catechol amines or ketosteroids in your chloracne cases?
Answer: "Do not know".

Dr. Merz said that he would check further into those questions which were answered above as "Do not know".

- - - - - - - - - -

Dylewski (Engineer): He explained that we are considering a distilled grade of 2,4,5-Trichlorophenol (2,4,5-T) as part of our product requirement.

Dr. Merz reiterated that Boehringer's management had decided not to distill this material because of the danger of the formation of chloracne inciting materials.

Mr. Dylewski was nevertheless interested to hear more about Boehringer's experience with the distillation and thereupon proceeded to describe his proposed procedure and to invite Dr. Merz's comments.

The procedure involves acidification of the aqueous phenate with either HCl or H_2SO_4 to a pH of 4.5-5.5 followed by separation of the 2,4,5-T oil from the salt brine, washing of the phenolic oil with water, drying by vacuum distillation and finally distilling of the 2,4,5-T without fractionation in a graphite still.

Dr. Merz said that they formerly distilled 2,4,5-T in copper equipment operating with a sump temperature in the range of 130-150°C. Chloracne inciters were formed presumably because of residual cations (Na) in the phenol which produced Na trichlorophenate thus leading to the formation of dioxin compounds. Mr. Dylewski asked if Dr. Merz could name a particular concentration of salt below which it would be safe to operate a distillation. Dr. Merz would not name a tolerable level but suggested that a water extraction could be better affected by use of a retainer solvent such as methylene chloride or chlorobenzol for the 2,4,5-T.

DOW 1 568536

Dr. Trapp asked Dr. Merz to describe how $Ba(OH)_2$ functions to produce a better quality product. Dr. Merz replied that $Ba(OH)_2$ traps carbonate which is an impurity in the caustic.

Dr. Merz was asked if he knew what the material of construction of the reactor autoclave was, and he replied, "Iron, or common steel".

In closing, Dr. Trapp informed Dr. Merz that we had not yet received the secrecy agreement papers from Boehringer and Dr. Merz said that he would check immediately on this because he was certain that they were completed and had assumed that they had been mailed.

##

Wir danken Ihnen nochmals für Ihre weiterer Unterstützung, Dr. Merz.

mit freundlichen grüssen,

Walter B. Trapp

Walter B. Trapp
Assistant Director
Benzene Research Laboratory
474 Building

bc: Hamburg Office (Grote/Kube)
G. A. Griess
S. W. Dylewski
L. Silverstein

DOW 1568537

4/9" WK

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THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
March 10, 1965

CONFIDENTIAL - SUBJECT TO [illegible]
D.C., E.D. MI. 4-4-78; DOW/EPA AGREEMENT 9-79

DOW 054098
MN073280

P. H. Riley, Special Chemicals Sales, AED
J. C. Tucker, Industrial Chemicals Sales, AED
H. H. Smiley, International Sales, AED
J. W. Harris, Chemical Sales, AED
E. B. Grant, Sales Administration, 47 Building
H. W. Poinsett, Chemicals Department, AED
C. O. Hutchenreuther, Org. Chem. Prod. Dept., 258 Building
E. C. Stuehling, Organic Chem. Products Dept., 172 Building
P. C. Amstutz, Herbicide Section, 441 Building
C. E. Cole, Bioproducts Department, Bioproducts Center
W. P. Halsey, Bioproducts Department, Bioproducts Center
K. Y. Hanson, Bioproducts Sales, Bioproducts Center
G. E. Lynn, Bioproducts Department, Bioproducts Center
R. C. Hoff, Chem. Prod. Qual. Services, 172 Building
W. H. Gill, Bioproducts Department, Bioproducts Center
W. J. McCoy, Bioproducts Sales, Bioproducts Center
H. G. Wilcox, Bioproducts Department, Bioproducts Center
J. D. Doedens, Chemicals Department, AED
D. E. Fletcher, Bioproducts Department, Bioproducts Center
K. C. Barrons, Bioproducts Department, Bioproducts Center
W. L. Corbin, Bioproducts Sales, Bioproducts Center
H. H. Hoyle, Biochemical Research Laboratory, 1701 Building
V. K. Rowe, Biochemical Research Laboratory, 1701 Building

HAZARD OF MONSANTO T ACID

Rabbit ear tests on twelve lots of Monsanto 2,4,5 T acid have shown moderate to severe response in eight cases at ten per cent concentration in ethanol. This confirms VPC analysis for 2,3,7,8-tetrachlorodibenzodioxin which was found in concentrations averaging about 10 ppm.

This material presents a definite hazard which would require all the precautions used in 199 Building and 349 Building to prevent injury, if it is processed at 257 Building.

Dow's involvement in shipping this material to Riverdale and Woodbury also concerns me. There is a definite risk to their employees, especially since they are probably unaware of the problem and are probably taking no precautions.

There is no assurance that their final products will be free of contamination. The available evidence points to the opposite. In my opinion their products should not be sold until animal tests show these products to be free of a significant hazard from the tetrachlorodibenzodioxin and related materials.

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I believe Dow has a definite obligation to advise [illegible] and Woodbury of the problem immediately.

[illegible]
Biochemical Research Laboratory
[illegible] Building

[illegible]

DOW 054099

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"20" uffl

St. Louis Dr. Paul Hoffman

March 17, 1965

2,3,7,8-Tetrachlorodibenzyl-*para*-Dioxane

FILE
Destroy
JTG
WMH

Mr. John Stephens
JSTEP

Enclosed is a sample of 2,3,7,8-tetrachlorodibenzyl-*para*-dioxane.

This was received from Dow Chemical Company, and according to them it is the most toxic compound they have ever experienced. It presumably is toxic by skin contact, as well as by inhalation. According to Dow it is 100 times as toxic as parathion. It is, likewise, capable of causing an incapacitating chloracne.

I would recommend that extreme care be used in handling; that dilutions be made under a hood; and that all equipment be washed out immediately, or disposed of. Even trace amounts of this (200 ppb) have caused chloracne in rabbits, according to Dow.

This is being given to you to calibrate the VPC method of analyzing for this compound in our 2,4,5-T. I wish you would save some of it for me, as we would like to do some biological evaluation also.

Please call me if you have any questions.

R. Emmet Kelly, M. D.

REK/ln
enc.

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THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

[redacted]

March 19, 1965

Emmet Kelly, M.D.
Medical Director
Monsanto Chemical Company
800 North Lindbergh Boulevard
St. Louis 66, Missouri

Mr. Francis Kennedy
Plant Manager
Diamond Alkali Company
80 Lister Avenue
Newark, New Jersey

Dr. J. Wilkenfeld
Technical Superintendent
Hooker Chemical Corporation
Niagara Falls, New York

Dr. Ed Chandler
Technical Service
Diamond Alkali Company
300 Union Commerce Building
Cleveland, Ohio

Mr. Raymond Verhoeze
Hooker Chemical Corporation
Niagara Falls, New York

Dr. John P. Frawley
Chief Toxicologist
Hercules Powder Company
Delaware Trust Building
Wilmington 99, Delaware

Gentlemen:

I am writing this same letter to each of you. I have talked with some of you and you have indicated the other persons within your own organizations who should be present.

As per these telephoned conversations, I am inviting each of you to come to Midland to discuss the toxicological problems caused by the presence of certain highly toxic impurities in certain samples of 2,4,5-trichlorophenol and related materials.

As I told all of you with whom I have talked, we have been doing analytical and toxicological research on this problem and wish to share our findings to date with all the producers of 2,4,5-trichlorophenol for the sole purpose of lessening any hazards to health that might be attributed to this and related products.

Our discussions will deal only with the toxicological and analytical aspects of the problem. We will not discuss manufacturing know-how, sales, or anything else not dealing with the problems of health.

It is our hope that through this meeting, we will acquire a better understanding of the problem and that each company will then proceed independently as it sees fit to institute such self-imposed controls on its production as are necessary to insure the safety of its products.

Enclosed is a copy of an analytical method our Analytical Laboratory has developed. Perhaps you would like to have your analysts look it over before coming here. Our analyst will be available to discuss the method with you.

I have reserved a room for each of you at the Midland Country Club for the night of March 23, 1965. When you arrive at the airport serving Midland, Bay City and Saginaw, get the Midland limousine and it will take you directly to the Country Club.

I suggest that we all meet in the lobby at 7:30 A.M. for breakfast and then we will come to our laboratory for our discussions.

I believe we can complete our discussions by lunch time so that reservations for your return trips can be made for any time after lunch.

If any of you have any questions, please call me.

Sincerely yours,

VKRowe

V. K. Rowe
Biochemical Research Laboratory
1701 Building
Phone ME 6-2376
Area Code 517

VKR/jd

To Dr. Frawley:

Please bring another person along if you wish. A room is reserved.

VKR

St. Louis

March 30, 1965

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uAL

P. Grolrock
F. B. Dunlap
R. R. Rumer

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Mr. Paul Hoffman

I talked with the Hercules representative who attended the Dow meeting on the 2,4,5-T problem. He was Dr. Jack Frawley, a toxicologist.

It appears the presentation was the same as the one you and I were given. Representatives of Diamond and Hooker were there. Dr. Frawley stated that Dow told the various companies in private what the content of dioxane was in their 2,4,5-T acid. I gathered that Diamond and Hooker had some but Hercules stated they were told they had none.

It appeared to Frawley that Dow was having this meeting because they did not think they could, in conscience, not tell industry about their findings. Hercules also seems to believe that the Public Health Service would be very happy to get into the act, whether or not the chloracne exists in the ultimate user. I must agree with them about this and it would seem almost mandatory that we see if we can first firm up our analytical methods and then devise ways to minimize the presence of this known chloracne agent.

There is also another very good reason for us to do this. Regardless of what we think of the rabbit test, this dioxane compound must be a potent contaminant. Very conceivably, it can be a potent carcinogen. We, therefore, will never know how close we are to having another epidemic at Nitro, and we certainly don't want to go through that again.

I am going to be out of the country until about April 20, but Dr. Johnson and Mr. Wheeler are quite familiar with the various aspects of this problem and are available for discussions.

R. Emmet Kelly, M. D.

REK/ln

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Copy to Bill Haberstroh
on 1-29-69
-OKR.

DOW THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
March 29, 1965

DOW029959

V. K. Rowe
Biochemical Research Laboratory
1701 Building

cc: F. H. Riley
R. N. Smiley
L. B. Grant
C. O. Hutchenreuther
F. C. Amstutz
W. P. Falsey
G. E. Lynn
W. M. Gill
M. G. Wiltse
D. E. Pletcher
W. L. Corbin
D. D. Irish
J. E. Peterson
J. C. Tucker
J. W. Harris
H. W. Feinauer
E. C. Staehling
C. E. Otis
K. Y. Hansen
R. C. Hoff
W. J. McCoy
J. D. Doedens
K. C. Barrons
H. R. Hoyle
B. B. Holder, M.D.
S. E. Sadek

REPORT ON THE CHLORACNE PROBLEM MEETING ON 3/24/65

Present: Dr. J. Wilkenfeld and
Mr. Raymond Verhoeze, Hooker Chemical Corporation

Mr. Francis Kennedy and
Dr. Ed Chandler, Diamond Alkali Company

Mr. C. L. Dunn and
Dr. John P. Frawley, Hercules Powder Company

V. K. recapped the Dow situation in terms of the problem and the initial studies by Toxicology and Environmental Research Laboratory regarding the in-plant situation. He expanded this in general terms to the study of end products, ours and other peoples. He made reference to symmetrical tetrachloro-p-dibenzodioxin. He referred to the evidence for unknown acnegens. There were some questions from the group about the unknowns. We (Dow) were not able to answer these questions except to review the evidence for their existence in the process samples and end products.

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EXHIBIT AA

Dr. Holder reviewed the medical side of the Dow experience; he said that we now have approximately 60 to 70 cases of individuals with chloracne ranging from two severe cases to some very mild cases that were difficult to diagnose. He showed slides of the more dramatic cases. The slides were exclusively views of the faces of the individuals afflicted. He described in fair detail the appearance of the individuals mentioning the blackheads specifically. He then reviewed the clinical studies that are being made on these people with emphasis on the liver function tests. He mentioned the single liver biopsy that has been taken and studied in which the liver was normal although the man had a rather pronounced case of chloracne. Dr. Holder also mentioned the incidence of fatigue among the afflicted people as being the only other significant finding in these folks. He touched briefly on treatment indicating that various topical treatments were not particularly effective. He described the cycling of this disorder in individuals who had been completely removed from exposure. He mentioned that some fellows are approaching the end of their trouble two or two and one-half years after onset of the skin disorder. He also described "acute chloracne" which is an acute inflammatory condition that appears considerably sooner than the normal chloracne in individuals and appears after pronounced single exposure. The acute chloracne shows up within a few days of exposure. Dr. Holder mentioned five to eight days specifically. There was considerable discussion by the group on the skin disorder itself. The Hooker representatives related experience of skin condition thirty years after exposure. Their cases were more similar to the Dowicide bumps which Dow has experienced in that there were large boils or large bumps rather than the multitude of small blackheads and eruptions which Dow is seeing in the current cases.

Dr. Sadek showed slides of ears and livers of rabbits that had been exposed to the symmetrical tetrachloro-p-dibenzodioxin. He discussed the pathology in detail which I will not attempt to summarize.

V. K. mentioned the studies in which the rabbit ears have been treated with TCBD in benzene or corn oil and then washed with soap and water at various time intervals later. If exposure occurs for very long, washing does little good. He also briefly mentioned the oral studies but without detail. Silverstein described the plant study on washing of contamination from tools and surfaces. This study indicated that benzene, acetone and Chlorothene NU were effective in removing the contaminant from tools and also that detergent and water with scrubbing action could clean up tools and equipment. Some discussion ensued on the use

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of detergent and water and the point was made again that strong scrubbing action was necessary for this approach to be successful.

Harold Gill then discussed the analysis for tetrachloro-p-dibenzodioxin by vapor phase chromatography. He listed the limit of sensitivity on various process materials. He mentioned the oil which he defined as a non-saponifiable mixture of chloro anisoles, tetrachlorobenzene and tri-chlorobenzene; the limit of sensitivity for TCBD in this material is 10 ppm. The limit is 1 ppm for 2,4,5-trichloro-phenol, and for 2,4,5-T Acid, either acetic or propionic. Gill then defined 1 ppm as a very discernible peak. He mentioned that he might estimate 0.5 ppm in some instances but to be conservative the analyst reports <1 ppm if the peak does not measure up to the quite identifiable level of 1 ppm. The analytical problem has not yet been solved for the T-Acid esters. The general procedure used for the T-Acids is to extract the sample (arbitrarily about 20 grams) with chloroform (about 40 milliliters), filter the chloroform to remove solids and wash with an equal volume of N/10 caustic to remove any acidic materials. The chloroform extract then is concentrated by evaporation to one-tenth the original volume; thus, the concentration of the dioxin in the chloroform will be ten times higher than in the original sample. When the analysis is conducted on tri-chlorophenol, the material is dissolved in N/1 caustic to the extent of 10%, and this solution is then extracted with the chloroform and handled as indicated above.

A question was asked about the utilization of detectors other than the flame ionization which is specified in the Analytical Laboratory write-up for this analysis. Gill has not tried the micro coulometric detector because he is not set up to do so, but he has experimented with electron capture. He stated that theoretically this unit should not provide any greater increase in sensitivity. In actuality he found a slight increase in sensitivity but there are usually too many chlorinated species present which may saturate the electron capture cell whose recovery is too slow to be of practical use. He summarized by saying that the slight increase in sensitivity is not worth the effort to switch from flame ionization to electron capture. A question was asked about how the extraction is performed. Gill stated that it is performed in a wide mouth bottle on a shaker for one hour. (It was not mentioned, but it is the case that this is done at room temperature.) He mentioned that spiked samples have been

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run this way and the recovery ranged from 90 to 100 per cent. The ratio of solvent to the material being extracted on this step is not critical according to Gill. Their standard procedure is 20 grams of sample and 40 milliliters of chloroform. On trichlorophenol samples specifically, 20 grams of phenol is converted to phenate -- about 10 per cent concentration in water. The phenate solution is extracted with 20 milliliters of chloroform in a single extraction. The chloroform is then concentrated so that the concentration of the dioxin will be ten times that in the original sample.

The question of volatility of dioxin came up and Harold Gill stated that he found he can distill o-dichlorobenzene away from tetrachlorobenzodioxin. He said that in his opinion the secret was to avoid distilling to dryness.

A member of the group asked if samples of standard TCBD were available. The answer was yes and 100 mg samples were provided to one of the representatives from each company. (A sample had previously been given to Dr. Kelly of Monsanto.) A question of laboratory safety in the analytical work came up and the basic precaution of wearing vinyl gloves was mentioned. Information relative to the gloves we used was provided to the group.

Disposal of contaminated laboratory materials and plant materials was discussed. We mentioned that Dow burns some small amounts of waste. Harold Gill stated that his laboratory study of combustion showed that 99.96 per cent of the dioxin sample was burned at 800°C. We described why we felt that our practice of burning small amounts of dioxin was a safe one.

V. K. then outlined the project in which plant samples and products (not mentioned by name) were spiked with known amounts of the TCBD. The spiked samples were split for the purpose of checking our analytical procedures for recovery and correlating these results with the bio-assay method.

The question of specification, quality control specification that is, was raised and we were asked if we could give levels of dioxin contamination which were permissible limits. V. K. mentioned that at present we are using zero with a confidence of 1 ppm in process samples. There was some discussion on the problem of customers using finished products under far less desirable conditions of health control than we can provide our workmen in our own plant. There seemed to be agreement among the group that we could not afford to sell contaminated products.

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Jack Peterson then discussed the data from animal experiments using pure symmetrical tetrachlorobenzodioxin. Doses ranging from 2 parts per billion to 1000 parts per million of tetrachlorobenzodioxin in benzene had been administered to the rabbit ear. Dosage in most cases was 0.1 ml per day. Both single and multiple exposures have been studied and multiple exposures administered on a five days per week basis. The significant factors in the study are dose, the number of applications and the days on exposure of the animals. The response which is reported in the gross observation of the condition of the rabbit's ear by the toxicologists. This does not include pathological findings -- there is not enough data in this area to discuss. The level of response ranges from none through very slight, slight, slight to moderate, moderate, moderate to severe, severe, and extremely severe. Jack indicated to the group that there is not a sharp definition between these categories of response and indicated also that there is some difficulty in graphing this type of response. He described the response from single applications to the rabbit ear first: at 100 parts per million there was a severe response in eight days; at 40 parts per million there was a slight response in eleven days; at 20, 10, 7 and 4 parts per million there was no response. These tests were run on single rabbits and without washing the material off. Jack then discussed the multiple application data which he took from his major graph of this data. The important points that he made from this data were first that at the limit of VPC sensitivity a severe response may be produced. In other words, even if the VPC does not detect TCBD, an animal response may still occur. His second important point was that the induction period for response averaged about ten days on the animals in the studies.

There was a brief discussion then about the air samples that were taken in the plant. Silverstein mentioned that some air samples have shown activity on the animals. The degree of response is slight and the number of samples that show activity is small out of the total number taken and the amount of air that must be sampled is very much larger than the amount a man normally breathes in an eight hour day.

The meeting was adjourned. The group then proceeded to the Toxicology Laboratory to view some of the test animals. They were shown responses of varying intensity and these were described. This demonstration appeared to have considerable impact.

L. O. Silverstein
Biochemical Research Laboratory
1701 Building

LOS:ejl

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Postscript

All participants seemed to appreciate well the problem and all indicated that they would return home and attempt to convince their management to institute safety specifications (really quality control) for their various products in this area. All agreed that the industry should meet its own responsibility. All were very appreciative of Dow's effort to steer them away from a danger area. Time will tell whether we accomplished our mission, but as of now I feel satisfied with our effort and the reception it received.

VKR

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"24" wk -

EXHIBIT

6/24/65

MIDLAND
June 24, 1965

DOW CONFIDENTIAL

Ross Mulholland
Manager
Bioproducts
Dow Chemical of Canada
Sarnia, Canada

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2,4,5-TRICHLOROPHENOL, THE "T" ACIDS, AND ASSOCIATED ACNEGENS

I have not been neglecting your request for information to use in discussing the subject problem with Naugatuck and the Co-Op. I have been stymied, however, because the analytical methods have been changed and are in the process of being cleared and reproduced. I expect them any day, but rather than wait longer, I thought I should advise you of the situation. I will send you copies of these methods as soon as they become available.

In regard to the overall problem, we are attempting to do everything possible to avoid the possible occurrence of chloracne in any applications involving the handling or use of trichlorophenol, trichlorophenoxyacetic acid and its derivatives. As you well know, we had a serious situation in our operating plants because of contamination of 2,4,5-trichlorophenol with impurities, the most active of which is 2,3,7,8-tetrachlorodibenzodioxin. This material is exceptionally toxic; it has a tremendous potential for producing chloracne and systemic injury. If it is present in the trichlorophenol, it will be carried through into the T acid and into the esters and hence into formulations which are to be sold to the public. One of the things which we want to avoid is the occurrence of any acne in consumers. I am particularly concerned here with persons who are using the material on a daily, repeated basis such as custom operators may use it. If this should occur, the whole 2,4,5-T industry will be hard hit and I would expect restrictive legislation, either barring the material or putting very rigid controls upon it. This is the main reason why we are so concerned that we clean up our own house from within, rather than having someone from without do it for us. In this way, we can approach the problem in an orderly manner. If the producers and handlers of this material will cooperate, there is no reason why we cannot get this problem under strict control and thereby hopefully avoid restrictive legislation; in other words, let us practice good citizenship. At the present time, we are of the opinion that material containing no tetrachlorodibenzodioxin with a certainty of 1 ppm does not present an appreciable hazard to consumers; likewise, we do not believe that such material constitutes a significant hazard to persons working in

DOW CONFIDENTIAL

June 24, 1965

E. Mulholland

plants handling such phenol, T acid, or T acid esters.

I might add that we are continuing our researches on this particular problem from the standpoint of studying the other impurities which may have the capacity to produce this type of reaction. Also, we are attempting to quantitate the effects of the known acnegens when added to base materials. This work is progressing well, but it will be several months before we have a completed story.

I would urge again that if your big customers such as Co-Op and Naugatuck have particular questions about this problem that you invite them to come to Midland where we will be glad to discuss the matter in detail with them and show them what we have learned. We are not in any way attempting to hide our problem under a heap of sand, but we certainly do not want to have any situations arise which will cause the regulatory agencies to become restrictive. Our primary objective is to avoid this.

I trust that you will be very judicious in your use of this information. It could be quite embarrassing if it were misinterpreted or misused.

V. K. Rowe
Biochemical Research Laboratory
1701 Building
MK 6-2376

VKR/jd

cc: L. Silverstein
C. Otis
Grady Holdeman
F. Amstutz
G. Goergen
H. Boyle
W. Palsey
V. K. Rowe (2)
T17.4-12-20
Correspondence

P.S. Under no circumstances may this letter be reproduced, shown, or sent to anyone outside of Dow.

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Mr Byrne   WM   Return to   Gary   2383

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EARLY DOW HISTORY OF

THE CHLORACNE PROBLEM - BIOCHEM'S CONTRIBUTION

Apl '61 1970

Date: 3/11/65
File: ?
By: KKS

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SUMMARY

An outbreak of chloracne among workmen in the trichlorophenol process in 199 Building and in 349 Building has resulted in approximately 40 cases of chloracne in Dow people. The outbreak was precipitated primarily by a series of process changes which increased the production of a chloracne-producing impurity in trichlorophenol. Increased exposure to operating and to maintenance personnel also contributed. Much effort by persons in the Analytical Laboratory, the Toxicology Laboratory, and the Environmental Research Laboratory has resulted in the isolation and identification of one impurity which is capable of having caused the difficulty, and has also resulted in control of the exposure situation so that no new cases of chloracne have appeared in the last four months. Some important questions remain to be answered. There is evidence that other compounds than the one already isolated and identified and studied are capable of producing chloracne. Their significance in the trichlorophenol process is not yet known.

CHLORACNE

Chloracne is a skin disorder characterized by the appearance of blackheads and small bumps. These appear first on the face of the individual affected, Depending upon extent of exposure, the skin disorder may spread to other parts of the body. Infection and irritation of the skin rash may cause enough discomfort ~~of the~~

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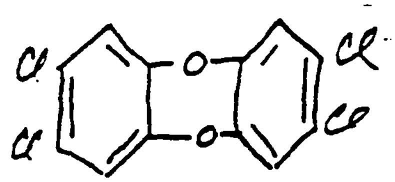
individual to result in time lost from work. This happened in two of the trichlorophenol plant cases.

The materials known to cause chloracne in humans are usually chlorinated complex organic molecules. The compound isolated from trichlorophenol caustic insoluble oil is 2,3,7,8-tetrachlorodibenzo-p-~~benzo~~dioxin (symmetrical).



This compound and others which have been shown to cause chloracne have also been shown by animal tests and some human experience in other companies to produce liver damage if the exposure is more extensive. Thus far, no liver injury has been detected by clinical examination of the affected Dow people.

Two aspects of the ailment are distinctive and somewhat frustrating. First, there is a latent period of approximately two months after sufficient exposure before the disorder is evident on the person. Secondly, once a person has contracted chloracne, the recovery period is from about six months to two years for the cases which Dow has encountered. In some instances, the Europeans have encountered recovery periods as long as five years before the man was completely free of ~~the~~ chloracne.

TOXICOLOGY RESEARCH

In 1941, Adams, Irish, Spencer and Rowe of the Biochemical Research Laboratory published a paper in Industrial Medicine on "The Response of Rabbit Skin to Compounds Reported to Have Caused Acneform Dermatitis". They described a ~~the animal~~ test using the rabbit ear, which has been extremely valuable in the studies of compounds which may cause chloracne in humans. The rabbit appears to be very sensitive to such compounds, but it is non-specific, that is, the folliculitis activity which occurs in rabbits does not identify the particular agent. Another shortcoming of the rabbit test is the period of time necessary for the folliculitis to develop. There appears to be an induction period of approximately one week for the tetrachlorodibenzo dioxin (hereafter abbreviated TCDD,) to produce folliculitis in rabbits regardless of the severity of exposure. There is ~~some~~ evidence that unknown acnegens may produce folliculitis in rabbits with a shorter induction period. Before a particular test sample is exonerated, the test is run for four weeks of repeated daily application to the rabbit's ear.

In 1944, research in the Benzene Research Laboratory produced a severe case of chloracne and toxicology studies on animals showed that the probable culprit was a chlorinated double ether produced from the experimental solvent being studied. At this time, samples from the trichlorophenol process were also studied and the caustic insoluble oil was shown to be active by the rabbit ear test. There was no human experience with chloracne in the trichlorophenol production group at that time. The phenate product was shown to be inactive by animal test~~s~~.

In 1955, a number of German manufacturers of trichlorophenol and at least one French company had human experience with chloracne that caused them to shut down production plants and to study the problem. Their studies contributed ~~much~~ to the medical picture and industrial hygiene to process improvements, but not much to the toxicology ~~of the~~ situation. The Germans ~~did~~ isolated the TCDD and did ~~do~~ some limited animal studies on it and on some chlorinated dibenzofurans (diphenylene oxides) but this was a very limited amount of work. They did even less ~~in the~~ To evaluate ~~of the~~ exposures of their people which led to the injuries.

In 1957, a series of process samples were acquired from 199 and 349 Buildings and tested on animals. The tests indicated that the caustic insoluble oil and coil reactor product in 199 Building were active and that the tar from the color stills in 349 Building was also active. The precautions first recommended in 1945 were re-emphasized. There was still no human injury in the trichlorophenol process.

About 1956, impurities in trichlorophenol produced by Dow and Hooker were isolated and studied by animal test and shown to be inactive ~~in terms of chloracne~~.

Over the years, some samples of end products such as Silvex, Ronnel, and 2,4,5-T acid have been tested on animals and in no case was chloracne activity detected in these products.

In 1962, supervision of 199 Building sent process samples to the Toxicology from the then existing process and from a pilot run utilizing a ~~proposed change in the process which was~~ a decrease in the caustic concentration ~~in the starting materials~~. These samples were tested on animals and again

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the caustic insoluble oil was shown to be active but no more active in the new process than in the old. The Biochem report reiterated the precautions necessary in handling the oil and the change was made at 199 Building. There was still no human injury.

When the chloracne outbreak occurred in early 1964, many more process samples were tested on animals with particular attention to the caustic insoluble oil. Two samples of this oil were dramatically different~~, qualitatively~~ than those tested before or since. These two samples killed the rabbits when applied at the same concentration as has normally been used. The oils had to be diluted to 0.1% concentratio before the animals survived and showed folliculitis. The normal test concentration of caustic insoluble oils up to that time had been 10% dilution. Subsequent studies on the TCBD have indicated that the amount of TCBD in these two samples of oil is probably not sufficient to cause the death of the animals. # In July of 1964, the rabbit ear test was used for the first time on wipe samples of the building equipment and surfaces at 199 Building. The wipe tests indicated extensive contamination of 199 Building. This test has been repeated periodically to the extent that over 600 animal tests have been run since ~~last~~ July 19 directly related to the chloracne problem.

A representative oil sample was selected in August 1964 to be fractionated in order to isolate and identify the chloracne-producing impurities. Abrm Skelly of the Analytical Lab isolated a number of fractions which were identified, among them the TCBD, which was also synthesized by Skelly from benzodioxin. The two materials were identical by ~~in terms of~~ infrared and melting point determination, and both showed extreme activity on the examination by

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rabbits. Other fractions indicated little or no activity on the animals. The isolated material was utilized by VPC (Vapor Phase Chromatography) to standardize a method for detecting this impurity. Harold Gill's group in the Analytical Laboratory has consistently improved the VPC sensitivity in process samples so that at the present about 1 ppm (parts per million by weight) of TCBD may be detected in various process samples. However, the animal studies have indicated that rabbits are sensitive to TCBD down to approximately 5 ppb (parts per billion by weight) upon repeated application to the ear. The rabbit test remains the most sensitive method of detecting acnegenic activity. ~~However~~, Single application studies on TCBD indicate that parts per million are necessary for a response so that VPC does provide a first step in evaluating the hazard from TCBD specifically. Many wipe samples and some process samples have indicated by VPC, unknowns in the region of the TCBD which we suspect are also acnegenic. Samples of chlorinated dibenzofurans were acquired from the K list and run by VPC. These compounds show up on a VPC chromatogram in the same region as some of these unknowns. However, the impurities isolated by Skelly also show up in this same region and were shown to be inactive on animals. The unknowns are truly that, with this evidence of activity, however; Many wipe samples with no detectable TCBD but ~~substantial~~ varying amounts of unknowns have shown more activity on the animals than can~~not~~ be accounted for by the low level of ~~dioxin~~ TCBD which may be present. The chlorinated dibenzofurans were tested on animals ~~many years ago and shown to be quite active~~. Research was ~~abandoned on these products because of their high~~ acnegenic activity. The samples ~~are impure by VPC analysis and have~~ not yet been

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These unknowns appear on ~~[illegible]~~ VPC chromatograms in the same time periods, relative to the known ~~[illegible]~~ TCBD, as do some of the compounds isolated from ~~the~~ caustic insoluble oil by Shelby, ~~[illegible]~~ which were inactive on animals.

Samples of impure chlorinated dibenzofurans were seen on VPC and some of the peaks coincided with some unknowns which were seen in wipe samples and process samples. Both the Biochem Lab and the Germans have reported animal tests with acnegenic activity, ~~from~~ these compounds ~~when~~ ~~th~~which showed. Neither group ~~[illegible]~~ indicates that the possibility of TCBD contamination of the furans had been ruled out.

purified and tested again on animals. The possibility exists that these are contaminated themselves by ~~dioxin~~ TCBD. This possibility has not been investigated as yet.

More detail on the results of process sample and wipe sample testing on animals will appear in the sections under specific building numbers.

Studies are now in progress on Dow ~~end~~ products made from Trichlorophenol and those of other manufacturers for acnegenic activity. Thus far, no Dow ~~end~~ products have shown activity on animals while some other manufacturers end products are showing activity on animals as well as detectable dioxin by VPC analysis. The Analytical Laboratory and the Toxicology Laboratory are presently conducting a project to determine the analytical and animal test limits of sensitivity for TCBD in various Dow products ~~starting~~ made from trichlorophenol. This project is aimed at developing a quality control specification for ~~the dioxin~~ TCBD in consumer products.

199 BUILDING

The first animal test on trichlorophenol process material was conducted in 1945, at which time the caustic insoluble oil was shown to be active. Precautions were recommended at that time. The second animal test took place in 1957. The caustic insoluble oil was again active and the coil reactor product was also active. Other process samples were not active. Precautions were recommended again for handling the oil.

In 1955, the C. H. Boringer John Company in Germany asked for information from the Givaudan Corporation, which company referred the request to Dow. A letter describing the hazards and precautions for safe handling of 2,4,5-trichlorophenol was sent to Boringer with a data sheet from Biochem enclosed. The letter answered seven specific questions regarding our own plant experience.

In 1957, Boringer sent Dow and all other known trichlorophenol manufacturers a letter describing the results ~~faults~~ of their research on chloracne in the trichlorophenol process. The letter described the danger points in the process and the limits which had to be observed in order to avoid producing acne exciter in trichlorophenol and in 2,4,5-T acid. A temperature limit of 150°C for the ~~reaction~~ was emphasized by Boringer. Which?

In 1962, the rabbit ear ~~above mentioned animal~~ test indicated that the caustic insoluble oil from a 73% caustic process and from a 24% caustic process were the same in that they both produced folliculitis on animals with ~~in~~ about the same magnitude ~~order~~ of response. The Biochem report reiterated the precautions but stated there was no evidence of increased hazard in the new process.

In July 1963, 199 Building started up on ~~new~~ tetrachlorobenzene which caused line plugging problems and increased exposure of personnel according to the plant superintendent. In November and December of 1963, the plant ran at capacity. The caustic insoluble oil production was above normal, ~~and~~ the oil was drawn off more frequently, and it was also being sampled regularly. The samples were taken to the lab for freezing point analysis. The temperature at which the plant process was run was also

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increased (? ...)

On January 23, 1964, the first medical report of ~~the~~ a case of chloracne initiated a survey by the Environmental Research Laboratory. ~~On January 23, 1964,~~ The trichlorophenol operators job was studied closely and a report issued on 2/5/64 recommend~~ing~~ed changes in the procedure and in personal hygiene habits. Some changes in the oil draw-off equipment and procedure were already initiated before the Environmental Research survey got under way. In the spring of 1964, process equipment changes were made by the Phoenix Sprinkler Company and at this ~~point~~ time, the caustic insoluble oil samples which killed the animals were taken at the plant.

In July 1964, the first wipe samples were taken. The building was found to be extensively contaminated. Some air sampling was begun at this time. No activity was found in the air samples.

In August 1964, VPC detected ~~tetrachlorobenzodioxin~~ TCBD in the waste oil. The oil was fractionated, ~~the dioxin~~ TCBD was isolated and identified, and was also synthesized.

In ~~the fall~~ August of 1964, ~~more cases of chloracne appeared.~~ some Phoenix Sprinkler men, some area shop people, and more 199 Building employees developed chloracne. Wipe samples indicated continued contamination. Extensive clean-up measures were undertaken. Wipe samples showed improvement but not complete elimination of the contamination. ~~Air samples were not active.~~

In late October 1964, there was a flare-up of some existing chloracne cases in 199 Building people. This was brought on by exposure to hot fumes from a screen in the phenate product line. Animal tests showed that this phenate was active and that the screen residue was extremely active. This phenate went to 349 Building and is the probable cause of the three cases which eventually appeared in 349 Building people. About November 1 1964, very stringent safety precautions were instituted in 199 Building. These included a full-time health supervisor whose job was to review each and every maintenance or installation job, ~~in the reactor~~ to specify the detailed safety procedures which the men should follow. Clean-up activity continued and extensive modifications of equipment and the building of an enclosure around parts of the process took place in November and December of 1964. ~~literally~~ Over one hundred~~s of~~ outside personnel were involved. Wipe tests indicated improvement in the contamination situation and air samples showed no activity on the animals.

In 1965, the full-time health supervision continues. VPC analysis is now being used for quality control of the phenate leaving the building. Wipe tests show substantial improvement. However, X air samples are beginning to show activity on the animals, although only one air sample thus far has shown detectable dioxin by VPC analysis. ¶ A very significant factor is that to the present date, there have been no new cases of chloracne since the institution of the full-ti health supervision and extreme safety precautions. Two cases have appeared at Medical since that date, but both of these have shown that the individuals were in the area and had possible exposure prior to the November 1st date. Since the induction period in people is about two months, and it is now approximately ~~three~~ four months since the height of activity in 199 Bldg with the many outside personnel, there is evidence that the safety precautions which ~~were~~ used were satisfactory. These precautions are being continued on jobs in 199 Building.

DOW 0001 122

349 BUILDING

Sodium trichlorophenate from 199 Building is received ~~by~~ at 349 Building where it is neutralized, ~~which effects~~ effecting a ten-fold concentration of the material to provide crude trichlorophenol. This "wet feed" is ~~sent~~ passed through a drying column; the "dry oil" is then distilled in two color stills.

The first animal tests run on 349 bldg samples in 1957 indicated activity only in the tar from the color stills. This was mild activity, less than that demonstrated by the caustic insoluble oil at 199 Building Similar samples taken in early 1964 again showed the tar from the color stills to be active. Samples taken in October 1964 showed activity in the wet feed, in the dry oil and again in the tar from the color stills. The product was still not active on animals. Samples taken in November 1964 showed activity again in the wet feed, the dry oil and the product ~~was~~ were inactive. The degree of activity in the crude material~~s~~ was less than that in the October samples.

The contaminated phenate ~~mentioned above,~~ found at the end of October 1964 in 199 bldg was processed by 349 Building. ~~The activities of two~~ In early November two pipe fitters and an operator at 349 ~~involved~~ cleaned lines and changed valves in lines which had carried the contaminated phenate. The actual exposure that brought on chloracne in the 349 Building personnel is not definitely established but this is the most likely situation which could have caused it.

In early November, Clare Bailey, 349 Building Superintendent, issued a written sheet describing precautions to be taken because of the

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potential hazard. This resulted from the 199 7/64 experience and was promulgated on Bailey's initiative as a precautionary measure. About the first of this year, 1965, objections by workmen to working in 349 caused the adoption of full-scale protective measures in that building in regard to the trichlorophenol process. Further complaints caused the extension of such precautions to the entire reactor room, including the bisphenol process. Wipe tests eventually indicated that the bisphenol parent area was ~~is~~ free of contamination. In fact, only limited areas of the trichlorophenol section show contamination. Clean-up and further wipe tests are being delayed until process equipment has been moved to a new location outside the work area of 349 Building. Extensive clean-up will be necessary in the alleyway behind 349 because of contamination from the trichlorophenol tar.

A health supervisor is now stationed at 349 Building and full precautions are being taken on any jobs where exposure is possible. Only three cases of chloracne have shown up at 349 314 thus far, none since the incident in early November.

Composite samples of finished trichlorophenol from 349 have been run on animals at either a 10% or 1% concentration in Dowanol PM. Under these conditions, no finished product from 349 has shown activity on animals. Quite recently, VPC has succeeded in lowering its sensitivity ~~of~~ for TCBD in trichlorophenol to about 1 ppm. They have since analyzed some retainer samples and found some with detectable ~~dioxin~~ TCBD plus unknowns that appear in the same place as the chlorinated benzofurans. These samples were extracted with chloroform for analysis. The chloroform extracts, ~~when~~ placed on rabbits' ears, are showing activity.

DOW 001 123

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Another tar, the catch-all tar in 349, has shown some slight activity on animals. This is the residue from catch-all distillation for 265 Building. The "catch-all" material itself did not show activity. The tar from the dichlor still was not active. Tar, crude product and final product from the Dowicide 3 process are currently being studied on animals. The Dowicide 3 Tar is showing activity. Dowicide 3 in the past has been regarded as a potential chloracne-producing material.

267 BUILDING

Finished trichlorophenol from 349 is processed in 267 Building to 2,4,5-T acid and to 2,4,5-T esters.

Process samples taken in early 1965 showed no activity with one exception. The residue from the sodium salt filter press showed slight activity on the rabbit ear.

Testing of Wipe samples taken ~~tests~~ in 267 Building are still in progress but show no activity at this date.

Human experience in 267 Building ~~would~~ indicates no problem in the past, but the degree of ~~circumstances of~~ exposure of workers could cause chloracne ~~lead to grave concern over future problems~~ if contaminated materials are processed at 267 Building.

265 BUILDING

A number of Dowicides are produced and packaged in 265 Building. Pentachlorophenol, tetrachlorophenol, and others are among the products. Penta- and tetra- have long been known to be capable of causing chloracne. ~~The~~ Human experience at 265 Bldg has indicated no particular problem; only an occasional case of chloracne through the years has been reported at Medical. At the present time, two individuals, an operator and a pipe fitter, have been reported to have mild cases of chloracne.

Process samples are currently being studied on ~~the~~ animals. No wipe testing has been done as yet at 265 Building, ~~itself~~.

266 BUILDING

Three cases of chloracne have been reported from 266 Building. None of the processes or materials in 266 Building have been known to cause chloracne in the past. Its proximity to the Dowicide plant ~~has~~ could result in contamination from there. ~~been investigated by virtue of~~ Wipe tests in 266 Building ~~and~~ Process samples ~~in~~ from the parahydroxybenzaldehyde process have also been tested on animals since the most significant case is in an operator on this proces None of the process samples were active; only one wipe test (on the mobil elevator in the warehouse section) was active on animals. This elevator has been decontaminated and painted. It is difficult to explain the contact which resulted in these three cases of chloracne.

206 BUILDING

This building has three cases of chloracne in operators who hav worked on the finishing and packaging end of the 6X process. 6X has bee known as a chloracne-producing material for many years. The cases in th building were reported to Medical in the middle of 1964. Study of the finishing end, distillation and drumming-off of 6X, indicated numerous opportunities for exposure. The process was not running on 6X itself, bu on ~~a~~ innocuous material using the same equipment and the circumstances as ~~are~~ used for 6X ~~6X purification.~~ Wipe tests were made of the equipment and area but no 6X was detected in any place. ~~6X is produced in the north end of 266 Building.~~ The 6X process equipment in the north end of 206 bldg has been idle. Wipe tests on ~~it~~ this equipment indicate and not decontaminated.

sentence doesn't belong here

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6X contamination. This equipment is presently being cleaned up for other service. Precautions are being taken.

The Dowicide 3 process will soon be moved, in its entirety, to 206 Building. Plans have been made to study it thoroughly in its initial operation in 206 Building.

206 Building is a neighbor of 199 Building and for this reason the question of neighborhood contamination from 199 was investigated by means of wipe tests in spots likely to have been contaminated by 199 effluents. None of these wipe tests were active. Some wipe tests at 199 itself indicated a rather quick drop-off of activity with distance from the vent on the roof of 199 which was the source of roof contamination at that building.

1603 BUILDING

Bradley's group in Chemical Physics Research Laboratory has been studying variations of the trichlorophenol process. Two of the group contracted severe cases of chloracne about two and one-half years ago as the result of exposure during laboratory runs. Their former work area in 294 Building and their present work area in 1603 Building were wipe tested and no active samples were found in either place.

Laboratory samples have been submitted by this group occasionall in the last two years, ~~approximately.~~ Many of these samples have demonstrated activity on the animals.

474 BUILDING

Widiger's group in the Benzene Research Laboratory has been studying the current trichlorophenol process. Wipe samples have been taken of the work areas in 474 Building. Those that have been completed showed no activity.

703 BUILDING

The Waste Disposal Department handles the caustic insoluble oil from 199 Building and the tar from 349 Building, both of which are active. Wipe samples have been taken in the tar burner area. Soil samples were also tested and wipe samples of the vertical tar burner are in process. Some activity was found on an area around the tar burner. Waste Disposal has been advised of necessary precautions.

Other possibly contaminated effluents have been discussed with the Waste Water group of Waste Disposal and arrangements made for necessary precautions when called for by work on waste disposal lines.

Larry Silverstein
March 10, 1965

jd

Unit Index

Distribution
Hutchenreuther
Goergen
Stalling
Armstrong
J. Kelly (W. Disposal)
Shannon "

Lueck
Bailey
Soulat

Mar 1, 1965 "25A" MR

225

DOW019294

AE 04419

TRICHLOROPHENOL SUMMARY

I. Trichlorophenol Producers

Trichlorophenol and derivatives producers are Dow, Monsanto, Hercules, Diamond and Hooker. Dow and Hooker isolate and distill the trichlorophenol prior to sales and use, and analyses of samples of their sales products show no exciter present. It is suspected that Hercules also distills the trichlorophenol as samples of their 2,4,5-T acid shows no exciter. Diamond and Monsanto do not isolate the trichlorophenol to purify it, but make all derivatives from the sodium salt. Analysis of Monsanto's 2,4,5-T acid shows 3 - 8 ppm. exciter, and analyses of Diamond's sodiumtrichlorophenate shows 8 - 24 ppm. exciter.

II. Present Knowledge of Toxicology

There are publications in the medical journals alleging chloracne response from 2,4,5-T acid and derivatives. Based on our data, we can readily see that such a response can occur from impure 2,4,5-T, but that pure 2,4,5-T will not give this response. We can identify one of the so-called exciters as 2,3,7,8-tetrachlorodibenzodioxin. It has been isolated from the Dow trichlorophenol operation and has been synthesized. Chemical structure and biological activity of each has been confirmed. It is one of the most toxic materials known causing not only skin lesions, but also liver damage. We have demonstrated positive action at 40 parts per billion and equivocal results at 4.0 parts per billion. We have developed a quantitative analytical procedure which will analyze for the exciter at 1.0 ppm. sensitivity. Over 500 samples have been analyzed and biologically checked to date. We have also isolated and identified the unsymmetrical tetrachlorodibenzodioxin and it is presently being checked for biological activity. In addition to the identifiable materials, VPC shows some 15 additional compounds which are of unknown activity and identity. Further research is required to isolate and identify these materials to determine their significance. The missing link in this entire study is that there is no quantitative relationship to animal response and human response at the present time.

III. Contacts with Trichlorophenol Producers

V. K. Rowe has had telephone conversations with the Medical Director and Assistant Medical Director at Monsanto and the Chief Toxicologist at Hercules. Rowe has discussed the problem and has given them our analytical methods. These men want to follow through on this problem and are in favor of a meeting with all the trichlorophenol producers. Since Rowe has no contacts at Hooker and Diamond, Lou Corbin of [illegible] products Sales will make these contacts requesting their designates get in touch with V. K. Rowe. This will be done March 1, 1965. Rowe will discuss the problem, invite them to the meeting, and offer our analytical methods.

IV. Proposed Meeting of Trichlorophenol Producers

A meeting of the trichlorophenol producers is tentatively scheduled on March 17, 1965 in Midland. The Chief Toxicologist, Medical Director, or Medical Consultant and a Chemical Specialist from each company will attend. The agenda will be: 181

1. Dow review the literature on the subject.
2. Dow discuss the toxicological data we have to date.
3. Dow to sell the group on the idea the industry must police itself or the government will.
4. If the producers accept this philosophy, decide if we should and who should go to the appropriate federal government agencies.

V. Status with Boehringer of Germany

In December 1964, Dow sent a team to Boehringer of Germany to discuss the chloracne problem. Boehringer had the same problem, solved it, and have operated 5 years safely. In Germany a verbal secrecy agreement was made to the effect that all oral and written process know-how received from Boehringer would be held secret by Dow for 10 years and Dow would pay $35,000 for its use. The team received Boehringer's process details and flowsheets while in Germany and various pieces of correspondence since they returned. Our new plant is designed on the basis of this know-how. At the present time a written, legal secrecy agreement is being negotiated.

J. D. Doedens
Chemicals Department
March 1, 1965

eb.

cc: V. K. Rowe

182

V26 untr

1253

DOW 746820

DOW THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
August 16, 1966

C. A. Highhill
2,4-D Plant
489 Building

cc: E. C. Staehling, Org. Chem. Prodn., 258 Building
F. C. Amstutz, Herbicide Section, 441 Building
F. I. Chase, 2,4-D Products, 469 Building
B. B. Holder, M.D., Medical Department, 607 Building
A. W. Wilson, Safety Department, 401 Building
V. K. Rowe, Biochemical Research Laboratory

I would like samples from your first run with 2,4,5-trichlorophenol in the direct ester process. The animal test will detect the presence of chloracne-producing compounds.

Please send me a sample of the final product and any intermediates that you think should be tested. If activity is detected, the intermediate may tell us where the trouble starts.

Because of the concern about chloracne, I think we should run animal tests on 2,4,5-T esters for a time to prove the lack of hazard, even if the first tests are negative.

L G Silverstein
L. G. Silverstein
Biochemical Research Laboratory
1701 Building

LGS:sjl

183

THE DOW CHEMICAL COMPANY

MIDLAND DIVISION
April 25, 1967

u274 WAC

1500

K. E. Coulter
Midland Division Research & Development
566 Building

HN069798

CHLORACNE RESEARCH PROGRAM

History of Chloracne Incidences at Dow:

Historically, Dow Chemical has been involved in chloracne incidences ever since Dow began the production of chlorophenols. At first, the commercial production of chlorophenols was conducted at 206 Building. During the period 1934-36 there was a severe outbreak among the employees which resulted in an unsuccessful lawsuit. The chloracne incidents were traced back to poor working conditions and the manufacture of Dowicide P. The manufacture of Dowicide P has since been terminated. New and improved working facilities for the Dowicide group were constructed at 265 Building in 1940.

Na SALTS OF Dow. 3 + Dow. 6

In the late 1930's, Wes Stoesser in 20A lab got a serious chloracne attack from chlorinated diphenylene oxide. Drastic treatments were used to cure this incident and no further work was done on this series of compounds. It is suspected that many of the other incidences of chloracne are caused by chlorinated diphenylene oxides or analogues thereof.

In the next ten years, another unfortunate situation occurred in the chloracne situation. Some of the Dow customers complained about dermatitis and/or chloracne from the use of Dow's Dowicide 3. I understand financial adjustments were made and the production of Dowicide 3 terminated. A purified material of related structure is now sold as Dowicide 31 and 32.

Dow 31 + MONO CHLORO-PHENOL

During the period 1940-65, the product 6X (diphenyl oxide chlorinated to the hexa level) was manufactured at 206 Building and at least one severe case of chloracne occurred because of this product. The production of 6X has been terminated.

In the research lab at 172 Building, there were some cases of chloracne from research exposures. In one case, a severe case resulted from the recycling of residues from the manufacture of 2,4,5-trichlorophenol using glycol as a solvent. In another case, several mild cases occurred hydrolyzing polychlorobenzenes using aqueous caustic at high temperature. The Chemical Physics Lab had several incidences of chloracne from the recycling of caustic insolubles in the alcoholic caustic hydrolysis of tetrachlorobenzene.

In 1963, the 2,4,5-trichlorophenol hydrolysis step at 199 Buildin was modified for economy and safety reasons from the use of 100% caustic to 23% caustic. The rabbit test for chloracnigens in the caustic insolubles obtained from a pilot run at this time indicat that the test response for chloracnigens showed no difference between caustic insolubles obtained by either procedure. During the latter part of 1963, the production department, in order to increase capacity, raised the reaction temperature and increased the throughput. This meant that more caustic insolubles were produced, and more Dempster loadings had to be made. This meant that employees had more exposures to the caustic insolubles, and the caustic insolubles due to the higher temperature had larger concentrations of chloracnigens. Thus the higher concentration of chloracnigens and the more frequent exposure caused many mild incidences of chloracne in 199 Building and two severe cases (LTI' In 1966, a new process (Boehringer) was put into operation using a batch reactor at low temperature, and so far has operated satisfactorily.

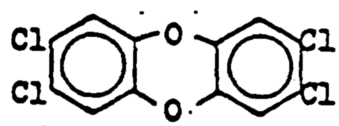
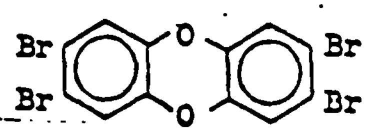
After they started up their Dowicide plant, the Canadians began to experience chloracne incidences in their employees. In Midlanc more than half of the Dowicide employees have chloracne of varying intensity and it is impossible to say when or where these incidenc occurred.

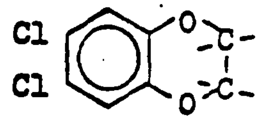
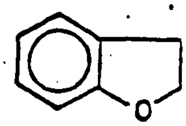
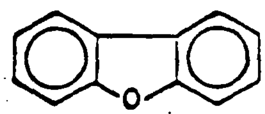
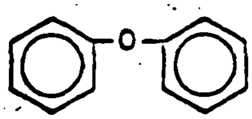
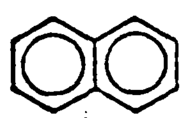
Research Program in Progress for Chloracne Reduction:

Because of the prevailing existence of chloracne in the Dowicide plants and a sincere desire to reduce or eliminate this, research has been initiated in 1966 on this problem. Progress has been slow due to the complexity of the problem. The problem involves isolation and determination of the identity of the chloracnigens. After being properly identified, work can progress on its reductic or elimination in the process.

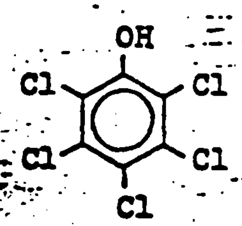
In commenting on chloracne, we must keep in mind that chloracne is a cosmetic evidence of the attack and serious liver damage is an invisible effect of the attack. Rabbit ear tests are a positive sensitive method of determining the chloracne activity of chlorophenol impurities.

Present Knowledge of Chloracnigens:

Compound	Activity
	2,3,7,8 Tetrachloro - Very positi Cl_{1-3} - Not active Cl_{5-7} - Possibly some cpds. activ Cl_8 - Not active
	Very active

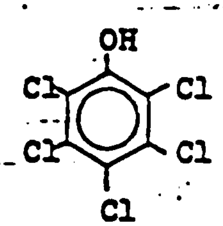
Compound	Activity
	Very active
	Cl_{1-X} - Unknown activity
	Cl_{1-2} - Unknown activity Cl_{3-6} - Some very active
	Cl_{4-6} - Some activity?
	Cl_3 + - Some activity

Materials possessing unexplained chloracne activity:



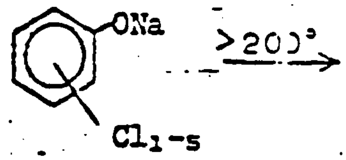
Some Midland batches are mild reactive

Many Canadian batches are mil reactive

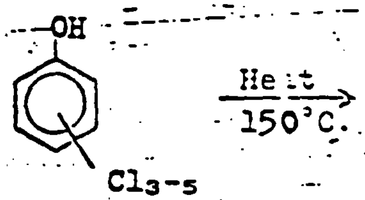
 $\xrightarrow{NaOH}$ Dowicide G

All sludges are active

Compound — Activity



All decompositions are activ[e]



Some have activity

Midland Research Program on Chloracne:

The following chloracne activity fractions are being examined for isolation, identification, and minimization of chloracne activity. Unfortunately, due to shortage of technical help, the program is proceeding quite slowly.

1. Dichlorophenol still residue.
2. Pentachlorophenol process samples.
   a. Dowicide 6 and 7 "active" batches.
   b. Dowicide G sludge.
   c. Dowicide G scrubber sludge.

The method of research is to first concentrate the sample (remove chlorophenols); then fractionate by chromatography; test fraction on rabbits, then further fractionate by chromatography, then test fraction on rabbits; etc., then determine structure by micro analysis; then determine method of analysis in original sample; and then investigate process changes which will minimize the chloracnigens in the process.

The Benzene Research Lab and the Biochem Research Lab are collaborating in this project. The Benzene Research Lab does the chemical research and the Biochem Research Lab does the testing on the rabbits on their charge.

Alex Widiger

Alex Widiger
Benzene Research Laboratory
474 Building

je

cc: W. H. Haberstroh, 474 Bldg.
R. C. Sauers, 474 Bldg.
S. L. Bender, 172 Bldg.
E. C. Staehling, 258 Bldg.
L. Silverstein, 1701 Bldg.

Dow
1752

DOW 1 129929

MIDLAND
February 15, 1957

William E. Dixon
Bioproducts Department
EPC

cc: W. L. Corbin, EPC
D. E. Pletcher, EPC
J. H. Cowell, EPC
W. J. McCoy, EPC
B. B. Holder, M.D., 607

THOMPSON CHEMICAL COMPANY, ST. LOUIS, MISSOURI

On February 2, 1957, W. J. McCoy informed me that a Mr. [illegible] S. Buckley of Thompson Chemical had called Dow indicating that they had had an accident associated with the manufacture of trichlorophenol, and that they had some men with what they thought was chloracne. They wondered if we could advise them in regard to medical practice. I contacted Dr. Holder, who then called Mr. Buckley and discussed with him medical aspects of the problem. It is my understanding from Dr. Holder that Mr. Buckley then started talking about the chemistry of this material, and Dr. Holder suggested that he contact me in regard to anything along this line.

On or about February 7 Mr. Buckley called me to see what we knew about chloracne caused by contact with materials associated with the manufacture of trichlorophenol from tetrachlorobenzene. I told him that under certain circumstances, which I did not describe, the caustic insoluble oils could contain considerable amounts of a very highly toxic substance which we had identified as 2,3,7,8-tetrachlorodibenzodioxin. I indicated to him that this material was not only extremely toxic systemically, but it was also an extremely potent chloracnogen. He indicated that they had been distilling some oils or tars containing anisoles when the operation got out of control, and the material either spilled or splashed onto a hot autoclave. He thought that the fumes and vapors of the anisoles had caused their difficulty. I told him I did not think the acne was caused by the anisoles, but rather by other materials present in the anisoles. 188

Apparently Mr. Buckley had asked Dr. Holder how to clean up the equipment, etc., and Dr. Holder indicated to him that he must take extreme precautions, including the use of rubber suits and gloves and respirators. He seemed surprised that we would recommend such severe measures, but I reiterated that such precautions were what we believed necessary. He then wanted to know if I thought they could clean up the contaminated equipment with steam. I felt at this point an obligation to tell him that steam was the worst thing he could use, simply because it would volatilize the material, causing it to recrystallize and deposit elsewhere. This was not the way to get rid of it. He suggested scrubbing down the equipment with detergent or solvents. I indicated that this could be done if he made sure that all necessary precautions were taken to prevent contact with the people. I suggested that he assay or take wipe samples of the equipment to determine the degree of contamination. I suggested that this should be done before and after the clean-up. He asked how such assays could be made. I indicated to him that we had developed a method of analysis and also used biological assay employing a rabbit ear. He did not ask me for details of these procedures, so I did not give them to him.

He then asked where he could find information about chloracne, and I volunteered to send him copies of pertinent articles from the published literature which I had, and this has been done.

My conversations with Mr. Buckley were within the framework of our discussion of the problem. The information on the physiological activity was perhaps even less than was given to the other producers of trichlorophenol over a year ago. This was because it was quickly apparent that Mr. Buckley had little understanding of the toxicological aspects of his problem. Had he asked for methods, etc., I would have agreed to send them to him. However, since he did not, I saw no reason to volunteer.

I don't know whether this information is of any value to you, but it will, at least, keep you informed. If you have any questions or suggestions for further action, please do not hesitate to contact me.

V. K. Rowe
Biochemical Research Laboratory
[illegible] Building

bcc: V. K. Rowe (2)
T47.4-23-20
Chloracne file 73[illegible]
Correspondence

189

vgg" ure 1554

DOW 746900

MN069799

MIDLAND, MICHIGAN
July 25, 1967

W. J. McCoy
Bioproducts Sales
BPC

cc: W. L. Corbin, BPC

2,4,5-T FORMULATIONS

I appreciate very much your note of 7/17/67 in which you informed me that some Diamond material has apparently caused serious skin problems among people applying the material. This goes along with a report that recently appeared in the South American literature which states that materials of this nature have also been noted to have caused similar difficulties. I am enclosing a copy of this publication for your information.

It would appear that our predictions of a few years ago are beginning to come to pass, unfortunately. Frankly, I am mighty glad that we took the position we did.

Please continue to keep me informed as best you can.

V. K. Rowe
Biochemical Research Laboratory
1803 Building

pgw

bcc: V. K. Rowe (2)
Correspondence

190

1538

"29" ...

OFFICE COPY

Biochemical Research Laboratory

The Dow Chemical Company

HLORACNE PROBLEM AT
ORT SASKATCHEWAN PLANT,
OW CHEMICAL OF CANADA

File: T2.1-18-2
Date: 3/21/69
By: L. G. Silverstein

DOW 7463398

HN0069799

Signed ______ Date 3-27-69

Checked H. ______ Date 3-28-69

PROBLEM

Workmen in Fort Saskatchewan have experienced chloracne. here may be another skin rash problem related to the weed killer peration but this has not been diagnosed definitely by a physician.

FINDINGS

1. An acnegen was found to be present in some process samples, specifically the Dowicide G product in the reactor and the Dowicide G product at the packaging location. In addition, a sample of crude dichlorophenol showed slight to moderate activity, and the caustic insolubles in the G Liquor settling tank showed severe acnegenic activity in the rabbit test.

2. No acnegenic activity was found on a series of wipe tests taken in the G and weed killer building.

3. Laboratory studies on the decomposition of chlorinated phenols have indicated the definite possibility of an acne hazard from overheated or decomposed materials.

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CONCLUSIONS

1. There is not enough exposure during normal operations to active materials to explain the degree of chloracne seen in workmen at Fort Saskatchewan.

2. The housekeeping observed and in the wipe samples I collected during my visit in October of 1965 indicated satisfactory housekeeping in the penta and weed killer plant.

3. Unusual exposure from maintenance or clean-out of equipment such as the dryer, or from accidents such as overheating of the dryer may have caused the severity of skin reaction noted in the workmen.

4. Personal cleanliness is of primary importance in avoiding skin problems and minimizing their severity once encountered. The instructions on the second page of the operator's manual for Fort Saskatchewan should be followed conscientiously: "Dow will provide a complete change of clothing for each operator, each day. This clothing including shoes, hats and gloves must be left in the lockers provided. To assure adequate cleanliness and hygiene, a shower must be taken by each operator prior to his leaving the Company premises at the end of each shift."

Discussions during my visit in October, 1965, indicated that [illegible] procedure had been relaxed or at least not enforced by supervision. It is my firm opinion that this is the most important step that management can take toward improving the situation.

5. Any unusual exposure should require immediate and thorough shower and change of clothes from the skin out to minimize the probability of injury. If exposure to airborne fume or dust, for example from the dryer during clean-out, is to be encountered, an air supplied hood should be a required item of clothing. Men should not be allowed to work in the vicinity of such an unusual exposure unless they too are protected from inhalation of the airborne material.

6. A clinical definition of the skin rash described by Kasanovich would be very helpful in determining if there is a second problem on the weed killer side.

7. Skin condition of the workmen afflicted should be followed clinically in order to determine if progress is being made in eliminating the skin condition.

DISCUSSION

"Dowicide bumps," or chloracne, is a skin condition characterized by blackheads and bumps appearing on the face of the individual afflicted, sometimes spreading to other parts of the body. The condition has been recognized for many years as an occupational hazard in the production of Dowicides, especially Dowicide G (sodium pentachlorophenate).

Fort Saskatchewan Dowicide production plant has experienced an outbreak of chloracne in its workmen. Tests on process samples from Fort Saskatchewan are summarized in Table 1.

A series of wipe tests in the Fort Saskatchewan plant are summarized in Table 2. All wipes were free of activity indicating that at the time of the survey housekeeping was good.

The mild activity of process and product samples, and the lack of the activity in wipe samples, plus the physical nature of the most likely exposure; that is, the solid Dowicide G; make it difficult to rationalize the severity of the chloracne in workmen at Fort Saskatchewan if their exposure was "routine," that is, to the normal process materials during normal operation of the plant.

On the other hand, the [illegible] response to the caustic insolubles in the G Liquor Tank and the [illegible] of animal response to decomposition products of Dowicide G in the laboratory study

DOW 746401

summarized in Table 3 indicate the possibility that nonroutine exposures to overheated Dowicide G or its fumes either during malfunction of the dryer or to the residue in cleaning out the dryer, or perhaps cleaning out the G Liquor settling tank may have brought on the pronounced chloracne in the persons affected.

From the description of his rash by Peter Kasanovich there may be a second skin problem related to the weed killer operation. This needs clarifying by a clinical examination of the men. According to Peter Kasanovich the rash appears and disappears rather promptly and is related to working and being off work on week-ends. This is not characteristic of chloracne. It does sound like a rash which occurred in Midland many years ago and was associated with 2,4-D production. When a bleaching step was added to the 2,4-D process to remove odor and color the rash disappeared along with improvement of the product.

Careful attention to housekeeping and personal cleanliness may eliminate this problem.

Sample Number	Sample Descriptions	Animal Responses Folliculitis	Burn	No. of Appl.	Days Exposure	µg TCDD/gm VPC Analysis	Re[illegible]
1	Crude DCP from reactor	None	Yes	3	24		tested
	Same, 50% in $CHCl_3$	Sl-Mod	Yes	4	11	<1	100% da[illegible] 5/65
2	Still bottoms from SPS	None	Yes	3	38		
	Same, 50% in $CHCl_3$	None	Yes	4	24	<1	100% da[illegible] 5/65
3	[illegible]ector effluent from bottom pot	None	No	15	24		
	[illegible]e, 50% in $CHCl_3$	None	No	17	38	<1	100% dat 5/65
4	[illegible]illed still bottoms from V-20	None	Yes	3	38		
	[illegible] 50% in $CHCl_3$	None	Yes	4	38	<1	100% dat 5/65
	[illegible]ol mixed dichlor tank	None	Yes	2	38		
		None	Yes	1	38	<1	100% da[illegible] 5/65
	[illegible]	None	Yes	1	24		
		None	Yes	4	[illegible]	[illegible]	100% dat 5/65
	[illegible] fines	Sl-Mod	Yes	3	11		
	[illegible], 50% in $CHCl_3$	Slight	Yes	4	11	12	100% da[illegible] 5/65
	[illegible]a beads	None	Yes	4	24		
	Same, 50% in $CHCl_3$	Slight	Yes	4	14	13	100% dat 5/65
	Penta 55-105 from reactor	Slight	Yes	2	[illegible]		
	Same, 50% in $CHCl_3$	Slight	Yes	3	[illegible]	[illegible]	100% dat 6/[illegible]
	Dow 7 to G batch 104	Slight	Yes	2	1[illegible]		
	Same, 50% in $CHCl_3$	Slight	Yes	2	1[illegible]	6	100% dat 6/3/6[illegible]
	Unoiled penta from flaker (65405)	None	No	19	2[illegible]		
	Same, 50% in $CHCl_3$	Slight	Yes	3	1[illegible]	13	100% dat 6/[illegible]

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Table 2. FORT SASKATCHEWAN WIPE SAMPLES -- [illegible] --
L. B. SILVERSTEIN

Penta Side and Control Room

1. Dowicide ? bagging -- handles.
2. Dowicide G bagging -- handles.
3. Door to warehouse -- handles.
4. Handrail to second floor, north end of [illegible] Building.
5. Floor -- doorway between washroom and "clean" locker room.
6. Floor -- doorway between plant and lunchroom.
7. G classifier platform.
8. Floor -- center of first floor in [illegible].
9. Valves near [illegible] tank [illegible].
10. Pipe near landing, north stairway of [illegible] Building.
11. Latch of penta reactor sample box.
Handles of flaker pumps.
13. Operator's desk -- penta reactor room, second floor.
14. Drier -- handles.
15. Door to control room from penta reactor room.
16. Benchtops in control room.
17. Operator's desk and clip boards, control room.
18. Tools in drawer -- control room.
19. Valve handles in G reactor dike area, [illegible]west corner of 151 Bldg.
20. G reactor -- handles, second floor outside.

Weed Killer Side

21. Stair treads -- first floor going up (caked with tar).
22. Handrail, first to second level.
23. Valves and handles on R-304, second floor.
24. Sample hood, second floor -- front lip and valve handles.
25. Valve handles on LUWA evaporator, third level.

UCON740404

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Table 3. LABORATORY STUDIES ON THERMAL DECOMPOSITION OF CHLOROPHENOLS

Sample Number	Sample Description	No. Appl./ No. Days	Rabbit Response
1	Sodium 2,4-dichlorophenate residue	10/19	Moderate
2	Sodium 2,4-dichlorophenate fume condensate	1?/22	Sl-Mod
3	Sodium o-chlorophenate, fume condensate	1?/21	Sl-Mod
4	Dowicide F fume condensate	7/11	Severe
5	Dowicide G fume condensate	14/21	Severe
6	Sodium 2,4-dichlorophenate control	?/22	None
7	Sodium 2,4-dichlorophenate held 7 hours at 150°C	16/22	None
8	Sodium 2,4-dichlorophenate held 7 hours at 170°C	?/11	Slight
9	Dowicide G control	15/22	None
10	Dowicide G held 7 hours at 170°C	10/14	Slight
11	Dowicide G residue from overheated sample from 265 Building, below grate in fluid bed dryer	12/13	Moderate

DOW 746405

DISTRIBUTION OF REPORTED ADVERSE EFFECTS FOLLOWING EXPOSURE OF FIELD WORKERS AND APPLICATORS TO 2,4-D FORMULATIONS

SOURCE	YEAR OF EPISODE	NO. OF CASES
GOLDSTEIN ET AL (31)	1955	3
MONARCA & DI VITO (55)	1960	1
TODD (80)	1960	1
BERKLEY & MAGEE (11)	1961	1
TSAPKO (81)	1966	GROUP
WALLIS ET AL (87)	1966	1
PAGGIARO ET AL (58)	1972	1

HUMAN EXPOSURES TO PHENOXY HERBICIDES, CHLORINATED PHENATE & T.C.D.C. COMPOUNDS

PURE PHEN. HERBICIDES	PHEN.HERB. WITH TRACE T.C.D.D. <0.1 PPM		PHEN. HERBICIDES WITH HIGH T.C.D.D. 1-30 PPM	ACCIDENTAL EXPO. HIGH T.C.D.D. WITH TCP (NO PHEN.HERB.)	PURE T.C.D.D.
	INFREQUENT EXPOSURE	REPETITIVE EXPOSURE	INFREQUENT EXPOSURE		
NONE	RURAL RESIDENTS	INDUSTRIAL WORKERS	VIETNAM (PRIMARILY NATIVE)	SEVESO	NONE
	2-3,000	FIELD APPLICATORS	# UNKNOWN	3,000+ (200 CHLORACNE)	
		1,000		INDUSTRIAL (1950-1978)	
				1,500 (800 CHLORACNE)	
		**** MOST APPROPRIATE POPULATION FOR PHENOXY HERBICIDE STUDY		**** MOST APPROPRIATE POPULATION FOR T.C.D.D. STUDY	

DOW052560

SEVESO

NEW INFORMATION RELATING TO TCDD / TCP HUMAN EXPOSURES

FETAL WASTAGE	NO SIGNIFICANT EFFECT	TUCHMANN-DUPLESSIS REGGIANI
IMMUNOLOGY	NO CHANGE IN IMMUNOGLOBULINS OR T & B LYMPHOCYTES	POCCHIARI
CYTOGENETICS	NO DAMAGE TO PERIPHERAL LYMPHOCYTES NORMAL FETAL TISSUE / MATERNAL BLOOD	PARLIAMENT COMMISSION REGGIANI
CANCER	NO DATA AS YET	

DOW052562

REPORTED ADVERSE EFFECTS FOLLOWING EXPOSURE OF FIELD WORKERS AND APPLICATORS TO 2,4-D FORMULATIONS

CNS IRRITATION

CNS DEPRESSION OR DYSFUNCTION

PERIPHERAL NEUROPATHY

HEMATOPOIETIC DEPRESSION

MYOPATHY

GASTROINTESTINAL IRRITATION

NEPHROPATHY

CARDIOPATHY

ASTHENIA

DERMATITIS

DOCUMENTED
HUMAN HEALTH EXPERIENCE
PHENOXY HERBICIDES

NO EFFECT (2,4-D)	0.5 G/DAY X 21	ASSOULY, 1951
	2.0 G SINGLE DOSE	SEABURY, 1962
LETHAL EFFECT (2,4-D)	>80 MG/KG	NIELSON ET AL, 1965
	>2000 MG/KG	DUDLEY & THAPAR, 1972

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DOCUMENTED HUMAN HEALTH EXPERIENCE - PHENOXY HERBICIDES

MORBIDITY	FINLAND	RIIHIMAKI (1978)	$\uparrow$ SYMPTOMS (NEUROLOGICAL) EEG FINDINGS - POOR STUDY
MORTALITY	SWEDEN	AXELSON (1977)	SLIGHT $\uparrow$ CA ? CONFOUND. AMITROL.
		HARDELL (1977)	CASE REPORTS ? $\uparrow$ MESENCHYME TUMOURS
	FINLAND	RIIHIMAKI (1978)	NO $\uparrow$ MORTALITY
REPRODUCTIVE--TERATOGENICITY			
	AUSTRALIA	GOVT. REPORT (1978)	NEGATIVE
	NEW ZEALAND	GOVT. REPORT (1978)	NEGATIVE

DOW002565

DOCUMENTED / ANECDOTAL

HUMAN HEALTH EXPERIENCE

TCDD / TCP

MULTIPLE INDUSTRIAL OVEREXPOSURES AND ACCIDENTS
1950 - 1978

GENERAL SYSTEMIC TOXIN

DISEASE

ONSET:	1 - 6 WEEKS
RECOVERY:	6 MOS. - MULTI-YEAR

INCREASING DOSE LEVEL

SKIN - CHLORACNE - HALLMARK

NEURO / PSYCHIATRIC

FATIGUE - DEPRESSION - ASTHENIA

PERIPHERAL NEUROPATHY

NEURO MUSCULAR

METABOLISM - CHOLESTEROL - ABNORMAL ENZYMES

LIVER

HEMATOLOGIC

PANCREAS - KIDNEY

CARDIO VASCULAR

PULMONARY

DEATH

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DOW032566

ONSET OF DISEASE

- ONSET OF EFFECTS DELAYED 1-8 WEEKS
- NO REPORTED "ACUTE" CASES

T C D D

TOXICITY IN HUMANS

DOW
025667

DOW0125568

DURATION OF DISEASE

ALL MILD TO MODERATE EXPOSURES HAVE RECOVERED FROM ALL SIGNS OR SYMPTOMS IN 1-2 YEARS POST EXPOSURE

DOW0032569

HUMAN LEVEL OF EFFECT

UNKNOWN -- CAN ONLY EXTRAPOLATE FROM ANIMAL DATA

MECHANISM OF ACTION

UNKNOWN

DOW0025970

DOCUMENTED CASES

APPROXIMATELY 500 - 800 CASES WORLD-WIDE SINCE 1940'S

SUMMARY

1. DELAYED ONSET

2. HALLMARK OR EARLY WARNING OF OVER-EXPOSURE — CHLORACNE

3. NO SIGNS OR SYMPTOMS DOCUMENTED IN ABSENCE OF CHLORACNE

4. DOSE DEPENDENT MULTI-ORGAN TOXICITY

5. RECOVERY DELAYED BUT USUALLY COMPLETE

DOW052572

ALLEGATIONS

HUMAN TERATOGEN

NO — SEVESO DATA

HUMAN MUTAGEN

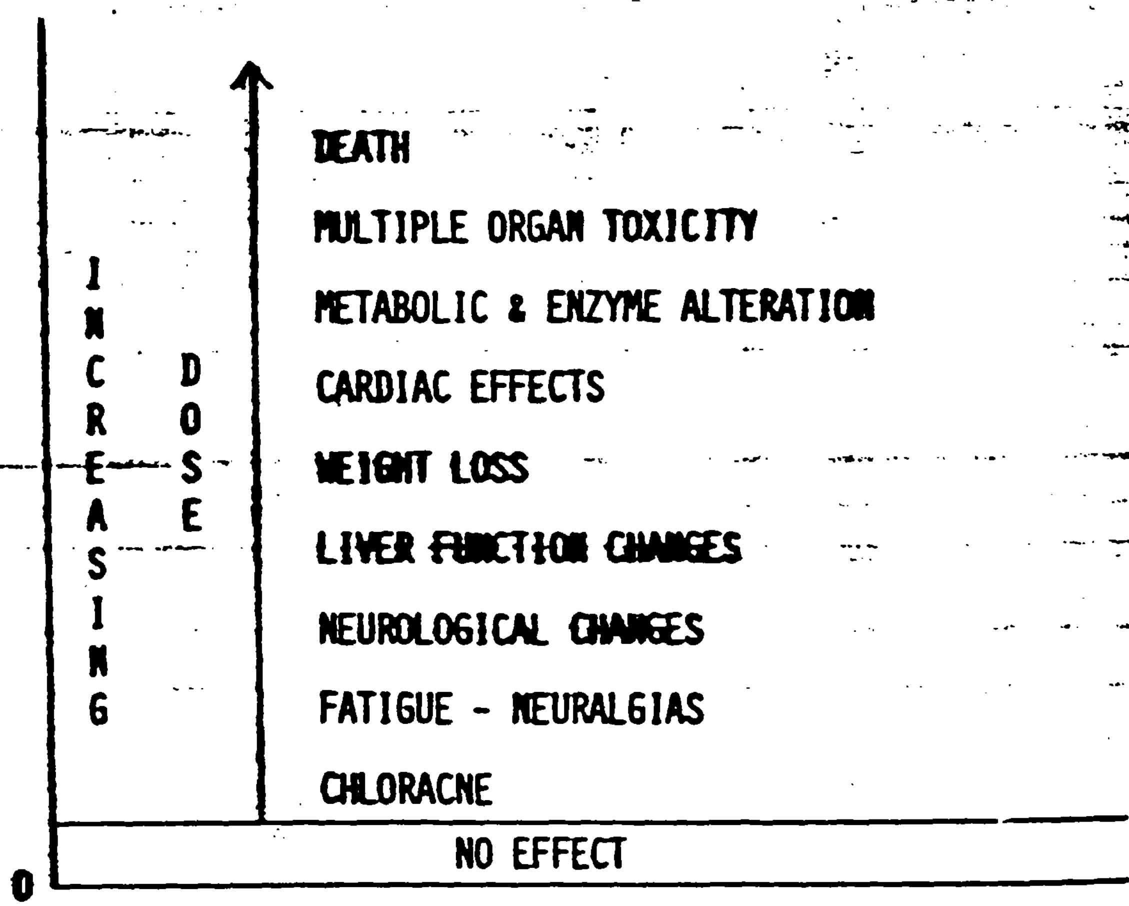
PROBABLY NO

- NO EXTENSIVE STUDY
- GENERAL EXPERIENCE DOES NOT INDICATE
- MORE STUDIES NEEDED

HUMAN CARCINOGEN

UNKNOWN

- AT BEST ONLY A WEAK CARCINOGEN
- 800 CASES WORLD-WIDE HAVE HAD OVER-EXPOSURE — HAVE NOT SHOWN ANY OBVIOUS CA EPIDEMIC
- MORE STUDIES NEEDED


DEATH
MULTIPLE ORGAN TOXICITY
METABOLIC & ENZYME ALTERATION
CARDIAC EFFECTS
WEIGHT LOSS
LIVER FUNCTION CHANGES
NEUROLOGICAL CHANGES
FATIGUE - NEURALGIAS
CHLORACNE
NO EFFECT
INCREASING
DOSE
0

DOW052573

u31" uAC

a Dow Canada
BACKGROUNDER

Dow Chemical Canada Inc.
P.O. Box 1012, Sarnia, Ont. N7T 7K7

Date: June 30, 1982

Release no. 155

Contacts. Don Stephenson 519-339-3599
Wayne Wolski 519-339-3384

Contributors. Dr. Richard Wilson, Harvard Univ.
(as reported in Weed Science Socie
of America "Newsletter" October 1

THE RISK IN SPRAYING 2,4,5-T HERBICIDE

Environmental activist groups hav- been demanding the ban of 2,4,5-T on the premise that it increases the risk of developing tumors.

Dr. Richard Wilson, a Harvard scientist, disputes the 2,4,5-T and tumors theory, however, he recently calculated the risks associated with spraying 2,4,5-T and found that if a person worked at applying 2,4,5-T with a backpack sprayer for 5 days a week, 4 months a year for 30 years his/her chances of developing a tumor would be 0.4 per million. Those conditions would represent a probable exposure level far greater than the general populace, even if they lived in a spray zone.

In comparison, other risks associated with developing a tumor are:

	Chances Per Million
Sunbathing	5,000.0
Smoking cigarettes	1,200.0
Being in a room with a smoker	10.0
Drinking one can of diet soda with saccharin/day	10.0
Drinking milk with aflatoxin or eating four tablespoons of peanut butter/day	10.0
Drinking one can of beer/day	10.0
Eating 1/4 lb. charcoal broiled steak/week	0.4

DOW

DOW CHEMICAL CANADA INC.

Modeland Road. P.O. Box 1012. Sarnia. Ontario. N7T 7K7

File - Spray Program
~~Duplicate copy~~

August 19, 1982

Mr. T. S. Thompson, Ph.D.
Public Affairs Manager
New Brunswick Electric Power Commission
527 King Street
Fredericton, New Brunswick E3B 4X1

Dear Mr. Thompson:

The attached letter and documents pertaining to the safety of phenoxy herbicides were sent yesterday to the enclosed list of Atlantic Provinces daily and weekly newspaper editors as well as two magazines covering the region. No broadcast media were covered because the complexity of the information does not lend itself to 60-second explanations.

The letter of transmittal is self-explanatory. The point is that there is a great deal of scientific evidence attesting to the safety of these products and there is no substance to alarmist claims.

Please feel free to use the information enclosed in any appropriate manner. Extra copies of any item are available by calling my office in Sarnia (519-339-3131), our agricultural chemicals sales representative in our Halifax sales office (902-429-5623), or write to either location.

We hope our initiative will lead to more balanced news coverage of the safety issue and result in a better informed public.

Yours very truly,

Harold Major /kan

Harold W. Major
Manager, Government Relations
Agricultural Chemicals

/kan

DOW CHEMICAL CANADA INC.

Modeland Road, P.O. Box 1012, Sarnia, Ontario, N7T 7K7

August 18, 1982

News Editor
The Daily News
446 Main Highway
Halifax, N.S. B4C 2S9

Dear Sir:

Recently the phenoxy herbicides 2,4-D and 2,4,5-T have been "in the news" in the Atlantic Provinces because of allegations that their use for brush and weed control in forestry and on right-of-ways involves significant risk to human health and the environment.

These pressures have resulted in some suspensions of proposed herbicide applications until "further study" can be undertaken, particularly in Nova Scotia. That has unfortunately strengthened some people's belief that the risk may indeed be real.

In view of the current controversy, we thought you might like to have information which summarizes what the world's scientific community knows about the health and environmental impact of these two herbicides. We also thought you might be interested in knowing the relative risk that these compounds pose versus other risks people readily accept.

In actual fact, so much is known about the effect of these two herbicides after more than thirty years of research and use that it is reasonable to say they pose thousands of times less risk to human health than sunbathing, for example!

The herbicide most recently in question is Esteron*3-3E, a Dow product which, in its concentrated form before dilution for use, is 42 percent 2,4-D, 40 percent 2,4,5-T, a small amount of an emulsifier, and the rest light furnace oil. This concentrate is diluted for actual spraying at ground level by mixing it with about 140 times its volume of water. This is a low volatile formulation which minimizes evaporation and drift.

It isn't necessary for you to read all the information enclosed (just skim the summaries and conclusions sections) to gain an insight into the huge body of data that exists on the effects of 2,4-D and 2,4,5-T. Moreover, government-approved application rates embody an additional hundred-fold safety factor.

(more...)

*Trademark of The Dow Chemical Company

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If I can help you understand and interpret all this science for your readers, please give me a call collect (519-339-3599) in Sarnia.

Yours very truly,

D. R. Stephenson

D. R. Stephenson
Director of Corporate Communications

/kan

Enclosures:

(1) "The Risk In Spraying 2,4,5-T Herbicide" - Dr. Richard Wilson, Harvard University, as reported in Weed Science Society of America newsletter, October '81. Dow Canada Backgrounder #155, June '82.

(2) "A Summary Of Pertinent 2,4-D Facts" - Backgrounder #159, Dow Canada, July '82 (supported by a bibliography of 134 literature references).

(3) "The Phenoxy Herbicides, Second Edition" - Published by the Council for Agricultural Science and Technology, August '78 (Note Summary on pg. 1, para's. 4 & 5). (Cites over 190 literature references).

(4) "What 56 World-Renowned Scientists From Eight Nations Say About The Safety Of The Herbicide 2,4,5-T" - Backgrounder #160, Dow Canada, July '82 (based on the results of the June '79 three-day Dispute Resolution Conference On 2,4,5-T, Arlington, Virginia. Journalists can obtain a copy of the complete 102-page report from Dow Canada).

(5) "The Safety Of The Herbicides 2,4-D And 2,4,5-T" - Forestry Commission Bulletin #57, United Kingdom, 1977; by D.J. Turner, B.Sc., Ph.D. et al, (Cites 242 literature references). (Note Summary on pg.4 and conclusions on pgs. 39-41).

(6) "On the Matter of Dioxins In Our Environment" - Backgrounder #131, Dow Canada, December 1980.

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V - RESULTS FOR ALL CAUSES OF DEATH

Results of the analyses for all causes of death combined (i.e. total mortality) are set out below, for the total cohort, and for two sub-groups of the total cohort, namely those with year first sprayed of 1959 or later and those with year first sprayed of 1958 or earlier. These two sub-groups were selected since there is evidence which suggests that diesel oil and used transformer oil was routinely mixed with the herbicide in 1959 and later years. If this is the case, these two sub-groups would have been exposed to a different range and mix of toxic agents.

Total Cohort

The SMR for the total cohort, for all durations since first exposure to the herbicide, is 154 (CI 126 to 188), based on 98 actual deaths versus 63.55 expected.

The corresponding results broken down by durations since first exposure to the herbicide are set out in Table 1 below.

TABLE 1

ACTUAL AND EXPECTED DEATHS, FOR TOTAL COHORT, BY DURATION SINCE FIRST EXPOSURE

Duration (Years)	Deaths: Actual	Deaths: Expected	SMR	CI
0 - 4	6	4.47	134%	49% - 292%
5 - 9	8	5.95	134%	58% - 264%
10 - 14	12	7.91	152%	79% - 266%
15 - 19	14	9.95	141%	77% - 237%
20 - 24	19	11.09	171%	103% - 267%
25 - 29	25	10.32	242%	157% - 358%
0 - 9	14	10.42	134%	73% - 225%
10 - 19	26	17.86	146%	95% - 215%
20 - 29	44	21.41	206%	150% - 277%
30 and over	14	13.86	101%	55% - 170%
25 and over	39	24.18	161%	114% - 220%
20 and over	58	35.27	164%	125% - 214%
15 and over	72	45.22	159%	125% - 201%
All durations	98	63.55	154%	126% - 188%

Therefore, for the total cohort, statistically significant excess mortality is observed for all causes of death for all durations combined (SMR = 154, CI 126 to 188), for durations 20 to 24 years (SMR = 171, CI 103 to 267), 25 to 29 years (SMR = 242, CI 157 to 385), 20 to 29 years (SMR = 206, CI 150 to 277), 15 years and over (SMR = 159, CI 125 to 201), 20 years and over (SMR = 164, CI 125 to 214) and 25 years and over (SMR = 161, CI 114 to 220).

SMOGER & ASSOCIATES
A PROFESSIONAL CORPORATION

ATTORNEYS AT LAW

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March 10, 1994

Paul Merrell, Esq.
7493 East Five Rivers Road
Tidewater, OR 97390

Re: Moyer v. Dow

Dear Paul:

Enclosed for your information find copies of miscellaneous documents regarding the above case. Should you have any questions or comments regarding any of the enclosed, please advise.

Very truly yours,

SMOGER & ASSOCIATES

By Gerson H. Smoger
Cerson H. Smoger (ph)

GHS:ph
Enc.

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DEPONENT/PLACE	DATE/TIME
Kenny Crump, Ph.D. **Ruston, LA**	**01/26/94 at 8:00 a.m.**
Dow Representatives (4) Midland, MI	03/09/94 beginning at 9:00 a.m.
Andrew Watson Bay City MI	03/09/94 9:00 a.m.
Herbert Nigg, Ph.D. Orlando, FL	03/14/94 9:00 a.m.
Benjamin Holder Punta Gorda, FL	03/16/94 9:00 a.m.
John Doull, Ph.D. Kansas City,	03/22/94 at 9:00 a.m.

STILL TO BE SET

Harold Gill
Marguerite Leng
Donald McCollister

UPCOMING HEARING

03/14/94 1:30 p.m. Plaintiff's Motion for Additional Relief & Motion to Compel Dow's Compliance with Court Order dated 03/19/91 and Defendant's Motion for Reconsideration of Order Compelling Discovery and Motion to Intervene and Protective Order before Judge Hauser, set by Dow

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MOYER V. DOW
836.1 RDS

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As of February 9, 1994

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A-3 Vol. 3 (08/29/89 - 01/03/90)
A-4 Vol. 4 (01/22/90 - 03/23/90)
A-5 Vol. 5 (04/17/90 - 07/05/90)
A-6 Vol. 6 (08/03/90 - 04/18/91)
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A-8 Vol. 8 (05/30/91 - 10/15/91)
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A-11 Vol. 11 (12/01/92 - 02/25/93)
A-12 Vol. 12 (03/01/93 -
A-13 SPECIAL PLEADING SECTION
- A. Dow's Renewed M/Compel Bob Moyer's statements
- B. Dow's Pet. for Writ of Common Law Cert. (Bob Moyer's Statements)
- C. Moyer's Appeal of SJ for Occidental

B MEMOS

B-1 Main Memo File
B-2 Info re Helena
B-3 Info re Pennwalt

C CORRESPONDENCE

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C-2 Vol. 2 (1/2/90 - 3/28/91)
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D **DEPOSITIONS/STATEMENTS**
(see "P" for Practice & Video Depos)

D-1 A Statement of Robert Moyer (3/20/89)
D-1 B Statement of Robert Moyer (4/29/89)
D-2 A Robert Moyer (2/13/90) Vol. I
D-2 B Robert Moyer (2/13/90) Vol. II
D-2 C Robert Moyer (2/14/90) Vol. III
D-2 D Robert Moyer (2/14/90) Vol. IV
D-2 E Exhibits to Deposition
D-2 F Robert Moyer - Video Deposition (9/6&7/90)(copy)
D-3 Ken Swanson
D-4 A Keshav Setaram (2/27/89)
D-4 B Exhibits to Deposition
D-5 Nick Sassick (3/22/89)
D-6 G.K. Carpenter (3/22/89)
D-7 Recorded Conference Call Among RDS, Dr. Epstein, Dr. Ellenbecker and Dr. Clapp (11/21/90)
D-8 Recorded Meeting of RDS, Robert Moyer, Dana Kinney and Ken Swanson (11/3/90)
D-9 Dana Kinney
D-10 Telephone conference w/Bob Moyer 4/91
D-11 Telephone conference w/Dr. Samuel Epstein
D-12 Statement of Bob Vincent
D-13 Videotaped Deposition of Robert Moyer (7/31/91)
D-14 Questions for Bob Moyer for Deposition
D-15 Andy Price
D-16 TCF between Heidi Garwood & Dana Kinney
D-17 VACANT
D-18 VACANT
D-19 Bobby Joe Pace - Helena Chemical Co. Rep.
D-20 John Endicott
D-21 Dr. G. L. Eilrich with exhibits
D-22 F. O. Hicks
D-23 Larry Silverstein
D-24 Dr. Karl Krumel
D-25 VACANT
D-26 Leon Humphrey Statement (P&S Witness)
D-27 Willis Walker Statment (P&S Witness)
D-28 VACANT
D-29 Suzanne & George Moletz Statement (P&S Witness)
D-30 Bob Num Statement (P&S Witness)

E **EXPERTS**

E-1 Samuel Epstein, M.D.
E-2 Daniel Teitelbaum, M.D., P.C.
E-2 (A) Time Diaries
(B) Agent Orange Package from Dr. T.
E-3 Lennart Hardell, M.D.

Deposition of Dr. Hardell Moyer v. Dow
Deposition of Dr. Hardell in HERR v. CAROLINA LOG BUILDINGS, INC. of 5/7 & 8/90
Exhibits to Hardell's depo. of. 5/7 & 8/90
Deposition & exhibits of Dr. Hardell in PERKINS v. NORTHEASTERN LOG HOMES, INC.

E-4 Dr. Richard Clapp
E-5 Possible Additional Experts
E-6 Dr. Michael Ellenbecker
E-7 Larry A. Platt, Ph.D.
E-8 Bernard F. Pettingill, Ph.D.
E-9 Julian Coggin, M.D.
E-10 Linda Jennings
E-11 William C. Hinds, Prof. Environmental Health Sciences
E-12 David L. Eaton (includes depos from other cases) (exhibits to Eaton depo in 3rd cabinet by RFB)
E-13 Dr. Alan Smith
E-14 Herbert Nigg, Ph.D.
E-15 Kenny S. Crump
E-16 Annette M. Shipp
E-17 Carl O. Schulz (with publications from V. A.)
E-18 Leonard Chiazze, Jr.
E-19 Trial Consultants, Inc. (TCI)
E-20 Dr. V. K. Rowe (includes depos from other cases)
E-21 Susan M. Daum, M. D. (Environmental & Occupational Medicine)
E-22 William O. Russell, M. D.
E-23 Ellen Silbergeld, Ph.D.
E-24 Jay Burke
E-25 Pro-Forma Subpoena Duces Tecum for Expert Witnesses
E-26 John Doull, Ph.D.

F FINANCIAL INFORMATION RE CLIENT

F-1 Income Tax Returns
F-2 Medical Expenses
F-3 Structured Settlement Proposals
F-4 Pre-Bill
F-5 Settlement documents re: Atochem & Asgrow
F-6 Settlement documents re: Woodbury
F-7 Settlement documents re: Chevron
F-8 Settlement documents re: Pennwalt & Asgrow

G BACKGROUND INFORMATION/OTHER FROM CLIENT
(see "K" for Employment Records)

G-1 Client Authorization Forms
G-2 Histories Compiled by Robert Moyer
G-3 Birth and Marriage Certificates
G-4 Grandparent's Death Certificates
G-5 Miscellaneous from Client

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G-6 Power(s) of Attorney
G-7 Last Will & Testament
G-8 Estate of Robert William Moyer, II
G-9 Death Certificate of Robert Moyer
G-10 Kim Moyer, (letters from client, etc.)
G-11 Medical Bills and Insurance information from Kim Moyer (11/11/93)

H HOSPITAL/MEDICAL RECORDS

H-1 Richard R. Andrews, D.D.S.
H-2 Walter Cerrato, M.D.
H-3 Florida Technological University Health Service
H-4 Geisinger Medical Center
H-5 James C. Giebink, M.D.
H-6 Kenneth S. Graff, M.D.
H-7 Jess Parish Memorial Hospital
H-8 Frederick Kadushin, Ph.D.
H-9 Richard M. Levine, M.D.
H-10 Medical Toxicology Partnership
H-11 Jose Ortiz, M.D.
H-12 John G. Penn, M.D.
H-13 Larry A. Platt, Ph.D.
H-14 Radiation Therapy Centers of Brevard, Inc.
H-15 Radiation Therapy Centers of Brevard, Inc.
H-16 Dr. Rojas/Dr. Ortez
H-17 Shands Hospital
H-18 James N. Spivey, M.D.
H-19 D.S. Springfield, M.D.
H-20 Ben Storey, M.D.
H-21 Fred H. Widerman, D.D.S.
H-22 M.D. Anderson Hospital
H-23 Stephen Mamus, M.D.
H-24 Sunshine Physical Therapy of Brevard, Inc. (Shirley Bratton, P.T.)
H-25 Craig P. Jones
H-26 Orlando Regional Medical Center
H-27 Triangle Laboratories
H-28 Aetna Life Insurance - Aetna/Prudential Med. Payments
H-29 Visting Nurse Association
H-30 Client's Medical Files

I INVESTIGATION

I-1 Investigation
I-2 Investigation by Vincent Ins. Adj.
I-3 Skinner Investigation

J JURY INSTRUCTIONS

J-1 Proposed Jury Instructions

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K EMPLOYMENT RECORDS

K-1 FPL records of Robert Moyer
K-2 Orange County records of Robert Moyer
K-3 Orange County records of Kenneth Swanson
K-4 Orange County records of Dana Kinney

L **LEGAL RESEARCH/LITIGATION ARTICLES**

L-1 Causation
L-2 Prejudgment Interest
L-3 Dow - Protective Orders
L-4 Motion to Dismiss and Motion to Transfer
L-5 Miscellaneous
L-6 Work Product
L-7 Info re Publications Etc re Toxic Tort/Prod Liab Litig
L-8 Articles re Defense of Toxic Tort/Prod Liab Litig
L-9 Memos of Law for 8/31/89 Hearing
L-10 Articles re Toxic Tort/Prod Liab Litig
L-11 AFTL "Secrets of the Tort Masters"
L-12 Health Effects Assoc. w/Exposure to Herbicides (Ag. Org. Sci. Task Force Review of Sci. Literature) 4/90
L-13 Articles re 2-4D from Law Firm that had 2-4D Case
L-14 Product Liability Statute of Repose
L-15 Product Liability Statute of Limitations
L-16 Relation Back Doctrine, Adding a new party to an existing CIA
L-17 Toxic Tort - Tactics
L-18 Articles on Real Limits of Expert Testimony
L-19 Punitive Damage
L-20 General Summary Judgmt. Rules and Cases
L-21 Federal Preemption Cases (FIFRA) Cited by 3d DCA
L-22 FIFRA & Fed. Cases No Preemption Found
L-23 Failure to Warn Issue Old Cases
L-23a Failure to Warn Current Cases
L-24 Notebook 1 - Motions in Response to Plfs' 4th Amd. Complaint
L-25 Notebook 2 - FIFRA & Related Federal Statutes
L-26 United States Environmental Protection Agency
L-27 Motions for Recusal
L-28 Statute of Repose
L-29 Survival Tactics
L-30 <u>Cippolone v Liggett Group, Inc.</u>, 60 U.S.L.W. 4703, 06/24/92
L-31 Sixth Amended Complaint
L-32 Fed. Presumption/Failure to Warn
L-33 Outdated Research

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L-34 FIFRA Preemption Recent Cases
L-35 Production of Documents (Young v. Santos), etc.
L-36 FIFRA AS AMENDED
L-37 Admissible Scientific Evidence
L-38 "Claim It Yourself" Michele Saadi (book in library)
L-39 Papas v. Upjohn Co.
L-40 Amended Statement of Claim (Fraud) filed in Canada
L-41 Junk Science Argument

M **MEDICAL/CHEMICAL RESEARCH & ARTICLES**
(see "E" for articles rec'd from and/or written by Experts)

M-1 General Information on Cancer
M-2 "Perspectives on the Safety of 2-4D" by CAST
M-3 TV Transcripts
M-4 Newspaper articles re chemicals and cancer
M-5 Databases re chemical research
M-6 Information obtained from databases
M-7 Research on epithelioid sarcoma
M-8 Herbicides & their link to cancer; Soft Tissue Sarcoma
M-9 Herbicides & their link to cancer; 2-4D
M-10 Herbicides & their link to cancer; Agent Orange
M-11 Herbicides & their link to cancer; misc. chemicals
M-12 Herbicides & their chemical components
M-13 EPA studies on chemicals (misc. articles):

A. Chapter 1 -Disposition & Pharmacokinetics (2,3,7,8-T - TCDD);
B. Chapter 2 - Mechanisms of Toxic Actions (same as A.)
C. Chapter 3 - Acute, Subchronic & Chronic Toxicity (same as A.)
D. Chapter 4 - Immunotoxic Effects (same as A.)
E. Chapter 5 - Reproductive & Developmental Toxicity (same as A.)
F. Chapter 6 - Carcinogenicity of TCDD in Animals (same as A.)
G. Chapter 7 - Epidemiology/Human Data (same as A.)
H. Chapter 8 - Dose-Response Relationships (same as A.)
I. Estimating Exposure to Dioxin-Like Compounds
J. EPA's Scientific Reassessment of Dioxin

M-14 Guide for Registration of Pesticides containing Bendiocarb (pub. by EPA)
M-15 Transcript/Hearings on Effects of 2,4,5,-T on Man & Environment
M-16 Book/Soft Tissue Sarcomas in Adults & Children

M-17 Book/Procedures to Estimate Risks from Exposure to Mixtures of Dibenzo-p-dioxins & Dibenzofurans
M-18 Book/Weed Science Principles & Practices
M-19 Book/Getting Well Again
M-20 Executive Summary re Chemical Sensitivity (Rpt. comm. / by New Jersey Dept. of Hlth.)
M-21 Locations of Major Producers of Chlorophenols and Their Derivatives
M-22 Pesticide Exposure and the Role of the Physician
M-23 Diquat Research
M-24 Non-Hodgkin's Lymphoma and Exposure to Phenoxyherbicides, Chlorophenols, Fencing Work, and Meat Works Employment: a Case-Control Study
M-25 A Case Control Study of Non-Hodgkin's Lymphoma and the Herbicide 2,4-Dichlorophenoxyacetic Acid (2,4-D) in Eastern Nebraska (Zahm)
M-26 A Case Control Study of Soft-Tissue Sarcoma
M-27 A Case-Referent Study of Soft-Tissue Sarcoma and Hodgkin's Disease
M-28 Odor vs. Exposure: Does Smell Indicate Harm?
M-29 Endothal Articles
M-30 NIOSH Current Intelligence Bulletin 40 (2,3,7,8 - Tetrachlorodibenzo-p - dioxin (TCDD, "dioxin")
M-31 Chemical Research (2,4,5-T - TCDD) (Cancer Mortality Among Workers in Chemical Plant Contaminated with Dioxin)
M-32 Cancer Mortality in Workers Exposed to 2,3,7,8-Tetrachlorodibenzo-p-dioxin
M-33 NIOSH Publications Catalog
M-34 Pesticide Exposure Article listing furnished by Edward N. Willey, M. D.
M-35 Toxic Peripheral Neuropathy Article listing furnished by Edward N. Willey, M. D.
M-36 Dioxin articles
M-37 Use of Hair Coloring Products & the Risk of Lymphoma, Multiple Myeloma & Chronic Lymphocytic Leukemia. American Journal of Public Health, Shelia Hoar Zahm, ScD.
M-38 American Journal of Public Health - July 1992 (Public Health Policy; Environment/Occupational Health)
M-39 "Risks to Human Health Associated with Exposure to Pesticides at the Time of Application & the Role of the Courts", Brett & Potter.
M-40 Toxicology - General
M-42 Environmental Illness
M-43 Environmental & Chemical Overexposure
M-44 Occupation-Induced Posttraumatic Stress Disorders
M-45 Agent Orange - Review of Scientific Literature
M-46 Cancer Mortality in Workers Exposed to Chlorophenoxy Herbicides and Chlorophenols
M-47 Book/Of Acceptable Risk, William W. Lowrance
M-48 Ground Applications of Forestry Herbicides, USDA Forest Service

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M-49 Defendant's Analysis of Chemicals Used in 1976 & 1977 (exhibits to Eaton's depo)
M-50 Lies & Contempt: Dioxin & Agent Orange by Liane Clorfene Casten (from Zumwalt) unpublished & unfinished book
M-51 Cancer Mortality Study (01/91) Fingerhut
M-52 Herbicides and Cancer (Morrison, Wilkins, Semenciw, Mao & Wigle; Journal of the National Cancer Institute - (This is a key article).
M-53 Report to the Secretary of the Dept. of Veterans Affairs on the Assoc. Between Adverse Health Effects and Exposure to Agent Orange, by Special Asst. Admiral E. R. Zumwalt, Jr., 05/05/90
M-54 Veterans & Agent Orange - Health Effects of Herbicides Used in Vietnam by Institute of Medicine 1993
M-55 EPA - Prog. to Reassess Pesticide Risks
M-56 Disease Diagram
M-57 General Risk Assessment
M-58 Pesticides - General

N ATTORNEYS NOTES AND DRAFTS

N-1 Attorneys Notes and Drafts
N-2 Draft of Resp/RTP from Woodbury (6/12/89)
N-3 Rough Drafts of Answers to Interrogatories

O OTHER CASES (ENTIRE "O" SECTION IN 3RD CABINET BY RFB)

O-1 Greenhill v. Dow
O-1 A Greenhill's RTP to Dow
O-1 B Dow's Interrogatories
O-1 C Transcripts
O-2 Davis v. Dow
O-3 Shoecraft v. Dow, Case No. CIV 74-662-PHX CAM
O-4 Agent Orange MDL 381 (Docket Sheets)
O-5 Agent Orange - Product Liability Litigation U. S. District Court - Eastern District of New York

A. Day 1
B. Day 2
C. Day 3
D. Day 4
E. Day 5
F. Day 6
G. Day 7
H. Day 8
I. Day 9
J. Day 10
K. Day 11
L. Day 12
M. Edward A. Metcalf Depo (from SODA)
N. Dr. Van Murray Sim Depo ("   ")
O. Dr. Robert A. Darrow Depo (")

P. Frank J. Vocci Depo (")
Q. Benjamin Harris Depo (")
R. Plaintiff's Pre-Trial Order with attachments
S. Diamond Shamrock's Log of Documents Identified in Response to Plaintiff's Interr to Def. (First Wave) Exhibit "A"

O-6 Canadian Litigation Against Dow (Documents RDS obtained from Jerry White during visit in 10/92)
O-7 AGNEW V DOW, ET AL., (Canadian Litigation rec'd from SODA)
O-8 VERTAC (from SODA)
O-9 Arkansas (from SODA)

P PHOTOGRAPHS, VIDEOS AND SLIDES

P-1 Photographs
P-2 Practice Depo of Robert Moyer
P-3 Day in the Life Film of Robert Moyer
P-4 Video Deposition of Robert Moyer (Volumes 1, 2 & 3) (9/6&7/90) (copy)
P-5 Photographs from Orange County
P-6 M.D. Anderson Slides
P-7 Video Statement of Robert Moyer (7/91)
P-8 Pre-Amputation Photos of Robert Moyer
P-9 Interview with Kim Moyer
P-10 Day in the Life File of Robert Moyer (12/02/91)
P-11 Bobby & Danny Video
P-12 Settlement Documentary (03/92)
P-13 Day in the Life of Robert Moyer (04/92)
P-14 Settlement Documentary (brochure)- Updated (05/06/92)

Q DISCOVERY PRODUCED BY US

Q-1 Resp/RTP from Helena (5/16/89)
Q-2 Ans/INT from Helena (5/16/90)
Q-3 Resp/RTP from Woodbury (6/4/89)
Q-4 Ans/INT from Asgrow (6/28/89)
Q-5 Ans/INT from Dow (7/24/89)
Q-6 Ans/INT from Asgrow (10/3/89)
Q-7 N/Compliance (4/2/90) **(AETNA RECORDS)**
Q-8 Resp/Order Compelling Photos (4/17/90)
Q-9 Ans/INT from Dow (1/5/90)
Q-10 N/Compliance (12/17/90) (Drs. Thompson, Jones, Freed, Mamus and Cerrato)
Q-11 Ans/Dow Interrogs (2/18/93)

R RECORDS PRODUCED BY DEFENDANTS
(also by Orange County and other sources)

R-1 Orange County - Bid Sheets & Correspondence (obtained by client)

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R-2 Orange County - Original Response to Subpoena D.T. (the important records - consists of several folders not individually indexed)

R-2A Charts re: Chemicals Purchased by Orange County in 1976 & 1977

R-3 Orange County - Contracts for Purchase of Chemicals (1984 - 1988)

R-4 Orange County - Records on Herbicides used <u>after</u> 1977

R-5 Orange County - Documents produced for Asgrow

R-6 Dow - Krumel & Arnold Report (not obtained from Dow?)

R-7 Ken Swanson's Journal (copy - original in R-2)

R-8 Dow's Response to our Requests (7/18/91)

R-9 Orange County - Water Quality Records

S CHEMICAL LABELS
(By Company)

S-1 Arjay
S-2 A&V, Inc.
S-3 Applied Biochemists, Inc.
S-4 Asgrow
S-5 Chevron
S-6 Ciba-Geigy
S-7 Citco
S-8 Dow
S-9 Helena
S-10 Monsanto
S-11 Pennwalt
S-12 Rhodia
S-13 Southern Mill Creek Products, Inc.
S-14 Thompson Hayward
S-15 Transvaal
S-16 3M Corp.
S-17 Other Companies
S-18 Diamond Shamrock Chemical Company

T TRANSCRIPTS

T-1 Transcript of Hearing (8/31/89)
T-2 Transcript of Hearing (12/4/90)
T-3 Transcript of Hearing (4/2/91)
T-4 Transcript of Hearing (4/24/91)
T-5 Transcript of Hearing (01/09/92)
T-6 Transcript of Hearing (09/25/92) Re: Pl. M/Sub. Party & M/File 6th Amended Complaint
T-7 Transcript of Hearing (10/02/92) Re: Dow's Motion to Appoint Commissioners & Our Motion to Quash (Teitelbaum)
T-8 Transcript of Hearing (11/23/92) Teitelbaum Production
T-9 Transcript of Hearing (01/05/93) Our M/Modify Teitelbaum

T-10 Transcript of Hearing (01/26/93) Dow/s M/Strike Paragraphs of 6th Amended Complaint
T-11 Transcript of Hearing (03/01/93) Dow's Motion to Strike Expert Witness; Pltf. Motion to Modify Court's Prior Ruling; Pltf. Motion for Rehearing

U DOCUMENTS RECEIVED FROM JOHN BETTS

U-1 Davis v. Dow
Exhibits # 1-277
Attachment to Memo of 11/13/91 - Exhibit List of Documents
Attachment to Memo of 11/13/91 - Supplemental List of of Legal Documents
Legal Documents, Exhibits #I - XVI
Exhibits #1 - 25 on Dow's Publications and Hype on Herbicides
Supplemental List of Exhibits on Dow's Publications and Hype on Herbicides
U-2 Keister v. Dow
Exhibits #1 - 49
Memo of 11/28/91 on Review of Documents
Attachment to Memo of 11/28/91
U-3 Newman v. AT&T
Exhibits #1 - 20
Memorandum of 11/29/91
Attachment to Memo of 11/29/91
U-4 Memo of 11/30/91 on 2,4-D and 2,4,5-T
List of Documents from Memo of 11/30/91 with exhibits #1 - 10
U-5 The Dow Story - Don Whitehead
U-6 Memo re: Canada Trip from John Betts with documents

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X EXHIBITS - GOLD FOLDERS

X-1 Asgrow's Resp/INT (4/30/90)
X-2 Asgrow's Resp/RTP (4/30/90)
X-3 Asgrow's Resp/RTP to All (4/30/90)
X-4 Monsanto's Resp/RTP (5/4/90)
X-5 Monsanto's Resp/RTP to All (5/4/90)
X-6 Monsanto's Resp/INT (5/4/90)
X-7 Helena's Ans/INT (5/11/90)
X-8 Helena's Resp/RTP (5/11/90)
X-9 Helena's Resp/RTP to All (5/11/90)
X-10 Woodbury's Resp/RTP to All (5/15/90)
X-11 Woodbury's Resp/RTP (5/15/90)
X-12 Woodbury's Ans to INT (5/23/90)

X-13 Dow's Resp/INT (5/29/90)
X-14 Dow's Resp/RTP (5/29/90)
X-15 Dow's Resp/RTP to All (5/29/90)
X-16 Chevron's Resp/INT (6/1/90)
X-17 Chevron's Resp/RTP to All (6/1/90)
X-18 Occidental's Resp/RTP to All (8/3/90)
X-19 Occidental's Ans to 1st Set of Ints from Pls (8/3/90) w/Supp Filing of Resp to Ints (8/14/90) (signature page)
X-20 Video Depo of Robert Moyer (Original Tapes - Volumes 1, 2 & 3 - 9/6&7/90)
X-21 Video Depo of Robert Moyer (Original Transcript - 9/6&7/90)
X-22 Monsanto's Resp/Pl. 2nd RTP (04/09/91)
X-23 Video Deposition of Robert Moyer (7/31/91) (Original)
X-24 Plaintiff's Ans. to 2nd Set of Rogs from Occidential (01/09/92)
X-25 Plaintiff's Ans. to 3rd Set of Rogs from Dow (01/09/92)
X-26 Dow's Response to RTP from Plaintiffs (02/05/92)
X-27 Plaintiff's Ans. to 2nd Set of Rogs from Dow (01/03/92)
X-28 Bobby Joe Pace - Helena Chem. Co. Rep. Deposition
X-29 Dow's Resp. to Pl. Expert Rogs (05/21/92)
X-30 Voir Dire
X-31 Deposition of Herbert Nigg, Ph.D.
X-32 Depo of Verald Keith Rowe
X-33 Allan Smith's Depo
X-34 Dow's Expert Rogs to Plaintiff (02/18/93)
X-35 Dow's Response & Objections to Plaintiff's Supplemental Interrogatories (12/18/92)
X-36 Dow's Response to Plaintiff's Request to Produce (12/18/92)
X-37 Occidential's Interrogatories to Plaintiff (01/18/93)
X-38 Helen Answers to Pltf. Interrogs (4/24/91)
X-39 Closing Argument
X-40 Kenny S. Crump original depo (04/01/93) with exhibits
X-41 Carl O. Schulz, Ph.D original depo (03/05/93) with exhibits
X-42 David Lee Eaton original depo (12/15/92) exhibits in 3rd cabinet by RFB
X-43 Helena's Ans to Expert Interrogatories (03/31/93)

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Z MISCELLANEOUS

Z-1 Mediation File
Z-2 Demand Letter
Z-3 Gerson Smoger, Esquire
Z-4 Other Chemical Incidents in Area
Z-5 Defense Strategy Folder
Z-6 John A. Betts
Z-7 ATLA Exchange
Z-8 2,4-D Advertisements
Z-9 "Defending Toxic Tort Litigation
Tenth Annual Toxic Tort Seminar
Z-10 Court papers pending action
Z-11 Status of Discovery printout
Z-12 Freedom of Information Request
Z-13 Occidental Annual Report (1987)
Z-14 Original court papers from defendants.
Z-15 Newspaper article re sprays
Z-16 Dow Financial Statements
Z-17 Questions for Dow Experts
Z-18 Mock Jury
Z-19 Task Force
Z-20 Index Demo from Gallant SODA Canada
Z-21 Boehringer (from SODA)
Z-22 DCA - 5th District
Z-23 Anonymous Chemical Safety Survey
Z-24 Experts/witnesses used by Dow in other cases
Z-25 Map-Michigan
Z-26 Post-Trial Interviews (from California Plaintiffs' Steering Committee on Implants)
Z-27 Consent to Employ Appellate Counsel (Caruso, Burlington)

UNITED STATES DISTRICT COURT

EASTERN DISTRICT OF NEW YORK

FILED UNDER SEAL

In re

"AGENT ORANGE"

PRODUCT LIABILITY LITIGATION

79-C-467	CV-80-2997	CV-81-991	CV-82-1142
79-C-747	CV-80-3256	CV-81-995	CV-82-1749
79-C-2752	CV-80-3336	CV-81-1199	CV-82-2004
79-C-2846	CV-80-3386	CV-81-2339	CV-83-1306
CV-80-0275	CV-81-512	CV-81-2721	CV-83-2022
CV-80-0613	CV-81-666	CV-82-3106	CV-83-4024
CV-80-0693	CV-81-1036	CV-82-0208	CV-83-4030
CV-80-0991	CV-81-559	CV-82-861	CV-84-1222
CV-80-1277	CV-81-1296	CV-82-1849	CV-84-1879
CV-80-1989	CV-81-2719	CV-82-1734	CV-84-1880
CV-80-2002	CV-81-511	CV-82-1852	
CV-80-2010	CV-81-522	CV-82-2493	
CV-80-2207	CV-81-665	CV-83-3122	MDL No.
CV-80-2280	CV-81-1295	CV-82-0783	381(JBW)
CV-80-2284	CV-81-2349	CV-82-4033	
CV-80-2440	CV-81-2726	CV-82-775	
CV-80-2631	CV-81-519	CV-82-2179	
CV-80-2908	CV-81-662	CV-82-3619	

EXHIBITS

Ronald D. Rossani
1910C Tysons Landing Court
McLean, VA 22102

MEMORANDUM FOR RECORD

SMUFD-BS-C , 9 September 1966

SUBJECT: Phone Call from Mr. Wayne Vanderventer, USAF Kelly Field, Texas, Re Visit of Dow Personnel

1. Dow is now proposing new formulation:

2.1 lb acid equivalent butyl 2,4-D
2.1 lb acid equivalent butyl 2,4,5-T
1.0 lb acid equivalent isooctyl picloram

Dow requested Vanderventer's approval. Vanderventer stated that recommendation of formulations was Army responsibility.

2. Dow people plan to go to Richmond to sell their new formulation to DSA.

3. Dow stated that Crops Division has no money for field testing and asked if USAF could field test the formulation. Answer was negative.

4. The undersigned informed Vanderventer that new formulation was an improvement over Tordon 101 but more active ingredients could be incorporated into one gallon to reduce logistic effort and sortie numbers. It should be possible to get 3 lbs of D, 3 lbs of T and 2 lbs of picloram per gallon. This would be a much more effective formulation.

C. E. Minarik

C. E. MINARIK
Chief, Crops Division

Distribution:
Dir/Bio Sciences Lab.
Captain C. Bartlett
Dr. J. W. Brown
Dr. R. Bunker
Dr. R. Darrow
Mr. K. Demaree
Mr. R. Frank
Mr. K. Irish, P&ROO
Dr. G. Truchelut
Lt. Col. Crowell, ACSFOR
Dr. W. W. Dorrell, ACSFOR
Mr. E. Hamory, AMC
Major Nord, OCRD
Lt. Crea, Eglin AFB

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SMUFD-AO-C 15 September 1966

SUBJECT: Production of Herbicides

1. Dr. Mark Wiltse and Dr. James Gowell, Dow Chemical Company, visited Crops Division on 15 September 1966 to discuss proposed new formulation of Tordon.

2. Dow would like to offer as a replacement for Orange, a mixture of herbicides, with the following composition per gallon:

2.15 lb a. e. n butyl 2,4-D
2.15 lb a. e. n butyl 2,4,5-T
1.0 lb a. e. iso octyl picloram.
1 qt. low viscosity oil (PENOLA OIL M3140)

"Super Orange"

The above mixture could be made by mixing 1/2 gal Orange, 1 qt. of isooctyl ester of picloram and 1 qt. oil.

3. Dr. Wiltse offered us 5000 gallons free for testing in RVN or Thailand. Since we can not operate in these two areas, we declined their offer but stated that we would cooperate with them if they could conduct tests in Hawaii. We are presently assisting them in locating a suitable test area through Mr. George Roth, a Crops Division Consultant who resides in Hawaii.

4. Dr. Wiltse stated that between the present and June 1967, there will be a deficit of 1,158,000 gals of Orange. The Government has scheduled procurement of Orange at the rate of 420,000 gals/month or a total of roughly 5 million gals.

Industry can not supply more than 3.5 million gallons of Orange, operating at peak capacity and diverting all of the product to the military.

The annual commercial requirement for 2,4,5-T acid is 10.5 million lbs

The military requirement is 21.5 million lbs, or a total of 32.0 million lbs, however, the total anticipated US annual capacity of T acid is expected to be 15 million lbs, considerably below the military requirement, leaving none for civilian use.

5. The Dow Freeport plant will be producing 280,000 lb/mo. of Tordon acid.

6. Dow's current production of 2,4,5-T acid is 560,000 lb/mo.

C. E. Minarik
C. E. MINARIK
Chief, Crops Division

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Dt-/Bio Sciences Lab.
Dr. Brown
Dr. Darrow
Dr. Truchelut
P&RO Office, ATTN: Mr. Irish

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MEMORANDUM FOR RECORD

[illegible]

7 October 1966

SUBJECT: Information Provided by Major Mulcahy

1. The following information was provided by Major Mulcahy, Aerospace Fuels, San Antonio Air Material Area, Kelly Air Force Base, Texas on 7 October 1966.

2. On or about 24 September three Dow representatives called on Col. Hagen, USAF, and offered him a new formulation of Orange-Tordon for evaluation in Viet Nam. Col. Hagen declined the offer, stating that it was the Army's responsibility to evaluate and recommend herbicides for use in VietNam, but he called in three Army officers to talk to the Dow representatives. One of the Army officers was Major Nord, the names of the other two wer not known to Major Mulcahy.

3. The Army officers are reported to have stated that the new formulation sounded good and they are reported to have accepted it for evaluation overseas.

4. Col. Hagan stated that if the Army wished to do this he would cooperate by arranging an air lift and he asked the Dow people for information on the number of packages, their weight and cube.

5. Dow provided the information in a letter dated 23 September 1966 which also appeared to put a little pressure on the military to proceed with the evaluation promptly.

6. Since then Dow has also been pressuring Aerospace Fuels to air lift the cargo of 22 drums of the new formulation.

C. E. MINARIK
Chief, Crops Division

Distribution:
Dr. Brown
Dr. Barrow
[illegible] Sciences Lab.
[illegible] ATTN: Mr. Irish
Commanding Officer

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THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

April 30, 1963

Dr. B. P. McNamara
Directorate of Medical Research
Edgewood Arsenal
Edgewood, Maryland

Dear Dr. McNamara:

Pursuant with your request, I have obtained the names of those custom operators who have been applying 2,4-D and 2,4,5-T in various forms for many years. I attempted to call you today, but you were not available so I gave the names to Dr. Averill and told him I would confirm them by mail. They are given on the attached sheet.

I am sure if you contact those men listed, that you will be able to get all the information you need.

It was certainly a pleasure to meet with you and if I can be of any further help, do not hesitate to call me.

Sincerely yours,

V. K. Rowe
Biochemical Research Laboratory
1701 Building

VKR/jd

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Asplundh Tree Expert Company
Jenkinstown, Pennsylvania
Attn: Ralph Kauffman

Oregon Agriculture
Tulelake, California
Attn: Ed Green

West Tree Service
Little Rock, Arkansas
Attn: A. D. West

Chemitrol Chemical Company
Gibsonberg, Ohio
Attn: Fred Karlovitz
Art Doust

Wilson Tree Company
Shelby, North Carolina
Attn: Hackett C. Wilson

Townsend Tree Service Company
Muncie, Indiana
Attn: Vaughn Townsend
Donald Townsend
Vernon Townsend

Consumers Power Company
Jackson, Michigan
Attn: Jack Stenberg

Laverty Sprayers, Incorporated
Indianola, Iowa
Attn: Charles Laverty

Bartlett Tree Expert Company
Stamford, Connecticut
Attn: Bob Bartlett

Tennessee Vally Authority
Chattenooga, Tennessee
Attn: Robert Mann

Lucas Tree Expert Company
179 Sheridan Street
Portland, Maine
Attn: Art Batson

West Penn Power Company
Washington, Pennsylvania
Attn: Fred Ashbaugh

Penn Line
Scottsdale, Pennsylvania
Attn: Howard Ferguson

Black Tree Company
Durham, North Carolina
Attn: Craig Black

Davey Tree Expert Company
Kent, Ohio
Attn: Homer L. Jacobs

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February 5, 1965

J. L. Spalding
Patent Department
[illegible] Building

You recently requested a recap of what we knew about the Federal Government's purchases of technical esters 2,4-D and 2,4,5-T which were blended as 50% by weight normal butyl ester of 2,4-D, 30% by weight normal butyl ester of 2,4,5-T and 20% by weight iso butyl ester of 2,4,5-T. It is my understanding that royalties due Dow Chemical are based on a percentage of the dollar value rather than on cents per pound. This is mentioned because on some of the following bids we have been unable to find out who took them or at what price. There is also the possibility that quotations were solicited but no material purchased. Some of the requests were based on gallons. Where it has been necessary to convert, we have used 10.7 pounds per gallon.

The dollar figures in brackets are estimated by [illegible] the price of the following bid so, if anything, should be on the low side.

November 1961 Bid DA-[illegible] was for a total of 68-,000 lbs. Dow had an inventory of 321,000 lbs. of a blend of 75% Normal Butyl Ester of 2,4-D and 25% Normal Butyl Ester of 2,4,5-T which was war surplus, which we had repurchased. We added 160,500 lbs. of iso butyl ester of 2,4,5-T to make 481,500 lbs. which was sold to U.S. Army Procurement at a negotiated price of $ .4763 lb. 229,338.45

The balance of 203,500 lbs. was sold at $ .61[illegible] lb. 124,887.25

June 12, 1962 Dow quoted $ .654 lb. on 5,000 gallons but did not receive the award. The next known price was $ .5897 lb. when Dow received the award of December 5, 1962 at this price. 5,000 gallons is estimated to be 53,500 lbs. (31,548.95)

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PLAINTIFF'S EXHIBIT

August 30, 1962 Dow quoted $ .6143 lb. on 500,000 lbs. but did not receive the award. The next known price of $ .5897 is used as an approximation.	(294,750.00)
September 26, 1962 Dow quoted $ .6143 lb. on 5,000 gallons but did not receive the award. 10.7 lb. per gal. is used to convert gallons to pounds and the estimated price is $ .5897.	(31,548.95)
December 5, 1962 Dow quoted on contract DA-30-070-AMC-[illegible](A) on 880,000 lbs. at $ .5897 lb. and was awarded that portion. The total bid was for 1,252,280 lbs. Diamond was awarded the balance of 372,280 lbs. at $ .60 lb.	223,368.00
April 24, 1963 Dow quoted on 6,000 gal. Using 10.7 lb. this would be 64,200 lbs. The next known price of $ .6143 lb. on the May 6 contract is used as an approximation. (Supplier unknown)	(39,4[illegible])
May 6, 1963 Dow was awarded contract [illegible] for 10,000 gallons at $ .6143 lb. Using 10.7 lb. this would be 107,000 lbs.	65,7[illegible]
September [illegible], 1963 Dow quoted on 3,000 gal. at 10.7 lb. per gallon at $.[illegible] lb. The next known price was $ .58 lb. (Supplier this bid unknown)	(18,618.00)
January 19, 1964 Dow quoted on 37,125 gal. at 10.7 lb. per gal. at $.[illegible] lb. This was request DSA [illegible]. Monsanto got the order for $229,303.75.	229,303.75
May 7, 1964 Dow bid on 119,000 gal. at 10.7 lb. per gal. at $.[illegible] lb. This was request DSA-[illegible]. The next known price was $ .5[illegible] lb. (Supplier of this bid unknown)	

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June 10, 1964 Dow bid on 150,000 lbs. at $ .672 lb. This was request DSA-6-64-209. The next known price was $ .5593 lb. (83,395.00)

$ 2,645,752.35

At this point the bids started calling for a formulation consisting of 50% Normal Butyl Ester of 2,4-D and 50% Normal Butyl Ester of 2,4,5-T.

June 17, 1964 Dow bid on 10,000 gal. at 10.7 lb. per gal. at $ .6955 lb. Monsanto took this bid at $63,055.10. $ 63,055.10

July 2, 1964 Dow bid verbally on 3,000 gal. at 10.7 lb. per gal. at $ .6955 lb. Supplier unknown. The next known price was $17,700.00 which Hercules bid for a like amount. This figures out to approximately $ .5514 lb. ($ 17,700.00)

July 30, 1964 Dow bid on 3,000 gal. at 10.7 lb. per gal. at 7.44/gal. Hercules took this for $17,700.00 or 5.90/gal. This was invitation [illegible]-65-6. $ 17,700.00

October 16, 1964 Dow bid on 5005 gal. at 10.7 lb. per gal. at $7.19 gal. Supplier unknown. The next known price was $5.875/gal. (29,4[illegible].40)

December 9, 1964. Dow bid on 50,000 gal. at 10.7 lb. per gal. at $6.71 gal. This was invitation DSA 6-65-210. Monsanto bid $5.875/gal. $ 293,750.00

Total $ 421,[illegible]39.50

Very truly yours,

R. F. Hanson
Agricultural and Industrial
Bioproducts Sales

lm

cc: C. E. Otis
W. L. Corbin

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P-00124

1960 —

PRODUCTS ☐ CHEM ☐ CONS. PROD ☐ D ☐ PACKAGING ☐

(FULL NAMES NOT INITIALS)

P. Beutel	J. H. Hanes	W. J. Ryan	D. E. Yorke
W. L. Corbin	. J. McCoy	R. A. Whitesell	
F. H. Gowell	. N. Patterson	R. W. Wright	

(FULL NAME IN FULL (DO NOT ABBREVIATE. INDICATE DIVISION OF COMPANY IF ANY))

1. Dept. of Defense (Hebbeler/Shade). 3. EDSA
2. Dept. of Defense (Rolle/Davis) 4. DGSC, Richmond

STREET CITY ZONE

See appropriate call

PERSONS INTERVIEWED & POSITIONS

See appropriate call

DOW SALESMAN	OTHERS PRESENT (IDENTIFY)	SALES OFFICE	CALL NO.	DATE CALLED	DATE WR
See appropriate call				8/16/67	8/18/
				DGSC 8/17/67	

MN012332

Because of the importance and similarity of subject matter in what would be a series of reports, we have incorporated these calls into one report.

The subject is Tordon.

1. DEPARTMENT OF DEFENSE - Pentagon 3A514, Washington D. C.
   Gen. James Hebbeler, U. S. Army, Force Development
   Lt. Col. Robert Shade, U. S. Army, Force Development

   Dow personnel: A. P. Beutel, R. A. Hickman, R. A. Whitesell

There has been no change in the thinking of Gen. Hebbeler's group in terms of the effectiveness of Orange or Tordon, except for slightly slower kill by Tordon. This has not proven a serious handicap to Tordon. They are interested in the development of a more effective herbicide, perhaps a combination of Orange, Tordon and Dowpon. This would increase the kill of broad leaf grasses which still constitute a cover for enemy troops.

Col. Shade intimated that there was still a possibility for increased use of Tordon to the level of possibly 5.5 M gallons annually during that period when new Orange production is not available.

Gen. Hebbeler pointed out that protective cover was now being flown for the ... spray airplanes because they had lost two to enemy ground fire, and this was presenting a bit of a problem as it does in all weaponry.

We discussed briefly the possibility of the use of spray nozzles of Dow design on jet aircraft. The present boom-type of sprayer would not be effective because of the hot gases in the exhaust of the jet. We advised them of the tests being conducted at Ft. Riley, Kansas, and at Eglin in 245 this field. A brief discussion was held in terms of whether the Arm or Air Force would buy product when the plant which will be built, financed and operated by the government for 2,4-D and 2,4,5-T comes on stream.

The reason for this inquiry is that at the moment herbicides are being purchased as chemicals under the 6810 code instead of as a wea under the 1380 code. If a change in classification would be made, a change would be made in the point of purchase.

2. DEPARTMENT OF DEFENSE - Pentagon 3C934, Washington, D. C.
Mr. Carl Rolle
Mr. Leon Davis, Assistant to Carl Rolle

Dow personnel: A. P. Beutel, R. A. Hickman, R. A. Whitesell

This office is OSD, I&L.

Mr. Davis replaced Mr. Fred Bates who was well known by many of the Dow personnel and who retired December 31, 1966. Mr. Davis was quite helpful in giving us bits and pieces of information that fitted in wi other information we had developed.

We were familiar, of course, with the fact that the Army is going to build, finance and operate a 2,4-D 2,4,5-T plant and is going to pu on an RFP from Edgewood a request for a TCB plant to be financed, ow and operated by industry. The 2,4-D 2,4,5-T plant will be built and operated at ~~either Muscle Shoals, Wilson Dam, or, as a second and mor preferable location,~~ the "moth balled" AEC plant at Weldon Springs, which is approximately 60 miles west of St. Louis [illegible]

The amount of money needed for the 2,4-D 2,4,5-T plant is approximat $19 M. Its capacity will be in the order of 8 M gallons of Orange pe The result is that industry will be asked to supply about 20% more ir to meet the requirement of 10-12 M gallons of Orange. (See quantitie shown in paragraph reporting call on Mr. Bills, DGSC, Richmond.)

In order to activate Weldon Springs, a powerhouse will have to be bui nearby to supply adequate power. The AEC plant was formerly operated by Mallinckrodt. There has been considerable pressure from the Office Emergency Planning and the Department of Agriculture to get adequate supplies of Orange without robbing the agricultural market. The bids will ask for maximum effectiveness of the plant in a minimum length time.

It was suggested to Mr. Davis that every caution be exercised in term of the health hazard of this plant, and, if possible, the wording of Army bids be such that the plants could be built near each other.

Mr. Davis advised us that the control of the bids, etc., would be in Mr. John Traub's office out of Edgewood and that contacts should be m by our management people there to make sure that Dow's contributions be made in the pre-planning of the writing of the RFP for the TCB pl 246

3. BUSINESS AND DEFENSE SERVICES ADMINISTRATION - Dept. of Commerce Building, Washingt

Mr. Wesley Koster
Miss Jane Lewis .

Dow Personnel: A. P. Beutel, R. A. Hickman, R. A. Whitesell, D. E. Yonka

A review of the above information was conducted with Miss Lewis and Mr. Koster. There was some additional input in that the figure of 125 M gallons of Tordon was established as the requirement on a cont ous basis, providing the war in Vietnam continues, irrespective of th requirements of Orange.

The Orange requirements which we reported above as being around 8 M g apparently are more nearly 12 M gallons according to the information developed with Koster-Lewis.

The odds are that our requirements for Tordon will continue at about same level, barring the increase Col. Shade indicated above, through f 1969 (June 30, 1969). The reason for this is that there has been app merely six months of planning in the fiscal year 1968, and certainly will be no production from any new Orange plant any sooner than 12-15 months at the most wishful estimation.

We were asked by Mr. Koster to exercise no more DO's against marginal suppliers other than Riley Tar in Indianapolis. According to Mr. Kost this only confuses the industry and does not make it possible for Rile Tar to complete any orderly planning.

We did learn that there are four companies very interested in bidding the plant that will be built for TCE. In all probability, since we c only guess and have affirmation made on our guesses, these companies a

1. Dow
2. Hooker
3. Monsanto or Diamond
4. A newcomer that might possibly by the Farm I Company in Kansas City. It is a firm that not now in the business, one that does have sufficient capital, one that wants to get in the business, one that says it can have a pl on stream within 15 months, but that it woul have to buy its know-how and has told BDSA i will buy this know-how abroad.

Both Koster and Lewis were complimentary of Ken Hanson's proposal on t new fact finding survey. The survey is to determine total 2,4-D capac and 2,4-D inventory in the United States as this is an area in which t government through USDA and CIP has expressed serious interest. In ad tion, there has been a great deal of pressure from Congressmen represe individual farmers and/or contractors.

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It is thought that the RFP's from Edgewood would be forthcomin[g] the next ten days. While, as reported above, Mr. Davis in OSD the plant might be built at Weldon Springs, ~~Louis/Kocher-Gelb- information indicated it would be built at Muscle Shoals.~~

We discussed the availability of Tordon from our Texas plant an[d] general philosophy of DDSA in not getting any more producers i[n] field than were necessary.

Government support for the TCB plant would be in the form of a of sale of product.

4.. DEFENSE GENERAL SUPPLY CENTER - Richmond, Virginia
Mr. Welton Bills
Mr. George Collins

Dow Personnel: R. A. Hickman, R. M. Patterson

Basically, we confirmed all of the above information.

We did pick up one bit of interesting information and that is October 1 the requirements for 1969 fiscal year herbicides are t[o] the hands of Mr. Bills. They need six months lead time on quan[tities] required. They need four months lead time on the dollars they require to procure these quantities. Therefore, having receive[d] quantities by October 1, they will establish the money needed b[y] December 1. Procurement then would be made in the four months [follow]ing December 1. It would be placed again on bid. Mr. Bills als[o indi]cated that the quantities of Tordon required would be about the [same as] previous years, and indicated that they had been purchasing abo[ut] gallons of herbicide annually in the last two years.

IMPORTANT - Jim Hanes and Bob Wright, please note.

Mr. Bills advised us that Public Law 87-653, sometimes known as "Truth in Negotiations" law will be exercised in the procuremen[t] and Orange next year. It is our suggestion that Mr. Hanes and [...] review the impact of the use of this law, if any, on our supply data to the government for either negotiation or renegotiation.

We were given permission, in fact we were requested, to acceler[ate] shipments of both Orange and Tordon under our present contracts.

Mr. Bills advised that they were not able to help John Williams [in get]ting the information he wants on purchasing of chemicals by prod[ucts]. [He] did say that his department has been buying in excess of 60% of [the pur]chases made by Richmond; he felt this meant that they would hav[e been] purchasing about 60% of the $600 M purchased annually by Richmo[nd]. [After] some lengthy discussion and parrying with guesses, we came away [fee]ling that between $250-350 M of chemicals are purchased each y[ear by] Richmond. John Williams had been here to discuss a breakdown o[f] chemicals purchased. Mr. Bills said this would require several the computer with no allowance for any other activity during that for other purposes. They can give us, as they did, a broad approx of their purchases of chemicals, but they cannot be specific by pr

We outlined the difficulties we were having with alpha picoline. Mr. Bills was in agreement with BDSA, he did point out that legall we were required to extend DO's on every product we have.

R. A. Hickman, Manager
U. S. Government Marketing Dept.

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SUPPLEMENTARY REPORT TO TORDON REPORT OF CALL DATED 8/18/67

In a follow-up meeting attended by Messrs. Beutel, Gowell, Hickman, Kennett, Nummy, Staehling and Yonka, it was decided action should be taken in the form of a phone call to Mr. John Traub at Edgewood concerning the contributions we could make on the RFP for the TCB plant.

A phone call was made and Mr. Traub advised that it was too late to make a call on the Edgewood plant; that a call could be made on Mr. Buckholtz the end of the week of August 21 without violating the law on competitive companies gaining information for RFP work.

We did learn that the 2,4-D 2,4,5-T plant will be built at Weldon Springs, Missouri. A team from Edgewood is in Kansas City finalizing the RFP with Mr. Buckholtz of the District Army Engineers Office. The RFP will be issued the first wee in September.

It will be left to the option of the contractor as to where he starts in the production of 2,4-D 2,4,5-T.

The method of production will be left to the option of the contractor.

Mr. Traub advised also that the Army proposal sent to the Department of Defense was based on

1. Industry producing Orange, starting with whatever point they wished including the building of a TCB plant.*

2. A government owned and contractor operated plant produci Orange and starting with primary chemicals.

3. A government owned and contractor operated Orange plant plus an industry owned and operated TCB plant with a guaranteed outlet.

The decision was Secretary McNamara's. He selected the thir alternate. Because of his trip to Vietnam, this decision wa delayed some six weeks.

This information was given to the group that was in session on Friday, August 18, at Dow.

It is well to note that on page 3 of the original report, we reported the Orange requirements as more nearly 12 M gallons. The statement should have been that the herbicide requirement are around 12 M gallons.

RJH:lsr

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THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN 48640

February 24, 1967

Brig. General J. A. Hebbeler
Director of CBR and Nuclear Operations
Asst. Chief of Staff for Force Development
Department of the Army
The Pentagon 3E455
Washington, D. C. 20310

Dear General Hebbeler:

On February 3, 1967, The Dow Chemical Company received a letter from Mr. John L. Traub, Chief, Chemical Process Laboratory, Weapons Development and Engineering Laboratories, Edgewood Arsenal, Maryland, concerning the conversi of the Fertilizer Development Works (FDW), Wilson Dam, Alaba to produce the herbicide Orange.

We have conducted a site survey and prepared a study and evaluation of this project. A letter of our findings was prepared for Mr. Traub.

As of the present time The Dow Chemical Company believes th alternates to the FDW proposal offer a more positive soluti to the problem in connection with the supply of herbicides.

Dow Capabilities

The Dow Chemical Company presented to the Department of Defense on January 26, 1967, its capabilities for producti of Orange or Orange equivalent which could be made availab beginning in 1969.

Dow has been doing additional work toward assessing the magnitude of the effort that would be required to increase Dow's Orange capacity.

It would be practical for Dow to increase its Orange capacity to a total of 3 or 4 million gallons per year. This capacity when combined with the 5½ to 6½ million gallons of Orange equivalent (Super Orange or Tordon 101) covered in the January 26, 1967, presentation indicates that the military's needs would be met for less capital outlay and, in addition, production would be realized at a much earlier date.

Brig. General J. A. Hebbeler -2- February 24, 1[...]

This work has involved the estimation of the capital requir[ed] to increase Orange capacity at Midland to 3,000,000 gallons per year total in one case and to 4,000,000 gallons per year total in a second case. In addition, in the following tabl[e] we are showing the increased capacity at the rate of 2,000,[000] gallons per year in order to present as complete a picture [as] possible.

The capital spending planned by Dow for these facilities ov[er] the next five to eight years has been deducted from these capital estimates to arrive at the net "extra" dollars of capital to meet military needs as follows:

"Normal" Schedule

Total million (M) gallons "Orange"	2M	3M	4M
Net "extra" dollars capital required to meet military needs for Orange (M)	$3.0M	$7.2M	$12.0M

"Shortcut" Schedule [illegible]

Total million (M) gallons "Orange"	2M	3M	4M
Net "extra" dollars capital required to meet military needs for Orange (M)	$4.8M	$10.3M	$16.5M

Dow Time

The time for engineering and construction could take from 1[...] 24 months depending on whether the project was carried out [on] a "normal" or "shortcut" basis.

The combination of this time advantage together with shorte[r] engineering and construction times means that a Dow-Midland facility could be operating at progressively increasing quantities and at capacity as much as a year sooner than would be the case at PDW.

Dow Manpower

As contrasted to PDW, Dow has extensive technical back-up personnel and facilities together with trained operating

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manpower already on the job. These factors would significa shorten the time required to attain capacity operation comp to PDW.

Summary

Dow has been actively engaged in tetrachlorobenzene process improvement for approximately 20 years and is now operating its fourth production facility. Because of certain product inefficiencies and because of certain health problems inher in the present process and which require extra cost for employee protection, Dow has plans underway to replace its present tetrachlorobenzene facility within one or two years

Dow has in operation now a new trichlorophenol facility wit this new process proven through over one-half year of opera tion. This facility is expandable.

Dow produces all of the basic raw materials--chlorine, caus dichlorobenzene, phenol, chloracetic acid and can keep the salt cycle, by product utilization, etc., in reasonable balance.

The compressor load at Midland will be slack during the spring and summer of 1967.

Due to the above factors plus the aforementioned advantages of providing this production capacity for "Orange" at Midla rather than at PDW, Dow is in an excellent position to move ahead with a substantial expansion of tetrachlorobenzene, trichlorophenol, and Orange.

Very truly yours,

A. P. Beutel

A. P. Beutel, Vice President
The Dow Chemical Company
47 Building
Midland, Michigan 48640

lsr

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THE DOW CHEMICAL COMPANY

MIDLAND MICHIGAN 48640

17 July 1968

Office of Assistant Chief of Staff
Force Development
Department of the Army
CBR and Nuclear Operations
Pentagon
Washington, D. C.

Attn: Brig. General J. A. Hebbeler, Director (3A430)

Dear General Hebbeler:

During the week of July 8, The Dow Chemical Company presented to various governmental agencies the advantages of Super Orange (M3393) as a better herbicide for use in Vietnam. Technical data supporting this premise was left with these agencies. Included with the data was a proposal for [illegible] gallons or less of Super Orange to be supplied by Dow at the price of $9.474 per gallon.

In a conversation with you after the formal presentation, I discussed the urgency of this application and the manner in which it could be implemented. On my return to Midland, I discussed this with our people and find them most responsive to sharing with the government the cost of this application for evaluation purposes. We are willing to supply [illegible] gallons of Super Orange (M3393) at no cost to the government in order to expedite the experiment. This would be shipped together with any quantity purchased at our quoted price of $9.474 per gallon.

We have every confidence that the technical data presented in favor of Super Orange (M3393) as a superior herbicide will be confirmed. We feel it is to the government's advantage to seek the most efficient product producing the quickest and most lasting results. At the same time we would like to re-emphasize that our price of $9.474 per gallon is based on careful inputs which clearly indicate that our future price negotiations will be in that range.

We would appreciate hearing from your office as soon as possible indicating any developments which have occurred as a result of our meetings and this proposal.

Yours very truly,

A. P. Beutel

A. P. Beutel, Vice President
Director of Government Affairs

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THE DOW CHEMICAL COMPANY

Copy to Bill Holcomb on 1-29-69 - OCR.

MIDLAND, Michigan
March 29, 1965

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V. K. Rowe
Biochemical Research Laboratory
1701 Building

cc: F. H. Riley
R. N. Smiley
L. B. Grant
C. O. Hutchenreuther
F. C. Amstutz
W. P. Falsey
G. E. Lynn
W. M. Gill
M. G. Wiltse
D. E. Pletcher
W. L. Corbin
D. D. Irish
J. E. Peterson
J. C. Tucker
J. W. Harris
H. W. Feinauer
E. C. Staehling
C. E. Otis
K. Y. Hansen
R. C. Hoff
W. J. McCoy
J. D. Doedens
K. C. Barrons
H. R. Hoyle
B. E. Holder, M.D. (VA?)
S. E. Sadek

REPORT ON THE CHLORACNE PROBLEM MEETING ON 3/24/65

Present: Dr. J[redacted] and
Mr. R[redacted]e, [redacted] Chemical Corporation

Mr. F[redacted]and
Dr. Ed [redacted], [redacted]lkali Company

Mr[redacted]and
Dr[redacted]ey, [redacted] Powder Company

V. K. recapped the Dow situation in terms of the problem and the initial studies by Toxicology and Environmental Research Laboratory regarding the in-plant situation. He expanded this in general terms to the study of end products, ours and other people's. [redacted] He referred to the evidence [redacted] the [redacted] (Dow) were not able to answer these questions except to review the evidence for their existence in the process samples and end products.

CONFIDENTIAL - SUBJECT TO INJUNCTION
D.C. F.D. M.I. 4-4-73; DOW/EPA AGREEMENT 9-79

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Dr. Holder revi[illegible] the medical side of the Dow experience; he said that we now have approximately 60 to 70 cases of individuals with chloracne ranging from the severe cases to some very mild cases that were difficult to diagnose. He showed slides of the more dramatic cases. The slides were exclusively views of the faces of the individuals afflicted. He described in fair detail the appearance of the individuals mentioning the blackheads specifically. He then reviewed the clinical studies that are being made on these people with emphasis on the liver function tests. He mentioned the single liver biopsy that has been taken and studied in which the liver was normal although the man had a rather pronounc[redacted] Dr. Holder also [redacted] people as being the only other significant finding in these folks. He touched briefly on treatment indicating that various topical [redacted] He described the [redacted] who had been [redacted]. He mentioned that some fellows are approaching the end of their trouble two or two and one-half years after onset of the skin disorder. He also described "ac[redacted]" which is an acute flammatory condition that appears considerably sooner than the normal chloracne in individuals and appears after pronounced single exposure. The acute chloracne shows up within [redacted] ht d[redacted]. There was [redacted] the group on the skin disorder itself. The [redacted]ves related [redacted]tion [redacted]-sure. [redacted] cases were more similar to the [redacted] which Dow has experienced in that there were large boils or large [redacted] rather than the multitude of small blackheads and eruptions which Dow is seeing in the current cases.

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[redacted] showed slides of [redacted] that had been exposed to the symmetrical tetrachloro-p-dibenzodioxin. He discussed the [redacted] in detail which I will not attempt to summarize.

V. K. mentioned the studies in which the rabbit ears have been treated with TCDD in benzene or corn oil and then washed with soap and water at various time intervals later. If [redacted]d. He [redacted] mentioned the oral studies but without detail. Silverstein described the plant study on washing of contamination from tools and surfaces. This study indicated that benzene, acetone and Chlorothene NU were effective in removing the contaminant from tools and also that detergent and water with scrubbing action could clean up tools and equipment. Some discussion ensued on the use

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of detergent and water and the point was made again that strong scrubbing action was necessary for this approach to be successful.

Harold Gill then [illegible] the analysis [illegible]chlorodibenzo-p-dioxin by vapor phase chromatography. He listed the limit of sensitivity on various process materials. He mentioned the oil which he defined as a non-saponifiable mixture of chloro anisoles, tetrachlorobenzene and trichlorobenzene; the limit of sensitivity for TCBD in this material is 10 ppm. The limit is 1 ppm in 2,4,5-trichlorophenol and for 2,4,5-T Acid, either acetic or propionic. Gill then defined 1 ppm as a very discernible peak. He mentioned that he might estimate 0.5 ppm in some instances but to be conservative the analyst reports <1 ppm if the peak does not measure up to the quite identifiable level of 1 ppm. The analytical problem has not yet been solved for the T-Acid esters. The general procedure used for the T-Acids is to extract the sample (arbitrarily about 20 grams) with chloroform (about 40 milliliters), filter the chloroform to remove solids and wash with an equal volume of N/10 caustic to remove any acidic materials. The chloroform extract then is concentrated by evaporation to one-tenth the original volume; thus, the concentration of the dioxin in the chloroform will be ten times higher than in the original sample. When the analysis is conducted on trichlorophenol, the material is dissolved in N/1 caustic to the extent of 10%, and this solution is then extracted with the chloroform and handled as indicated above.

A question was asked about the utilization of detectors other than the flame ionization which is specified in the Analytical Laboratory write-up for this analysis. Gill has not tried the micro coulometric detector because he is not set up to do so, but he has experimented with electron capture. He stated that theoretically this unit should not provide any greater increase in sensitivity. In actuality he found a slight increase in sensitivity but there are usually too many chlorinated species present which may saturate the electron capture cell whose recovery is too slow to be of practical use. He summarized by saying that the slight increase in sensitivity is not worth the effort to switch from flame ionization to electron capture. A question was asked about how the extraction is performed. Gill stated that it is performed in a wide mouth bottle on a shaker for one hour. (It was not mentioned, but it is the case that this is done at room temperature.) He mentioned that spiked samples have been R run this way and the recovery ranged from 90 to 100 per cent. The ratio of solvent to the material being extracted on this step is not critical according to Gill. Their standard procedure is 20 grams of sample and 40 milliliters of chloroform. On trichlorophenol samples specifically, 20 grams of phenol is converted to phenate -- about 10 per cent concentration in water. The phenate solution is extracted with 20 milliliters of chloroform in a single extraction. The chloroform is then concentrated so that the concentration of the dioxin will be ten times that in the original sample. *

The question of volatility of dioxin came up and Harold Gill stated that he found he can distill o-dichlorobenzene away from tetrachlorobenzodioxin. He said that in his opinion the secret was to avoid distilling to dryness.

A member of the group asked if samples of standard TCBD were available. The answer was yes and 100 mg samples were provided to one of [redacted] safety [redacted] came up [redacted] basic precaution of [redacted] Information relative to the gloves we used was provided to the group.

Disposal of [redacted] Harold Gill stated that his laboratory study of [redacted] We described why we felt that our practice of burning small amounts of dioxin was a safe one. ⊛ VULCANUS

V. K. then outlined the project in which plant samples and products (not mentioned by name) were spiked with known amounts of the TCBD. The spiked samples were split for the purpose of checking our analytical procedures for recovery and correlating these results with the bio-assay method.

The question of specification, quality control specification that is, was raised and we were asked if we could give levels of dioxin contamination which were permissible limits.

[redacted]

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Jack Emerson then discussed the data from animal experiments using pure symmetrical tetrachlorobenzodioxin. Doses ranging from 2 parts per billion to 1000 parts per million of tetrachlorobenzodioxin in benzene had been administered to the rabbit ear. Dosage in most cases was 0.1 ml per day. Both single and multiple exposures have been studied and multiple exposures administered on a five days per week basis. The significant factors in the study are dose, the number of applications and the days on exposure of the animals. The response which is reported in the gross observation of the condition of the rabbit's ear by the toxicologists. This does not include pathological findings -- there is not enough data in this area to discuss. The level ... response ranges from none through very slight, slight, slight to moderate, moderate, moderate to severe, severe, and extremely severe. Jack indicated to the group that there is not a sharp definition between these categories of response and indicated also that there is some difficulty in graphing this type of response. He described the response from single applications to the rabbit ear first: at 100 parts per million there was a severe response in eight days; at 40 parts per million there was a slight response in eleven days; at 20, 10, 7 and 4 parts per million there was no response. These tests were run on single rabbits and without washing the material off. Jack then discussed the multiple application data which he took from his major graph of this data. The important points that he made from this data were first that at the limit of VPC sensitivity a severe response may be produced. In other words, even if the VPC does not detect TCBD, an animal response may still occur. His second important point was that the induction period for response averaged about ten days on the animals in the studies.

There was a brief discussion then about the air samples that were taken in the plant. Silverstein mentioned that some air samples have shown activity on the animals. The degree of response is slight and the number of samples that show activity is small out of the total number taken and the amount of air that must be sampled is very much larger than the amount a man normally breathes in an eight hour day.

The meeting was adjourned. The group then proceeded to the Toxicology Laboratory to view some of the test animals. They were shown responses of varying intensity and these were described. This demonstration appeared to have considerable impact.

L. G. Silverstein
Biochemical Research Laboratory
1701 Building

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LGS:sjl

V. H. Rowe - 6 - March 29, 1965

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Postscript

All [illegible] seemed to appreciate [illegible] the problem and all indicated that they would return home and attempt to convince their management [illegible] safety specifications (really quality control) [illegible]. All agreed that the industry should [illegible]. All [illegible] effort to steer them away from [illegible] will tell whether we accomplished our mission, but [illegible] I feel satisfied with our effort and the reception it received.

VKR

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DOW019294

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TRICHLOROPHENOL SUMMARY

I. Trichlorophenol Producers

[illegible]chlorophenol and derivatives [illegible] Dow, Monsanto, Hercules, [illegible] and Hooker isolate and distill the trichlorophenol prior to sales [illegible], and analyses of samples of their sales products show no exciter present. It is suspected that Hercules also distills the trichlorophenol as samples of their 2,4,5-T acid shows no exciter. Diamond and Monsanto do not isolate the trichlorophenol to purify it, but make all derivatives from the sodium salt. Analysis of Monsanto's 2,4,5-T acid shows 3 - 8 ppm. exciter, and analyses of Diamond's sodiumtrichlorophenate shows [redacted] exciter.

II. Present Knowledge of Toxicology

There are publications in the medical journals alleging chloracne response from 2,4,5-T acid and derivatives. Based on our data, we can readily see that such a response can occur from impure 2,4,5-T, but that pure 2,4,5-T will not give this response. We can [redacted] 2,3,7,8-tetrachloro[redacted] has been isolated [illegible] the Dow trichlorophenol operation [redacted] synthesized. [redacted] biological activity [redacted] confirmed. [redacted] but also liver damage. We have demonstrated positive [redacted] parts per billion and equivocal results at 4.0 parts per billion. We have developed a quantitative analytical procedure which will analyze for the exciter at 1.0 ppm. sensitivity. Over 500 samples have been analyzed and biologically checked to date. We have also isolated and identified the unsymmetrical tetrachlorodibenzodioxin and it is presently being checked for biological activity. In addition to the identifiable materials, VPC shows some 15 additional compounds which are of unknown activity and identity. Further research is required to isolate and identify these materials to determine their significance. The missing link in this entire study is that there is no quantitative relationship to animal response and human response at the present time.

III. Contacts with Trichlorophenol Producers

V. K. Rowe has had telephone conversations with the Medical Director and Assistant Medical Director of Monsanto and the Chief Toxicologist at Hercules. Rowe has discussed the problem and has given them our analytical methods. These men want to follow through on this problem [redacted] phenol producers. Since [illegible] contacts at Hooker and Diamond, Lou Corbin of [illegible] Products Sales will [illegible] contacts requesting their designates [illegible] in touch with V. K. Rowe. This will be done March 1, 1965. Rowe will discuss the problem, invite them to the meeting, and offer our analytical methods.

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IV. Proposed Meeting of Trichlorophenol Producers

A meeting of the trichlorophenol producers is tentatively scheduled on March 17, 1965 in [redacted]. The Chief Toxicologist, Medical Director, [illegible] Consultant and a Chemical Scientist from each company will

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DOW019295

1. Dow review the literature on the subject.
2. Dow [illegible] the toxicological data we have to date.
3. Dow to sell the [illegible] on the idea [illegible] must police itself or the government will.

*DOW BOUGHT THE PATENT

4. If the producers accept this philosophy, decide if we should and who should go to the appropriate federal government agencies.

V. Status with Boehringer of Germany

In December 1964, Dow sent a team to Boehringer of Germany to discuss the chloracne problem. Boehringer had the same problem, solved it, and have operated 5 years safely. In Germany a verbal secrecy agreement was made to the effect that all oral and written process know-how received from Boehringer would be held secret by Dow for 10 years and Dow would pay $35,000 for its use. The team received Boehringer's process details and flowsheets while in Germany and various pieces of correspondence since they returned. Our new plant is designed on the basis of this know-how. At the [illegible] written, legal secrecy agreement [illegible]d.

W. D. Dearden
Chemicals Department
March 1[illegible]

eb.

cc: V. K. Rowe

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EXHIBIT Hochberg-2A id 3/23/84 TL

INTER-OFFICE CORRESPONDENCE

	DATE October 4, 1968
TO M. Hochberg	FROM Mr. A. F. Wilkerson

TASK FORCE MEETING
RE: WELDON SPRINGS

I attended a meeting today at Monsanto's headquarters in St. Louis with other representatives of the 2,4-D and 2,4,5-T industry. The purpose and agenda are as outlined on the attached. Present were:

John Connor - Council for NACA but in "free lance" attendance
Bill Rogers - Legal Staff - Monsanto
Robert Purer - General Manager - Ag. Div. - Monsanto
Doug Huff - Monsanto
Stu.D. Daniels - Monsanto
"Ted" Zorch - Monsanto
Ken Givens - Hercules
H. H. Howard - Thompson-Hayward
Dan Miller - Hooker
Stan ? - Hooker

WEINSTEIN
EXEMPTED
S/J
C/A

Invited but not present - Dow Chem and Chipman, both of whom however submitted production capacities through Thompson-Hayward's Mr. H. H. Howard.

Uninvited and not present - Thompson Chemical and Hoffman-Taff.

NEPACCO
(TIMES BEAC

Based upon present industry capacity to produce both D and T, as opposed to present purchase patterns of the Military, it was concluded we have a case to present to the Defense and Commerce Departments. Thompson-Hayward's Mr. Howard agreed to chair this endeavor, with John Connor being appointed as the group's Council. Expenses are anticipated to be minimal for the foreseeable future and will undoubtedly be shared by the participating 6 member companies.

At best we hope to prevent completion of the Weldon Springs plant or at least confine its production to only that amount o T or D needed by the Government, but unavailable from industry. Details will be submitted to you as they are available.

Of general interest are the following annual production capacities as secretly submitted to Mr. Connor today. He totaled them and our discussion then centered about the totals only:

	2,4-D	2,4,5-T
Total capacity (lbs.) of 6 participating members	95.MM	32.2MM
The group's estimate for non-participating companys' capacities were:		
Thompson Chemical		1.3
Hoffman-Taff		2.0
Woodbury Chemical (under construction)	5.	
TOTALS	100.MM	35.5MM

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A bit of upside-down reading gave the following breakdown of the participating members' capacities. These were coded but are exact. I have attached Company names which may or may not be, with the exception of Diamond, associated correctly with the capacity number.

	2,4-D	2,4,5-T
	5.0 MM - Hercules	5.5MM - Hercules
	12.0 MM - Diamond	3.0MM — Diamond
	40.0 MM - Dow	12.0MM- Dow
	24.0 MM - Monsanto	7.2MM - Monsanto
	14.0 MM - Chipman	4.5MM - T-Hayward
TOTALS	95.0 MM	32.2 MM

T-Hayward acknowledged they produced no 2,4-D as did Chipman for 2,4,5-T.

This group's best estimates for total annual domestic requirements of D and T were:

2,4-D - 55 MM lbs.
2,4,5-T - 18 MM lbs.

Hooker acknowledged they now have TCB capacity to supply all producers, on the basis of these estimates, except for Dow (who produce their own) and T-Hayward (who are presently being supplied TCP by Dow.)

M. F. WILKINSON

MFW/ln

cc: J. A. Wilson
R. A. Guidi
C. L. Troph
J. O. King

P.S.

The following position statement has been drawn up by Mr. Connor and is being submitted October 7 to Miss Jane Lewis of the Commerce Department:

SUMMARY OF POSITION

The group of phenoxy herbicide producers at their meeting on October 4, 1968 after estimating the capacity of the domestic industry to produce 2,4-D and 2,4,5-T; after estimating as accurately as possible the domestic civilian consumption of these products and the military requirement based upon the stated needs and current delivery schedules, concluded that there is sufficient domestic production of 2,4-D to fully meet both the civilian and military requirements, and that the production of 2,4,5-T would meet a substantial part of both the civilian and military need. It was concluded that the questions which prompted the Government

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Officials to make the decision to construct and place in operation a plant at Weldon Springs to produce both 2,4-D and 2,4,5-T have changed, and that the industry should request an opportunity to explore these data with the Government.

It was further concluded that even if it is assumed that the military will require the full amount of its needs as heretofore estimated, that there would be a very substantial over-production of both 2,4-D and 2,4,5-T if the Weldon Springs plant is operated at full capacity. This raised questions of serious import to the domestic industry which thoroughly explored with the Government.

/s/

M. F. WILKERSON

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THE DOW CHEMICAL COMPANY

MIDLAND
February 22, 1965

[illegible] 1965

Present: V. K. Rowe
W. P. Falsey
K. C. Barrons
W. L. Corbin
R. C. Hoff
K. R. Hoyle
D. E. Pletcher

[illegible] Gill
L. Silverstein
C. I. Otis
G. E. Lynn
F. C. Amstutz
E. C. Stoehling

cc: J. D. Doedens

[illegible] recent [illegible] present [illegible] products is concerned [illegible] valves, [illegible] These basic decisions are to be made without consideration of economic impact.

Summarizing past experiences, V. K. Rowe said that Dow had no chloracne problems related to trichlorophenol production for 25 years until process changes were effected in the spring of 1964. Based on research information accumulated over the years, some ideas have been put together regarding the likely compounds which give rise to this problem. The 2,3,7,8-tetrachlorodibenzodioxin has been pretty well established as a possible contaminant. Also, there is an indication of the possible presence of the 2,3,7,9 derivative and two other components designated as "Unknown No. 1" and "Unknown No. 2".

Hoyle said that the rabbit test will detect 4 ppb of the 2,3,7,8-dioxin. VPC will detect 0.2-0.5 ppm of the 2,3,7,8-dioxin in trichlorophenol. Also, VPC will detect about 5.0 ppm of the 2,3,7,8-dioxin in 2,4,5-T acid. (By phone on Feb.15,1965, Hoyle indicated to the writer that it is now felt that VCP will detect 1.0 ppm.)

In samples checked from October, 1961, to the present, no dioxin was found in trichlorophenol samples from 349 bldg. using the animal test. The animal test has indicated some activity in one sample of a filter cake which represented impurities removed in T-acid processing.

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EXHIBIT 12

DOW 1 129845

Setting of limits of analytical methods and correlation of TCP and actual test data are not complete.

Chloracne applications at 4 ppb in TCP represents the threshold for animal reaction.

Ten exposures at 0.5 ppm in TCP gives a mild reaction.

One exposure at 40 ppm in TCP gave a positive reaction.

It is encouraging to note that exacting tests have indicated no evidence of liver damage in exposed operators. It was agreed that Dow should move ahead with contact with U.S. Public Health Service and Department of Agriculture representatives as soon as our [redacted] lated. [redacted] Staehling summarized analytical data on process samples of trichlorophenol as follows:

Date	Unknown No.1	2,3,7,9 Dioxin	2,3,7,8 Dioxin	Unkn No. 2	Calc'd as Dioxin 1 + 2
1963: June	<1	<1	<1	6	6
Oct.	3	<0.5	<0.5	14	17
1964: Feb.	2	<1	<1	2	4
June	3	<1	6	4	7
Sept.	25	<1	<1	20	45
Nov.	3	<0.5	0.8	5	8
Dec.	3	<0.5	<0.5	3	6
1965: Jan.7	8	<0.5	0.8	9	17
Feb.8	10	<0.5	<0.5	20	30
Feb.15	3	<1.0	<1	10	13

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DOW 1 12994C

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[redacted]

[redacted] This specification should continue until suitable correlation between bio-assay and analytical data are shown to warrant changing the specifications.

[redacted]

[redacted]

DEF

D. E. Fletcher
Bioproducts Department

DEF:ea

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Exhibit 17

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EXHIBIT
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Co...

THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN
August 11, 1966

DOW 1 119997

C. E. Otis
BPC

cc: W. L. Corbin
J. H. Gowell
W. J. McCoy
M. G. Wiltse

DEFOLIATION PROJECT - 1966 AND 1967

Following a lengthy session involving several of our resource people most immediately concerned, our thinking and recommendations were brought up to date as follows

MILITARY NEEDS

(As expressed by Government Procedure at Richmond)

FOR ORANGE IN GALLONS

1966					1967					
Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
320M	370M	370M	420M	420M	420M	420M	420M	420M	420M	420M

It appears likely that the 420,000 gal. per month need for Orange will continue from July 1967 through December 1967.

Orange is composed of 4 lbs. A/E of 2,4,5-T and 4 lbs. A/E of 2,4-D per gallon.

The U.S. chemical industry at present can produce 17,000,000 lbs. of 2,4,5-T acid annually and 65,000,000 of 2,4-D acid. Foreign sources are probably 300,000 lbs. of 2,4,5-T acid annually or less.

Between now, August, and the end of next June, the military will need 4,420,000 gal. of Orange or 17,680,000 lbs. of 2,4,5-T acid. During these 11 months, U.S. industry can produce approximately 16,190,000 lbs. of 2,4,5-T with a

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resultant shortage to the military during this period of approximately 1,490,000 lbs. of 2,4,5-T acid or enough 2,4,5-T to make 372,000 gal. of Orange. The military requirement is in addition to the commercial requirements of approximately 10 million pounds of 2,4,5-T per year.

Under the present procurement policy of "maximum Orange balance Tordon" we can expect to sell all our 2,4,5-T production (6,500,000 lbs. annually) plus 372,000 gallons of Tordon 101 Mixture if the military demanded all the 2,4,5-T production.

Priorities have not been established. The result has been that since commercial business is more profitable to the industry, the military has not been offered even the existing production of 2,4,5-T.

An example:

Between August, 1966, and January, 1967, the military has need for 2,320,000 gallons of Orange.

Industry has been willing to commit to only 1,208,000 gallons of Orange.

The net result has been that the procurement officials have contacted Dow Government Affairs regarding 1,184,000 gals. of Tordon 101 Mixture to be shipped as follows: (Gallons)

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
	250M	200M	200M	200M	167M	167M
Dow capabilities:						
	250M	50M	100M	164M	164M	47M

Our capabilities with present thinking on Tordon 101 is to supply them with 775,000 gal. rather than 1,184,000 gals. which they desire.

We could supply the military additional quantities of Tordon 101 from January, 1967, through June, 1967; however, we have no firm commitment and therefore have little alternative but to supply our normal commercial channels for 1967. We would be willing and happy to deny the civilian market Tordon for 1967 if we can get a firm commitment from the military soon. Even with firm commitments we will be unable to supply the military with their total requirements.

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We have been quoting \$7.39 per gallon on Orange and \$7.58 per gallon on Tordon 101 Mixture, both of which are our lowest book prices.

Even though our competitors have been quoting a lower price on Orange, I believe it is in our best interest to continue to quote \$7.89 per gallon on Tordon 101 Mixture.
\$7.58

The real meat of our recommendations to you and Lew is not to suggest our presently successful strategy on Orange and Tordon 101 Mixture be changed, but rather to recommend to you a program whereby we can supplant both Orange and Tordon 101 Mixture in time to sell the maximum output of our Texas Tordon plant when it comes on stream June 1, 1967.

Accordingly we suggest:

1. A superior formulation be sold to the military, this formulation to contain 1 lb. of Tordon A/E, 2 lbs. of 2,4,5-T A/E and 2 lbs. of 2,4-D A/E per gallon as esters.
2. This formulation to be applied at a 2 gal. per acre rate rather than the presently used 3 gal. per acre rate.
3. The price to be such that 2 gals. of this proposed mixture be relatively competitive to 3 gal. of presently used Orange. This is another major reason that Orange should approach the \$7.39 per gallon price rather than the \$6.00 per gallon price.

While the above offers advantages to Dow, the strategy offers particular advantages to the military which are:

1. More efficient, longer lasting defoliation.
2. Adequate supplies of 2,4,5-T under present production capabilities.
3. Logistic advantages in transportation and application.

Assuming that the rate of consumption for defoliants will continue at the 420,000 gal. per month rate, we can project the following with the new formulation:

DOW 119939

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1967

	July	Aug.	Sept.	Oct.	Nov.	Dec.
Formulation	280M	280M	280M	280M	280M	280M
2,4,5-T A/E	560M	560M	560M	560M	560M	560M
Tordon A/E	280M	280M	280M	280M	280M	280M

1968

	Jan.	Feb.	Mar.	Apr.	May	June
Formulation	280M	280M	280M	280M	280M	280M
2,4,5-T A/E	560M	560M	560M	560M	560M	560M
Tordon A/E	280M	280M	280M	280M	280M	280M

This program not only would give better defoliation but would only use up 6,720,000 lbs. of 2,4,5-T annually which can be met by present national production. This should be of interest in Richmond.

If the government establishes priorities on Orange, we can expect to sell 45,000 to 50,000 lbs. of Tordon A/E per month or a maximum of 600,000 lbs. annually but with the foregoing recommendation we believe we can sell 280,000 lbs. of Tordon A/E per month or 3,360,000 lbs. annually.

With the above in mind it becoms necessary that we get a good, fair market price for Orange. May we have your comments?

C. A. Bryant, Manager
Industrial Vegetation Control
Agricultural and Industrial
Bioproducts Sales

Resource people present:

Malcolm Barbour	K. Y. Hanson
John Branaman	Paul Ritty
Bill Gill	M. G. Wiltse

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DOW 120000

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Exhibit 2

IN THE DISTRICT COURT OF THE UNITED STATES

FOR THE NORTHERN DISTRICT OF OHIO

EASTERN DIVISION

ELEANOR C. PLAS, Executrix, Etc., Plaintiff, vs. RAYMARK INDUSTRIES, INC. Defendant	)	Civil Action No. C 78-946

* * *

COURT'S RULING ON GOVERNMENT SPECIFICATIONS

* * *

TRANSCRIPT OF PROCEEDINGS HAD BEFORE THE HONORABLE JOHN M. MANOS, JUDGE OF SAID COURT, COMMENCING FRIDAY, APRIL 22, 1983

* * *

APPEARANCES:

On behalf of the Plaintiff:

Ronald Motley, Esq.
John McCarthy, Esq., and
Thomas H. Hart, III, Esq.

On behalf of the Defendant:

Richard J. DiSantis, Esq. and
David Mellott, Esq.

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TUESDAY AFTERNOON SESSION — MAY 3, 1983

CHAMBERS DISCUSSION

MR. HART: I would like to move that any reference to Government specifications be stricken —

THE COURT: What you are moving is to strike the affirmative defense of Government specifications.

MR. HART: Yes.

THE COURT: Dick?

MR. DiSANTIS: I believe there is evidence in the record from Mr. Scowcroft that regarding the course of dealing with the Government, when companies such as Raybestos - Manhattan would sell to the Government, that they would be required to do so pursuant to the specifications set forth by the evidence.

THE COURT: The evidence that I heard is that Raybestos - Manhattan invented the material which they sold to the Government; they worked with the Government on specifications, and the material they sold to the Government was the same material they sold to the private sector.

C E R T I F I C A T E

I, Gloria A. Dixon, Official Court Reporter in and for the District Court of the United States for the Northern District of Ohio, Eastern Division, do hereby certify that the above and foregoing is a true and correct transcript of the proceedings had herein.

Gloria A. Dixon

Gloria A. Dixon
Official Court Reporter

Sec of Def: 4/19/67 — Exhibit 26 — conditional Thompson

T+H Contract 4/20/8

01 DSA 400678

STANDARD FORM 26, MAY 1966

AWARD/CONTRACT

PAGE 1 OF

1. CONTRACT (Proc. Inst. Ident.) NO.: -400-67-C-8172

2. EFFECTIVE DATE: 19 Apr 67

3. REQUISITION/PURCHASE REQUEST/PROJECT NO.: See Schedule.

4. CERTIFIED FOR NATIONAL DEFENSE UNDER BDSA REG. 2 AND/OR DMS REG. 1. RATING: C9(e) Uncl

5. ISSUED BY: Directorate of Procurement & Production, ATTN: PC423, Defense General Supply Center, Richmond, Virginia 23219

6. ADMINISTERED BY: Director, DCASR, 1136 Washington Street, St. Louis, Missouri 63101

7. DELIVERY: ☒ Other

8. CONTRACTOR NAME AND ADDRESS: Thompson Chemicals Corp., 3028 Locust Street, St. Louis, Mo. 63103

FACILITY CODE

9. DISCOUNT FOR PROMPT PAYMENT: Net

10. SUBMIT INVOICES (4 copies unless otherwise specified) TO ADDRESS SHOWN IN BLOCK 12

11. SHIP TO/MARK FOR: See Schedule

12. PAYMENT WILL BE MADE BY: Disbursing Office, DCASR, 1136 Washington Street, St. Louis, Missouri 63101

THIS PROCUREMENT WAS ☐ ADVERTISED, ☒ NEGOTIATED, PURSUANT TO: ☒ 10 U.S.C. 2304 (a)( ) ☐ 41 U.S.C. 252 (c)( )

ACCOUNTING AND APPROPRIATION DATA: 97X4930.0000 51 63 06 25 504300

15. ITEM NO.	16. SUPPLIES/SERVICES	17. QUANTITY	18. UNIT	19. UNIT PRICE	20. AMOUNT
	PLANT LOCATION: Thompson Chemical Corp., 1017 S. Wharf Street, St. Louis, Mo. — INSPECTION OFFICE: Director, DCASR, 1136 Washington Street, St. Louis, Missouri 63101 — CONFIRMING TELEGRAPHIC OFFER DATED 14 APRIL 1967 AND ACCEPTANCE DATED 19 APRIL 1967.				

CONFIRMING — DO NOT DUPLICATE

Four Deletia auth DGSC msg 141710Z F.680

TOTAL AMOUNT OF CONTRACT $ 1329692.00

CONTRACTING OFFICER WILL COMPLETE BLOCK 22 OR 26 AS APPLICABLE

22. ☒ CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return 2 copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein. (Attachments are listed herein.)

26. ☐ AWARD (Contractor is not required to sign this document.) Your offer on Solicitation Number ____, including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.

23. NAME OF CONTRACTOR: THOMPSON CHEMICALS CORP.

BY: Robert B. Mitchell (Signature of person authorized to sign)

27. UNITED STATES OF AMERICA

BY: George N. Collins (Signature of Contracting Officer)

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24. NAME AND TITLE OF SIGNER (Type or print): Robert B. Mitchell

25. DATE SIGNED

28. NAME OF CONTRACTING OFFICER (Type or print): George N. Collins

29. DATE SIGNED

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Standard Form 36
Prescribed by General Services Administration, Fed. Proc. Reg.

CONTINUATION SHEET
(SUPPLY CONTRACT)

CONTRACT, ORDER, OR INVITATION NO.: DSA-400-67-C-8172

ITEM NO.	SUPPLIES OR SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT

SUPPLY WARRANTY (FEB 67) (338 A)

(a) Notwithstanding inspection and acceptance by the Government of supplies furnished under the contract or any provisions of this contract concerning the conclusiveness thereof, the Contractor warrants that at the time of delivery:

(i) all supplies furnished under this contract will be free from defects design, material or workmanship and will conform with the specifications and all oth requirements of this contract; and

(ii) the preservation, packaging, packing, and marking, and the preparatic for and method of shipment of such supplies will conform with the requirements of this contract.

(b) The Contracting Officer shall give written notice to the Contractor of any breach of the warranties in paragraph (a) of this clause within one year from the la delivery under the contract.

(c) Conformance of supplies or parts thereof subject to warranty action shall determined in accordance with the applicable sampling procedures contained in the contract except as provided herein. For sampling purposes, the Contracting Officer may group any supplies delivered under this contract. The size of the sample shall be that required by sampling procedure specified in the contract for the quantity of supplies on which warranty action is proposed. Warranty sampling results may be projected over supplies in the same shipment or other supplies contained in other shipments even though all of such supplies are not present at the point of reinspect provided, the supplies remaining are reasonably representative of the quantity on which warranty action is proposed. The original inspection lots need not be reconstituted nor shall the Contracting Officer be required to use the same lot size as c original inspection. Within a reasonable time after notice of any breach of warrant in paragraph (a) of this clause as determined herein, the Contracting Officer may exercise one or more of the following options:

(i) require an equitable adjustment in the contract price for any group c supplies;

(ii) screen the supplies grouped under this clause at Contractor's expense return all nonconforming supplies to the Contractor for correction or replacement;

(iii) require the Contractor to screen the supplies at depots designated by the Government within the continental United States and to correct or replace all nc conforming supplies:

(iv) return the supplies grouped under this clause to the Contractor for screening and correction or replacement.

NAME OF BIDDER OR CONTRACTOR

THOMPSON CHEMICALS CORP.

Standard Form 36
Nov. 1960 Edition

Exhibit 28

531
8005

THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

FSA

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June 1, 1962

Mr. J. Ray Frank
Crops Division
Chemical Corps Biological Laboratories
United States Army
Fort Detrick, Maryland

Dear Mr. Frank

I am attaching our Sales Specification sheets on our butyl esters of 2,4-D and 2,4,5-T and also on the acids.

Our laboratory has given us the following information regarding boiling points.

n-Butyl esters of 2,4,5-T

10 mm - 200°C.
25 mm - 224.5°C.
50 mm - 244.5°C.
100 mm - 267°C.

n-Butyl esters of 2,4-D

Our records show several distillations were made at 2.5 mm and they ranged about 147°C.

We do not have any data on isobutyl ester boiling points as we always considered they would boil approximately five degrees lower than the n-butyl esters.

With respect to melting points the laboratory gives us the following information

Obtained by crystallizing the ester at a low temperature and slowly warming and recording the temperature where the last crystals disappeared into solution.

Mixed butyl esters 2,4-D - Approximately 20°C.
Mixed butyl esters 2,4,5-T - 10°C. to 12°C.

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With respect to viscosity they supplied the following:

Mixed butyl esters of 2,4-D

6.5 Centipoise at 140°F.
28.5 Centipoise at 77°F.
210.0 Centipoise at 32°F.

Mixed butyl esters of 2,4,5-T

11.4 Centipoise at 140°F.
86.6 Centipoise at 77°F.
1690.0 Centipoise at 32°F.

Specific gravity at 68/68°F. was given as follows:

Mixed butyl esters of 2,4-D - - - 1.2440
Mixed butyl esters of 2,4,5-T - - - 1.3260

Solubility in water is as follows:

Mixed butyl esters of 2,4-D - - 0.002 gms in 100 gms wat
Mixed butyl esters of 2,4,5-T - 0.0016 gms in 100 gms wa

I trust this information will be of some help to you. Incidentally, we received a request for the same or similar information from Lt. Bertram and I presume this was a duplicate request. Will you kindly check with Lt. Bertram and give him this information if he is in need of it.

We do not have surface tension information on these straight esters; possibly we could run these for you if it is pertinent and if you do not have facilities for doing this. It is a measurement that we have not felt in need of because for non-military uses the esters are formulated and dispersed in the carrier before application.

Very truly yours

Keith C. Barrons

Keith C. Barrons, Director
Plant Science Research and Development
Bioproducts Department
Agricultural Research Center

KCB/mm

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Exhibit 29

PROCEEDINGS OF THE FIRST DEFOLIATION CONFERENCE, 29 - 30 JULY 1963

JANUARY 1964

UNITED STATES ARMY
BIOLOGICAL LABORATORIES
FORT DETRICK

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Secondly, we need materials that will act rapidly. As General Delmore stated, it is premature at this time to say that these materials should act within an hour or a day or some other finite unit of time, but we certainly want them to act as rapidly as possible. I know that this factor will be discussed in more detail later and I will say no more about it at this time.

It goes without saying that the materials must be applicable by ground and air spray, that they must be logistically feasible, and that they must be nontoxic to humans and livestock in the area affected. Not only should these materials be nontoxic, but it seems to me that it is important that they not have any cosmetic effect. If, for example, a material had a marked red fluorescence and a number of people were obviously stained by the material, then our enemy might derive considerable propaganda value from this fact even though the individuals were not in any way injured by the material.

In a very real sense, this program in defoliation is a little bit unique with respect to the usual military-industrial collaboration. Ordinarily, in military R&D we have a military concept that leads to the statement of a military requirement, technical characteristics, performance specifications, and other strictly delimited aspects. In this program we do not have rigidly specified characteristics. I have stated some of the broad requirements that a successful defoliating chemical should have, but within this general framework we will accept and use materials that will do a job for us. In a few years it may be that we will come up with more definite specifications but at the moment we simply solicit the assistance of you gentlemen in finding materials that can be used successfully within the reasonably broad and general guidelines that General Delmore has stated and that I have repeated.

It has been both a pleasure and a privilege to speak to you gentlemen this morning. I know that I speak for all of us who have responsibility in this program when I say that we are most gratified at the very wonderful response industry has shown and we are confident that your interest and your capability will lead to success in this program.

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Exhibit 33

CONFIDENTIAL - SUBJECT TO INJUNCTION
D.C. ED. MI. 4-4-78, DOW/EPA AGREEMENT 9-

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RECEIVED
MAY 8 1965
Biochem. Res. Lab.

May 4, 1965

2,4,5-T ACID PRODUCT SPECIFICATION

Present at conference: F. C. Amstutz
R. C. Hoff
J. J. Sculati
L. Silverstein
L. C. White, Jr.

cc: R. C. Dosser - PAPRL - 267 Building
K. A. Smith - 2,4,5-T - 267 Building

DOW 0012 035

EXHIBIT T

The product specification for 2,4,5-T acid has been changed to include an analysis for 2,3,7,8 tetrachlorobenzo-p-dioxin.

The conference was held to discuss the dioxin addition to the specification. It was decided to set up a tentative program of testing for the dioxin in Dow production of 2,4,5-T acid. The procedure is listed below.

1. An analysis for the 2,3,7,8 dioxin isomer will be run on each tank car shipment of 2,4,5-Trichlorophenol and reported to J. J. Sculati before the tank car is unloaded. Obtaining and reporting of the analysis will be the responsibility of the Trichlorophenol Department personnel.

2. A spot sample (1 quart) of production 2,4,5-T acid will be taken once a week and divided into three parts. Part one will be sent to Harold Gill for GLC dioxin analysis. Part two will be sent to Larry Silverstein. Part three will be kept in Lab #1 for a retainer.

The spot sample can be either the wet or dried acid, however, it might be advisable to alternate these samples whenever possible. Dry acid is not always available as the dryer is not operated full time and when this occurs it will be necessary to sample the wet acid.

The sample of wet acid will be submitted to the lab where it will be dried in the air circulating oven. The oven dried sample will then be sent to the personnel listed above.

A copy of Gills dioxin analysis will be sent to Sculati, Silverstein and Hoff.

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3. A sample will be taken of the filter cake during the filtration of the sodium salt step. This sample will be sent to Larry Silverstein for animal tests.

Take two - eight ounce samples. One will be kept in the lab as a retainer.

4. At the present time Silverstein would like to test the filter cake from the water process. This will probably be for a short time only.

5. At a later date the dioxin analytical data on the 2,4,5-T acid will be reviewed. At that time a decision will be made to determine the extent of analytical data needed for the future in order to comply with the specification.

ms

L. C. White, Jr.
Process & Formulations
Research Laboratory
867 Bldg. - 6/3625

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Exhibit 34

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DL No. 381

THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

THIS IS A FILE COPY. FOR OUTSIDE DISTRIBUTION OBTAIN COPIES WITH [illegible] AND WITHOUT DOW REFERENCES.

ANALYTICAL METHOD

June 22, 1965

MLW.65.11

HN 060263

DOW 1201728

THE DETERMINATION OF 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN IN 2,4,5-TRICHLOROPHENOXYACETIC ACID BY GAS-LIQUID CHROMATOGRAPHY

1. Scope

This method is applicable to the determination of 2,3,7,8-tetrachlorodibenzo-p-dioxin in 2,4,5-trichlorophenoxyacetic acid. The dioxin can be detected at the one ppm level with a lower limit of 0.5 ppm possible at optimum operation conditions.

2. Principle

The 2,3,7,8-tetrachlorodibenzo-p-dioxin is separated from the 2,4,5-trichlorophenoxyacetic acid by means of an extraction with chloroform. The chloroform extract is concentrated and then chromatographed. The 2,3,7,8-tetrachlorodibenzo-p-dioxin in the sample is measured and compared to a known standard.

3. Safety Precautions

2,3,7,8-Tetrachlorodibenzo-p-dioxin is capable of causing a severe delayed skin response (chloracne) upon minimal contact. Samples suspected of containing any of this compound should be handled so as to prevent all skin contact and inhalation. Wear impervious gloves (rubber, polyvinyl chloride, etc.) at all times when contact is a possibility. Clean all equipment with acetone followed by a chloroform wash. Dispose in such a manner as to prevent all skin contact, any potentially contaminated equipment or materials which are not readily cleaned with chloroform, i.e., towels, gloves, etc.

4. Apparatus

(a) Gas chromatograph, Aerograph A-600-D with flame ionization detector, Wilkins Instrument and Research, Inc., Walnut Creek, California, or equivalent.

(b) Recorder, -0.05 to +1.05 millivolt, full span, one-second full response time.

(c) Syringe, Hamilton microliter, No. 701N, or equivalent.

(d) Syringe, Multifit 5 cc, Becton, Dickinson and Company, or equivalent.

(e) Syringe, Yale 1/4 cc, Becton, Dickinson and Company, or equivalent.

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EXHIBIT S

(f) Centrifuge
(g) Injector insert, Pyrex glass for A-600-D. Available from Wilkins Instrument and Research, Inc., Walnut Creek, California (Note 11a).
(h) Column, 1/8-inch O.D., 0.081-inch I.D., stainless steel tubing, five feet in length packed with reagent 5(c).

5. Reagents

(a) Solid support, Chromosorb W, 60/80 mesh, Johns-Manville.
(b) Partitioning agent, SE-30, Silicone gum rubber-methyl (Note 11b).
(c) Column packing, five percent by weight of SE-30 on 60/80 mesh Chromosorb W. Available from Wilkins Instrument and Research, Inc., Walnut Creek, California.
(d) Carrier gas, nitrogen, commercial grade.
(e) Chloroform, ACS grade.
(f) 2,3,7,8-Tetrachlorodibenzo-p-dioxin, available from The Dow Chemical Company, Midland, Michigan.
(g) Sodium hydroxide, 1 N solution. Dissolve 40 grams of reagent grade sodium hydroxide in one liter of water.

6. Chromatographic Conditions

(a) Oven temperature, 225°C.
(b) Inlet temperature, 250°C.
(c) Carrier gas flow rate, 75 ml. per minute as determined by the moving soap bubble technique.
(d) Attenuation, such that a response of at least 50% of scale is obtained from a 1.0 microliter sample of a standard containing 100 micrograms of 2,3,7,8-tetrachlorodibenzo-p-dioxin in one milliliter of chloroform.

7. Preparation of Standard

(a) Again read Section 3.
(b) Weigh, using a micro-balance, one milligram of 2,3,7,8-tetrachlorodibenzo-p-dioxin into a ten ml. volumetric flask.
(c) Dilute to the mark with chloroform.
(d) Inject a 1.0 microliter sample into the chromatograph. See Figure I for a typical chromatogram.

8. Procedure

(a) Weigh 10.0 grams of the sample into a four-ounce bottle.
(b) Add 20.0 milliliters of chloroform and shake for one hour.
(c) Place the solution in a centrifuge tube and, with proper balancing, centrifuge for five minutes.
(d) Using an eye-dropper, draw off as much of the clear chloroform layer as possible into a two-ounce bottle.

(e) Add 25 ml. of 1 N sodium hydroxide to the chloroform extract and shake for 15 minutes (Note 11c).

(f) Centrifuge for five minutes.

(g) Using a five-milliliter syringe, draw off as much of the bottom chloroform layer as is possible into a small vial. Note this volume.

(h) Evaporate to dryness in a hood.

(i) Take up with chloroform to 5.0% of the volume noted in step (g). This final solution represents ten grams of sample per ml. of chloroform.

(j) Inject 1.0 microliter into the chromatograph and measure the response of the 2,3,7,8-tetrachlorodibenzo-p-dioxin. Figure II shows a representative chromatogram.

9. Calculations

Let:

A = The area of the 2,3,7,8-tetrachlorodibenzo-p-dioxin in the sample.

B = The attenuation of the chromatograph for the sample.

C = The micrograms per milliliter of the 2,3,7,8-tetrachlorodibenzo-p-dioxin in the standard.

D = The area of the response from the 2,3,7,8-tetrachlorodibenzo-p-dioxin in the standard.

E = The attenuation of the chromatograph for the standard.

Then:

$$\text{ppm of 2,3,7,8-tetrachlorodibenzo-p-dioxin} = \frac{A \times B \times C}{D \times E \times 10}$$

10. Accuracy

The accuracy of this method is ± 5%, or less, relative.

11. Notes

(a) Glass inlet liners have been found to be necessary to provide reproducible results.

R 286

(b) Silicone FS-1265 (fluro) has been found to work well as a stationary phase. It also is available from Wilkins Instrument and Research, Inc., Walnut Creek, California.

(c) Any 2,4,5-trichlorophenoxyacetic acid which has dissolved in the chloroform extract must be removed as it will interfere with the chromatographic analysis of the 2,3,7,8-tetrachlorodibenzo-p-dioxin.

12. Analytical Laboratory References

(a) Gill, H. H., "The Determination of Compounds Capable of Causing Chloroacne in 2,4,5-Trichlorophenol Process Samples by Gas-Liquid Chromatography", MLW.64.19, November 30, 1964.

(b) Silverstein, L., Personal Communication.

(c) Tiffany, P. A., Analytical Laboratories, Book 9, pp. 92, 102.

sjs

P. A. Tiffany
H. H. Gill
Analytical Laboratories
574 Building

0000463

CONFIDENTIAL

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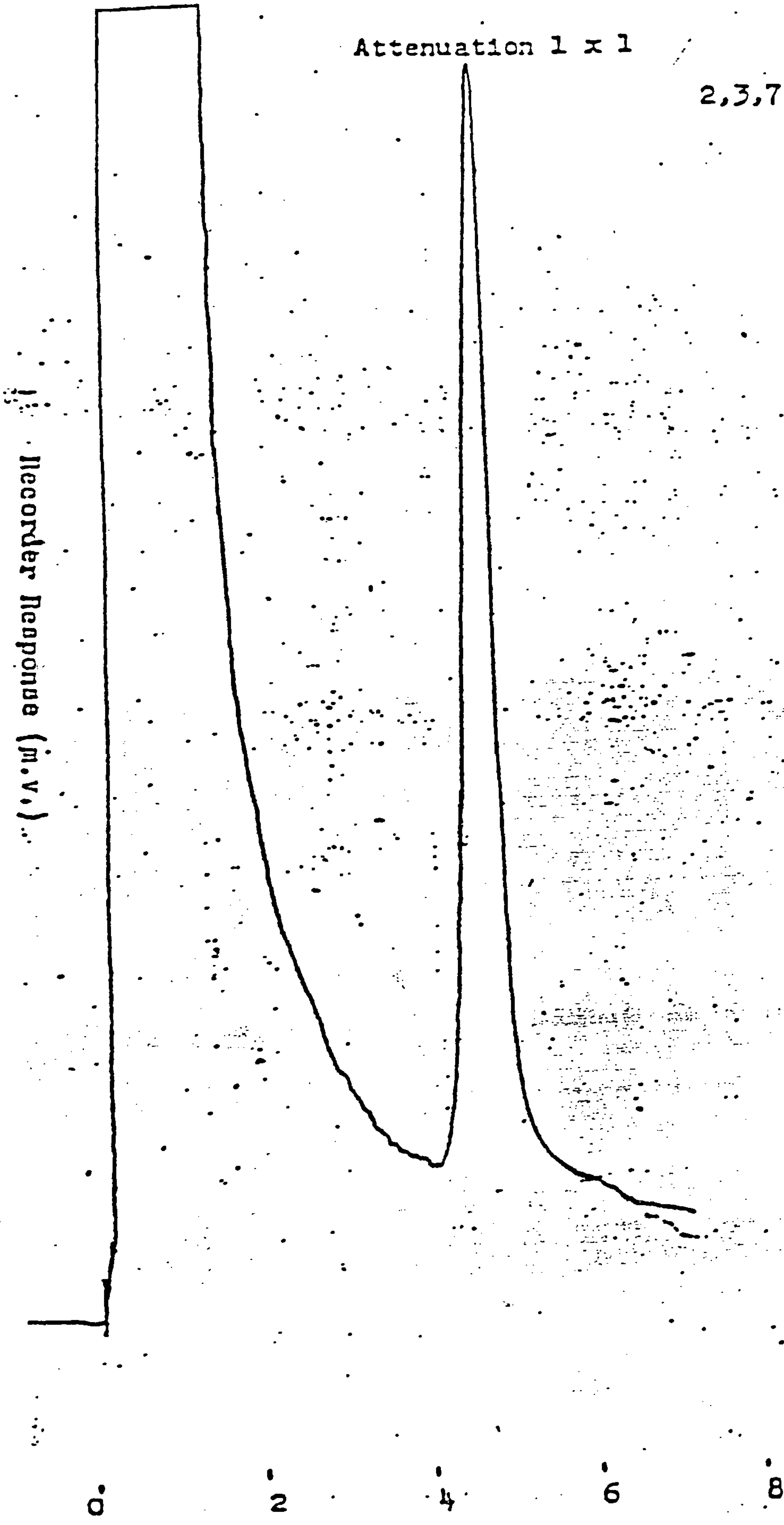
J 22, 1965 FIGURE I MLW.65.11



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June 22, 1965

FIGURE II

MLW.65.11

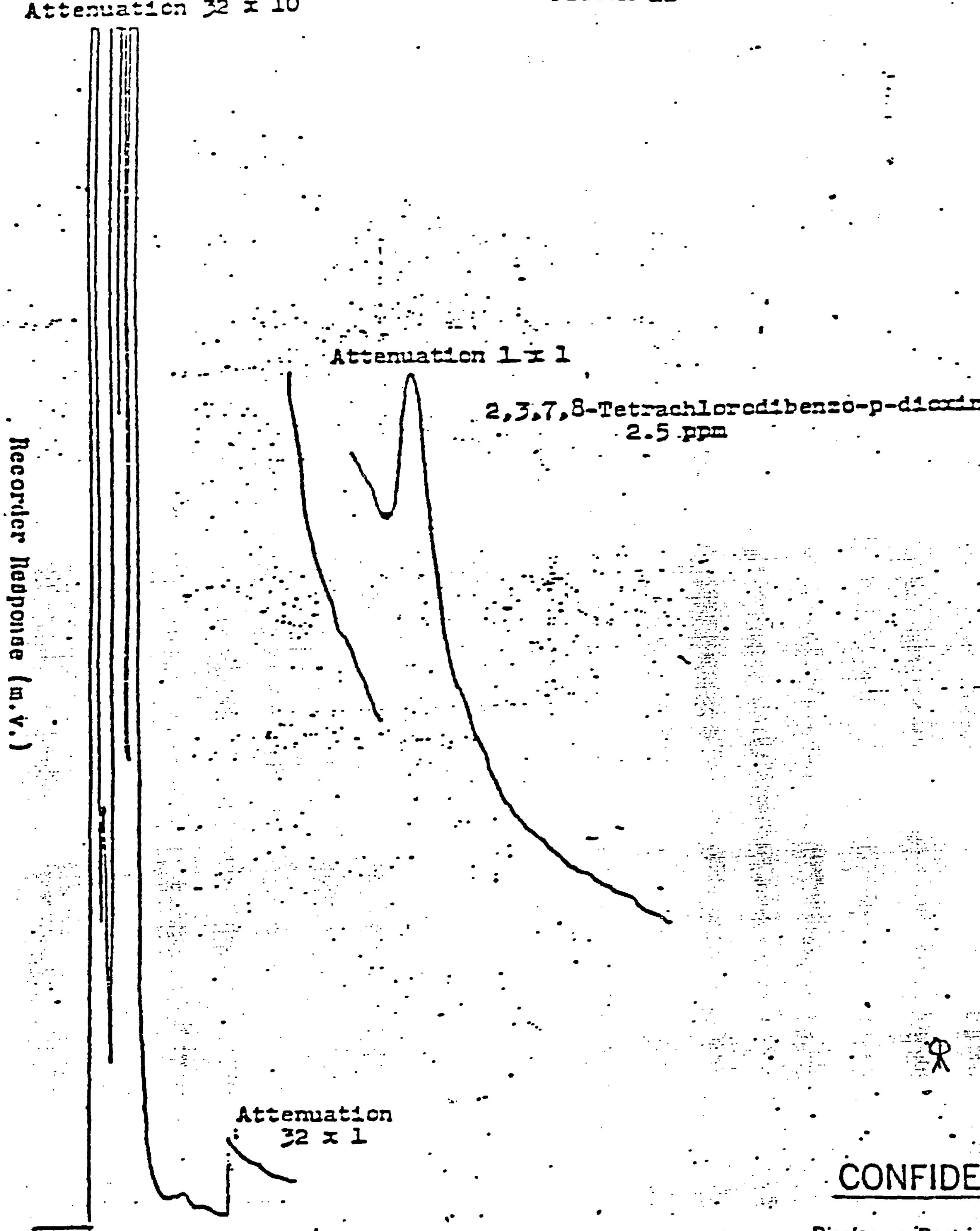

Exhibit 35

DOW 1 129860.

MIDLAND
June 24, 1965

DOW CONFIDENTIAL

Ross Mulholland
Manager
Bioproducts
Dow Chemical of Canada
Sarnia, Canada

2,4,5-TRICHLOROPHENOL, THE "T" ACIDS, AND ASSOCIATED ACNEGENS

I have not been neglecting your request for information to use in discussing the subject problem with Naugatuck and the Co-Op. I have been stymied, however, because the analytical methods have been changed and are in the process of being cleared and reproduced. I expect them any day, but rather than wait longer, I thought I should advise you of the situation. I will send you copies of these methods as soon as they become available.

In regard to the overall problem, we are attempting to do everything possible to avoid the possible occurrence of chloracne in any applications involving the handling or use of trichlorophenol, trichlorophenoxyacetic acid and its derivatives. As you well know, we had a serious situation in our operating plants because of contamination of 2,4,5-trichlorophenol with impurities, the most active of which is 2,3,7,8-tetrachlorodibenzodioxin. This material is exceptionally toxic; it has a tremendous potential for producing chloracne and systemic injury. If it is present in the trichlorophenol, it will be carried through into the T acid and into the ester, and hence into formulations which are to be sold to the public. One of the things which we want to avoid is the occurrence of chloracne in consumers. I am particularly concerned here with persons who are using the material on a daily, repeated basis such as custom operators may use it. If this should occur, the whole 2,4,5-T industry will be hard hit and I would expect restrictive legislation, either barring the material or putting very rigid controls upon it. This is the main reason why we are so concerned that we clean up our own house from within, rather than having someone from without do it for us. In this way, we can approach the problem in an orderly manner. If the producers and handlers of this material will cooperate, there is no reason why we cannot put this problem under strict control and thereby hopefully avoid restrictive legislation; in other words, let us practice good citizenship. At the present time, we are of the opinion that material containing no tetrachlorodibenzodioxin with a sensitivity of 1 ppm does not present an appreciable hazard to consumers. Likewise, we do not believe that such material constitutes a significant hazard to persons working in

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DOW 120801

DOW CONFIDENTIAL

R. Mulholland - 2 - June 24, 1965

plants handling such phenol, T acid, or T acid esters.

I might add that we are continuing our researches on this particular problem from the standpoint of studying the other impurities which may have the capacity to produce this type of reaction. Also, we are attempting to quantitate the effects of the known acnegens when added to base materials. This work is progressing well, but it will be several months before we have a completed story.

I would urge again that if your big customers such as Co-Op and Naugatuck have particular questions about this problem that you invite them to come to Midland where we will be glad to discuss the matter in detail with them and show them what we have learned. We are not in any way attempting to hide our problem under a heap of sand, but we certainly do not want to have any situations arise which will cause the regulatory agencies to become restrictive. Our primary objective is to avoid this.

I trust that you will be very judicious in your use of this information. It could be quite embarrassing if it were misinterpreted or misused.

V. K. Rowe
Biochemical Research Laboratory
1701 Building
ME 6-2376

VKR/jd

cc: L. Silverstein
C. Otis
Grady Holdeman
F. Amstutz
G. Goergen
M. Hovis
W. Palsey
V. K. Rowe (2)
717.4-12-20
Correspondence

P.S. Under no circumstances may this letter be reproduced, shown, or sent to anyone outside of Dow.

VKR

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RESEARCH DEPARTMENT
HERCULES INCORPORATED
RESEARCH CENTER

cc: Mr. J. M. Eagan - Syn.
Mr. C. L. Dunn - Syn.

Dr. M. A. Taves
Mr. A. Z. Conner

Exhibit

EXHIBIT
H 0099

Wilmington, Delaware
June 13, 1966

TO: MR. E. E. CHRISTOFANO, MEDICAL DEPARTMENT

FROM: J. J. FORD, ANALYTICAL DIVISION

DIOXIN FORTIFIED SAMPLES FOR BIOASSAY TESTS

In accordance with your letter of November 18, 1965, the samples listed below are being sent to you for transmittal to Dr. Oettel of Badische, for use in the bioassay tests.

Approximately 10 grams of each sample (except for the pure dioxin sample) is included. The samples are packed in four shipping containers, and the contents of each are listed on the outside of the container. The individual samples are also clearly identified with an appropriate label. I have indicated which samples have dioxin added to them, but have not shown the fortification level on the label. If you wish to provide Dr. Oettel with this information, it is included in the attached list. It would be useful to point out to Dr. Oettel that the samples from Group 3 and Group 6 are more easily sampled if heated as indicated.

J. J. Ford

JJF/cbb
Attachment

H01441

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R 292

Mr. E. E. Christofano   Page 1 Attachment   June 13, 1966

SAMPLES PREPARED FOR BIOASSAY TESTS.

(1) Standard 2,4,5 T Acid With Added Dioxin

Sample Designation	ppm. Dioxin Added
X14867-41-1	0
X14867-41-2	2
X14867-41-3	5
X14867-41-4	10
X14867-41-5	20

(2) Plant Grade 2,4,5 T acid with Known Dioxin

Sample Designation	ppm. Dioxin
X15280-56-8	3
X15280-56-9	1

(3) Plant Grade Sodium Trichlorophenate with Added Dioxin
Fortification is based on a 35% NaTCP Content.

Sample Designation	ppm. Dioxin
X15280-55-1	0
X15280-55-2	1.2
X15280-55-3	2.4
X15280-55-4	5.7
X15280-55-5	13.0

Heating the above samples to 65°C. aids in sampling.

(4) Dioxin Sample - 2,3,7,8 tetrachlorodibenzo-p-dioxin - Designated X15280-56-10.

(5) 2 Ethyl hexyl ester of 2,4,5 T with added dioxin (Brush-Rhap LV-4-0)
Fortification is based on 44.1% 2,4,5 T acid.*

Sample Designation	ppm. Dioxin
X15280-56-1	0
X15280-56-2	2
X15280-56-3	5
X15280-56-4	10
X15280-56-5	20

(6) Non-saponifiable fraction from wash solvent still. Designated X15280-56-7. This sample contains unreacted tetrachlorobenzene and relatives, anisol of trichlorophenol and related phenols, toluene and a small amount of NaTCP. Sidwell believes this is where the dioxin would end up in our process. We are storing [illegible] rate of 2-3 drums per day. To melt,

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EARCH DEPARTMENT
E. I. DU PONT DE NEMOURS & COMPANY (partially legible: "ES OWDER COMPANY")
EXPERIMENTAL STATION: "...CH CENTER"

Exhibit 37

EXHIBIT
H0050

ABSS 8/27/65

Wilmington, Delaware
August 26, 1965

I'll need some filling in for Dept'l Res. Mtg. scheduled for June 31

TO: DR. M. A. TAVES, SYNTHETICS RESEARCH DIVISION

FROM: J. J. FORD, ANALYTICAL DIVISION

ANALYSIS OF 2,4,5-T ACID AND NaTCP FOR "DIOXIN" IMPURITY

Attached is a summary of the analytical data obtained to date on the "dioxin" content of current production 2,4,5-T Acid from the Jacksonville Plant. Also included are the values obtained for three NaTCP samples. At lease duplicate analyses have been performed on each sample; this includes individual extraction and workup prior to gas chromatography. Values enclosed by brackets represent multiple injections of the same extract.

The values reported for the NaTCP are calculated on an as received basis. I do not know the actual NaTCP content. I feel these results for the NaTCP samples imply a greater sensitivity than we have demonstrated to date. These are simply the values calculated from a given response on the GC curve. Additional work, including fortification and recovery, should be completed before much emphasis is given to a difference between 0.2 and 0.4 p.p.m.

Portions of samples representing Lots L, N, Q, and current have been sent to Dow for analysis along with three samples to which known amounts of dioxin have been added.

The remaining samples of 2,4,5-T Acid submitted by Jacksonville should be completed shortly. These results will be communicated to you, as well as Dow's findings, as soon as available.

John J. Ford

JJF/agg

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Dr. M. A. Taves | Attachment page 1 | August 2[illegible], 1965

DIOXIN VALUES FOR SELECTED SAMPLES OF 2,4,5-T ACID AND NaTCP

Sample	Designation	Date	p.p.m. Dioxin	Average Value
2,4,5-T Acid	Lot L	4-15-65	3.6, 2.9, 3.0, 3.2, 3.0	3.2
	Lot M	6-1-65	(2.0,4.8,4.9)(2.6,3.4,3.1)(1.6,2.2,2.1)	3.0
	Lot N	6-15-65	2.3, 2.6, 3.2, 3.6, 3.3	3.0
	Lot P	7-1-65	3.7, 2.9	3.3
	Lot Q	7-19-65	(1.8,1.8) 2.7, 2.5	2.2
	Current	7-7-65	1.7, 0.9, 1.1, 1.6 (1.5,1.2)	1.3
NaTCP	Batch 282	4-23-65	(.18, .21)(.25, .23)	0.2
	Batch 260	4-15-65	(.33, .31)(.52, .63, .44)	0.4
	X13387-95-2	4-9-65	(.81, .81, .70)(.88, .84)	0.8

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19

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H0066

Exhibit

HERCULES POWDER COMPANY

CC: MR. H. E. WILDER
MR. J. M. EAGAN - SYN. - WILM.
MR. C. L. DUNN - SYN. - WILM.
TECH. FILE

Jacksonville, Arkansas
~~March 30, 1965~~

CONFIDENTIAL

TO: DR. JOHN P. FRAWLEY - MEDICAL - WILM.

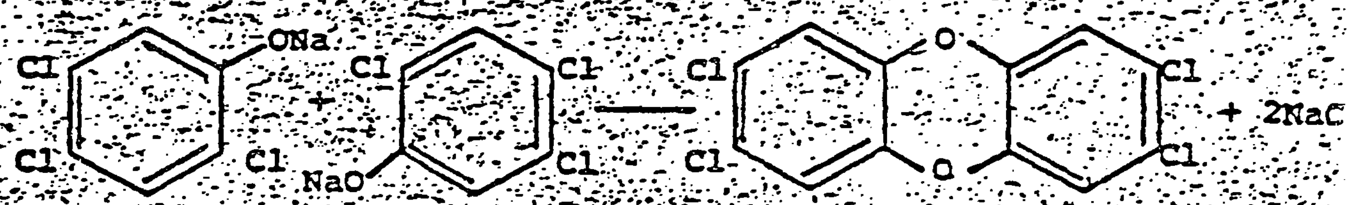
FROM: [redacted] SIDWELL

2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN
COMMENTS ON ITS PROBABLE MODE OF FORMATION

The report of your meeting with representatives of the Dow Chemical Company on the toxicity of trichlorophenol impurities is very interesting and, of course, will be held in confidence.

As outlined to you by telephone at an earlier date, it is our belief that the temperature and concentration conditions which we use in the production of sodium trichlorophenate are such that very little, if any, of the compound 2,3,7,8-tetrachlorodibenzo-p-dioxin is produced. We believe that if higher concentrations and, accordingly, higher temperatures are employed in the production of sodium trichlorophenate, a reaction similar to the following might take place:

Two molecules of 2,4,5-trichlorophenol might react together with the elimination of sodium chloride in such a manner as to produce the compound in question. This is illustrated below:



2 NaTCP —— 2,3,7,8-tetrachlorodibenzo-p-dio

It is our opinion that such a reaction would be favored by high concentrations of sodium trichlorophenate and high temperature.

6

H01332 296

2453-12-59 400M

HERCULES POWDER COMPANY

It may have been a fortunate circumstance that our production procedure was limited in pressure by the design characteristics of the original vessel purchased by Reasor-Hill Corporation, which automatically forced us to operate at lower temperatures and lower concentrations. In any case, the reaction of caustic with symetrical tetrachlorobenzene in methanol is definitely exothermic and, since methanol and dimethyl ether produced as a side product have high vapor pressures, we are limited to a working pressure of approximately 325 pounds psig. Our peak temperature during the reaction occasionally reaches 175°C, and our maximum pressure rarely exceeds 320 pounds psig.

Experiments carried out in a small (1 liter) Parr pressure bomb a number of years ago indicated to us that if the concentration of alcohol is too low, or if the concentration of caustic is too high, excessive temperatures and pressures are reached, even sufficient to cause pyrolytic charring of the charge. Under such conditions, it is possible to use up all the caustic and actually generate hydrogen chloride, developing pressures of above 900 psig.

A.E. Sidwell

AES:bg

297

H01333

Exhibit 39

June 10, 1965

2, 3, 7, 8-T
dioxin

Mr. V. K. Rowe
Biochemical Research Laboratory
1701 Building
The Dow Chemical Company
Midland, Michigan 48640

Dear V. K.:

Thank you for your letter of May 13 regarding analysis of 2, 3, 7, 8-tetrachloro-p-dioxin in 2,4,5-T acid. I have not replied before now because I have not had much to report other than continued frustration of our analytical people.

As you probably know, two of our analysts visited Mr. Gill in Midland and reported a pleasant and satisfactory visit. In brief, the major difficulty was associated with a difference in the standard adjustment of the flame impinger in relation to the emission coil of two different models of the gas chromatographs. It appears this is a critical point for this determination which no one ever anticipated, including GC manufacturers. This problem could have gone on for years. I think we are finally underway.

Thanks again for your help.

Sincerely,

~~John P. Frawley, Ph.D.~~
Chief Toxicologist

JPF/esw

cc: Mr. E. P. Wheeler

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H01364

EXHIBIT 298

Exhibit 4C

THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN
February 3, 1967

B. JOHNSON

MAR 24 '83

William Thomason - 1

DOW 751571

To: V. K. Rowe

cc: W. L. Corbin
D. E. Pletcher
J. H. Gowell

From: W. J. McCoy WJM

THOMPSON CHEMICAL COMPANY, ST. LOUIS, MISSOURI

Mr. M. S. Buckley of Thompson Chemical phoned Howard Sheldon February 2, indicating that he believed they have a severe chloracne problem with some of their employees. He indicated that they already have two men affected and believe that they may have two more employees that appear to be affected as well. They are using Hooker's tetrachlorobenzene to make their trichlorophenol.

Buckley was asking if Dow would have any recommendations for medical treatment for their employees. We do not feel friendly toward this competitor as far as business relationships are concerned but believe that any advice would be in order. If you concur, he would appreciate a phone call and his number is Area Code 314, JE 5-6608.

jk

65

299

EXHIBIT P-4 1-21-23 [illegible]

Exhibit 41

[illegible] CORRESPONDENCE

DATE 3/25/65

TO: JOHN [illegible], JR.

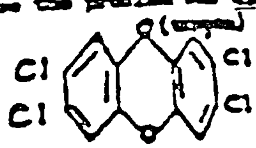
FROM: E. L. [illegible]

SUBJECT: [illegible] - [illegible]

cc: F. L. Kennedy - Mgr., Newark plant
J. O. [illegible]
E. J. [illegible]

On March 24, Mike Kennedy and I met with two people from [illegible] Chemical Co., two from Hercules, and with the Dow group to discuss the toxicological impurities associated with 2,4,5 trichlorophenol and related materials.

Dr. Rowe of Dow Chemical opened the meeting by stating that they had operated for 25 years without trouble; but, in the last year, they had 60 to 70 cases of chloracne. Ten of these were moderate, and five to ten were extremely severe. Their approach was a qualitative one at first. They wanted to [illegible] the material, learn how to identify it, and try to avoid continual trouble with the material. They tested various materials from tar fractions and from, as they put it, "junk", etc. They found that there are a number of suspect materials, probably 26 or 27; but the major "bad actor" that they identified and which seemed to consistently cause the problem was 2,3,7,8-tetrachlorodibenzo-p-dioxin (symmetrical).



→ 2,3,7,8-TETRACHLORODIBENZ p-Dioxin (Symmetrical)

This incidentally was previously listed as a suspect material by Cy Perkins of our company. A similar material is the unsymmetrical 2,3,7,9-[illegible], also sometimes listed as 2,3,7,9-[illegible].

The Dow people used the white glove approach and found this contaminant on tool handles, benches, instruments, and other facilities. In test animals, they could consistently cause the symptoms to appear. Dr. Holder of Dow, one of their medical doctors, had excellent color slides of the various patients. The difficulty starts with [illegible] blackheads resulting in closed cystic structures which make the patient look like he needs to wash his face. The disease develops slowly, not appearing until six weeks to two months after mild exposure but appearing in five to seven days with very heavy exposure.

One bench chemist has been under treatment for two years and his face is starting to show signs of clearing. Dr. Holder says that he believes this man's problems will be solved in another six months. Dr. [illegible], who does their micro-scopic work in connection with their animal laboratory, showed photo micrographs of the cysts as they formed in the ears of rabbits. The cysts correlated with those found on the faces of the men.

-S 1030344 -2-

B. JOHNSON

FEB 6 '83

EXHIBIT 41 66

EX Chandler-7

300

Chloracne - Dow Meeting (EC) -2- March 25, 1965

Basically, there is a keratinized deposit in the hair follicles and oil ducts in the face. These eventually go from the blackhead stage to form a almost, heavy cyst deposit. The chemical cannot be found in the facial tissues or in the cysts, but the problem still persists after exposure. The best description of the acute stage is that the facial tissues resemble the exaggerated surface texture of an orange, rather glazed and mainly with the enclosed hard core deposits.

A secondary symptom, which does not correlate directly with the amount of facial dermatitis, is a systemic reaction where the employee is completely listless, tired out, and nearly incapacitated. A complete biopsy of liver, kidney, etc., shows no degeneration of major organs. A complete clinical examination of the patients shows no measurable effect on heart, blood pressure, respiration rate, blood sugar, etc. The fatigued patients seemed to be helped by heavy doses of vitamins, perhaps related in some way to the curative metabolism of the body involving Vitamin A, etc.

DETOX

RECOVERY FROM VITAMINS

An oral dose of 27 micrograms immediately killed the test animals. The Dow people did not lower this dosage to obtain an LD50 but decided that, when they can detect this compound, it should not be in the product. They found that, after exposure to the material, washing within 15 minutes did not help a great deal, but did slow down the speed at which the symptoms appeared. Washing after one hour was of absolutely no help whatsoever in reducing total dermatitis or speed of appearance of the reaction. Moderate scrubbing with detergent does not remove this material. Extremely hard scrubbing can accomplish the task or the use of solvents, such as 1,1,1-trichloroethane.

Dow has developed a new analytical method in which they have confidence in their sensitivity to 1 ppm. They can only state in levels below this that some may be present below the 1 ppm. They stated that they have not used micro-colorimetric methods, and the electron capture tests that they ran made only a very slight improvement in sensitivity with this compound. Their analytical chemist stated that the electron cell saturates because of the presence of other materials in high concentration compared to the dioxin.

This material has some strange properties. It has a fairly high vapor pressure but nevertheless is quite persistent as a contaminant. It can be separated from benzene by boiling if it is not carried down to dryness. The Dow people are extremely careful in all of their work with this compound. They use PVC throw-away gloves, and all samples are burned in a special furnace which operates at 800°F. These samples are sealed before going to the burner. They use bioassay methods on rabbits for qualitative assaying only.

The Dow people state that they intend to set a limit of zero with sensitivity of plus or minus 1 ppm on this material. They have analyzed materials from other companies, including our company, and have found amounts as high as 10 ppm in 2,4,5-T acid and 20 to 30 ppm in phenates.

They have made a single application to the ears of test rabbits and found that 20 ppm will not give folliculitis. Forty ppm does give a slight effect, and 100 ppm is severe. They have made repeat applications of from 10 to 100 ppm, and 25 of these treatments do not cause a response; however, 1000 ppb (1 ppm) gives a slight response with nine applications and a severe reaction with 11 applications.

Supralinear dose resp

They conclude, therefore, that 1 ppm with repeat exposure can create a real problem.

Dow's people outlined a method for extracting and running samples on 2,4,5-T; 2,4,5-TP; and phenols. It involves a chloroform extraction, followed by

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a caustic wash, and a reduction by boiling to one-tenth the volume before putting it in the chromatograph. They have given the gas-liquid chromatography method to us, along with analytical-grade dioxin material. Mike Kennedy has these materials and intends to pursue the laboratory work necessary to ascertain where and how much, if any, of this dioxin appears in our 2,4,5-T process.

The purpose of this meeting was obviously designed to help us solve this problem before outsiders confuse the issue and cause us no end of grief. Dow is passing the test results on our material to us, incidentally, and this will further check our techniques, etc.

Sincerely,

EL

E. L. Chandler

ELC:mam

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Exhibit 42.

CONFIDENTIAL
HERCULES POWDER COMPANY

P-13 ID
[illegible] 3-8-83

cc: Jack Copeland - Synthetics
John [illegible] - Synthetics
C. L. [illegible] - Synthetics
E. L. [illegible] - [illegible]
Attn: Dr. A. B. [illegible]
J. G. [illegible] - Legal
L. C. [illegible] - Medical

[illegible] 2,4,5-T

On July 9, 1965, Mr. [illegible] of Dow Chemical Company telephoned me stating that he was calling at the request of Mr. [illegible], Vice-President of Dow to inquire how serious I considered the chloracne problem in relation to the commercial use of 2,4,5-T. When I suggested that he should discuss this with Hercules management rather than with me, he stated that on the advice of their toxicologists Dow has gone to great expense to alter their manufacturing conditions in order to produce 2,4,5-T acid which has less than 1 ppm acnegen.

Since several months ago Dow had made available to all other producers the same data which convinced their toxicologists to set an internal specification of 1 ppm on the acid, they had assumed that the other producers would take similar action. On the basis of their chemical analyses, they are convinced that no one else has done anything to remove the acnegen from their 2,4,5-T and consequently, they wanted my opinion whether they had been mis-advised by their own toxicologists.

I advised Mr. [illegible] that I did not think this was a proper question for me and that he should seek outside advice from a private consultant if he doubted the advice of his own toxicologists. I pointed out that considerable individual professional judgment would be involved in establishing a specification of this type because all of the important facts are not known.

He then stated that Dow was extremely frightened that this situation might explode. They are aware that their competitors are marketing 2,4,5-T which contains alarming amounts of acnegen and if the government learns of this the whole industry will suffer. They are particularly fearful of a Congressional investigation and excessive restrictive legislation on manufacture of pesticides which might result.

I advised Mr. [illegible] that we shared his fear but were not aware of his allegation that the competitors' products were hazardous. He asked if Hercules had established an internal specification. I stated that he should discuss this with someone in our management and referred him to Mr. Copeland. I reminded him that we had experienced great difficulty in conducting the analyses for the acnegen by the Dow procedure, and that only within the past few weeks, following a visit of our chemists to Midland, have we been able to obtain any useful information. I suggested that if he wanted any additional information on this problem he should talk to Mr. Copeland. He asked that he be transferred to Mr. Copeland.

(After the call was transferred I learned that Mr. Copeland was out of town and Mr. [illegible] left word that he would call on Monday, July 1[illegible]).

JPF/[illegible]
July 1[illegible], 1965
[illegible] Medical Department

to 22531

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EXHIBIT FF

[illegible]

[illegible]

[illegible] of the [illegible] [illegible] the possibility of [illegible] 2,4,5-T [illegible] [illegible] 2,4,5-T [illegible] with hourly [illegible] considerably [illegible] of three [illegible] a large percentage [illegible] new department [illegible]

I am convinced that [illegible] the problem is to isolate the [illegible] material and [illegible] it from the process [illegible] to the product.

The Kettering Laboratory [illegible] developed a test using [illegible] I have asked them to estimate the cost of [illegible] or not [illegible] control the problem [illegible] cost estimates [illegible]

It is my recommendation [illegible] as rapidly as [illegible]

R. E. Sodes

[illegible]

Attachment

SCHEDULE 85

MONSANTO CORPORATION [illegible] ROLL 88

70 Monsanto

EXHIBIT 55

304

Monsanto

[illegible])

On the 17th of November, 19[illegible] [illegible] was producing a batch of trichlorophenol from tetrachlorobenzene when the process exceeded control pressure and temperatures [illegible] at Nitro. No one was injured at the time. [illegible] as clean-up was being carried out, the first cases of chloracne developed. Fifteen or sixteen cases (6 serious) developed within the next 1-2 months and additional cases showed up during the next 10-12 months until there was a total of 50-60 cases.

50-60 chloracne cases

I [illegible] photographs [illegible] cases [illegible] neck, [illegible] It is my impression that their severe cases were [illegible] ours. In addition to the skin manifestations [illegible] been reported [illegible] as experi[illegible]

About two days following [illegible] rabbits (in open wire cages) were placed in the operating area for 2-[illegible] There were no obvious symptoms which developed in the animals [illegible] week after exposure [illegible] [illegible] department, others in cages suspended inside the decontaminated autoclave and some in the adjacent department. All [illegible] following exposure. Subsequently, animals placed in the cages which had previously been in the department died [illegible].

[illegible] trichlorophenol process (or [illegible] [illegible] of the indicated materials:

[illegible]
[illegible] of chlorinated [illegible]
[illegible]

005607

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[illegible] this impurity can show up in the production of any chlorinated phenols and is probably responsible for any chloracne which has been attributed to chloronaphthalenes, pentachlorphenol, chlorinated biphenyls, etc.

[illegible] chlor- [illegible] not aware [illegible] in Dr. [illegible] (References [illegible] Postnatal Development and Functional Histology of the Sebaceous Glands in the Rat, Am. J. Anat., [illegible], 1949). He is convinced that [illegible] reported in the attached reprint is significant. In this regard, [illegible] now [illegible] from Bayer, [illegible] the production of [illegible] (chemist - Research Director At Elberfeld).

Radische has been able to reproduce in the laboratory the conditions which lead to the incident such as theirs and ours at Nitro and was quite [illegible] given [illegible] process information [illegible] with 3 mols of trichlorphenol [illegible] and a tem- [illegible] his remarks [illegible] not certain of his remarks.

Dr. Oettel [illegible] of our materials [illegible]

(1) Samples of any of the materials involved in our 1949 incident including [illegible]

(2) [illegible]

(3) Any samples from raw materials, intermediates, and final product which may have been involved in our cases which developed during our [illegible] production in the plant following the initial incident.

MONSANTO
* NITRO,
W.V.

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[redacted]

[redacted] Hygiene Foundation [redacted]

(2[redacted] - Clinical and Environmental Survey at [redacted]

(3[redacted] Survey Carried Out In [redacted] at Nitro, February 2, 1956. MONSANTO

We reviewed thoroughly Mr. Weger's excellent "History of Chloracne" which he sent to me with covering memo dated May 15, 1956, and which included descriptions of Kettering's reports on their human and animal research. I did not give Dr. Cottel a copy of this account because I did not have permission to do so. As a result of my visit, it may be desirable to edit this report somewhat and add further process information before forwarding this to Badische. * HUMAN EXPERIMENT

Any [redacted] possible.

[redacted]

EF:ch

Attachment

005669

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307

SCHEDULE #4

General Offices

June 16, 1959

CHLORACNE PROBLEM - GERMAN ARTICLE

Reference: Your memo 6/4/59

Mr. L. C. Weger
Nitro, West Va.

I certainly thank you for the translation of the German article on chloracne. I wish we had been able to investigate the previous difficulties completely enough to isolate the chlorinated di-benzodioxine (diphenyleneodioxide) as an important causing agent. Similarly, we would have been quite pleased if Monsanto research or that at Mellon Institute or Kettering Laboratory had developed the information on the 2,3,6,7-tetrachlorodibenzodioxine.

The article appears to bear out Dr. Oettel's statement in 1955 that he believed that a chlorinated diphenylenedioxide was responsible and that such materials could be produced in any process of chlorination of phenol.

Elmer P. Wheeler

EPW:dh

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Exhibit 51

EXHIBIT 59

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SCHEDULE #1

308

[illegible]

[illegible] [illegible]

[illegible]

K. Y. Dunlap
[illegible]

At a recent meeting I had an opportunity to talk privately with Dr. V. K. Rowe of Dow. You will recall he is the gentleman who "opened the can of worms" on the [illegible] situation a couple of years ago.

Dr. Rowe was a little reluctant to discuss the problem in any detail. He did tell me however:

1. Dow was able to isolate tetrachlorodiphenylene-dioxyd from their product.

2. They then synthesized this material.

3. They tested both samples in animals and found that in microgram quantities the samples [illegible].

I asked Rowe what technique they followed in the animal studies. He replied that the materials were so potent that putting it on the skin anywhere on the animal resulted in a "positive" response.

The toxicology test in the past has been to use the interior surface of rabbit ears. This technique when followed by different laboratories has given equivocal results.

Dr. Kelly thought I ought to pass this information on to you.

Elmer P. Wheeler

[illegible]

005995

EXHIBIT 61

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FILE

I talked with V. K. Rowe [illegible] this morning. He stated the following:

1. [illegible] the 20 cases of chloracne he did not tell me [illegible]

2. They analyzed the trichlorophenoxyacetic acid [illegible] found [illegible] ppm of [illegible] chloro-[illegible]. This, he states, he is sure is the chloracne agent, although there may be other impurities. At any rate, he is so concerned that they are having [illegible] whether to use these [illegible] material [illegible]

3. [illegible] on rabbit ears [illegible]. When I tried to say that some of our people have not been able to cause it with other material, he just scoffed and said there was [illegible] chloracne by [illegible] rabbit [illegible] that he has run about 500 tests on rabbit ears.

4. [illegible] I don't know. He was not too clear on where material it was and how [illegible] developed.

5. He had heard that the [illegible] is looking into this problem and [illegible] concerning the [illegible]

6. Dow will have a management meeting today to decide whether or not they will [illegible] them. He asked if we had any specifications on the presence of this particular contaminant and I said we did not.

7. [illegible] with all the [illegible] particular contaminant [illegible]

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EXHIBIT 62

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Monsanto

0224

SCHEDULE [illegible]

[illegible]

February 24, 1965

[redacted]

R. [illegible] Kelly, M. D.

REK/ln

R

005973

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DISCUSSIONS WITH DOW CHEMICAL COMPANY
February 10-11, 1965

The following participated in various discussion sessions on February 10 and 11, 1965, relative to 2,4,5-trichlorophenol:

For Dow Chemical Company

Mr. C. J. Williams, Director of Marketing
Mr. L. E. Grant, General Sales Manager
Mr. W. L. Corbin, Agricultural & Industrial Bioproducts Sales Manager
Mr. T. W. Harris, Sales Manager, Chemicals Department
Mr. J. C. Tucker, Product Sales Manager, Industrial Chemicals
Mr. C. E. Otis, Manager, Plant Science Dept. of Agri. & Indus. Bioproducts
Mr. L. Silverstein, Biochemical Research
Mr. James Doedens, Chemicals Department (Production)
R. J. Minbiole, General Sales Manager, St. Louis Office

For Thompson-Hayward Chemical Company (T+H)

R. S. Thompson, President
L. [illegible], Vice President, Research & Development

Mr. Doedens explained that cases of chloracne began developing in the trichlorophenol production plant in December, 1964, and were particularly noticeable among maintenance men. He said that a temporary measure taken to reduce chloracne was to change the conditions of hydrolysis of tetrachlorobenzene to trichlorophenol, particularly the lowering of the production rate to about 25% of normal. Other steps are being taken to improve output of chloracnegen-free material and include adding more production units, and making a thorough study of optimum production conditions. AV REE

Dr. Silverstein stated that an all-out effort was being made to check the presence of chloracnegens in previous batches of trichlorophenol which had been retained. He said the method being used was sensitive to 1 ppm. The latest analytical method has not even been written up, but an older method (HLW.64.19) of November 30, 1964, was presented to Thompson-Hayward. Also, Dr. Silverstein presented to Thompson-Hayward a paper entitled "The Preparation of Trichlorophenoxyacetic Acid Avoiding the Formation of Chloracne Exciters." He offered to acquaint Thompson-Hayward analysts with the current method of analysis for chloracnegens if they would visit Midland, Michigan.

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Dr. Silverstein also stated that the chemical or gas chromatographic method of analysis for chloracnegens was not as sensitive as the animal test method which involved applying dilute solutions to rabbit ears. 312

-2-

* In V/N, 3-5 gallo remained in 55 gal drums ∴ use "empty barrels" were most likely to have contaminants contact handlers.

He suggested that in addition to sending someone from the analytical department of Thompson-Hayward to learn Dow's test method, that Thompson-Hayward's industrial hygienist also should visit Dow. He mentioned that V. K. Rowe was responsible for health hazard aspects of Dow's products.

Mr. Doedens stated that some of the new findings regarding production were being tried out in the plant, and by February 15 he expected an indication if it would result in improvement in quality and also in volume of trichlorophenol produced. He stated that Dow's trichlorophenol in the finished form as it leaves the plant contained no detectabl amount of any chloracnegen known. He said that the still residues did contain some of these substances, implying that change in method of handling the still bottoms had to be developed. He felt that a reduced reduction rate (25% normal) might remain in effect three or four months unless a break through occurred.

Mr. Thompson reviewed Thompson-Hayward's experience in producing and using trichlorophenol, [illegible] in 1950 and [illegible], at that time, Thompson-Hayward had learned of destruction of [illegible] of other plants which had [illegible] trichlorophenol. [illegible] had talked with representatives [illegible] Monsanto, Diamond, [illegible] 1950, and [illegible] the possibility of [illegible] being present in [illegible] destroyed plant. He said that fortunately this did not prove to be the case, possibly because of the almost complete destruction of the plant by fire which may have consumed any of these compounds present. He said he was impressed by Dow's [illegible] and by the quality of Dow's trichlorophenol, as well as by their repeated statements that Dow had never had any problem with chloracne from their trichlorophenol. As the result of Dow's trichlorophenol quality and record, Thompson-Hayward entered into a contract to purchase trichlorophenol from Dow in 1962.

Mr. Thompson also stated that he felt Thompson-Hayward had a firm contrac with Dow for up to 1 million pounds of trichlorophenol in 1965. He said the only exceptions were acts of God, war, flood, strikes, or accidents. He felt none of these had occurred, and that Dow was obligated to supply Thompson-Hayward's requirements or to stand any losses incurred by Thompson-Hayward by purchasing elsewhere at higher prices. He indicated it appeared likely that Thompson-Hayward could purchase elsewhere, probably from Monsanto who could furnish about 10 tankcars of isooctyl ester of 2,4,5-T.

Mr. Thompson mentioned that under the terms of Thompson-Hayward's trichlorophenol contract with Dow, Thompson-Hayward was to be charged [illegible] million pounds were used. He pointed

313

of all TCP that Dow could supply. Mr. Grant agreed this was a reasonab request.

Mr. Grant said he felt the first problem was taking care of customers and expressed surprise that Thompson-Hayward could cover their requirements. He said Dow did not feel they could do this and he was quite pleased that Thompson-Hayward had been more successful.

Various ways of handling the needs of both Thompson-Hayward and Dow were discussed. Mr. Thompson suggested that it might be less expensive to obtain 2,4,5-T acid from Monsanto, ship it from Dow to be converted into ester, and then ship back to Thompson-Hayward than for Thompson-Hayward to buy the ready-made ester from Monsanto. It was decided that this would be evaluated, but that the most important point was to take care of the requirements. Jim Doedens indicated that conversion of the acid might be the least expensive route.

In a private discussion, Mr. Grant told Mr. Thompson that his legal staff would not let him admit any liability, but that Dow was a company that wanted to be fair and would try their best to work out a fair settlement for Thompson-Hayward to cover losses resulting from Dow's inability to supply TCP. Mr. Grant felt that Thompson-Hayward should seek to cover its needs for 2,4,5-T acid or equivalent from other sourc as long as Dow's TCP supply situation remained uncertain.

It was agreed that Thompson-Hayward would give further consideration to the purchase of requirements of 2,4,5-T esters from other sources and then discuss the matter further with Mr. Minbiole. Also, all contacts with Dow preferably should be handled through Mr. Minbiole.

Lindley S. DeAtley
February 15, 1965

R

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FSA

DEFENSE SUPPLY AGENCY
DEFENSE GENERAL SUPPLY CENTER
RICHMOND, VIRGINIA 23219

IN REPLY REFER TO DGSC-PF

23 January 1968

SUBJECT: IFB-DSA-400-68-R-3734 - Specification AFPID dtd 7 Nov 67

TO: Commanding Officer
Hq SAAMA (SAOR) Mr. Burton

Request your comments on the changes proposed by Dow Chemical Company to specification AFPID dated 7 November 1967 as specified in attached letter.

FOR THE COMMANDER:

1 Encl

GEORGE F. COLLINS
Contracting Officer
Directorate of Procurement and Production

81

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MEMORANDUM FOR RECORD

SMUFD-AS-C

14 February 1967

SUBJECT: Comparison of TORDON 101 and 2,4-D, 2,4,5-T based on Dow Labels

1. Attached are two Dow labels, one for TORDON 101, the other for Dow's oil soluble brush killer which contains 2,4-D and 2,4,5-T. Please note that directions for use as a foliage spray are almost identical - mix one gallon in 100 gallons of water and drench the foliage thoroughly.

2. Based on these labels one would assume that the two herbicide formulations possess equal biological effectiveness. Therefore, one concludes that four pounds of the esters of 2,4-D:2,4,5-T contained in one gallon of ESTERON are equivalent in herbicidal activity to the active ingredients in one gallon of TORDON 101. Approximately 25 pounds per acre of 2,4-D:2,4,5-T esters on an acid equivalent basis are required for acceptable defoliation of the dense tropical jungle in RVN. This quantity of active ingredient is contained in six gallons of ESTERON Brush Killer O.S. Since one gallon of TORDON 101 is equivalent to a gallon of ESTERON, it should require six gallons of TORDON 101 to provide the same degree of defoliation in RVN as does the 25 pounds of 2,4-D:2,4,5-T which is contained in three gallons of ORANGE.

3. Dow is being inconsistent when they state that three gallons of TORDON 101 will be as effective as three gallons of ORANGE in RVN, while their labels state that TORDON 101 is equivalent to a formulation containing only one-half the quantity of active ingredient contained in ORANGE.

C. E. MINARIK
Chief, Crops Division

2 Incls

Distribution:
Commanding Officer
Technical Director
Mr. Irish, PASOO
Mr. Deyth, MUCOM
Mr. Emory, AMC
Maj. Hord, OCRD
LTC Rhode, CASYCR
Mr. Walton, DDSC
Mr. Vanderventer, Kelly AFB
Dr. J. W. Brown
Dr. R. A. Darrow
Dr. G. E. Tschirley
Mr. K. D. Demaree
Mr. J. R. Frank

WHERE TO USE

...USH-RHAP® BUTYL 2D-2T [illegible]

WOODY PLANTS CONTROLLED

...USH-RHAP® BUTYL 2D-2T [illegible]

[illegible]	Cottonwood	Mulberry	Sassafras
[illegible]	Elder	Oak	Sumac
[illegible]	Elderberry	[illegible]	Sweet gum
...herry	Elm	Persimmon	Wild cherry
...lder	Hawthorn	Poison ivy	Wild grape
...brush	Hickory	Poison oak	Wild plum
...rose	Honeysuckle	[illegible]	Willow
...cherry	Locust	[illegible]	

DIRECTIONS FOR USE

...NERAL — (As Water Spray) [illegible]

...Oil Spray) — [illegible]

...AL TREATMENT — [illegible]

...UMP TREATMENT — [illegible]

BRUSH-RHAP®

BUTYL-2D-2T

HERBICIDE

2,4-D 2,4,5-T BUTYL ESTER

2 Lbs. of 2,4-D and 2 Lbs. of 2,4,5-T Acid Equivalents Per Gallon

ACTIVE INGREDIENTS:

Butyl Ester of 2,4-Dichlorophenoxyacetic Acid (Equivalent to [illegible] of 2,4-D Acid)	[illegible]
Butyl Ester of 2,4,5-Trichlorophenoxyacetic Acid (Equivalent to [illegible] of 2,4,5-T Acid)	[illegible]
INERT INGREDIENTS	[illegible]
TOTAL	[illegible]

EPA REGISTRATION NO. [illegible]

MADE BY

TRANSVAAL, INC.

JACKSONVILLE, ARKANSAS

72076

FRILL TREATMENT [illegible]

CAUTION [illegible]

WARRANTY [illegible]

NET CONTENTS: GAL.

83

FL BATCH 31 FSC JUS0004

Do not use after Jan 1, 1985

DOW

SPECIMEN LABEL

ESTERON BRUSH

FOR THE CONTROL OF MANY KINDS OF BRUSH AND

DIRECTIONS

FOLIAGE TREATMENT

PREPARING THE SPRAY

OIL SPRAYS

WATER SPRAYS

OIL-WATER MIXTURE SPRAYS

TO AVOID DIFFICULTY
FOLLOW ABOVE DIRECTIONS AS GIVEN

BASAL BARK TREATMENT

STUMP TREATMENT

MIDLAND, MICHIGAN

MIDLAND DIVISION

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OW

SH KILLER O.S.

WARNING

CAUTION! MAY CAUSE SKIN IRRITATION

NOTICE

NICAL COMPANY
MICHIGAN
DIVISION

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'Do not use after Jan. 1, 1965"

SPECIMEN LABEL

TORDON* 101 MI

TORDON 101 MIXTURE is recommended for use on utility right-of-ways to control unwanted brush such as aspen, balsam, birch, blackberry, elm, hickory, honeysuckle, locust, maple, oak, pine, poison oak, sassafras, spruce, wild cherry, wild rose and many other woody plant species.

USE DIRECTIONS

Use 1 gallon of **TORDON 101 MIXTURE** in 100 gallons of water and apply as a drenching spray to woody plants, up to 6 or 8 feet tall, after the foliage is well developed. Spray should thoroughly wet all plant parts including foliage, stems and root collar. For hard to kill species such as ash and oak, also spray the soil around the root collar. Under good growing conditions, in humid areas, application made up to 3 weeks before frost is usually effective. However, application made when the foliage has lost its normal green color and vigor may not give satisfactory results.

NOTE: **TORDON 101 MIXTURE will not mix with oil.**

***TRADEMARK**

ACTIVE INGREDIENTS:

4-amino-3,5,6-trichloropicolinic acid† as the triisopropanolamine salt	**10.2%**
2,4-dichlorophenoxyacetic acid as the triisopropanolamine salt	**39.6%**
INERT INGREDIENTS	**50.2%**

ACID EQUIVALENTS:

4-amino-3,5,6-trichloropicolinic acid	**5.7%**
2,4-dichlorophenoxyacetic acid	**21.2%**

† Known under the trademark TORDON

86-1160 Printed in U.S.A. in February 1964

REPLACES SPECIMEN LABEL 86-1160 PRINTED IN JUNE 1963. THE ONLY COPY CHANGE CONCERNS A REVISION OF THE INGREDIENT STATEMENT.

USE PR

Since **TORDON** herbicide a
minute quantities may cau
growing and dormant peri
otherwise permit **TORDON**
taining it to contaminate soi
ble plants nor to contact susc
flowers, grapes, fruit trees,
types, including soybeans
plants. Applications by air
pensers should be carried o
from drift. Do not apply by
grapes or other desirable
sprays are less likely to drif
contaminate water used f
domestic purposes. Do not
lizers, seeds, insecticides, fu
cause of the difficulty of
and other equipment follov
TORDON 101 MIXTURE, su

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FLA

MIXTURE · BRUSH KILLER

3SE PRECAUTIONS

herbicide and 2,4-D are highly potent, even
s may cause damage to plants during both
mant periods Therefore, do not apply or
TORDON 101 MIXTURE or spray mist con-
minate soil used to grow desirable suscepti-
ontact susceptible plants such as vegetables,
uit trees, ornamentals, cotton, beans of all
soybeans and other desirable broadleaved
ons by airplane, ground rigs and hand dis-
carried out only when there is no hazard
apply by airplane in the vicinity of cotton,
desirable susceptible vegetation Coarse
e drift. Do not allow the material to
er used for irrigation, drinking or other
. Do not store near food, feedstuff, ferti-
ticides, fungicides or other pesticides Be-
ficulty of thoroughly cleaning sprayers
ent following its use for application of
XTURE, such equipment should not be used
for applying other materials to desirable plants Shipping containers should not be re-used for other materials which may be applied to desirable plants.

Note: Be sure that all use of TORDON 101 MIXTURE conforms to local regulations.

CAUTION

HARMFUL IF SWALLOWED
CAUSES EYE IRRITATION
MAY CAUSE SKIN IRRITATION

Avoid Contact with Eyes, Skin and Clothing

In case of contact, flush eyes and skin with plenty of water; for eyes get medical attention. Remove grossly contaminated clothing and wash before re-use.

STORE OUT OF THE REACH OF CHILDREN AND ANIMALS

NOTICE

Seller makes no warranty of any kind, express or implied, concerning the use of this product Buyer assumes all risk of use or handling, whether in accordance with directions or not

U. S. Patent No 2,453,983 A164

30 Gallons

DOW

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN
MIDLAND DIVISION

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HERCULES INCORPORATED

WILMINGTON DELAWARE 19899 · TELEPHONE 302-656-9811

October 25, 1967

87341
FSA

Mr. W. E. Vandeventer
SAAMA
Attn: SAOQT
Kelly AFB Texas 78241
San Antonio, Texas

Dear Mr. Vandeventer:

Under separate cover we have sent you four (4) copies of proposed Specifications for product ORANGE. We believe these are both practical and sufficiently rigid to be acceptable to industry and to the government agency concerned.

Attached to each of the four copies is a set of auxilliary notes presenting supplemental information for those portions where the change or addition seemed to require a bit of explanation. There may be some points which merited explanation but didn't get it; if so, please let me know and we will provide it.

We would appreciate any comments you may have and stand willing to discuss any or all parts.

It certainly was a pleasure to have you visit in Wilmington with us. We felt it was a very constructive meeting and appreciated the opportunity to exchange thoughts on this very important matter.

Please call me if you have any questions or wish clarification on any points.

Very truly yours,

R. B. Scott

R. B. Scott
Director of Development

Attachments
RBS:alc

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2.2 Other Publications

The reference to the Association of Official Agricultural Chemists (AOAC), Tenth Edition, 1965 was omitted since the proposed Specifications do not include the Cl assay procedure.

4.4.2 For Test

Lot sizes would generally be expected to be less than 545 55-gallon drums due to physical limitations for tankage and mixing equipment, thus lot size was cut off at that point. For those instances where lot size exceeds 545 drums, the Sample Size would be determined by multiplying the Lot Size by 0.015.

4.5.2 For Test

Alternative sampling procedures were contemplated but not included. For example, a snap sample from each of several drums of a lot, put together in one sample container would result in only one actual sample for analysis, thus reducing the number of analytical determinations required; only one duplicate set need be run, generally. Also some thought was given to collecting a representative sample by compositing several samples taken during the filtering step, or during operation. These perhaps merit further consideration.

4.6.1 Composition

The infrared spectrophotometric procedure for determination of n-butyl 2,4-D ester and n-butyl 2,4,5-T ester contents of ORANGE is covered in paragraphs under the 4.6.1 heading. Word has been passed on to us that the Philadelphia laboratory has been quite happy with the method and it has worked well in their hands. We believe it will be an eminently satisfactory method with regard to accuracy, precision, simplicity and time per analysis.

6.3 Information

A few additional notes covering other relevant aspects of ORANGE have been included. Although flash point, freezing point, and viscosity should not be specifications, these characteristics are desirable to know, for guidance purposes.

October 24, 1967

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FSA

MIL-
October 24, 1967

MILITARY SPECIFICATION

DEFOLIANT; ORANGE

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers one type of defoliant.

1.2 Classification. Orange is a mixture of equal parts by weight of technical n-butyl 2,4-dichlorophenoxyacetate (n-butyl 2,4-D) and technical n-butyl 2,4,5-trichlorophenoxyacetate (n-butyl 2,4,5-T).

2. APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents, of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS AND STANDARDS

FEDERAL

PPP-D-729 - Drums: Metal, 55-Gallon (For shipment of non-corrosive material).

FED-STD-595 - Colors.

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for inspection by attributes.

(Copies of specifications and standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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2.2 Other Publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified the issue in effect on the date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM Standards

D664 - Method of Test for Neutralization Number by Potentiometric Titration.

D1533 - Method of Test for Water in Insulating Liquids (Karl Fischer Method).

(Application for copies should be addressed to American Society for Testing Materials, 1916 Race St., Philadelphia 19103.)

UNITED STATES PHARMACOPEIAL CONVENTION, INC.

The Pharmacopeia of the United States of America (USP) Sixteenth Revision, 1960.

(Copies of the USP may be obtained from the Mack Publishing Company, Easton, Pennsylvania 18042.)

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Ratings, Rules, and Regulations.

(Application for copies of these freight classification rules should be addressed to the Uniform Classification Committee, 202 Union Station, Chicago, Illinois 60606.)

3. REQUIREMENTS

3.1 Material.

3.1.1 Composition. The composition of the defoliant, "Orange" shall approximate a 50%-50% mixture by weight of technical n-butyl

2,4-D and technical n-butyl 2,4,5-T esters. The percent by weight of technical n-butyl 2,4-D and the percent by weight of technical n-butyl 2,4,5-T present in the mixture shall each be 47.5 percent minimum when tested as specified in 4.6.1 et seq.; the total content of technical n-butyl 2,4-D and n-butyl 2,4,5-T present in the mixture shall be 95 percent by weight minimum.

3.1.2 Appearance. The defoliant shall be a clear, amber to dark red-brown colored liquid.

IT WAS ORANGE COLORED. WHEN SPRAYED

3.2 Free Acid.

The free mineral acid content of the defoliant shall not be greater than 0.5 percent and

The total free acid of the defoliant shall not be greater than 1.5 percent, when tested as specified in 4.6.2.

3.3 Undissolved Matter. The defoliant shall be completely soluble and shall show no evidence of undissolved matter when tested as specified in 4.6.3.

3.4 Moisture Content. The moisture content of the defoliant shall not be greater than 0.2 percent when tested as specified in 4.6.4.

3.5 Specific Gravity. The specific gravity of the defoliant shall not be less than 1.275 nor more than 1.295 at 20/20 C. when tested as specified in 4.6.5.

3.6 Weight per Gallon. The weight per U. S. gallon of the defoliant shall be not less than 10.62 nor more than 10.79 pounds. The weight per gallon shall be calculated by multiplying the specific gravity, observed in 3.5, times 8.33.

3.7 Preproduction Sample. When specified in a contract or purchase order, a preproduction sample of the defoliant shall be submitted for examination and tests.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Special Provisions.

4.2.1 Alternative Inspection. The supplier may utilize any alternative inspection procedure which will insure equal or better assurance of quality by submitting a written proposal, with justification, and obtaining written approval from the Government prior to instituting the procedure. In case of dispute the procedures of this specification shall govern.

4.2.2 Objective Evidence. The supplier shall provide evidence acceptable to the contracting officer that the requirements of section 3. and section 5. have been satisfied.

4.3 Lotting. A lot shall consist of the defoliant mixture, produced by one manufacturer under essentially the same manufacturing conditions and with no changes in material, with the following additional limitations:

(a) When produced by a continuous process, the defoliant mixture produced within a 24-hour period shall constitute a lot.

(b) When produced by a batch process, each batch shall constitute a lot.

(c) When the defoliant mixture cannot be identified with either of the above conditions, all defoliant mixture offered for acceptance at one time shall constitute a lot.

4.4 Sampling.

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4.4.1 For Examination. Sampling shall be conducted in accordance with MIL-STD-105.

4.4.2 For Test. Sample containers shall be taken at random from each lot as follows:

Lot Size	Sample Size
1 Container	1
2-275 Containers	2
276-545 Containers	3

The sample size for lots exceeding 545 55-gallon drums shall be determined by multiplying the number of containers in the specific lot by 0.015. The number resulting, 1.5 percent of the number of containers, represents the number of sample containers which should be taken at random for examination.

4.5 Inspection Provisions.

4.5.1 For Examination. The preparation for delivery shall be examined in accordance with the classification of defects and MIL-STD-105.

4.5.2 For Test. Two separate, 250-ml samples shall be removed from each sample container and placed in a clean, dry container labeled to identify the lot and the container from which it was removed.

Each sample shall be tested as specified in 4.6.

4.5.3 Classification of Defects.

4.5.3.1 Preparation for Delivery (Section 5).

Categories	Defects	Acceptance Standard
Critical:	None defined	
Major:	AQL 1.0 percent defective	
101	Container closure incorrect	
102	Marking incorrect or illegible	

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4.6 Tests. Tests shall be conducted as follows:

4.6.1 Composition.

4.6.1.1 Method. This method is based upon infrared absorption at 12.5 microns (800 cm^{-1}) for the 2,4-D ester and 8.8 microns (1135 cm^{-1}) for the 2,4,5-T ester. Both absorption bands are associated with the substitution on the aromatic ring.

Known mixtures of the 2,4-D and 2,4,5-T reference standard esters are used to calibrate the spectrophotometer. This is done because a base-line shift is noted when the two components are mixed.

4.6.1.2 Apparatus.

(1) Infrared Spectrophotometer - Beckman IR-4, or equivalent.

(2) Absorption cells, sealed, 0.1 mm. light path, with sodium chloride (NaCl) windows. Two are required.

4.6.1.3 Reagents. Carbon disulfide (CS_2), ACS Reagent Grade or Spectro-Grade.

4.6.1.4 Reference Standards.*

(1) n-butyl 2,4-D ester, Federal Reference Grade.

(2) n-butyl 2,4,5-T ester, Federal Reference Grade.

4.6.1.5 Calibration of IR Spectrophotometer.

Weigh accurately sufficient amounts of each reference standard ester into 10-ml volumetric flasks to give the following known mixtures:

2,4-D Ester	2,4,5-T Ester
0.45 g.	0.55 g.
0.50 g.	0.50 g.
0.55 g.	0.45 g.

* A supply of each of the Federal Reference Standard esters may be obtained upon request directed to the Contracting Officer.

Add carbon disulfide to the mark, stopper and mix carefully. Avoid loss of CS_2 by improper closure or seepage due to liquid expansion by heat from handling.

4.6.1.5.1 Calibration for 2,4-D Ester. Using a pair of 0.1 mm. NaCl sealed cells, obtain the spectrum of each of the known mixtures from 13.5 microns (742 cm.$^{-1}$) to 11.5 microns (870 cm.$^{-1}$) versus CS_2 contained in the reference beam of the spectrophotometer using standard instrument conditions.

Determine the absorbance ΔA** for each of the known mixtures by drawing a tangent baseline from 12.75 microns (785 cm.$^{-1}$) to 12.30 microns (815 cm.$^{-1}$), and measuring the difference in absorbance from the baseline to the maximum at 12.55 microns (800 cm.$^{-1}$).

Plot a calibration curve *** of these values for the ΔA versus the mg./ml. of the 2,4-D ester in each known mixture.

4.6.1.5.2 Calibration for 2,4,5-T Ester. Using the same pair of sealed NaCl cells, obtain the spectrum from 9.5 microns (1050 cm.$^{-1}$) to 8 microns (1250 cm.$^{-1}$) for each known mixture versus an approximately 48 to 50 mg./ml. solution of 2,4-D reference standard ester in CS_2 in the photometer reference beam using standard instrument conditions.

Determine the absorbance ΔA for each of the known mixtures as follows:

$$\Delta A = A_{8.8\mu}\ (1135\text{ cm.}^{-1}) - A_{8.65\mu}\ (1160\text{ cm.}^{-1})$$

where $A_{8.8\mu}$ is the observed absorbance for the CS_2 solution of the known mixture at 8.8 microns

and $A_{8.65\mu}$ is the observed absorbance of the same solution at 8.65 microns.

Plot a calibration curve of the values for ΔA versus the mg./ml. of 2,4,5-T ester in each of the known mixtures.

** Figure 1, (4.6.1.5.3) illustrates the infrared spectrum of a typical sample of "Orange."

*** Figure 2, (4.6.1.5.4) illustrates typical calibration curves.

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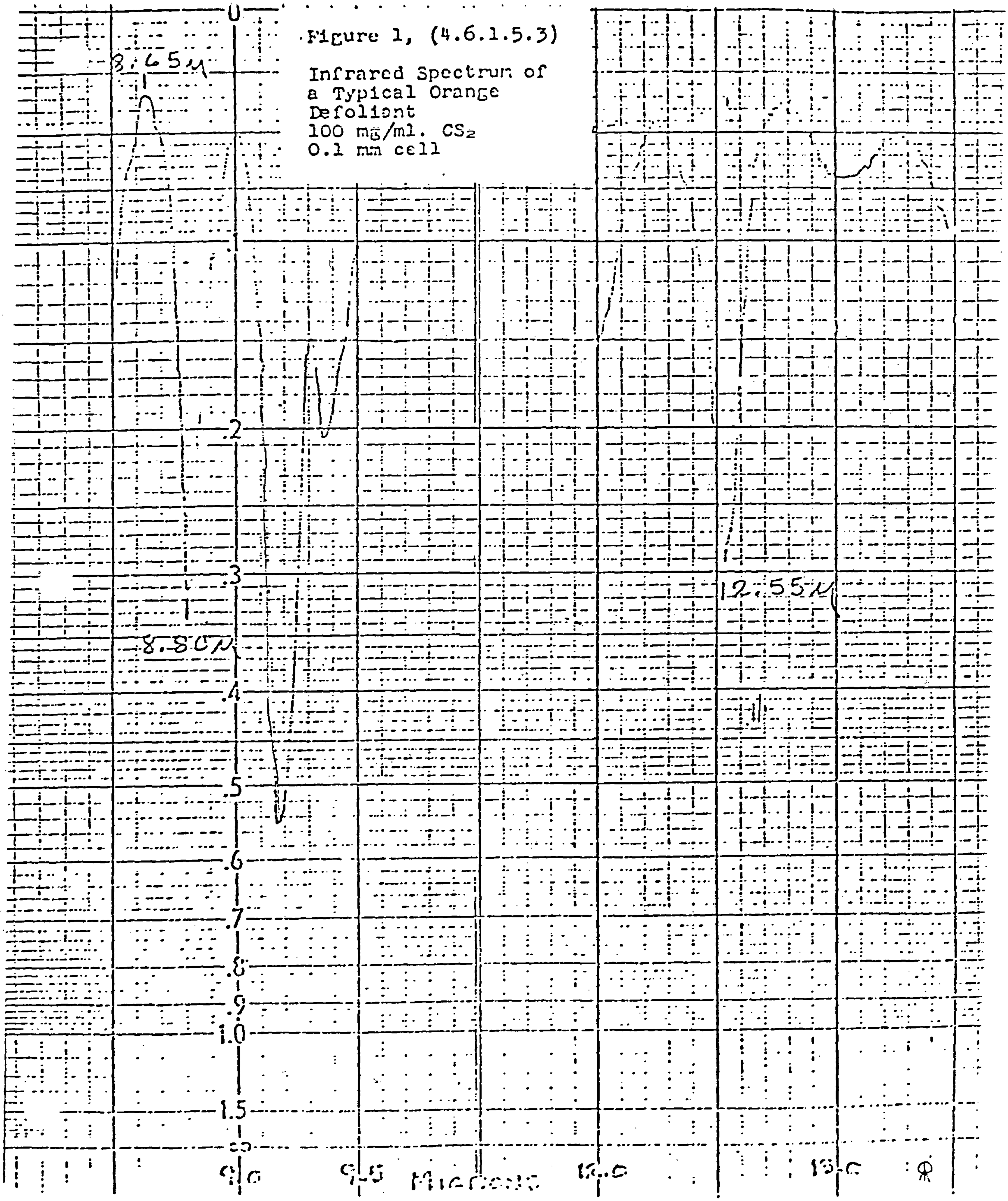
Figure 1, (4.6.1.5.3)

Infrared Spectrum of
a Typical Orange
Defoliant
100 mg/ml. CS_2
0.1 mm cell



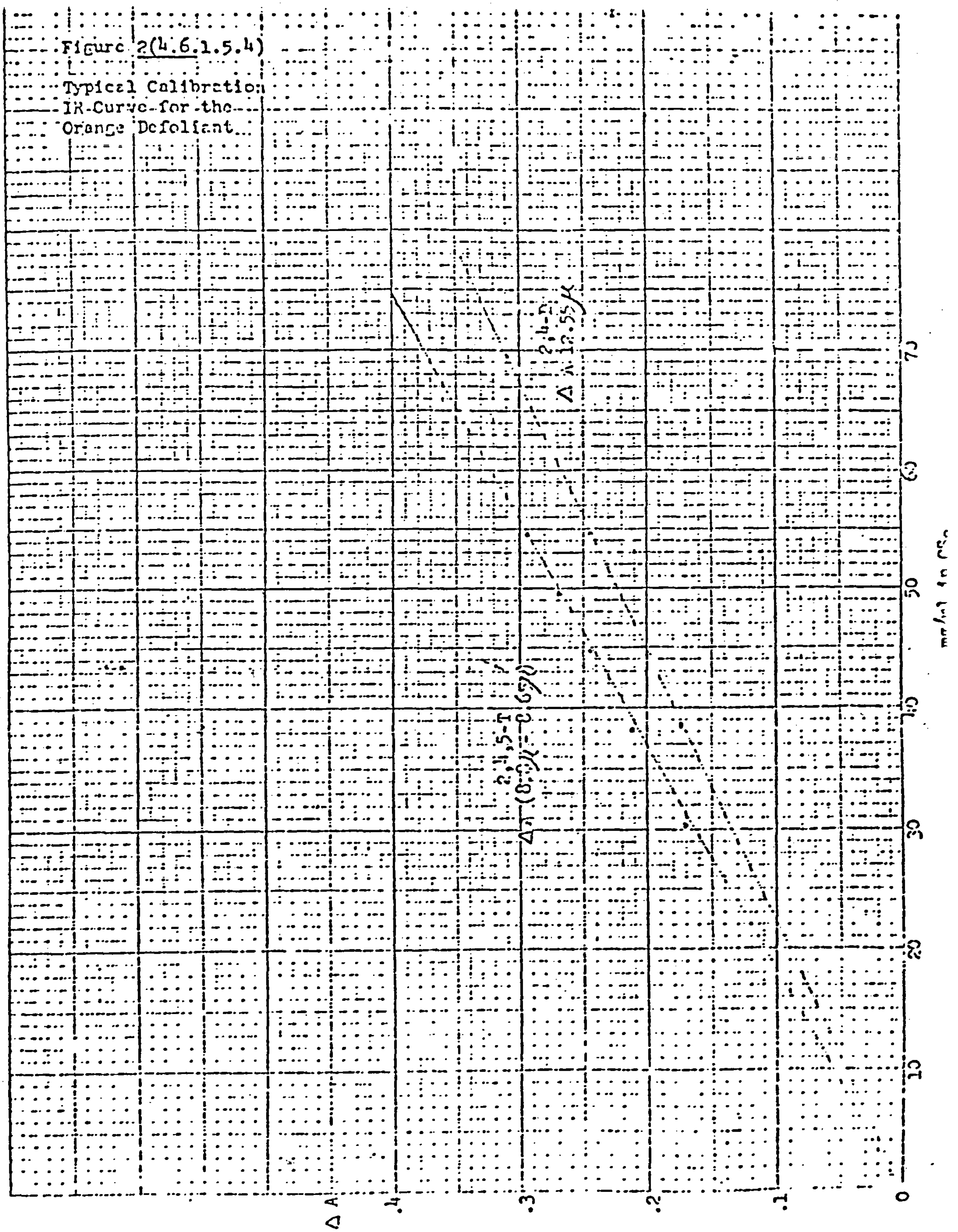


Figure 2(4.6.1.5.4)
Typical Calibration IR-Curve for the Orange Defoliant

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4.6.1.6 Procedure for "Orange"

The procedures outlined in 4.6.1.6.1 and 4.6.1.6.2 should be applied in duplicate to the sample of Orange.

4.6.1.6.1 2,4-D Ester Content. Weigh accurately a sufficient amount of the Orange defoliant to give a solution that contains 100 mg./ml. (1.0 g. in 10 ml.) in carbon disulfide.

Obtain the spectrum of this solution from 13.5 to 11.5 microns using the same NaCl cells and instrument conditions as outlined under 4.6.1.5.1 and 4.6.1.5.2.

Calculate the Δ A for the 2,4-D ester in the same manner as described under 4.6.1.5.1. Using the values of ΔA observed, read the corresponding amount of mg./ml. of ester present in the Orange solution from the 2,4-D calibration curve.

Calculations:

$$\frac{\text{mg./ml. of 2,4-D ester found} \times 100}{\text{mg./ml. Orange in sample sol.}} = \text{\% 2,4-D Ester in Orange}$$

where mg./ml. of 2,4-D ester found = value read from calibration curve.

4.6.1.6.2 2,4,5-T Ester Content. Prepare a compensating solution of the 2,4-D ester reference standard containing from 45 to 50 mg./ml. in carbon disulfide, approximately equal to the concentration of 2,4-D ester calculated to be present in the Orange test solution.

Obtain the spectrum of the sample solution of Orange from 9.5 microns to 8.0 microns versus the prepared compensating solution of 2,4-D ester in the reference beam, using the same NaCl sealed cells and instrument conditions as outlined under 4.6.1.5.1 and 4.6.1.5.2.

Calculate the ΔA for the 2,4,5-T ester in the same manner as described under 4.6.1.5.2. Using the observed ΔA value, read the corresponding value of mg./ml. of 2,4,5-T ester from the calibration chart.

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Calculations:

$$\frac{\text{mg./ml. of 2,4,5-T ester found} \times 100}{\text{mg./ml. Orange in sample sol.}} = \text{\% 2,4,5-T Ester in Orange}$$

where mg./ml. of 2,4,5-T ester found = value read from the calibration curve.

4.6.1.7 Precision of Method. The 95% confidence level for a single determination by this method is ± 1.8% for each ester; for the average of duplicate analyses the 95% confidence level would be ± 1.3%.

4.6.2 Free Acid. Determine the free mineral acid and total free acid present in the defoliant using the apparatus and procedure for strong acids specified in ASTM Standard Test Method D-664 or any other standard method, using ACS grade isopropyl alcohol or USP ethyl alcohol as the solvent and 0.1 N sodium hydroxide as the titrant.

Titrate first to a pH of 3.5 and record the volume (V) of alkali used. Then continue the titration to pH 7.5 and record the total volume (V^1) of alkali used.

Calculate the percent free mineral acid and the percent total free acid using the formula:

$$A_1 = \frac{22.10 \quad V \quad N}{W} \qquad A_2 = \frac{22.10 \quad V^1 \quad N}{W}$$

where A_1 is the percent free mineral acid (calculated as 2,4-D Acid)

A_2 is the percent total free acid (calculated as 2,4-D Acid)

V is milliliters of 0.1 N NaOH to pH 3.5

V^1 is milliliters of 0.1 N NaOH to pH 7.5

N is normality of NaOH solution

W is weight in grams of sample taken for the test.

22.10 is the appropriate factor of the molecular weight of 2,4-D Acid.

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4.6.3 Specific Gravity. Determine the specific gravity of the sample by means of a suitable hydrometer, pycnometer or other standard procedure which is accurate to four significant figures. Perform the test after cooling or warming the sample to 20°C.

4.6.4 Undissolved Matter. Dissolve 10 parts of the sample by volume in 40 parts of reagent grade benzene (C_6H_6). Thoroughly agitate or stir the mixture and visually examine the solution for evidence of undissolved matter.

4.6.5 Moisture Content. Determine the moisture content of the sample in accordance with ASTM Standard Test Method D1533 or any other standard Karl Fischer method, using anhydrous methanol as the solvent.

5. PREPARATION FOR DELIVERY

5.1 Packing.

5.1.1 Level A (surface transportable only). The mixture shall be packed in a 55-gallon drum conforming to type II of PPP-D-729. Drums shall not affect nor be affected by the material contained.

5.1.2 Level A (air transportable). The mixture shall be packed in a 55-gallon drum conforming to ICC 17C requirements. Interior and exterior surface preparation and finish shall be as specified in PPP-D-729. Drums shall not affect nor be affected by the material contained.

5.1.3 Level C. Fifty-five gallons of mixture shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification Ratings, Rules, and Regulations, or regulations of other carriers applicable to the mode of transportation. Drums shall not affect nor be affected by the material contained. * THEY LEAKED FROM THE BUNGS

5.2 Marking. Each drum shall be marked in accordance with instructions from the appropriate government agency plus one orange band, approximately three inches wide, encircling the drum at the center line (between the rolling hoops). The orange color used shall match as closely as possible No. 32246 of Fed-Std-595.

5.3 Identification Marking. Each drum shall be marked as specified in 5.2 and in addition shall include the manufacturer's lot or batch number.

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6. NOTES

6.1 Ordering Data. Procurement documents should specify the following:

(a) Title, number and date of this specification.

(b) Level of packing required.

(c) Whether air transportable drums are required (see 5.1).

(d) Preproduction requirements (when required).

1. Quantity required.

2. Time allowed for submission of samples for Government test and evaluation after award of contract.

3. Name and address of test facility when testing is performed by the Government.

4. Shipping instructions when applicable.

5. Time required for the Government to notify the supplier whether or not to proceed with production.

6.2 Batch. A batch is defined as that quantity of material which has been manufactured by some unit chemical process or subjected to some physical mixing operation intended to make the final product substantially uniform.

6.3 Information. Material otherwise meeting the specifications set forth herein for "Orange" will exhibit the following characteristics, approximately:

Flash Point: The flash point as determined by the Tagliabue Open Cup Method lies above 230°F. (110°C.), since no flashing occurs up to and including this temperature.

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Freezing Point: Orange will tend to freeze below -26°F. (-32°C.) when permitted to stand at that temperature for several days. Seeding or agitation at this temperature will speed up the relatively slow process of crystallization.

Viscosity: The viscosity in centipoise of Orange has the approximate values at the temperatures given: 15°C. - 4.0 cp.; 25°C. - 2.9 cp.; 35°C. - 2.5 cp.

This information is deemed useful in consideration of use and handling of the material.

6.4 Precaution. IMPORTANT. For procurement of herbicide for use on lands owned by, or otherwise managed as military installations, use Federal Specification 0-H-200. Defoliant procured by this specification must not be diverted to domestic use.

CUSTODIAN:

PREPARING ACTIVITY:

Project No. 1380-

R

105

FSA

Monsanto
COMPANY

800 N. Lindbergh Boulevard
St. Louis, Missouri 63166
(314) Oxford 4-1000

January 30, 1968

Fwd to Kelly AFB
To: C.S. Feb 68

Col. Edward J. Bartlett, USAF
Director, Procurement and Production
Defense Supply Agency
Defense General Supply Center
Richmond, Virginia

RE: RFP DSA-400-68-R-3785 dated 22 December 1967; proposal of Monsanto Company in response thereto dated 15 January 1968; Monsanto Company teletype dated January 19, 1968 and DGSC teletype received January 24, 1968.

Dear Colonel Bartlett:

This letter will detail the clarifications requested by you in referenced DGSC wire, with respect to Paragraphs 3.1.1, 3.2 and 4.1.1 of ASPID 6840-1 dated 7 November 1967.

PURCHASE DESCRIPTION OF ORANGE FSC 6840

3. Requirements

3.1.1

It should be clear that purity of the N-Butyl T and N-Butyl D esters is on an acid equivalence basis--not IR; if the latter, then the assay limits will be lower and should be agreed to by Monsanto.

a.

The specification states that purity of N-Butyl 2,4,5-T, specification MIL-H-51148, shall be 98.0% minimum by weight. Assuming assay on an acid equivalence basis is intended, this limit should be stated as 97.6% minimum because the original specification gave total acid equivalence as 80-82% and $\frac{80}{82} \times 100 = 97.56\%$.

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b.

Purity of 99.0% minimum acid equivalence basis is not correct. MIL-H-51147 provides acid equivalence limits of 78-80% and $\frac{78}{80}$ X 100 = 97.5% minimum. In addition, under b of this same paragraph 3.1.1 it is stated that acid equivalence shall be not less than 79.9% nor more than 80.0%. This percentage range is impractical because 79.76% is theoretical. The 79.9% figure may represent a typographical error; the Defense Department may have intended 79.0-80.0%. Although the 79.0-80.0% range differs from MIL-H-51147, we can accept 79.0-80.0%. Then $\frac{79}{80}$ X 100 = 98.75% minimum assay acid equivalence basis.

3.2 Finished Mixture (Orange)

3.2.2 - Free Acid

The specification provides that the maximum free acid calculated as 2,4-D acid be dropped to 0.5% by weight. This requirement will lengthen the manufacturing process, resulting in lower production. The limit should be 1.0% maximum. If the 0.5% figure was intended to reduce corrosion, there will be no difference in corrosion to aircraft when spraying Orange containing 1.0% or 0.5% free (weak-organic) acid. We have previously gone on record as objecting to reducing the acid equivalence of 2,4,5-T ester to 0.5% max. and the acid equivalence of finished Orange to 0.5% max. The 0.5% max. limit does not allow for any hydrolysis during storage and blending of Orange.

4. Quality Assurance Provisions

4.1.1 - Composition

There is not enough detail here. We agree to assay by IR or equivalent as stated; however, the details of standardizing the spectophotometer or equivalent equipment are not given. In addition, the acceptability limits by instrumentation for the two esters are not stated. We propose that limits for these two esters not be absolute, but be stated as follows: (1) True technical Butyl 2,4-D ester by instrumentation range 45-49%; (2) True Butyl 2,4,5-T ester range 45-51.5%; or the assay limits of the two esters could be stated on a technical basis, either percent by weight or percent by volume.

The attached correspondence between C. H. Russell, Monsanto Company, and Mr. W. J Wiswesser, U. S. Biological Laboratory, Fort Detrick, Maryland, will help clarify instrumental assay limits of Orange. The attachments are C. H. Russell's letters

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FINISHED PRODUCT SPECIFICATION

67362

This herbicide mixture shall be composed of 50% n-butyl 2,4-D by volume and 50% n-butyl 2,4,5-T by volume (one gallon butyl 2,4-D mixed with one gallon n-butyl 2,4,5-T) Tolerance ± 2.5% for each)

	Characteristic	Limits	Typical Value	Method
(R)	Technical Butyl Ester of 2,4-D Acid, by weight	about 47.0-49.5	48.22	Calculated
(R)	True Butyl 2,4-D by VPC	about 45.0-49.0 (1)	45.8	12,980
(R)	Technical Butyl Ester of 2,4,5-T Acid, by weight	about 50.5-53.0	51.78	Calculated
(R)	True Butyl 2,4,5-T	about 45.0-51.5	50.20	12,980
(R)	Total Acid Equivalence as 2,4-D Acid	91.00-94.60%		12,676
(R)	Free Acid	1.0% max.		12,676
(AB)	Sp. Gr. @ 25/25 C	1.275 - 1.285	1.2809	12,600

TYPICAL INFORMATION

Equivalent 2,4-D Acid	37.6 - 38.6%		91.4
Equivalent 2,4,5-T Acid	41.45 - 42.46		93.69 - 97.0
Lbs./Gallon		10.7	

(1) Assuming technical DE esters used assay ... by VPC and esters from 92-97%. However, this will vary with ... of the technical is used. Our VPC objective is to ... normal tech. butyl esters each supplied.

REF: Proposed MIL-D-51... (CU)

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ATTACHMENT

BID NO. DSA400-68-R-3784

Changes necessary to permit compliance of product under specifications for: HERBICIDE - ORANGE

Page 6, Item 3.1.1, paragraph a.

After the word "weight", add ---and assay may be performed by saponification-back titration---.

Page 6, Item 3.1.1, paragraph b.

Change the last line to read ---shall not be less than 79.0% nor more than 80.0% and assay may be performed by saponification-back titration.---

Page 7, Item 3.2.3 Viscosity.

Eliminate completely. The product is a mixture of technical esters and nothing can be done to control viscosity.

Page 7, Item 3.2.4 Total Acid Equivalent (as 2,4,D Acid).

Change "91.0% minimum by weight" to read ---90.5% minimum by weight---. (Specification MIL-H-51239A, submitted to The Dow Chemical Company for review, was reissued under date of June 30, 1967 with the above change.)

Page 7, Item 4.1.1 Composition.

Eliminate completely. Infrared determination of composition is not acceptable since no definition of the standards to be used, the wave length to be used, and the limits of acceptance have been agreed upon.

Page 7, Item 4.1.2 Free Acid.

Change "91% isopropyl alcohol" to read ---95% ethyl alcohol---.

Page 8, Item 4.1.2 Reagents, paragraph (1)

Eliminate entire paragraph and substitute ---Alcohol, ethyl, 95% neutral.---

Page 8, Item 4.1.2 Procedure

In the first paragraph, change "91% isopropyl alcohol" to read ---95% ethyl alcohol---

Page 9, Item 4.1.3 Viscosity, Brookfield method.

Eliminate completely for the reasons outlined under 3.2.3.

Page 10.

Eliminate completely as it is a duplication of Page 9.

Page 14, PACKING

Change the second sentence from "Each drum to contain 55 gallons of product." to ---Each drum to contain 580 pounds of product.--- (This is the standard by which The Dow Chemical Company has been providing Orange on all contracts for Orange to date. It is not felt that the change to a gallon measurement would accomplish what is desired by the military.)

The Dow Chemical Company
Midland, Michigan 48640

lsr

1/19/68

R 110

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Hercules
Contract #
DGA 400 68 C6093

STANDARD FORM 26 | AWARD/CONTRACT | PAGE 1 OF 19

1. CONTRACT (Proc. Inst. Ident.) NO. DSA-400-68-C-6093
2. EFFECTIVE DATE 20 May 1968
3. REQUISITION/PURCHASE REQUEST/PROJECT NO. See Schedule
CERTIFIED FOR NATIONAL DEFENSE UNDER BDSA REG. 2 AND/OR DMS REG. 1 RATING: DO-C9 12 CLASS.

5. ISSUED BY
Directorate of Procurement & Production
ATTN: FC432
Defense General Supply Center
Richmond, Virginia 23219

6. ADMINISTERED BY
Phila. Region, DCASR
P. O. Box 7478
Philadelphia, Pa. 19101

FSA 74169

7. DELIVERY: FOB DESTINATION / OTHER (See below) [X]

8. CONTRACTOR NAME AND ADDRESS
Hercules, Inc.
Synthetics Department
910 Main St.
Wilmington, Delaware 19899

9. DISCOUNT FOR PROMPT PAYMENT
0.00%

10. SUBMIT INVOICES (4 copies unless otherwise specified) TO ADDRESS SHOWN IN BLOCK 12

11. SHIP TO-MARK FOR
See Schedule

12. PAYMENT WILL BE MADE BY
Disbursing Officer, DCASR
P. O. Box 7478
Philadelphia, Pa. 19101
SEE BELOW

13. THIS PROCUREMENT WAS [ ] ADVERTISED [X] NEGOTIATED, PURSUANT TO [X] 10 U.S.C. 2304(a)( ) [ ] 41 U.S.C. 252(c)( )

14. ACCOUNTING AND APPROPRIATION DATA
57X4921.030 61 63 06 151 S04300

15. ITEM NO. | 16. SUPPLIES/SERVICES | 17. QUANTITY | 18. UNIT | 19. UNIT PRICE | 20. AMOUNT

PLANT LOCATION
Hercules, Inc.
Jacksonville, Ark. 72176

INSPECTION OFFICE:
Commander, DCASR
Mercantile Mart Bldg.
500 South Ervay Street
Dallas, Texas

STATUS CONTROL ACTIVITY/INVENTORY CONTROL POINT:
SAAMA (SAOR)
Kelly AFB TX 78241
PH: WA-5-6227/Mr. J. Burton

PAYMENT WILL ONLY BE MADE FOR QUANTITY COVERED BY THIS ORDER/CONTRACT AND ANY AUTHORIZED VARIATION IN QUANTITY. SHIPMENTS IN EXCESS OF QUANTITY ORDERED, AND ANY UNAUTHORIZED VARIATION, WILL BE RETURNED AT CONTRACTORS EXPENSE.

CONFIRMING TELEGRAPHIC RFP DATED 29 APRIL 1968, AS AMENDED 9 MAY 68, TELEGRAPHIC OFFER DATED 30 APRIL 68 AS AMENDED 9 MAY 68 AND TELEGRAPHIC ACCEPTANCE DATED 20 MAY 1968

CONFIRMING
DO NOT DUPLICATE
FOR OFFICIAL USE ONLY

21. TOTAL AMOUNT OF CONTRACT $ 5??2500.00

CONTRACTING OFFICER WILL COMPLETE BLOCK 22 OR 26 AS APPLICABLE

22. [ ] CONTRACTOR'S NEGOTIATED AGREEMENT

26. [ ] AWARD ... Your offer ... Ref: RFP dated 29 Apr 1968 ...

23. NAME OF CONTRACTOR
BY ...

27. UNITED STATES OF AMERICA
BY [signature]
(Signature of Contracting Officer)

24. NAME AND TITLE OF SIGNER (Type or print)
25. DATE SIGNED
28. NAME OF CONTRACTING OFFICER (Type or print)
29. DATE SIGNED

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STANDARD FORM 36 JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

CONTINUATION SHEET

REF. NO. OF DOC. BEING CONT. A150 | PAGE 1 | OF

NAME OF OFFICE OR CONTRACTOR: FOR OFFICIAL USE ONLY

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT

SUPPLY WARRANTY (ASPR 1-?C) 338 A

(a) Notwithstanding inspection and acceptance by the Government of supplies furnished under the contract or any provisions of this contract concerning the conclusiveness thereof, the Contractor warrants that at the time of delivery:

(i) all supplies furnished under this contract will be free from defects in design, material or workmanship and will conform with the specifications and all other requirements of this contract; and

(ii) the preservation, packaging, packing, and marking, and the preparation for and method of shipment of such supplies will conform with the requirements of this contract.

(b) The Contracting Officer shall give written notice to the Contractor of any breach of the warranties in paragraph (a) of this clause within one year from the last delivery under the contract.

(c) Conformance of supplies or parts thereof subject to warranty action shall be determined in accordance with the applicable sampling procedures contained in the contract except as provided herein. For sampling purposes, the Contracting Officer may group any supplies delivered under this contract. The size of the sample shall be that required by sampling procedure specified in the contract for the quantity of supplies on which warranty action is proposed. Warranty sampling results may be projected over supplies in the same shipment or other supplies contained in other shipments even though all of such supplies are not present at the point of reinspection, provided, the supplies remaining are reasonably representative of the quantity on which warranty action is proposed. The original inspection lots need not be reconstituted nor shall the Contracting Officer be required to use the same lot size as on original inspection. Within a reasonable time after notice of any breach of warranties in paragraph (a) of this clause as determined herein, the Contracting Officer may exercise one or more of the following options:

(i) require an equitable adjustment in the contract price for any group of supplies;

(ii) screen the supplies grouped under this clause at Contractor's expense and return all nonconforming supplies to the Contractor for correction or replacement;

(iii) require the Contractor to screen the supplies at depots designated by the Government within the continental United States and to correct or replace all nonconforming supplies;

(iv) return the supplies grouped under this clause to the Contractor for screening and correction or replacement.

(d) When return, correction or replacement is required, the Contracting Officer shall return the supplies and transportation charges and responsibility for such supplies while in transit shall be borne by the Contractor. However, the Contractor's liability for such transportation charges shall not exceed an amount equal to the cost of transportation by the usual commercial method of shipment between the designated destination point under this contract and the Contractor's plant, and return.

FOR OFFICIAL USE ONLY

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BATCH 473 FSA JUS1006

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TOPM

REQUEST FOR AND RESULTS OF TESTS

PAGE NO.	NO. OF PAGES
1	1

SECTION A — REQUEST FOR TEST

1. TO: Commander Defense Personnel Support Center 2800 South 20th Street Attn: Dir/Tech Opns, Lab Div Philadelphia, Pennsylvania 19101	2. FROM: 83107 R. G. Knott QAA DCASR - Detroit Room 314, Federal Building Bay City, Michigan 48706
3. PRIME CONTRACTOR AND ADDRESS The Dow Chemical Company Midland, Michigan 48640 CONTRACT NUMBER DSA-400-68-C-6163	4. MANUFACTURING PLANT NAME AND ADDRESS The Dow Chemical Company Midland, Michigan 48640 P. O. NUMBER DSA-400-68-C-6163

5. END ITEM AND/OR PROJECT	6. SAMPLE NUMBER	7. LOT NO.	8. REASON FOR SUBMITTAL	9. DATE SUBMITTED
Herbicide ("Orange")	30	734828	Verification Testing	10/29/68

10. MATERIAL TO BE TESTED	10a. QUANTITY SUBMITTED	11. QUANTITY REPRESENTED	12. SPEC. & AMEND. AND/OR DRAWING NO. AND REV. FOR SAMPLE & DATE
Same as 5.	1-8 oz Bottle	8200 gal *	per APPID 6340-1

13. PURCHASED FROM OR SOURCE	14. SHIPMENT METHOD	15. DATE SAMPLED AND SUBMITTED BY
Source	P.P.	10/29/68 R. G. Knott QAA

16. REMARKS AND/OR SPECIAL INSTRUCTIONS AND/OR WAIVERS

FSA

RELIABLE

50-50 mixture (by volume) of n-butyl ester of 2,4-D and 2,4,5-T

SEE G8222
G8223

17. SEND REPORT OF TEST TO

* FAILED QC.

SECTION B — RESULTS OF TEST

1. DATE SAMPLE RECEIVED	2. DATE RESULTS REPORTED	3. LAB. REPORT NO.
4 November 68	12 November 68	[illegible] 5553

4. TEST PERFORMED	RESULTS OF TEST SAMPLE RESULT	REQUIREMENTS
[illegible]	FAILURE (DCSC TQPL) BLEND RATIO	TEST DEPLICATE BLEND RATIO SP GR FREE ACID TOTAL [illegible] WT/GAL

19 NOV [illegible]

DATE	TYPE NAME AND TITLE OF PERSON CONDUCTING TEST	SIGNATURE
12 Nov 68		George W. Mouery/eju

DD FORM 1222 REPLACES DD FORM 1222 1 JUL 55 WHICH IS OBSOLETE

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DEFENSE SUPPLY AGENCY
DEFENSE GENERAL SUPPLY CENTER
RICHMOND, VIRGINIA 23219

83105

IN REPLY REFER TO DGSC-PII

12 December 1968

FSA

SUBJECT: DSA 400-68-C-6163, MIPR FD2050-8-10340

TO: Commander, SAAMA (SAOR) SMOQT
ATTN: Mr. J. Purton
Kelly AFB, Texas 78241

1. Attached laboratory test report G-8221 indicates failure of 8200 gallons of herbicide to meet the blend ratio.

2. Your prompt comments on acceptability of subject material is requested.

FOR THE COMMANDER:

W. A. Fenner

1 Encl ....

W. A. FENNER
Contracting Officer
Directorate of Procurement and Production

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Characteristics	Deter/Sple Units	Test Results			L. A.	Requirements
..ific Gravity 20°/20°C	2	1.289	1.289		1.289	1.275 to 1.295
.. Acid (By weight) %	2	0.0 (2)			0.0	0.5 max
..l Acid Equivalent % (as 2, 4D)	2	93.67	93.81		93.74	90.0 min 94.0 max
..ght Per Gallon	2	10.74	10.74		10.74	10.70 ± 0.08 lbs @ 20°C
..position % by vol:						
2, 4-D	2	49.1	49.0	49.5	49.2	50 ± 1.5
2, 4, 5-T	2	44.6*	44.8*		44.7*	50 ± 1.5

FAILURE (DGSC

FSA

3948

88632

FSA

11 Sep 1967

MEMO FOR COLONEL STEGER

Subject: Herbicides

1. On 8 Sep 1967, OT advised that the Hercules plant, Jacksonville, Arkansas, which produces Orange herbicide, had been shut down due to a quality problem. OT was disturbed since the shut down occurred on 29 Aug 1967 and they were not advised until 8 Sep 1967.

2. Since we (OQT) had not heard of any problem, I contacted Mr. Buxton (DSA) on 8 Sep 1967 to find out details of problem. The following information was obtained:

a. Samples of the Orange herbicides taken by inspector tested at Philadelphia laboratory showed product not to be a 50-50 blend.

b. DSA advised DGSC (Mr. Bills) of problem and DGSC ordered the Jacksonville plant closed on 29 Aug 1967.

c. Hercules has 27,000 gallons (four box cars) on track ready to ship, which have been rejected due to failure to meet specifications.

3. Mr. Buxton will advise OQT today (11 Sep 1967) of corrective actions taken to assure delivery of specification material.

4. OT (Mr. Beatty) was advised 8 Sep 1967 of information obtained from Mr.Buxton on shipment delay.

Wayne E. Vandeventer
WAINE E. VANDEVENTER
Chemist/OQT

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DOW 336070

DOW 2,4,5-T AMINE WEED KILLER

Triethylamine Salt Formulation—2,4,5-T Acid Equivalent 4.0 Pounds per Gallon

REVISED

FOR THE SELECTIVE CONTROL OF BROAD-LEAVED WEEDS IN RICE

INGREDIENTS

Active Ingredient:

Triethylamine Salt of 2,4,5-Trichlorophenoxyacetic Acid	57%
2,4,5-Trichlorophenoxyacetic Acid Equivalent 40.9%	
Contains the equivalent of 4.0 pounds of 2,4,5-Trichlorophenoxyacetic Acid per gallon	
Inert Ingredients	43%

U. S. Patents No. 2,390,941; [illegible]6,511, and 2,451,9[illegible]

DIRECTIONS

The following directions are believed to be accurate and reliable, but users should follow recommendations of local agricultural authorities, which may differ somewhat in different areas.

Use the recommended amount of Dow 2,4,5-T Amine Weed Killer per acre in the amount of water required for even distribution. In mixing sprays, add half the required amount of water to the tank, then add the Dow 2,4,5-T Amine Weed Killer with agitation, and finally the balance of the water, with continued agitation. Apply at moderate pressure (40 to 80 pounds) during warm weather when weeds are growing actively. Do not apply by airplane in the vicinity of cotton or other 2,4,5-T susceptible crops.

WEED CONTROL IN RICE: Treat [illegible] to 8 weeks after emergence of the rice. Where flooded, treat between 7 and 9 weeks after seeding, when plants have emerged above water surface and leaves are standing erect. Use 1½ to 2½ pints of Dow 2,4,5-T Amine Weed Killer in approximately 5 to 7 gallons of water per acre.

For best results weeds should be young and actively growing. With resistant weeds such as Mexican weed and [illegible] up to 3 pints of Dow 2,4,5-T Amine Weed Killer per acre may be necessary but yield may be reduced. For many weeds 1½ pints per acre may be enough. Treatment after flooding is usually safer than treatment before flooding. Consult your local State Experiment Station or Extension Service for more specific local recommendations.

WARNING!

Do not apply Dow 2,4,5-T Amine Weed Killer directly to or otherwise permit it to come into contact with vegetables, flowers, grapes, fruit trees, ornamentals, cotton or other desirable plants which are sensitive to 2,4,5-T, and do not permit spray mist containing it to drift onto them since even minute quantities of the spray may cause injury. (Coarse sprays are less likely to drift.) Accordingly, applications by airplane, ground rigs and hand dispensers should be carried out only when there is no hazard from drift. Do not contaminate irrigation ditches or water used for domestic purposes. Do not store near fertilizers, seeds, insecticides or fungicides. Excessive amounts of 2,4,5-Trichlorophenoxyacetic Acid in the soil may temporarily inhibit seed germination or plant growth. Because of the difficulty of thoroughly cleaning sprayers and other equipment used with 2,4,5-T formulations, such equipment should not be used for handling or applying other agricultural chemicals. Shipping containers should not be re-used for any material which will be applied to desirable vegetation.

Be sure that use and methods of use of this product conform to local regulations. Consult your agricultural agent or experiment agent if in doubt.

Dow 2,4,5-T Amine Weed Killer exposed to sub-freezing temperatures should be warmed to at least 40° F. and mixed thoroughly before using.

NOTE: One tablespoonful in 1½ gallons of water is approximately equivalent to one quart in 100 gallons of water.

WARNING!

UNDILUTED WEED KILLER CAUSES IRRITATION OF SKIN AND EYES

Do not get in eyes. Avoid contact with skin and clothing. In case of contact with the undiluted weed killer, flush eyes with plenty of water for at least 15 minutes and get medical attention; wash skin with soap and plenty of water. Remove and wash contaminated clothing before re-use. Do not wear contaminated shoes.

Seller makes no warranty of any kind, express or implied, concerning the use of this product. Buyer assumes all risk of use or handling, whether in accordance with directions or not.

THE DOW CHEMICAL COMPANY
MIDLAND MICHIGAN
MIDLAND DIVISION

EXHIBIT
D-0180

S-1/63

350

Aspen	Dogwood	Maple	Post oak
Birch	Elder	Me[illegible]	Prickly pear
Black oak	Elm	O[illegible]nge	Red oak
Blackjack oak	Hackberry	Pe[illegible]	Scrub oak
Buckbrush	Hawthorn	Pe[illegible]	Sumac
Bur oak	Hickory	Pin oak	Sweet gum
Choke cherry	Iron wood	Poison ivy	Wild blackberry
Cottonwood	Larkspur	Poison oak	

DIRECTIONS FOR USE

AS WATER SPRAY

Add the recommended amount of product to about one-half the volume of water to be used in spraying. Mix well, then add remaining water and mix until spray mixture is uniform. Foliage and bark should be thoroughly wet with a coarse spray. Best results are obtained when applications are made while the plants are well leafed and actively growing. Repeat applications may be necessary if new growth appears.

For control of woody plants up to 6 to 8 feet in height, this product should be applied at the rate of 1 gallon mixed with 99 gallons of water. Poison ivy, brambles, and some other species may be controlled by using 2 quarts in 100 gallons of water.

For control of woody growth over 8 feet in height, basal, stump, or frill treatment is usually preferred.

AS OIL SPRAY

Add the recommended amount of product to diesel oil, No. 1 or No. 2 fuel oil, or kerosene in the spray tank and mix thoroughly.

BASAL TREATMENT: Dilute 3 gallons of product with 97 gallons of oil (1 pint to 4 gallons), and use a knapsack sprayer to cover bark around trunk and stems from soil surface to about a height of 12 to 15 inches. Cover bark thoroughly, even to the point of runoff at the soil line. Application can be made any time of the year except when snow or water prevents application at the soil line. Although basal has proved to be quite effective, delayed response and kill often occur.

STUMP TREATMENT: Dilute 3 gallons of product with 97 gallons of oil (1 pint to 4 gallons), and apply to freshly cut stumps of large trees or woody plants. Make application with knapsack sprayer having a nozzle of medium orifice or by brush or swab. For best results, both sides and top of stumps should be thoroughly wet. Application can be made any time of the year except when snow or water prevents application at the soil line. Repeat application should regrowth appear.

FRILL TREATMENT: For control of plants having trunks more than 6 inches in diameter, make overlapping cuts in the bark around the trunk as close to the ground as possible. Treat fresh cuts with a mixture of 3 gallons of product in 97 gallons of oil (1 pint to 4 gallons). Application may be made in any season.

AS OIL-WATER AERIAL SPRAY

Best results are obtained when application is made to plants well leafed and actively growing.

RANGELAND: For the control of Mesquite, mix 1 gallon of product with 5 gallons of diesel oil and then mix with 18 gallons of water. The emulsion should be applied at the rate of 4 gallons per acre (⅔ lb. 2,4,5-T acid equivalent per acre).

For control of Hickory, Blackjack, and other Scrub oaks, mix 1 gallon of product with 2 gallons of diesel oil and then mix with 7 gallons of water. Apply this emulsion at the rate of 5 gallons per acre (2 lbs. 2,4,5-T acid equivalent per acre).

PINE RELEASE: For the control of undesirable hardwoods in pine plantings, mix 1 gallon of product with 2 gallons diesel oil and mix with 7 gallons of water. Apply [illegible] gallons per acre (2 lbs.

(1966, 1967, 1964
label not available)

rights-of-way, forest management, rangeland [illegible]stures, and for other [illegible]crop uses.

ACCEPTED
APR 22 1966
[illegible]

ACCEPTED
APR 22 1966
[illegible]

HERCULES

BRUSH-RHAP®

HERBICIDE

LOW VOLATILE 4T

2,4,5-T

CAUTION: READ ENTIRE LABEL FOR ADDITIONAL HANDLING PRECAUTIONS. KEEP OUT OF REACH OF CHILDREN.

ACTIVE INGREDIENT:	
2-Ethylhexyl Ester* of 2,4,5-Trichlorophenoxyacetic Acid	63.6%
(Equivalent to 43.1% of 2,4,5-Trichlorophenoxyacetic Acid)	
INERT INGREDIENTS:	36.5%
TOTAL	100.0%
*An Isooctyl Ester [illegible]	

MADE BY
AGRICULTURAL CHEMICALS
SYNTHETICS DEPARTMENT
HERCULES POWDER COMPANY
INCORPORATED
WILMINGTON, DELAWARE, U.S.A.

[illegible] apply this product to flowers, fruits, vegetables, grapes, ornamentals, cotton, alfalfa, soybeans, clover, or other desirable plants. Minute quantities of this material may cause severe injury to beneficial or desirable plants, therefore caution must be exercised in the use of the chemical in close proximity to such plants. Avoid drift of spray. Use a coarse spray, which is less likely to drift.

Though this product contains an ester of low volatility, the vapors from the product may injure the more susceptible plants in the vicinity of the application.

DO NOT contaminate any body of water by direct application, cleaning of equipment, or disposal of wastes and containers. Excessive amounts of this material in the soil may temporarily inhibit seed germination and plant growth.

DO NOT apply this product on lawns. Legumes, such as white clover, are susceptible to the chemical and may be severely damaged or killed.

DO NOT graze dairy animals on treated areas within 7 days after application.

DO NOT store this product near fertilizers, seeds, insecticides or fungicides. DO NOT contaminate feed or foodstuffs.

DO NOT use spray equipment contaminated with this product for any other purpose. Such equipment SHOULD NOT be used for the application of insecticides, fungicides, or other agricultural products unless it has been first cleaned very carefully with a suitable chemical cleaner.

DO NOT mix with liquid fertilizers.

CAUTION

This product may cause skin irritation. Avoid inhaling spray mist. Do not take internally. Avoid contact with the eyes, skin, or clothing. Flush eyes with clear water and get prompt medical attention.

Keep out of reach of children.

NONWARRANTY

Because this product will be used under many different conditions over which the manufacturer has no control, we do not guarantee the suitability of this product in any particular situation. This product is sold without warranty, express or implied, and buyer assumes all responsibility for loss or damage arising from the handling and use of this product, whether done in accordance with directions or not.

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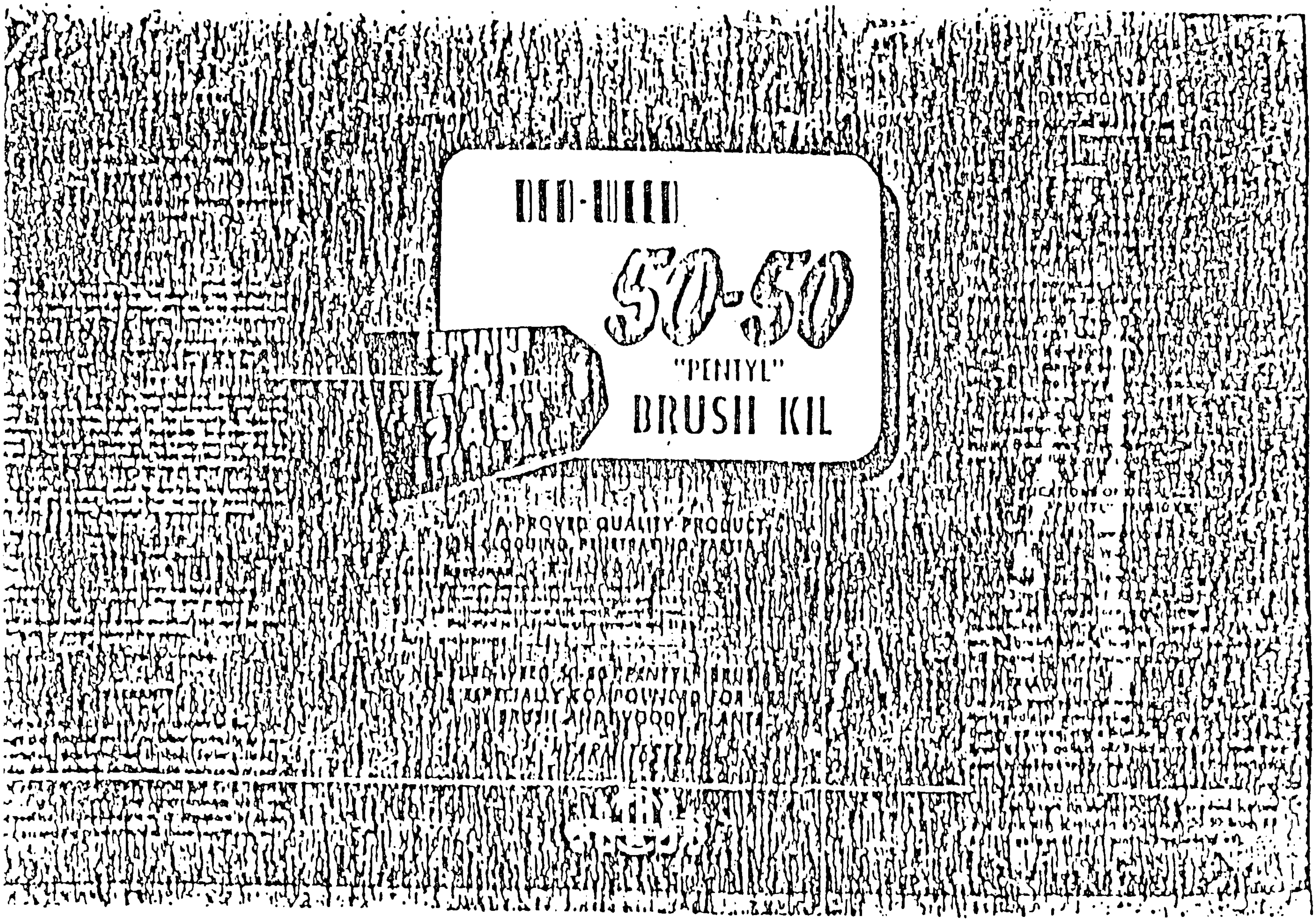

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86-1000 Printed in U.S.A.

501187

SPECIMEN LABEL

BRUSH KILLER 50-50

A BRUSH AND WEED KILLER

Containing 4.95 Pounds Per Gallon Of The Butyl Esters Of 2,4-D And 2,4,5-T Total Acid Equivalent 4.0 Pounds Per Gallon

For the Control of Most Broad-Leaved Annual Weeds and Many Woody and Herbaceous Perennials

INGREDIENTS

Active Ingredients:		
2,4-Dichlorophenoxyacetic Acid, Butyl Ester	[illegible]%	
2,4,5-Trichlorophenoxyacetic Acid, Butyl Ester	[illegible]%	
Inert Ingredients	[illegible]%	
Acid Equivalent:		
2,4-Dichlorophenoxyacetic Acid (2,4-D)	[illegible]%	2.0 lb./gal.
2,4,5-Trichlorophenoxyacetic Acid (2,4,5-T)	[illegible]%	2.0 lb./gal.

Brush Killer 50-50 is recommended for use in controlling both woody and herbaceous plants growing in pastures, fence rows and farmyards, and along ditch banks and right of ways including power, telephone and pipe lines, highways and railroads. It is effective in controlling practically all woody and brushy species normally found in such areas such as alder, aspen, birch, brambles (raspberry and blackberry), choke cherry, elder, elderberry, elm, hawthorn, hickory, honeysuckle, locust, osage orange, poison ivy, poison oak, salmon berry, sassafras, sumac, sweet gum, wild cherry, wild grape, wild rose, and willow as well as other species.

DIRECTIONS

TO PREPARE SPRAY: Add half the required amount of water or oil to the spray tank, then add the Brush Killer 50-50 with agitation, and finally the balance of the water or oil with continued agitation. **WARNING:** If Brush Killer 50-50 is to be used in preparing straight oil mixtures, do not let water get into the Brush Killer 50-50 itself nor into the finished mixture. **NOTE:** Brush Killer 50-50 forms an emulsion, not a solution, with water which tends to separate on standing. Provide agitation to prevent such separation and ensure uniformity of spray mixture.

For mixing small quantities of spray, one tablespoonful of Brush Killer 50-50 in [illegible] gallons of oil or water is approximately equivalent to one quart in 100 gallons.

FOLIAGE TREATMENT: Spray woody growth 6 to 8 feet tall after foliage is well developed, using a drenching spray containing 1 to 4 quarts of Brush Killer 50-50 per 100 gallons of water. Taller brush can be sprayed successfully, although in many cases basal bark or stump treatment is preferable. Coverage should be complete, and all parts of the plants, including foliage, shoot stems and bark, should be wet with the spray. Best results usually will be obtained from applications made soon after maximum foliage development in the spring. With good growing conditions, application may be made up to 2 or 3 weeks before normal frost time. Power equipment with pressure up to 350 pounds will aid in obtaining satisfactory spray coverage. Repeat applications may be required as new growth appears. Usually, a single treatment in any one year is sufficient. Do not apply by airplane in the vicinity of cotton or other 2,4-D susceptible crops.

BASAL BARK TREATMENT: Brush and small trees can be controlled by spraying the basal parts of brush stems and tree trunks to a height of 12 to 15 inches from the ground line. Use a solution of 6 gallons of Brush Killer 50-50 in 94 gallons (1 pint in 2 gallons) of diesel oil, fuel oil, or kerosene mixed thoroughly. With certain species 4 gallons of Brush Killer 50-50 in 96 gallons of diesel oil, fuel oil or kerosene is effective. Knapsack or power equipment may be used, but complete wetting of the indicated area is necessary, particularly at the ground line. This means spraying until run-down or run-off to the ground line is noticeable. Old or rough bark requires more spray volume than young or smooth bark. Low pressures are desirable. Apply at any time including the winter months. Often delayed response and killing can be expected. Treated brush or trees preferably should not be cut for a period of one year following application.

STUMP TREATMENT: Where growth is more than 6 to 8 feet tall, cut it close to the ground and spray the stumps and stubs. Use a solution of 6 gallons of Brush Killer 50-50 in 94 gallons (1 pint in 2 gallons) of diesel oil, fuel oil or kerosene mixed thoroughly. All exposed bark, as well as cut surfaces, should be wet thoroughly. This means spraying until run-down or run-off to the ground line is noticeable. Old or rough bark requires more spray volume than young or smooth bark. Apply at any time including the winter months (preferably to freshly cut stumps). Best results are usually obtained on stumps two inches across or larger.

"FRILL" TREATMENT: For large trees, make a single bark girdle or frill of overlapping axe cuts at a convenient height. Treat the injured area with a mixture of 2 gallons of Brush Killer 50-50 in 100 gallons (1 pint in 2 gallons) of oil or water.

WARNING!

Do not apply Brush Killer 50-50 directly to, or otherwise permit it to come into contact with vegetables, flowers, grapes, fruit trees, ornamentals, cotton or other desirable plants which are sensitive to 2,4-D and similar materials, and do not permit spray mist containing it to drift onto them, since even minute quantities of the spray may cause severe injury during both growing and dormant periods. (Coarse sprays are less likely to drift.) Accordingly, applications by airplane, ground rigs and hand dispensers should be carried out only when there is no hazard from drift. Vapors from this product may injure susceptible plants growing nearby. Do not contaminate irrigation ditches or water used for domestic purposes. Do not store near fertilizers, seeds, insecticides or fungicides. Excessive amounts of 2,4-Dichlorophenoxyacetic Acid in the soil may temporarily inhibit seed germination or plant growth.

Because of the difficulty of thoroughly cleaning sprayers and other equipment used with this product, such equipment should not be used for handling and applying other agricultural chemicals. Shipping containers should not be used for handling any material which will be applied to desirable vegetation.

Be sure that use and methods of use of this product conform to local regulations. Consult your agricultural agent or experiment station if in doubt.

CAUTION! MAY CAUSE SKIN IRRITATION

Avoid Contact with Eyes, Skin or Clothing

Seller makes no warranty of any kind, express or implied, concerning the use of this product. Buyer assumes all risk of use or handling, whether in accordance with directions or not.

U. S. Patents No. 2,390,941; 2,396,513; 2,413,141; [illegible] 23,115 and 2,171,176

MADE BY

THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

120

[illegible]

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TIPPON 2-2 has not been manufactured or shipped since 1970. In 1970 stickers as shown on the following pages were attached to the product. The label is under revision for use if and when the product is again manufactured.

SPECIMEN LABEL

TIPPON® 2-2

BRUSH AND WEED KILLER

Containing [illegible] Pounds per Gallon of Powerful, Low Volatility Esters of 2,4-D and 2,4,5-T — Total Acid Equivalent 4 Pounds per Gallon

FOR THE CONTROL OF MANY KINDS OF BRUSH AND TREES, AND MOST HERBACEOUS WEEDS

[illegible] Ingredients:
2,4-Dichlorophenoxyacetic Acid, Propylene Glycol Butyl Ether Esters .... [illegible]%
2,4,5-Trichlorophenoxyacetic Acid, Propylene Glycol Butyl Ether Esters .... [illegible]%
[illegible] Ingredients .... [illegible]%

[illegible] Equivalent:
2,4-Dichlorophenoxyacetic Acid (2,4-D) .... [illegible]%—2 lb./gal.
2,4,5-Trichlorophenoxyacetic Acid (2,4,5-T) ...... [illegible]%—2 lb./gal.

U.S.D.A. Registration No. [illegible]

[illegible]: Tippon 2-2 is recommended for controlling both woody and herbaceous [illegible] growing in rights-of-way, including power, telephone and pipe lines, highways [illegible] railroads, and in rangelands, pastures, fence rows, farmyards, and along ditch [illegible]. It is effective in controlling practically all woody and bushy species normally [illegible] in such areas, including alder, aspen, birch, brambles (raspberry and black[illegible]), [illegible], elder, [illegible]berry, elm, [illegible], hickory, honeysuckle, locust, [illegible], osage orange, [illegible], poison oak, salmonberry, sassafras, sumac, sweet gum, [illegible] cherry, wild [illegible], wild rose, willow, as well as other species.

DIRECTIONS

[illegible] THE SPRAY: Add the Tippon 2-2 to the required amount of oil in the [illegible] tank and mix thoroughly. This mixture can be made at any time before actual [illegible], and no separation will occur.

TO AVOID DIFFICULTY FOLLOW ABOVE DIRECTIONS AS GIVEN

[illegible] BARK TREATMENT: Brush and small trees can be controlled by spraying [illegible] basal parts of brush stems and tree trunks to a height of 12 to 15 inches from the ground line. Use a solution of 4 gallons of Tippon 2-2 in 96 gallons (1 pint in 3 gallons) of diesel oil, fuel oil, or kerosene mixed thoroughly. With certain species, 6 gallons of Tippon 2-2 in 94 gallons (1 pint in 2 gallons) of diesel oil, fuel oil, or kerosene mixed thoroughly is effective in the control of resistant species. Knapsack or power equipment may be used but complete wetting of the indicated area is necessary, particularly at the ground line. This means spraying until run-down or run-off to the ground line is noticeable. Old or rough bark requires more spray volume than young or smooth bark. Low pressures are desirable. Apply at any time, including the winter months. Often, delayed response and killing can be expected.

DORMANT CANE BROADCAST: Treat any time after brush is dormant and most of the foliage has dropped. Stems should be concentrated at the base of stems and in addition, the upper parts of the stems should be broadcast sprayed enough to wet them. Under rank suckering species such as sumac, persimmon, sassafras and locust, also spray the ground area to control small root suckers that may not be visible. Mix 1½ gallons of Tippon 2-2 in 100 gallons of fuel oil. Brush of average density and 4-6 feet high may take up to 150 gallons of spray mixture per acre.

STUMP TREATMENT: Where growth is more than 6 to 8 feet tall, cut it close to the ground and spray the stumps and stubs. Use a solution of 4 gallons of Tippon 2-2 in 96 gallons (1 pint in 3 gallons) of diesel oil, fuel oil, or kerosene mixed thoroughly. With certain species, 6 gallons of Tippon 2-2 in 94 gallons (1 pint in 2 gallons) of diesel oil, fuel oil, or kerosene mixed thoroughly is effective in the control of resistant species. All exposed bark, as well as cut surfaces, should be wet thoroughly. This means spraying until run-down or run-off to the ground line is noticeable. Old or rough bark requires more spray volume than young or smooth bark. Apply at any time, including the winter months, preferably to freshly-cut stumps. Best results are usually obtained on stumps two inches across or larger.

"FRILL" TREATMENT: For large trees, make a single hack girdle or "frill" of overlapping axe cuts completely around the tree, as close to the ground as possible. Treat the injured area with a mixture of 3 gallons of Tippon 2-2 in 97 gallons (1½ pints in 3 gallons) of diesel oil, fuel oil, or kerosene. Apply at any time, including the winter months, preferably to freshly "frilled" trees.

WARNING

Do not apply Tippon 2-2 directly to, or otherwise permit it to come into contact with vegetables, flowers, grapes, fruit trees, ornamentals, cotton or other desirable plants which are sensitive to 2,4-D or 2,4,5-T and do not permit spray mist containing it to drift onto them, since even minute quantities of the spray may cause severe injury during both growing and dormant periods. (Coarse sprays are less likely to drift.) Accordingly, applications by airplane, ground rigs and hand dispensers should be carried out only when there is no hazard from drift. Do not apply by airplane in the vicinity of cotton, grapes or other desirable vegetation which is susceptible to 2,4-D or 2,4,5-T. At high temperatures vaporization may cause injury to susceptible plants growing nearby.

Do not use on lawns of creeping grasses, such as bent, except for spot spraying, or on freshly seeded turf until grass has become well established. Many legumes are severely damaged or killed. Do not contaminate irrigation ditches or water used for domestic purposes. Do not store near fertilizers, seeds, insecticides or fungicides. To avoid injury to desirable plants, do not store, handle or apply other agricultural chemicals with the same containers or equipment used for Tippon 2-2.

Local conditions may affect the use of herbicides. State agricultural authorities in many states have recommendations to fit local conditions.

Be sure that the use of this product conforms to all applicable regulations.

CAUTION

MAY CAUSE SKIN IRRITATION

Avoid Contact with Eyes, Skin and Clothing

KEEP OUT OF THE REACH OF CHILDREN

NOTICE: Seller makes no warranty of any kind, express or implied, concerning the use of this product. Buyer assumes all risk of use or handling, whether in accordance with directions or not.

U. S. Patents No. [illegible]

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN
MIDLAND DIVISION

B6-1144 Printed in U.S.A. in May 1965

REPLACES SPECIMEN LABEL B6-1144 PRINTED IN SEPT. 1961

REVISIONS INCLUDE: (1) MINOR CHANGE IN INGREDIENT STATEMENT (2) ADDITION OF RECOMMENDATION FOR "DORMANT CANE BROADCAST" (3) ADDITION OF U.S.D.A. REGISTRATION NO. AND REQUIRED PRECAUTIONARY LABELING.

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SPECIMEN LABEL

VEON® BRUSH KILLER

CONTROLS MANY SPECIES OF TREES, BRUSH AND BROADLEAVED WEEDS

Active Ingredients:
Dimethylamine Salt of 2,4-Dichlorophenoxyacetic Acid .... [illegible]%
Triethylamine Salt of 2,4,5-Trichlorophenoxyacetic Acid .... [illegible]%
Inert Ingredients .... 47 [illegible]%

Acid Equivalents
2,4 Dichlorophenoxyacetic Acid ... 20 [illegible]% – 2 lb /gal
2,4,5-Trichlorophenoxyacetic Acid.. 20 [illegible]% – 2 lb /gal.
E P A. Registration No 464-198-AA

…N BRUSH KILLER is recommended for use in controlling herba… …s and woody plants growing in right of ways, railroad road… …, roadsides and industrial sites. It is effective on such …cies as:

…spen	elm	hard and	sassafras
…irch	hickory	soft maple	Virginia creeper
…lackberry	honeysuckle	oak	wild cherry
…lderberry	locust	osage orange	wild rose
		poison ivy	

…well as many other woody and herbaceous weeds

…allowed to stand after mixing it must be agitated again before …ng VEON BRUSH KILLER will not mix with oil and should not be …d for stump or basal sprays. It is not recommended for selective … in crops

DIRECTIONS

…ray woody growth up to 6 or 8 feet tall after foliage is well …veloped, using a drenching spray containing 1 gallon of VEON …USH KILLER per 100 gallons of water. Coverage should be com…ete and all parts of the plants, including foliage, shoot stems and bark, should be thoroughly wet with the spray. Best results usually will be obtained from applications made soon after maximum foliage development in the spring. Less effective control may result during hot, dry weather. Under good growing conditions, in humid areas, applications made up to three weeks before fall frost are usually effective. (Application in late summer and fall in some areas, including Texas and Oklahoma, is not recommended.) Spraying after leaves have lost their normal green color and vigor may not give satisfactory control. Repeat applications may be necessary as new growth develops

USE PRECAUTIONS

Do not apply VEON BRUSH KILLER directly to, or otherwise permit it to come into contact with vegetables, flowers, grapes, fruit trees, ornamentals, cotton or other desirable plants which are sensitive to 2,4,5-T and 2,4-D. Do not permit spray mist containing it to drift onto them, since even minute quantities of the spray may cause injury. (Coarse sprays are less likely to drift.) Accordingly, applications by airplane, ground rigs and hand dispensers should be carried out only when there is no hazard from drift. Do not contaminate irrigation ditches or water used for domestic purposes. Do not store near fertilizers, seeds, insecticides or fungicides. Excessive amounts of 2,4,5-Trichlorophenoxyacetic Acid and 2,4-Dichlorophenoxyacetic Acid in the soil may temporarily inhibit seed germination or plant growth. Because of the difficulty of thoroughly cleaning sprayers and other equipment used with 2,4,5-T and 2,4-D formulations, such equipment should not be used for handling or applying other agricultural chemicals. Shipping containers should not be re-used for any material which will be applied to desirable vegetation.

Be sure that use and methods of use of this product conform to local regulations. Consult your agricultural agent or experiment agent if in doubt. VEON BRUSH KILLER exposed to subfreezing temperatures may crystallize. Should crystallization occur, warm gradually to room temperature and mix thoroughly before using. Do not use direct or open flame.
Do not use around the home, recreation areas or similar sites.

WARNING

KEEP OUT OF THE REACH OF CHILDREN
CAUSES IRRITATION OF SKIN AND EYES
Do Not Get In Eyes
Avoid Contact with Skin and Clothing

In case of contact with the undiluted weed killer, flush eyes with plenty of water for at least 15 minutes and get medical attention; wash skin with soap and plenty of water. Remove and wash contaminated clothing before re-use. Do not wear contaminated shoes. Store out of reach of children and animals.

NOTICE: Seller warrants that the product conforms to its chemical description and is reasonably fit for the purposes stated on the label when used in accordance with directions under normal conditions of use, but neither this warranty nor any other warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE, express or implied, extends to the use of the product contrary to label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to seller, and buyer assumes the risk of any such use.

…-1130 PRINTED IN U.S.A. IN NOVEMBER, 1971.

…PLACES SPECIMEN LABEL 86-1130 PRINTED IN FEBRUARY, 1965.

…EVISIONS INCLUDE: (1) U.S.D.A. CHANGED TO E.P.A. (2) NOTICE …EVISED. (3) "DITCH BANKS" DELETED. (4) RESTRICTION ON USE …ROUND HOME AND RECREATION AREAS ADDED. (5) ZIP CODE ADDED.

DOW

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN 48640

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SPECIMEN LABEL

VEON* 245

FOR THE CONTROL OF MANY SPECIES OF TREES, BRUSH AND BROADLEAVED WEEDS AND FOR THE SELECTIVE CONTROL OF BROAD-LEAVED WEEDS IN RICE

Active Ingredient:

Triethylamine Salt of 2,4,5-Trichlorophenoxyacetic Acid	56.7%
Inert Ingredients	43.3%
2,4,5-Trichlorophenoxyacetic Acid Equivalent	40.6%

A Triethylamine Salt of 2,4,5-T—Total Acid Equivalent 4.0 Pounds per Gallon

VEON 245 is recommended for use in controlling herbaceous and woody plants growing in right-of-ways, railroad roadbeds, ditch-banks, roadsides and industrial sites. It is effective on such species as aspen, birch, blackberry, elderberry, elm, hickory, honeysuckle, locust, hard and soft maple, oak, osage orange, poison ivy, sassafras, Virginia creeper, wild cherry and wild rose, as well as many other woody and herbaceous weeds. If allowed to stand after mixing it must be agitated again before using. VEON 245 will not mix with oil and should not be used for stump or basal sprays. It is not recommended for selective use in crops.

DIRECTIONS

Spray woody growth up to 6 or 8 feet tall after foliage is well developed, using a drenching spray containing 1 gallon of VEON 245 per 100 gallons of water. Coverage should be complete and all parts of the plants, including foliage, shoot stems and bark, should be thoroughly wet with the spray. Best results usually will be obtained from applications made soon after maximum foliage development in the spring. With good growing conditions and adequate soil moisture, applications may be made up to 2 to 3 weeks before normal frost date if plants are actively growing. Less effective control may result during hot, dry weather. Repeat applications may be necessary as new growth develops.

(A)

WARNING

Do not apply VEON 245 directly to, or otherwise permit it to come into contact with vegetables, flowers, grapes, fruit trees, ornamentals, cotton or other desirable plants which are sensitive to 2,4,5-T, and do not permit spray mist containing it to drift onto them, since even minute quantities of the spray may cause injury. (Coarse sprays are less likely to drift.) Accordingly, applications by airplane, ground rigs and hand dispensers should be carried out only when there is no hazard from drift. Do not contaminate irrigation ditches or water used for domestic purposes. Do not store near fertilizers, seeds, insecticides or fungicides. Excessive amounts of 2,4,5-Trichlorophenoxyacetic Acid in the soil may temporarily inhibit seed germination or plant growth. Because of the difficulty of thoroughly cleaning sprayers and other equipment used with 2,4,5-T formulations, such equipment should not be used for handling or applying other agricultural chemicals. Shipping containers should not be re-used for any material which will be applied to desirable vegetation.

Be sure that use and methods of use of this product conform to local regulations. Consult your agricultural agent or experiment agent if in doubt. VEON 245 exposed to sub-freezing temperatures should be warmed to at least 40°F and mixed thoroughly before using.

DOW 5300056

NOTICE

Seller makes no warranty of any kind, express or implied, concerning the use of this product. Buyer assumes all risk of use or handling, whether in accordance with directions or not.

WARNING

CAUSES IRRITATION OF SKIN AND EYES

Do not get in eyes. Avoid contact with skin and clothing.

In case of contact with the undiluted weed killer, flush eyes with plenty of water for at least 15 minutes and get medical attention, wash skin with soap and plenty of water. Remove and wash contaminated clothing before re-use. Do not wear contaminated shoes.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN
MIDLAND DIVISION

06-1133 Printed in U.S.A.

EXHIBIT D-0181

) CONTROL IN RICE: Treat 4 to 8 weeks after emergence of the rice. Where folded, treat between 7 and 9 weeks after
ding when plants have emerged above water surface and leaves are standing erect. Use 1 to 2 1/2 pints of Veon 245 in
roximately 5 to 7 gallons of water per acre. For best results weeds should be young and actively growing. With
later weeds such as Mexican weed and curly indigo, up to 3 pints of Veon 245 per acre may be necessary, but yield may

CHART LABEL

DOW

VERTON® CE

WEED AND BRUSH KILLER

A General Weed and Brush Control Formulation for Forming Inverted Emulsions

INGREDIENTS [illegible]

U.S.D.A. Registration No. [illegible]

[illegible]

USE DIRECTIONS

[illegible]

to two or three weeks before normal frost time. Control may be less during hot and dry weather when soil moisture is deficient.

Mixing Instructions: To a clean dry spray tank, equipped with good mechanical agitation, add the required amounts of VERTON CE and No. 2 fuel oil or kerosene and agitate until thoroughly mixed. Then, with continued vigorous agitation, add the amount of water required to give the amount of spray needed. After the water has been added, with continued agitation, recycle the mixture through the spray pumping system and back into the tank for approximately 20 minutes to develop the desired thickness [illegible]. Minor variations in thickness may be obtained by adding small amounts of water to increase the thickness or small amounts of oil to decrease the thickness.

The following mixing proportions table shows the amount of each spray ingredient to be used to prepare various sized batches of total spray, based on the pounds of acid equivalent required per acre.

MIXING PROPORTIONS*

Pounds of acid equivalent (ae) desired/acre	Total gallons of spray desired/acre	Gallons of VERTON CE to use	Gallons of oil to use	Gallons of water to use
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*[illegible]

[illegible]

USE PRECAUTION

[illegible]

Carefully note the following points:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

[illegible]

CAUTION

KEEP OUT OF THE REACH OF CHILDREN
MAY CAUSE SKIN IRRITATION
MAY BE HARMFUL IF SWALLOWED
Avoid Contact with Eyes, Skin and Clothing

NOTICE: [illegible]

THE DOW CHEMICAL COMPANY MIDLAND, MICHIGAN 48640

[illegible]

MRID 131668

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ESTERON* 76 B

HERBICIL

For the Control of Many Broadleaf Weeds, Herbaceo
Perennials and Woody Plants Susceptible to 2,4-D
Grass Pastures, Certain Crops and Non-Crop Are

2,4-Dichlorophenoxyacetic Acid, Butyl Esters 79.2%
INERT INGREDIENTS: 20.8%
2,4-D Acid Equivalent 63.2%—6 pounds per gallon
E.P.A. Registration No. 464-279

USE DIRECTIONS

Use ESTERON 76 BE herbicide to control bitterweed, croton, dandelion, docks, galinsoga, henbit, kochia, lambsquarters, marshelder, mustards, peppergrass, pigweed, plantains, ragweed, shepherdspurse, thistles, vetch, wild radish, and many other broadleaf weeds without injury to most established grasses; also for control of 2,4-D susceptible woody plants such as coastal sage, sandsage, elderberry, hazel, locust, poison oak, sumac and willow. Use in small grains, corn, sorghum, grass seed crops, pastures, rangeland and in non-crop areas.

Apply ESTERON 76 BE as a water or oil spray during warm weather when weeds or brush are actively growing. Application under drought conditions often will give poor results. Use low spray pressure to minimize spray drift. On cropland and along roadsides, do not exceed 20 psi pressure. Apply enough spray volume to provide uniform coverage of weeds and brush, usually 5 to 20 gallons per acre by ground equipment and 3 to 5 gallons by aircraft. Higher gallonage may be used if desired to improve spray coverage and to reduce the hazard from spray drift.

Generally, the lower dosages recommended on this label will be satisfactory for young succulent growth of sensitive weed species. For less sensitive species and under conditions where control is more difficult, the higher dosages will be needed. For crop uses, do not mix with oil or other adjuvants unless specifically recommended on this label. Deep-rooted perennial weeds such as Canada thistle and field bindweed and many woody plants usually require repeated applications for maximum control. Do not apply ESTERON 76 BE when spray drift may contact nearby susceptible crops or other desirable plants or may contaminate water for irrigation or domestic use. Do not apply in the vicinity of 2,4-D sensitive crops or ornamental plants since vapors from this product may cause injury to such crops or plants. Read and follow all Use Precautions given on this label.

NOTE: If there are uncertainties concerning special local use situations or specific crop variety tolerances to 2,4-D, consult local Extension Service or University Specialists for advice.

TO PREPARE THE SPRAY: (1) Fill the spray tank about half full with water, then add the required amount of ESTERON 76 BE, with agitation, and finally the rest of the water. NOTE: ESTERON 76 BE in water forms an emulsion which tends to separate unless the mixture is kept agitated. (2) If oil is added, first mix the ESTERON 76 BE and the oil and then add this mixture to the water with agitation. However, with adequate agitation, the oil can be added after the ESTERON 76 BE is mixed in the water if strong agitation is provided. (3) If straight oil is used, a solution is formed and separation does not occur. Do not allow any water to get into the oil-herbicide mixture to avoid formation of an invert emulsion.

WEED CONTROL IN SMALL GRAINS NOT UNDERSEEDED WITH A LEGUME: NOTE: Water is recommended to make up the spray. If oil is used, there is a greater risk of crop injury and of spray drift. Do not permit dairy animals or meat animals being finished for slaughter to forage or graze treated grain fields within 2 weeks after treatment.

Spring Wheat and Barley: Apply 1/3 to 2/3 pint per acre by air or ground equipment. A 1/2 pint per acre rate of ESTERON 76 BE is an average dosage, effective on many weeds. Spray when grain is in full tiller stage (usually 4 to 8 inches tall) but before the boot stage and when weeds are small. Do not apply before the tiller stage nor from early boot to the dough stage. Higher rates (up to 1 1/3 pints per acre) may be required to control certain weeds but crop injury may result.

Winter Wheat and Rye: Apply 1/3 to 1/2 pint per acre in the spring at the full tiller stage but before the early boot stage. See more complete use directions under Spring Wheat and Barley.

Spring Seeded Oats: Apply 1/3 pint per acre at the full tiller stage but before the early boot stage. Oats are less tolerant to 2,4-D than wheat or barley and are more likely to suffer some injury, especially if higher rates (1/2 to 2/3 pint) are used to control difficult weeds.

Preharvest Treatment: Apply 2/3 to 1 1/3 pints per acre when grains are in the hard dough stage to control large weeds that may interfere with harvest. Best results will be obtained when soil moisture is sufficient to cause succulent weed growth. NOTE: Do not feed treated straw to livestock.

WEED CONTROL IN CORN: Use one of the following three programs: Preemergence: Apply 1 1/3 to 2 2/3 pints per acre to soil anytime after planting but before corn emerges. Do not use on light sandy soil. Emergence: Apply 2/3 pint per acre just as corn plants are breaking ground. Postemergence: After emergence of corn, use 1/3 pint per acre. Application of 1/2 to 2/3 pint per acre may be needed for maximum control of some weeds but such rates are more likely to injure the corn. If corn is over 8 inches tall, use drop nozzles to keep the spray off the corn foliage as much as possible. Do not apply from the tasseling to dough stage. Do not use with oil, atrazine or adjuvants. Crop injury is more likely to occur if corn is growing rapidly under high temperature and high soil moisture conditions. To reduce breakage of stalks from temporary brittleness caused by 2,4-D, delay cultivation for 8 to 10 days after treatment. NOTE: Hybrids vary in response to 2,4-D and some are easily injured. Spray only varieties known to be tolerant to 2,4-D. Contact seed company and Extension Service Weed Specialists for this information.

SPECIMEN
LABEL

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inches tall. A higher rate [illegible] may be [illegible] but the chance for crop injury is likewise increased. Do not use with oil or other adjuvants. Do not treat before the sorghum is 5 inches tall nor during the boot, flowering or early dough stages. If sorghum is taller than 8 inches, use drop nozzles to keep the spray off the foliage as much as possible. Temporary crop injury may occur under conditions of high soil moisture and high air temperatures. Varieties vary in tolerance to 2,4-D and some hybrids are quite sensitive. Spray only varieties known to be tolerant to 2,4-D. Contact seed company and Extension Service Weed Specialists for this information. Do not apply in the vicinity of cotton, soybeans and other 2,4-D susceptible plants.

WEED CONTROL IN GRASS SEED CROPS: Use ⅔ to 1 pint per acre in the amount of water required for uniform application by air or ground equipment. Apply to established stands in spring from the tiller to early boot stage. Do not spray in boot stage. New spring seedings can be treated with the lower rate after the grasses have at least five leaves. Perennial weed regrowth can be treated in the fall.

WEED AND BRUSH CONTROL IN RANGELAND AND GRASS PASTURES BY AIR OR GROUND EQUIPMENT: NOTE: Do not graze dairy animals on treated areas within 7 days after application. The following treatments will injure or kill legumes so use only where loss of legumes can be tolerated. Do not apply on newly seeded areas until grass is well established. Do not apply from early boot to milk stage when grass seed production is desired.

Broadleaf Weeds: To control bitterweed, broomweed, croton, docks, kochia, marshelder, muskthistle and others, use 2½ to 3 pints of ESTERON 76 BE per acre in the amount of water needed for uniform application. If the weeds are young and growing actively 1½ to 2 pints per acre will provide control of many species. Deep-rooted perennial weeds may require repeated treatments in the same year or in subsequent years.

Chaparral Brush Species: To control chamise, manzanita, buckbrush, coastal sage and certain other chaparral species, use 1½ to 2 quarts per acre in 8 to 10 gallons of water. A gallon of oil per acre may be included in the spray mixture for added effectiveness. For effective control, the brush must be fully leafed out and growing actively when sprayed. Retreatment may be needed.

Big Sagebrush: Use 1½ to 2 quarts per acre in 2 to 3 gallons of oil or in 3 to 5 gallons of oil-water emulsion spray. For effective control the sagebrush should be in full foliage and growing actively when sprayed.

WEED CONTROL IN NON-CROP AREAS SUCH AS LAWNS, AIRFIELDS, ROADSIDES, VACANT LOTS, DRAINAGE DITCH BANKS: Apply 1 to 2 quarts of ESTERON 76 BE per acre in the amount of water needed for uniform application. Usually 1½ quarts per acre provides good weed control under average conditions. Treat when weeds are young and growing well. Do not use on golf greens nor on dichondra or other broadleaf herbaceous ground covers. Do not use on creeping grasses such as bent and St. Augustine except for spot treating, nor on newly seeded turf until grass is well established. Reseeding of treated areas should be delayed following treatment. With spring application, reseed in the fall; with fall application, reseed in the spring. Legumes are usually damaged or killed so do not treat areas where the legumes are desired. Deep-rooted perennial weeds may require repeated treatments in the same season or in subsequent years.

WOODY PLANT CONTROL IN NON-CROP AREAS: To control species susceptible to 2,4-D in right-of-ways, fencerows, roadsides, and along drainage ditchbanks, spray brush up to 5 to 8 feet tall after spring foliage is well developed, using 2 to 3 quarts of ESTERON 76 BE in 100 gallons of water and wetting all parts of the brush including foliage, stems and bark. This may require up to 400 gallons of spray for adequate coverage of solid stands of brush. Make application in such a way as to prevent drift of the spray off the area being treated. Spraying can be effective at any time up to 3 weeks before frost as long as soil moisture is sufficient for active growth of the brush. Less effective control may be obtained during hot dry weather when soil moisture is deficient and plants are not actively growing. Oil or wetting agent may be added to the spray, if needed for increased effectiveness. For more resistant species and for general control of mixed brush, use ESTERON Brush Killer or ESTERON 245 herbicide.

SPOT TREATMENT: To control broadleaf weeds in small non-cropland areas with a hand sprayer, use ¼ pint of ESTERON 76 BE in 3 gallons of water and spray to thoroughly wet all weed foliage. Keep spray mixture agitated to prevent separation.

Esteron

USE PRECAUTIONS

Do not apply ESTERON 76 BE herbicide directly to, or otherwise permit it to come into contact with cotton, grapes, fruit trees, vegetables, flowers or other desirable crop or ornamental plants which are sensitive to 2,4-D herbicide. Do not permit spray mist to drift onto them, since even very small quantities of the spray, which may not be visible, can cause severe injury during both growing and dormant periods. Use coarse sprays to minimize drift. With ground equipment, spray drift can be lessened by keeping the spray boom as low as possible; by applying 20 gallons or more of spray per acre; by using no more than 20 pounds spraying pressure with flat fan or flooding flat fan nozzle tips, by spraying when wind velocity is low; and by stopping all spraying when wind exceeds 6 to 7 miles per hour. Do not apply with hollow cone-type insecticide or other nozzles that produce a fine-droplet spray.

With aircraft application, drift can be reduced by applying a minimum of 5 gallons of spray per acre, by using no more than 20 pounds spray pressure at the nozzles, by using nozzles which produce a coarse spray pattern, and by spraying only when the wind velocity is less than 5 miles per hour.

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when the wind is blowing toward susceptible crops or ornamental plants.

This is a high-volatile 2,4-D ester formulation. Vapors from this product may injure susceptible plants growing nearby. Do not use in or near a greenhouse. Excessive amounts of this herbicide in the soil may temporarily inhibit seed germination or plant growth.

This product is toxic to fish. Keep out of lakes, streams and ponds. Do not apply when runoff is likely to occur. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not contaminate irrigation ditches or water used for irrigation or domestic purposes.

To avoid injury to desirable plants, do not handle or apply other agricultural chemicals with the same equipment used for ESTERON 76 BE except as specified on this label. This product can be stored in an unheated building but do not store near fertilizers, seeds, insecticides, or fungicides. If exposed to subfreezing temperatures, it should be warmed to at least 40 F and mixed thoroughly before using. Do not reuse container. Dispose of empty containers by punching holes in them and burying with waste in non-cropland away from water supplies or follow official local recommendations for container disposal.

132 Local conditions may affect the use of herbicides. Consult your State Agricultural Experiment Station or Extension Service weed specialists for advice in selecting treatments from this label to best fit local conditions. Be sure that use of this product conforms to all applicable regulations. Apply this product only as specified on this label.

CAUTION

KEEP OUT OF REACH OF CHILDREN
HARMFUL IF SWALLOWED
MAY CAUSE IRRITATION

Avoid Contact with Eyes, Skin and Clothing

Esteron

NOTICE: Seller warrants that the product conforms to its chemical description and is reasonably fit for the purposes stated on the label when used in accordance with directions under normal conditions of use, but neither this warranty nor any other warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE, express or implied, extends to the use of this product contrary to label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to seller, and buyer assumes the risk of any such use.

G1172

THE DOW CHEMICAL COMPANY

AND SUBSIDIARIES

MIDLAND, MICHIGAN 48640, USA   ZURICH, SWITZERLAND   HONG KONG, BCC
CORAL GABLES, FLORIDA 33134, USA   SARNIA, ONTARIO, CANADA

99894

DIRECTIONS FOR USE

[illegible] ... recommended for use ...

FOLIAGE TREATMENT: Foliage or leaf stem sprays are applied during the growing season on dense brush or where ... growth ... Greenbriers and ... woody ... Apply LINE RIDER 22 after ... developed, using a drenching spray ... 3 to 4 quarts in 100 gallons of water. Coverage should be complete, wetting all parts of the plants, including leaves and stems, to the point of runoff. ... brush ... over 8 to 10 feet high. Do not treat during periods of severe drought ... healthy green color ... may need retreatment the following season.

BASAL BARK TREATMENT: This treatment is not adapted to ... dense stands of brush and woody ... can be used anytime of the year ... Apply LINE RIDER 22 at the rate of 4 quarts in 25 gallons ... 1 pint in 3 gallons of fuel oil, diesel oil, or kerosene, treating the basal parts of stems ... ground line to a height of 12 to 18 inches ... wetting ... all sides of the ...

STUMP TREATMENT: To prevent regrowth from cut stumps ... apply a solution of 4 quarts of LINE RIDER 22 ... 25 gallons of ... fuel oil ... 1 pint in 3 gallons. Wet thoroughly the ... surfaces of the stump ... ground line ... Best results are usually obtained when applied to fresh cut stumps ...

FRILL TREATMENT: For trees ... inches in diameter ... frill ... a solution of 2 quarts of LINE RIDER 22 in 25 gallons of ... fuel oil ...

NOTE: When stored at temperatures below freezing it may be necessary to warm ... at least 40° F ... agitate thoroughly before using.

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ESA

®

Brush Killer

LINE RIDER® 22

Contains 2.0 Pounds Each of 2,4-D and 2,4,5-T Acid Equivalent Per Gallon

ACTIVE INGREDIENTS:

Butyl Ester of 2,4-Dichlorophenoxyacetic Acid*	28%
Butyl Ester of 2,4,5-Trichlorophenoxyacetic Acid**	27%
INERT INGREDIENTS	4[illegible]%
TOTAL	100%

*Equivalent to 2,4-Dichlorophenoxyacetic Acid 22.2%

**Equivalent to 2,4,5-Trichlorophenoxyacetic Acid 22.2%

[illegible]

CAUTION

Harmful ...

DO NOT ...

DO NOT ...

DO NOT ...

DO NOT ...

DO NOT ...

WARRANTY ...

SELLER warrants that this material conforms to the chemical description on the label ... purposes stated ... SELLER ... warranty ... agent of SELLER ... In no event shall SELLER's liability ... exceed the purchase price ...

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013 711 ESA

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UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NEW YORK
MDL No. 381

In re : Deposition of:

"AGENT ORANGE" : WILLIAM J.

Product Liability Litigation : MC CARVILLE

TRANSCRIPT of testimony as taken by and before MARGARET J. TEILHABER, a Certified Shorthand Reporter and Notary Public of the State of New Jersey and New York, at the offices of TOWNLEY & UPDIKE, 405 Lexington Avenue, New York, New York, on Friday, February 11, 1983.

405 Northfield Avenue
West Orange, New Jersey 07052
(201) 731-9555

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A. Yes.

Q. Thereafter did you ever hear from anyon that your product was being and had been used in Viet Nam?

A. Yes.

Q. When did you hear it for the first time

A. My recollection, sometime in the early seventies.

Q. Were you surprised?

A. I don't recall one way or ~~the other~~.

Q. Do you remember having any feeling at a when you hired for the first time that that produc was being used in Viet Nam?

MR. SABETTA: Objection to the form.

A. Did I have any feeling at all?

Q. Any feeling one way or the other or any feeling of surprise or shock.

MR. SABETTA: Objection to the form.

Q. Any emotional reaction at all.

A. I guess it explained why they bought so much, yes.

Q. Did you have that question of why they bought so much for a number of years?

A. Not physically, no. 13

Q. When you say I guess it explained why 9 they bought so much, you as the director of produ sales and the person who was selling the stuff wanted to sell as much as possible presumably. I that true?

A. Wanted to sell as much as we could in respon to the government request.

Q. Your answer is you did want to sell as much as possible. Wasn't that your job? Isn't t true?

A. The government was a customer.

Q. Your job wasn't to sell as much of any product that you manufactured as you could?

A. Since this was a problem, a customer that I couldn't influence, I responded.

Q. In any event, sometime in the early seventies your question as to why there was so mu of this product sold was answered. Is that corre

A. My recollection, yes.

Q. You found out that it was being used i Viet Nam. Is that correct?

A. Yes.

Q. When you talk about the early seventie was that after 1973 or from the period of, say, ' to '73?

A. I don't recall exactly when. At one point i

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NEW YORK
MDL No. 381

In re : Deposition of:

"AGENT ORANGE" : CECIL H. RUSSELL

Product Liability Litigation :

TRANSCRIPT of testimony as taken by and before NANCY C. BENDISH, a Certified Shorthand Reporter and Notary Public of the State of New Jersey, at the MARRIOTT, St. Louis, Missouri, on Monday, May 2, 1983, commencing at 9:30 in the forenoon.

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405 Northfield Avenue
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(201) 731-9656

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you've spoken about before, but what have you published for Monsanto?

A. Well, the three fertilizer blending articles and the Scotts standard method of analysis.

Q. Anything else?

A. Nothing in the literature.

Q. Well, that's what we'll be talking about, about publishing that would be in the literature.

A. Yes.

Q. And when you say you published private matters, I'm trying to ascertain what you mean, sir?

A. Well, the private matters would be procedural.

Q. What do you mean, sir?

A. Processes, manuals of operation, that sort of thing.

Q. And did any of those privately published articles have to do with phenoxy herbicides?

A. No.

Q. Did any of those --

A. Correction. Specifications.

Q. We'll talk about that. You created the specifications for Orange 1, did you not?

MR. SABETTA: Objection to the form.

Q. Did you create the specification for Orange 1?

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MR. SABETTA: Objection to the form.
A. I wrote it, my version of it.
Q. Well, when you say you wrote your version of it, was not your version the one that was then incorporated into MIL specs?
MR. SABETTA: Objection.
A. They were the same.
Q. And your version that you created was created before the MIL spec, was it not?
MR. SABETTA: Objection.
A. No.
Q. Was your version that you created created after the MIL specs?
A. Almost simultaneously. Slightly after it. I don't remember who. We worked together, more or less.
Q. When you say we, who do you mean?
A. Couple of gentlemen from the military.
Q. Colonel Bartlett, is he one?
A. That don't sound like it. They came here but I don't specifically remember their names. They were chemists.
Q. Government chemists who came to Monsanto, right?
A. Yes.

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UNITED STATES DISTRICT CO
EASTERN DISTRICT OF NEW Y
MDL No. 381

In re : Deposition o

"AGENT ORANGE" : WESLEY R. KOS

Product Liability Litigation :

TRANSCRIPT of testimony as taken by and bef THOMAS L. LA FERA, a Certified Shorthand Reporte and Notary Public of the State of New Jersey, at TREASURE ISLAND INN, Daytona Beach, Florida, on Friday, the 27th day of January, 1984, commencin 10:09 in the forenoon.

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MR. WHITE: Objection.

A. That's my understanding of the directed order yes.

Q. In other words, it logically follows and it can be assumed that in the event a chemical company does not choose to make the herbicide, it could refuse.

MR. BURKE: Objection.

A. My understanding is yes.

Q. In your earlier testimony, you stated, and it was shown in exhibits, that termination letters were distributed on or about December 16th, 1968, for contracts --

A. Or telegrams, I think it was -- it was done by TWX.

Q. Do you recall, thereafter, if any contracts for the Herbicide Orange were negotiated between the Government and any of the chemical companies after December 16, 1968?

A. No, sir, I don't recall any.

Q. Had there been any such negotiations, would you have been involved in each and every one or would somebody else possibly have negotiated?

A. Someone else could have been. I would have been the most likely one, I would say.

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producing Agent Orange or any company producing th components thereof?

A. I don't remember specific cases of any such thing, but I think Miss Lewis did that as a matter of course.

Q. Do you recall her ever indicating such appeal underway?

MS. BOLGER: Objection.

A. Would you repeat the question?

Q. Do you ever recall her specifically saying to you that chemical company A has appealed directive order X?

A. I can't recall any specific instance of that.

MR. TYRRELL: Objection.

Q. If a company was not producing the products required by the Department of Defense, would the Defense Production Act of 1950 as amende require that they begin production if such a directive or rated order was issued?

MR. GOLDSTEIN: Objection. It calls fo a legal conclusion.

MR. TYRRELL: Objection.

Q. You may answer.

A. I can answer it. There was an understanding that I had in those years which I can't define rig now, and can't remember them as to whether a compa be forced to make a given product if they did not normally make it. My recollection is that we coul not.

Q. Sir, you retired in 1970?

A. Two.

Q. And in 1972 was Miss Jane Lewis still working with you?

A. She changed jobs at some time. I can't recal whether it was before I retired or after. She mov to another place in the department.

Q. Would it have been close to 1972 if it was before, do you recall?

A. I would say it would have been that she would have still been in the department through all this period here which goes up to September or October 1968. I don't think she made any move before that

Q. What about between 1968 and 1972, do yc recall?

A. No. That's the area I'm not sure of. She ma have still been there in that time and I don't knc

Q. Sir, you have no specific recollection ever discussing chloracne with Jane Lewis, do you, sir --

MR. GOLDSTEIN: Objection.

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UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NEW YORK

IN RE "AGENT ORANGE" PRODUCT LIABILITY LITIGATION ALL CASES	))))	MDL #381

Aug 23, 84

DELCARATION OF JOHN A. RICHARDS

I, John A. Richards, being duly sworn, depose and state that based on the records, files and documents to which I have access, control and supervision, the following is true to the best of my knowledge, information and belief:

(1) I am Director of the Office of Industrial Resource Administration, an office in the International Trade Administration of the U.S. Department of Commerce. Formerly, we were named the Office of Industrial Mobilization. Since 1968, I have been employed in numerous capacities within this office.

(2) a) The Defense Production Act of 1950, as amended, (50 U.S.C. App. 2061 et. seq.) authorizes the President "to require that performance under contracts or orders (other than contracts of employment) which he deems necessary or appropriate to promote the national defense, shall take priority over performance under any other contract or order, and, for the purpose of assuring such priority, to require acceptance and performance of such contracts or orders in preference to other contracts or orders by any person he finds capable of their performance."

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(b) Executive Order 10480, as amended, 3 CFR 962 (1949-1953 comp.), 50 U.S.C. App. 2153, delegates authority with respect to all materials and facilities except petroleum, gas, solid fuels, electric power, food, transportation, storage, port facilities, and distribution of fertilizer and farm equipment, through the Director of the Federal Emergency Management Agency to the Secretary of Commerce.

(c) Department of Commerce Organization Order 10-3 (45 FR 641, January 25, 1980) provides for the organization and assignment of functions and delegations of authority including certain authorities of the Defense Production Act of 1950, as amended, to the Under Secretary for International Trade.

(d) International Trade Administration Organization and Function Order No. 41-1 (45 FR 11862, February 22, 1980) provides that the Office of Industrial Mobilization shall perform national defense and mobilization functions, including administration of a system of priorities and allocations to guarantee an adequate supply of strategic, critical, and other products and materials for defense and defense-supporting activities authorized by the Defense Production Act of 1950, as amended.

(e) The Defense Materials System Reg. 1, as amended, and Defense Priorities System, Reg. 1, as amended, (recently combined into the Defense Priorities and Allocations System (15 C.F.R. Part 330 et. al.) but previously cited as 32A CFR Parts 621-662) establish an operating system under which allocations and priorities are administered in order to keep defense programs on schedule.

(f) The Department of Commerce in BDC Del. 1 (41 FR 13641) (now Office of Industrial Resource Administration) delegated to the Secretary of Defense authority to place and authorize others to place mandatory acceptance orders.

(g) The above items 2(c) through (f) set forth the delegations of authority under the Defense Production Act of 1950, as amended, within the Department of Commerce, and to the Department of Defense by the Department of Commerce, as they currently exist. During the period September 20, 1966, through September 18, 1968, the following delegations were in effect:

1) Department of Commerce Order 152 (October 10, 1953) 18 FR 6503, as revised 29 FR 5408.

2) National Production Authority Reg. 2, as amended, (March 23, 1953) 18 FR 1684.

3) Defense Materials System Reg. 1, as amended, (December 2, 1959) 24 FR 9595.

4) Business and Defense Services Administration Del. 1, as amended, (May 31, 1960) 25 FR 5788.

(3) a) On September 20, 1966, the Defense Supply Agency, of the Department of Defense, Cameron Station, Alexandria, Virginia, requested assistance from the Business and Defense Services Administration, (now the Office of Industrial Resource Administration), to obtain and accelerate the delivery of the herbicide - defoliant "Orange." 14

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b) In response to this request for special priorities assistance, the Office of Industrial Mobilization on March 24, 1967, issued directives to producers of defoliant "Orange" (Diamond Alkali Company, Dow Chemical, Hercules Incorporated, Monsanto Company, Thompson Chemicals), to accelerate monthly rates of delivery of "Orange." Also the Office of Industrial Mobilization issued directives to Hooker Chemical Corporation, a producer of tetrachlorobenzene and trichlorophenol which are intermediates used to produce "Orange," for shipment of these intermediate chemicals to the above listed defoliant manufacturers and to Uniroyal Ltd. (Elmira, Canada). The above listed United States producers of "Orange" and intermediates used to produce "Orange" were further directed to provide the Department of Commerce with a monthly report of production, shipments against rated orders, inventories, and production capacity for "Orange," and for intermediate products.

c) On September 18, 1968, the above listed producers of defoliant "Orange," and intermediates used to produce the defoliant, were notified that the March 24, 1967 directive requiring shipment of defoliant "Orange" and intermediates was rescinded.

(4) a) Prior to the time in which the cited directives were issued, Department of Commerce officials were aware that the chemical companies mentioned above were already in production of herbicides used for defoliation purposes (See e.g. attached letter of Dow Chemical dated March 29, 1967). 142

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Therefore, the purpose of the directives to those companies were to accelerate production from already existing company production rates to accelerated monthly production rates which met the requirements of the Department of Defense.

b) At the time the Office of Industrial Mobilization issued its directives to each of the producer's of "Orange," the directive required the companies to notify the Business and Defense Services Administration if they were unable to accelerate production as directed. Our files do not reveal that any company, which was directed to accelerate production, appealed to this Department on the basis that the company did not produce "Orange" or could not increase production. Some companies responded that they could comply with the directives if sufficient quantities of production materials were supplied.

I declare under penalty of perjury that the above is true and correct.

Date: August 23, 1984

John A. Richards

JR

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NEW YORK

Aug 30, 84

IN RE "AGENT ORANGE PRODUCT LIABILITY LITIGATION ALL CASES	)

DECLARATION OF ALVIN L. YOUNG

I, Alvin L. Young, being duly sworn, depose and state that based on the records, files and documents to which I have access, control and supervision, the following is true to the best of my knowledge, information and belief:

(1) I am a Senior Staff Scientist (AFSC 2616) with the United States Air Force, currently detailed as Senior Policy Analyst Office of Science and Technology Policy, Executive Office of the President, Washington, D.C. Since 1968, I have served as an expert for the government in areas of science related to the military herbicide Agent Orange. Specific areas of expertise include formulation, equipment design, application, military use, dioxin contamination, environment fate, toxicology and human risks to exposure.

(2) Agent Orange, as formulated and procurred for the Department of Defense, consisted of approximately a 50:50 mixture of the normal-butyl esters of 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid. The product was formulated to contain approximately 8.6 pounds active ingredient (acid equivalents of 2,4-D and 2,4,5-T) per gallon of liquid. Thus the product contained roughly 4 pounds of each herbicide in the acid form.

(3) The herbicides 2,4-D and 2,4,5-T have been commercially available and widely used since the late 1940's. Numerous formulations including the iso-butyl and normal-butyl ester formulations were used commercially in the United States prior to, during, and after the use of Agent Orange in Vietnam. In the 1960 Farm Chemicals Handbook, formulations of the normal-butyl ester of 2,4-D containing 4 and 6 pounds per gallon active ingredient were recommended for weed control in wheat and other field grains. In the same handbook, formulations of the normal-butyl esters of both 2,4-D and 2,4,5-T (as a mixture) were recommended for brush control on rangelands and in reforestation. Typically these latter formulations contained the active ingredient at 4 and 6 pounds per gallon. As late as 1980 normal-butyl esters of 2,4-D were commercially available (DOW ESTERON 76BE) containing 6 pounds (acid equivalents) per gallon.

4. Analyses in the early 1970's of archived samples of commercial formulations of 2,4,5-T and archived samples of Agent Orange showed similar levels of dioxin (2,3,7,8-tetrachlorodibenzo-p-dixoin) contamination (See Young, A.L. et al. 1978. The Toxicology, Environmental Fate, and Human Risk of Herbicide Orange and Its Associated Dioxin, Air Force Technical Report OEHL - 78-92).

(He didn't say anything of substanc

I declare under penalty of perjury that the above is true and correct.

Date: August 30, 1984

Alvin L. Young

Alvin L. Young

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THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN 48640

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August 9, 1967

Albert M. Kligman, M.D., Ph.D.
Department of Dermatology
Hospital of the University of Pennsylvania
36th and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Dr. Kligman:

I have your note of a few weeks ago and apologize for not answering it sooner. We do want you to come to Midland to present a progress report on the work that you have done with the acnegens. At the present time I do not know when will be a good time. I hope we can work it in early this fall. Is there any time when it would be best for you or any time when it would be impossible for you? If you will let me know the answer to these questions, I will do my best to fix a date.

In answer to your question I do not know whether acnegens have been found to be carcinogens and I did not know that carcinogens were potent acnegens. I am very interested, however, and should like to discuss this matter further with you. We're looking forward to your visit.

My best personal regards.

Sincerely yours,

V. K. Rowe
Biochemical Research Laboratory
1803 Building

ks

cc: Correspondence
V. K. Rowe (2)

MOYER FILE MEMORANDUM

TO: RICHARD SCHULER

FROM: JOHN BETTS

SUBJECT: REVIEW OF EXHIBITS AND PRODUCTION DOCUMENTS FROM KEISTER v. DOW IN MARK KRESSENBERG'S OFFICES (JONES & GRANGER LAW FIRM) IN HOUSTON, TEXAS (NOVEMBER 18 - 20, 1991)

DATE: NOVEMBER 28, 1991

This litigation involved the tracking down of the corporations responsible for the worst dioxin disaster in the United States. Dow Chemical, along with Vertac and its Jacksonville, Arkansas predecessor Hercules Powder Company, were named in a lawsuit filed by 183 former workers at the chemical plant and their families. The suit was styled Keister v. Dow and maintained that Dow Chemical, through its ongoing supply of herbicides to Vertac, with the full knowledge of their potentially detrimental effects, shared the guilt for health problems that the workers had suffered.

Back in 1965, at a secret meeting called by Dow Chemical at its Michigan headquarters, Hercules, Diamond Shamrock, and Hooker Chemical met to determine how to handle the mounting adverse health effects caused by the dioxin present in their 2,4,5-T products. The greater problem for these chemical companies was in deciding where they could dump these highly concentrated dioxin wastes being created at several tons per week at each production facility. They decided to place these wastes in 55 gallon drums at the Hercules Jacksonville plant by burying the dioxin-filled drums in unlined pits at the plant site or carting them off to a nearby city dump, where unwitting residents sometimes bought the "used" 55-gallon drums from the dump's manager to burn trash in. Some of the Agent Orange waste was simply hosed into Rocky Branch Creek which ran into a neighborhood to the south.

In the years to come, this process became the worst hazardous waste situation known in the U.S., more serious than Love Canal, N.Y. and Times Beach, Missouri. Babies were dying and adults were succumbing to sudden disease in the three neighborhoods that bordered these sites in Jacksonville, Arkansas. This litigation led to the discovery of gross neglect and mismanagement by federal and state governments and the hidden involvement of multinational corporations and foreign entanglements. Once loyal plant workers and chemists who had aided their companies in these coverups, were now coming forward and testifying to everything that had happened over the years.

In the neighborhood bordering the Jacksonville facility, residents were saying to visitors, "welcome to cancer alley." Jack Park, a 23-year resident of this neighborhood and head of the Herecules chemical laboratory testified that bulk chemicals of the agent orange herbicides were brought in by the train carload from Dow Chemical and also Hooker Chemical (the company responsible for Love Canal). Park, who was tested as having the highest levels of chemicals in his blood, had tried to get a court order to do a door-to-door evaluation of all the neighborhood residents. He pointed to spots in his driveway where hydrochloric acid had eaten away the cement from contaminated rain water. Park said the plant used a pound of hydrochloric acid for every pound of herbicide produced. He pointed out grape plants gnarled and twisted with mutation, and told of his next-door neighbor who was dying of liver cancer.

A 71 year-old resident who had lived two blocks from the plant since 1946 conducted her own survey within a four block radius of her home and discovered from her list of 50 deaths in recent years, most of them had been cancer victims. Another 17 of her neighbors were undergoing chemotherapy and other cancer treatment programs for various forms of cancer. Since no state or federal agency would agree to conduct an official study of the area's cancer rate, local residents were the only monitors.

Hazardous-chemicals expert Dr. Samuel Epstein testified "the only real way to cope with this issue is to have a high-level congressional inquiry that would investigate not only the role of the chemical industry, but also the EPA, the state and the industry's consultants."

Hercules Inc., who had manufactured 25% of the Agent Orange used to defoliate the Vietnamese jungles, was being sued by Vertac Chemical who had run the plant for the last 16 years. Then in an attempt to duck its legal obligations, Vertac suddenly transferred (in 1987) its assets into a series of newly formed corporations and left Arkansas. This is where Dow Chemical entered the picture. Headquartered in Midland, Michigan, with 50,000 employees worldwide, the multinational had for years been both Hercules' and Vertac's main supplier of chemicals, many of which were at one time sold under the Dow label, but manufactured at the Jacksonville plant site. When Vertac pulled out of Arkansas and tried to hide its holdings, Dow counter-sued Vertac for millions in default damages on chemicals they had delivered to Vertac for the continued manufacture of their products. It turns out that Dow, who made $11 billion in global revenues in 1987, was tied in behind the scenes with several jointly-owned chemical companies worldwide, with most of their assets hidden in Swiss holding company accounts. Vertac was an acronym for the names of four chemical companies that had merged in 1976, but initially set up by former executives of Union Carbide. Majority ownership was traced to a wealthy Italian named Vittorio de Nora who made his home in Geneva, Switzerland and had made his fortune in the electrochemical segment of the industry. At a Milan-based company he had established more than 50 years ago, de Nora had pioneered a process used in making chlorine, the basic building block of chlorohydrocarbon herbicides that had been developed by Dow Chemical. To protect themselves from possible patent lawsuits, de Nora set up companies all over the world that could be financially isolated and sat on most of their board of directors. Executives moved back and forth between these major companies held by de Nora including the "big five" in the U.S. which are Dow, Monsanto, Diamond Shamrock, Uniroyal, and

Thompson-Hayward Chemical. Anytime decisions had to be made in the U.S., it was Dow Chemical who called the shots. The major Japanese chemical interests also entered the picture, but this just goes on and on.

When 2,4,5-T herbicides were banned in April of 1970 for most domestic uses and finally banned completely in 1979, Dow simply changed labels and registration certificates and continued to sell the banned products as hidden "inerts" in other companies herbicide products. They also created a new Agent Orange under the label of Esteron 245C herbicide and sold it through their Mexico City facilities to third world countries, who in turn spray these banned chemicals on agriculture products that are sold in most U.S. markets. For a few more years, up until late 1983, Dow slipped their Agent Orange product out under the Esteron 245BE label. Due to an accidentally discovered contaminant batch of this label by a curious midwest distributor, Dow at first tried to hide it from the newly reorganized EPA administrators, and finally had to cease production under the Esteron 245BE label and go to the exported Esteron 245C label.

The documents and exhibits I was able to locate came from 26 "banker file boxes" that were selected by Mark Kressenberg from a warehouse load of total boxes, some in Arkansas, some in Memphis, Tennessee, and the rest in Houston. There were still several key exhibits he wanted me to look at, but the EPA has had custody of many of the boxes while doing their own investigation on Dow Chemical for several months now.

The key exhibits I copied included the original patents for 2,4,5-T by Dow; the actual production formulas used by Hercules and Vertac at the Jacksonville plant and sold under the Dow Label; the minutes of the famous "1965 Country Club Secret Meeting" called by Dow at their Midland headquarters to decide how to deal with the dioxin problem; key Agent Orange litigation documents including experts testimony, the Plaintiff's Memorandum on Causation, and many excellent research papers connecting the role of 2,3,7,8-TCDD with various disease processes including various forms of cancer. Also included are several years of memos and letters between the chemical companies, mostly Dow, trying to decide how to handle their dioxin problem without having it exposed to the media, the public or the EPA. See the attached exhibit list to this memorandum for all the documents I obtained.

high; Regards dioxin as weakly carcinogenic, weakly mutagenic, very fetotoxic and teratogenic, that is with experimental animals;

Frawley will testify to his knowledge of the extreme toxicity of dioxin, his knowledge of the relationship between the manufacturers and the government, and that Hercules itself sold 2,4,5-T to the military in 1965 that contained an average of 3 ppm dioxin; his knowledge of propensities of dioxin to inflict harm long prior to the March 24, 1965 meeting between manufacturers, and the fact that no one at Hercules, to his knowledge, informed the government of the risk involved.

Harold Gill	Manager, Operations, Analytical Laboratory, Dow Chemical, Midland, MI; will testify concerning fact that he was advised in approximately August, 1964 that dioxin was contained in the was stream of TCP manufacturing process at Dow and in the Butyl esters of 2,4,5-T; He developed Dow's analytical method dated 12/22/64, for determining presence of dioxin in caustic insoluble of waste stream of process. Estimated time plaintiffs' examination less than 1/2 day; defendants' exmination unknown, but estimated at one hour or less.
Richard Hickman	Route 4, No. 10 Yocum Road, Rogers, Arkansas, Dow's former government sales manager, deposed 12/1/83, who, between 1963 and 1970 had eight men contacting government selling Dow's products will offer testimony concerning Dow's marketing efforts to sell herbicides to the government, his knowledge of dioxin, failure to warn the government; the Dow sales process and bids for government business; pricing procedure; Transcript of deposition p5-8,ll1-25,p9ll3-25,p10,ll1-2,p11,ll14-25,p1-13,p13,ll2-4,pl18-25,pp15-21,ll1-25,p22,ll1-15,&23-25,p23,ll1-25,p24,ll1-3,25,ll21-25,pp26-64,ll1-2

5,p65,ll1-22,p68,ll16-25,p69,ll1-6,p70,l1.

Benjamin B. Holder	5203 Bloomfield St., Midland, Michigan; Dow's Medical Director; to testify as to knowledge of chloracne incidents at Dow before, during and after 1964; contentions re; notification of "appropriate" governmental officials; his opinion that there has not been demonstrated a "no minimum effect level" in dioxin exposure, and, adversely under cross, on causation theories; failure to warn; knowledge of toxicity of TCDD.
Harry Holland	1604 Angus Court, Crafoward, Maryland; Friend of Lambiotte's; health and damages witness; testimony 1 hour total.
F. Gerard & Vada Hukill	220 W. Tyler, Magnum, OK,73554; Danny Jordan's in-laws, will testify as to effect of Dan's injuries and those of his children; approximate total testimony 2 hours.
John Jennings	Apt.B, 12 Lansdowne Avenue, Lansdowne, Pa.,High School friend of George Ewalt who was in Vietnam at same time and knows his medical problems will testify to exposure on damages issues; total testimony 1 1/2 hours.
Lynne Keller	208 Brasewood, Austin, Tx 78704; Friend of Danny Jordan's who will testify to health and damages issues; total length of testimony 1 1/2 hours.
Van A. Kelly	Attempting to locate, in Philadelphia, Pa., was with Ewalt in Vietnam will testify concerning exposure and damage issues; total estimated length of testimony 2 hours.
Eugene R. Kenaga	1281 N. Wagner Road, Essexville, Michigan; Dow employee re environmental persistence, toxicity; knowledge of dioxin and herbicides in the environment; failure to warn;

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	as Director of Laboratories and Licensing; Ph. D. in chemistry; Director of Development from 1964 through mid-'70s. Will testify to his knowledge of 2,4,5-T and that it contained dioxin. Claims to have no knowledge of cooperation between Hercules and Dow re testing of dioxin; Examination by plaintiff, less than 1/2 day; examination by defendants brief, perhaps less that 1 hour.
Taves, Milton Arthur	210 N. Spring Road, Wilmington, Delaware; Personal services contract with Hercules; Organic chemist, Ph. D.; research manager of synthetics research division for 16 years, beginning in 1964; The question of detecting and measuring the amount of dioxin in 2,4,5-T first came to his attention in March, 1965. He directed the work of John Ford. Never communicated with other companies or with the government regarding the dioxin contamination problem; will testify as to keeping the government ignorant of their own testing inadequacies which was to advantage of Hercules; knew that government did not know of dioxin and avoided telling them; Plaintiffs' examination approximately 1 hour; defendants examination estimated at 1/2 hour or less.
Treisback, Arthur L.	2502 Landon Drive, Chalfonte, Wilmington, Delaware; Deposition not yet completed and transcript not yet received. Jacksonville, Arkansas Plant Manager for Hercules 1968-72; Chemical engineer; Testimony concerning Hercules' manufacture of 2,4,5-T, Agent Orange, phenoxy herbicides, generally concerning his knowledge of dioxin, toxicity and health hazards; detection and reduction methods; sales to the government.
Leng, Marguerite	1714 Sylvan Lane, Midland, Michigan: Research Associate, Dow Chemical; Will testify concerning the

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registration process and department at Dow; her responsibilities working with Donald D. McCollister, and what information the Company did and did not afford the Federal Government concerning the toxicity of herbicides and dioxin; Reference her deposition; stated in one document that "our not informing the government is what got us into all this trouble in the first place." Total length of testimony less than 1/2 day.

Silverstein, Larry	5409 Mason Street, Midland, Michigan: Employed by Dow in the capacity of an Industrial Hygienist from 1955 to 1979, when he left to become the Manager of Industrial Hygiene for Dow Corning Corporation; was an Industrial Hygienist that attended a great many "Exciter problem" meetings at Dow referrable to the dioxin contamination of the 199 building and the dioxin contamination of 2,4,5-T and Agent Orange; Was the author of numerous documents identified as exhibits including minutes of the March 24th, 1965 meeting at Dow among Industry representatives at which the toxicity of dioxin was discussed, a document entitled "Hazards of Monsanto T-acid" and others; plaintiffs believe Mr. Silverstein should be ordered produced as an employee in view of the substantial control and connection maintained over him by Dow as an owner of the Dow Corning Company, by whom Mr. Silverstein claims to be employed. Has substantial factual knowledge of the events of 1964,65 and beyond relative to health problems, the actions of the co-workers at Dow, and claimed contacts with governmental "authorities" in the form of State of Michigan officials, and alleged attendees at medical conferences at the University of Michigan from time to time. Total length of testimony 1/2 day.

Donald McCollister	5522 Whitehall Street, Midland, Michigan; now Director International Regulatory Affairs, Health and Environmental Sciences for Dow Chemical Company; has been employed by Dow since 1942 when he was hired as an organic chemist and was part of the Toxicology Research Laboratory until 1967 and thereafter dealt in the registration process with respect to the relevent herbicides; was the immediate supervisor of Ms. Marguerite Leng; has expertise in toxicology of herbicides and facts concerning what information was given to the United States Government from time to time; expected length of plaintiffs' examination is less than one half day and expected length of defendants' examination less than one quarter day.

DONALD HORNIG	16 LONGFELLOW PARK, CAMBRIDGE, MASS. Special Assistant to the President for Science and Technology and Director of the Office of Science and Technology in the Executive Office. Also Chairman of Federal Counsel for Science and Technology and Chairman of PSAC (1964-69). Did not understand health hazards of dioxin in the mid-60's. Not generally discussed. Whether this witness is produced live or through deposition excerpts awaits ruling of Court.
PAUL DOTY	4 KIRKLAND DRIVE, CAMBRIDGE, MASS. Assigned to PSAC's Pesticide Panel and Chaired the Civil Defense Panel. From 1965 to 1970, was a consultant for arms control and disarmament to the National Security Counsel. Whether this witness is produced live or through deposition excerpts awaits ruling of Court.
MELVIN CALVIN	2683 BUENA VISTA WAY, BERKELEY CALIF. Dow Chemical company Director who learned of dioxin in 1964 or 1965 at a Board of Directors' meeting. The subject was never discussed at PSAC, however. Whether this witness is produced live or through deposition excerpts awaits ruling of Court.
FRED FALANA	Address to come; as a member of Danny Ford's unit, Fred Falana will testify to the various locations which their unit was assigned, including recently defoliated areas traveled to by vehicle and often by foot, as well as the conditions of their unit in these various locations in Vietnam. Less than 1/2 day total testimony.
CAPT. FARMER	Address to come; Captain Farmer will testify to the assigned locations of Danny Ford's unit, including the defoliated areas

Plaintiffs respectfully submit the following list of witnesses to be presented for the use of deposition testimony in conformity with paragraph IV(E)(2) of the Magistrate's Pre-trial Order No. 17.

Graydon Holdeman	2006 Manor Drive, Midland, Michigan; retired employee, receives pension from Dow; last employed Feb. 28, 1977; plaintiffs' reserve the right to demand the production of this witness at trial; relevant testimony concerns the development of the product specifications for the herbicides by Holdeman at Dow, the similarity between the so-called government specifications, the fact that industry actually developed the specifications for the basic herbicides; in the event the testimony is presented by deposition, transcript of Nov.30, 1983, p5,ll14-25,pp6-37,ll1-25,p38,ll1-8,p39,ll19-25,p40,ll8-22,p41,ll2-25;p42,ll1-1-22;p43,ll4-25;p44,ll1-9&22-23;pp45-54,ll1-25;p55,ll18-25;pp56-62,ll1-25;p63,ll1-15;p64,ll8-25;pp65-86,ll1-25;p88,ll21-25;p89,ll1-3;p90,ll13-24;p92-ll3-25;p93ll1-4,10-25;p94,ll1-25;p95,ll1-25;p96,l&19-25;p97,ll1-15;p98,ll3-25;pp99-109,ll1-25;p110,ll1-24;p112,ll9-25;pp113-156,ll1-25 (objections to be ruled upon).
Lawrence Eugene Dotson	c/o Foote Mineral Company, Kings Mountain, North Carolina (residence address not available through transcript); Lawrence Dotson was the Technical Services Engineer at Nitro from 1961 through 1965, and was the Production Supervisor, supervising the 2,4,5- T plant from 1965 through 1967. He was employed by Monsanto from 1958 through 1969. During the time that he - Production Supervisor, h responsible for production yi

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Never heard of anyone in Monsanto ever informing the Govt. up until 1970 of the potential hazards of 2,4,5-T.
He proposed a program in 1965 to reduce the amount of dioxin in 2,4,5-T and this was tested in January of 1969.
Dioxin is extremely toxic and he has felt that way since he first heard of dioxin. He wrote to certain personnel that dioxin was highly toxic, advised people to use extreme caution in handling it.
Attended a meeting at Dow with Elmer Wheeler and John Mason in 1970. The meeting was concerned with dioxin and potential risk associated with dioxin and Dow's desire to have an industry effort to study the program.
At a meeting in January of 1969 Udell acknowledgd that if you made the product safer and reduced the dioxin it would take longer to produce and Monsanto would get less of it. He said that the decreased production is the price that must be paid for the decreased dioxin conentration.
Transcript of May 4, 1983; p6,ll13-25;p7,ll13-17;p8,ll4-18;p10, ll2-20;p13,ll3-25;p14,ll5-14&22-25;p 17,ll15-25;p18,ll1-13;&21-25;p19,ll1 1-25;p20,ll1-22;p22,ll1-19;p23,ll18- 25;p24,ll1-5;p25,ll19-25;p26,ll1-2&1 5-25;p27,ll5-25;p28;p29,ll1-8;p32,ll 16-25;p33,ll1-7;p34,ll18-24;p35,ll13 -24;p36,ll15-25;p37;p38,ll1-18;p39,l l11-25;p40,ll1-4&8-11;p41,ll102-5;p4 2,ll1-19;p43,ll13-25;p44,ll1-15&19-2 1;p45,ll21-25;p46,ll1-8;p46,ll18-25; p47;p48,ll1-6&13-17&22-25;pp49-50;p5 1,ll1-3&7-14&16-25;p52,ll1-10;p52,l2 5;p53,ll1-22;p55,ll18-23&25;p58,ll1- 3&5-19;p60,ll4-9&19-25;p61,ll1-3&20- 25;p62,ll1-6;p65,ll12-25;p66,ll1-7,p 67,ll6-23;p68,ll2-25;p69,ll17-23;p70 ,ll14-20;p71,ll13-19;p72,ll3-6;p72,l l12-25;p73,ll1-8&22-23;p74,ll19-25;p 76,ll15-25;p77,ll1-12;p78,ll9-11&22- 25;p79,ll1-5;p84,ll10-15&19-25;p85,l l5-18;p89,ll24-25;p90,ll1-16;p92,ll7 -25;p93,ll1-12&18-25;p94,ll3-10;p95,

ll13-18;p97,ll10-25;p98,ll1-7&19-25;p99,ll1-2&20-23;p100;p101,ll1-15;p103,ll3-6&12-25;pp104-106;p107,ll1-5;p108,ll9-10&18-22;p109,ll1-21;p110,ll4-15;p112,ll1-4&7;p114,ll2-3&6-10;p115,ll11-13&16;p116,ll9-25;p117;p118,ll3-7;p119;p120,ll1-5;p122,ll13-19;p128,ll14-24;p129,ll13-28;p130,ll14-22;p124,ll16-24;p135,ll2-6;p137,ll12-15;p144,l25;p145,ll1-23;p146,ll20-25;p147,ll2-16;p150,ll3-23;p156,ll1-16&20;p158,ll15-20;p165,ll2-16;p167,ll14-21;p174,ll18-24;p178,ll10-22;p185,ll3-13&19-25;p186,ll2-12;p187,ll19-25;p188,ll2-8;p202,ll20-25;p203,ll1-9;p204,ll6-25;p205,ll1-10;p206,ll24-25;p207,ll1-4;p209,ll7-12;p210,ll1-6.

Charles P. Zorsch

Route5 Box 30, Pacific, Missouri
Born - April 20,1910
Employed by Monsanto for 21 years 1950-1971. He receives $288/month as a lifetime pension from Monsanto.
He was Assistant Manager of Pesticides from1950-1960. Manager of Formulated Pesticides Sales, including 2,4,5-T and 2,4-D from 1960 - 1963.
From 1963-1970 he was the Product Supervisor, Agricultural Division. He was supervisor of 2,4,5-T and 2,4-D sales.
Never heard of chloracne problems at Nitro until latter 1960's. But never asked anyone either what happened at Nitro in 1948 or what the causes of the worker health problems were.
Never knew what chloracne was at Monsanto for 20 years.
It was Quality Control's obligation to inform a customer if any product that was sold contained a contaminant.
Cecil Russell was his superior. Dr. Hoffman was the Manager of the Division.
The sole products he was resonsibile for as product supervisor from 1963 to 1970 were 2,4,5-T and 2,4-D.
Quality Control was responsible for the quality of the product.
New Agent Orange as being used in Vietnam and assumed U.S. Govt. was

employee; He also wanted to sell Tordon as opposed to Agent Orange for the reason that Tordon was a patented Dow product; Deposition transcript of Novwember 16, 1983;

p.5,111-2&15-17;p.6,116-11;p.10,1120-25;p.11,111-25;p.12,1121-24;p.17,1119-25;p.18,111-25;p.19-111-4;p.20,1110-25;p.21,111-5&8-19&22-25;p.22,111-15&18-25;p.23,111-7&10-13;p.24,116-9&11-14&23-25;p.25,111-11&15-25;p.26,111-25;p.27,111-4&6-8&15-25;p.28,1113-24;p.29,111-7&10-16&18-20&22-24;p.30,111-6&8-18,20&25;p.31,111-11;p.32,1121-25;p.33,111-2&3-6&8-12&19-21&23-25;p.34,111-5&10-14&25;p.35,111-2&5-7&9-10&12-13&16-17&20-21;p.37,1115-18&20&21-15;p.38,111-8&11-13&16&17&19-20;p.39,1124-25;p.40,111&3-7&9;p.42,116-9&11-15&17-20&22;p.46,1122-24;p.47,111-9&12-15&18-25;p.48,111-8&10-19&21-24;p.49,111-4&6-13&16-19&22-24;p.50,111-2;p.53,1111-12&17-20&23-25;p.54,111-3&6-13;p.55,115-7&10-16&17-18&23-25;p.56,11;p.62,1124-25;p.63,111-11&17-19&22-24;p.64,111-4&5-9&11-12.

Ray D. Holmes

11021 Abbot Avenue, Sun City, Arizona: Supervisor of Building 199 at Dow Chemical, Midland Michigan, from approximately 1938 to 1965, which manufactured sodium trichlorophenate, a precursor chemical to 2,4,5-Trichlorophenol; he will testify as to the process used at Dow for manufacturing 2,4,5-Trichlorophenol,and to the certain manufacturing changes which took place at the Dow Chemical Company with regard to the TCP it produced; the changes increased the temperature and pressure of the reaction and, as a result, increased the amount of diosin in the waste stream and in the end product; Holmes will testify that he and others in the 199 building contracted chloracne and to the steps that were taken to sanitize the building after the contamination was discovered in 1964; excerpts from the deposition of March 23,

producing Orange and says perhaps he did see documents which indicated that. Russell was "possibly" involved in writing the specifications. Acknowledges that Russell "perhaps he could have" indicated to him that Russell was so involved. Does not remember when he approved the specifications whether he compared the Government specifications and the Monsanto specifications. Doesn't recall whether the specifications call for production of dioxin. If he knew that following specifications would have produced an acutely toxic by-product, the production would not have been approved.
Transcript of January 20, 1984:
p.49 L. 6-25; p.46 L. 1-8; p.52 L. 22-25; p.53 L. 1-16; p.54 L. 7-20; p.57 L. 3-25; p.58 L. 1-15; p.59 L. 12-25; p.60 L. 1-25; p.61 L. 1-2; p.61 L. 21-25; p.62 L. 1-5; p.63 L. 12-25; p.64 L. 1-25; p.65 L. 1-25; p.66 L. 1-23; p.67 L. 6-25; p.68 L. 1-25; p.69 L. 1-25; p.70 L. 1-24; p.72 L. 13-25; p.73 L. 1-25; p.74 L. 1-25; p.75 L. 1-25; p.76 L. 1-25; p.77 L. 21-25; p.78 L. 1-25; p.79 L. 1-4; p.81 L. 15-25; p.82 L. 2-25; p.83 L. 1-25; p.84 L 1-24; p.86 L. 1-25; p.87 L. 1-25; p.88 L. 1-25; p.99 L. 9-18; p.101 L. 2-22; p.103 L. 19-25; p.104 L. 1-25; p.105 L. 1-8.

Warren Crummett (D)

808 Crescent Drive, Midland, Michigan; Dow scientist; evidence concerning Dow liability issues. Time constraints have made it impossible to abstract the deposition of Mr. Crummett; Leave is asked to include excerpts in amended Pretrial Order.

William F. Falsey (D)

6706 Lakeview Drive, Lake City, Michigan; Time constraints have made it impossible to abstract the deposition of Mr. Falsey; Leave is asked to include excerpts in amended Pretrial Order.

George C. Kempson

143 South Gore, Webster Groves,

work for our department." Job was to try to develop new areas of government business, and did so. Aware of the manufacture and development of 2,4,5-T. Involved in testing of 2,4,5-T for brush control purposes. Claims not to have been aware of dioxin, and attended meetings with government representatives during relevant periods; Traveled to Washington, D.C., Edgewood Arsenal and Saigon regarding government's use of defoliants, and recommended use of Tordon to U.S.; Believed Tordon less toxic than 2,4,5-T; Never told any government employee about health problems among workers at Dow in the 2,4,5-T plant; Excerpts of the transcript of December 13, 1983, include p. 12,LL2-16; p.13, LL8-15&21-25;p.14,LL1-3;p. 15, LL6-10;p. 16,LL13-16;p.17, LL21-15; p.18,LL1-17;p.20, LL4-22, p. 5, LL.5-25; p.22, LL.1-25; p. 23, LL1-25; p. 24,LL1-25; p.25, LL1-25; p.26, LL1-26;p.27, LL1-25; p.28, LL1-25; p. 29,LL 1-25; p.30,LL1-25; p.31, LL1-21;p.33, LL9-25; p.34, LL1-4;p.35, LL20-25; p.36, LL1-5.

William Ralph Nummy

711 West Meadowbrook Drive, Midland, Michigan; former employee of Dow, now works for a company known as Doan Resources Company; worked for Dow Chemical for over 30 years, leaving as Vice-President of Merrell Dow Laboratories in Cincinnati; Excerpts from the deposition of October 28, 1983 that may be used include; p.7, LL8-22;p.8, LL2-13&19-25;p.,9,LL 1-25; p. 10, LL1-2;p.11, LL4-16&24-25;p.15, LL8-21; p. 16, LL 13-25; p. 17, LL1-1-8&14-25; p. 18, LL1-25; p. 19, LL 1-15; p.27, LL5-25; p.28, LL 1-25; p. 29, LL 1-8&17-21; p.30, LL1-11; p.33, LL9-11&21; p.34 LL 9-13&17-18; p. 44, LL10-23; p. 45, LL11-14, 16-19; p. 46, LL24-25; p. 47,LL1-24; p. 48, LL 1-15, 25; p.49, LL 1-25; p. 50, LL 1-12 & 16-25; p. 51, LL 1-10 & 13,24,25; p. 52,LL 1-14; p. 53, LL 25; p. 54, LL5-6 &

	56, all; p 57, all; p 58, all; p 59, all; p 60, L 1-16; p 61, L 5-8; 63, L 12-25; p 64, L 1-22; p 65, L 15-25; p 67, L 23-4; p 68, L 1-2, 24-25; p 69, all; p 70, L 1-11; p 81, L 9-17; p 132, L 8-24; p 134, L 1-25; p 135, L 1-25; p 136, all; p 137, all; p 138, all; p 139, L 1-15.
Melvin Calvin	2683 Buena Vista Way, Berkeley, CA. Deposed on November 9, 1983, and December 2, 1983. A Nobel Prize winning chemist who was both a member of PSAC from 1963-66, and a member of the Dow Board of Directors from 1964-75. As a member of the Dow Board he was informed in 1964-65 that dioxin was in the Dow 2,4,5-T. However, never revealed this information to PSAC since he was never asked. P 25, L 3-25; p 28, L 16-25; p 29, L 1-25; p 30, L 1-22; p 38, L 7-25; p 39, L all; p 40, all; p 45, L 6-25; p 46, L 20-25; p 47, L 1-7; p 49, L 18-25; p 50, all; p 51, all; p 52-54, all; p 55, L 1-20; p 67, all; p 68, L 1-9; p 84, L 10-25; p 85, L 1-16; p 89, L 9-20; p 93, L 10-13, 19-25; p 98, L 14-22; p 99, L 21-25; p 100, L 2-22; p 101, L 8-11; p 118, L 17-25; p 119, L 3-25; p 122, L 18-22; p 128, L 16-22; p130, L 8-19, 25; p 131, L 1-16, 19-25; p 133, L 18-21, 23-25; p 134, L 18-25; p 135, L 1-5; p 143, L 2-7; p 164, L 15-25; p 168, L 19-25; p 169, all; p 170, L 1-2; p 173, L 9-25.

°Treating Physicians of Plaintiffs:

Dr. Gianferro	Treating physician for George Ewalt
Dr. El Child	Treating physician for George Ewalt
Dr. George Wilson	""""
Dr. Joan Hurlock	"
Dr. Salkind	"

TABLE 4-2

Locations of Major Producers of Chlorophenols and Their Derivatives[a]

CHEMICAL	PRODUCER
2,4-D acid and esters	Alco Chem. Corp., Philadelphia, PA[b]
	*Amvac-Chem. Corp., Los Angeles, CA
	Chempar, Portland, OR
	*Diamond Shamrock Corp., Tuscaloosa, AL
	Cleveland, OH
	*Dow Chemical, U.S.A., Midland, MI
	Fallek-Lankro Corp., Tuscaloosa, AL
	GAF, Linden, NJ
	*Guth Corp., Hillside, IL
	Hercules, Inc., Jacksonville, AR
	Imperial, Inc., Shenandoah, IA
	Miller Chem., Whiteford, MD
	Monsanto, Co., Sauget, IL
	North American Phillips Corp., Kansas City, KS
	*PBI-Gordon Corp., Kansas City, KS
	Rhodia, Inc., Portland, OR
	St. Paul, MN
	St. Joseph, MO
	*Rhone-Poulenc, Inc., Portland, OR
	*Riverdale Chem. Co., Chicago Heights, IL
	Rorer-Amchem, Fremont, CA
	St. Joseph, MO
	Thompson Chemical, St. Louis, MO
	Union Carbide Corp., Ambler, PA
	*Velsicol Chem. Corp., Beaumont, TX
	Bayport, TX
	Vertac, Inc., Jacksonville, AR
	Woodbury, Orlando, FL
2,4,5-T	Chempar, Portland, OR
	Diamond Shamrock, Cleveland, OH
	*Dow Chem., U.S.A., Midland, MI
	Hoffman-Taft, Inc., Springfield, MO
	Monsanto Co., Sauget, IL
	North American Phillips Corp., Kansas City, KS
	PBI-Gordon Corp., Kansas City, KS
	Rhodia Inc., Portland, OR
	St. Joseph, MO
	*Riverdale Chem. Co., Chicago Heights, IL
	Rorer-Amchem, Ambler, PA
	Fremont, CA
	St. Joseph, MO
	Jacksonville, AR

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TABLE 4-2 (cont.)

CHEMICAL	PRODUCER
2,4,5-T (cont.)	Thompson Chem., St. Louis, MO
	Union Carbide Corp., Fremont, CA
	St. Joseph, MO
	Ambler, PA
	Vertac, Inc., Jacksonville, AR
2,4,5-T derivatives	*Dow Chem. U.S.A., Midland, MI
Silvex esters and salts	Hercules, Inc., Jacksonville, AR
	North American Phillips Corp., Kansas City, KS
	*Riverdale Chem. Co., Chicago Hts., IL
	Vertac, Inc., Jacksonville, AR
Ronnet	*Dow Chem. U.S.A., Midland, MI
Erbon	*Dow Chem. U.S.A., Midland, MI
Hexachlorophene	Givaudan Corp., Clifton, NJ
2,4,5-TCP and salts	Diamond Shamrock Corp., Cleveland, OH
	Dow Chemical, U.S.A., Midland, MI
	GAF Corp., Linden, NJ
	Hercules, Inc., Jacksonville, AR
	Hooker Chem., Niagara Falls, NY
	Merck and Co., Inc., Rahway, NJ
	Nalco Chem. Co., Chicago, IL
	North Eastern Pharmaceuticals, Verona, MO
	Roberts Chem., Inc., Nitro, WV
	Rhodia, Inc., Monmouth Junction, NJ
	Vertac, Inc., Jacksonville, AR
2,3,4,6-tetrachlorophenol	*Dow Chem. U.S.A., Midland, MI
	Sanford Chem., Port Neches, TX
PCP and salts	J.H. Baxter and Co., San Mateo, CA
	Dow Chem. U.S.A., Midland, MI
	ICC Industries, Inc., Dover, OH
	Monsanto Co., Sauget, IL
	Nalco Chem. Co., Chicago, IL
	*Reichhold Chem., Inc., Tacoma, WA
	Sanford Chem., Port Neches, TX
	*Vulcan Materials Co., Wichita, KS

[a]Sources: Esposito et al., 1980; SRI, 1982; U.S.I.T.C., 1982

[b]Company names indicated with an asterisk are the major producers of chlorophenols and their derivatives at the present time.

IN THE CIRCUIT COURT OF THE NINTH JUDICIAL CIRCUIT OF FLORIDA, IN AND FOR ORANGE COUNTY.

CASE NO: CI 89-8657
DIVISION: 32 PFEIFFER

ROBERT W. MOYER, II and
KIM MOYER, his wife,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY,
et al.,

Defendants.

<u>THE DOW CHEMICAL COMPANY'S RESPONSE TO PLAINTIFFS' REQUEST FOR PRODUCTION OF DOCUMENTS TO ALL DEFENDANTS</u>

1. If you supplied any 2,4-D, 2,4,5-T, Diquat, Hydrothal or Silvex to Orange County during the years 1974 through 1977, please produce the following:

a. All documents pertaining to your purchase of said chemicals from the manufacturer or intermediate supplier;

b. All invoices for said chemicals;

c. All correspondence between the manufacturer and your company;

d. All documents pertaining to your sale of said chemicals to Orange County, Florida;

e. Any complaints received by you regarding the above chemicals, or any documents evidencing any dissatisfaction in any way whatsoever with the above chemicals;

f. All documents forwarded to you by the manufacturer regarding the above chemicals, the use of such chemicals, the application of such chemicals, the warnings on such chemicals, or related to any defects in such chemicals that were sent to you at any time whatsoever and not limited to the four (4) years set forth above;

g. any manuals, instruction sheets, informational sheets, labels or other documents pertaining to the use, application, effectiveness, instructions, or composition of said chemicals.

ANSWER: The Dow Chemical Company ("Dow") objects to this request on the grounds that it is overly broad, unduly burdensome and not reasonably calculated to lead to the discovery of admissible evidence to the extent that it seeks information concerning 2,4,5-T, which plaintiff has not alleged that he was exposed to or injured from in his complaint and to the extent it requests information about Diquat and Hydrothal, which Dow never manufactured. Without waiving these objections, Dow states that it does not have any records indicating it sold products to Orange County during the years 1974-1977.

2. If you are a manufacturer as opposed to a supplier, please produce the following for the years 1974 through 1977 pertaining to 2,4-D, 2,4,5-T, Diquat, Silvex or Hydrothal:

a. All documents pertaining to your manufacturing of said chemicals;

ANSWER: Dow objects to this request on the grounds that it is vague, ambiguous, irrelevant, overly broad and unduly burdensome.

b. All invoices or documents pertaining to the sale of said chemicals;

ANSWER: Dow objects to this request on the grounds that it is irrelevant, ambiguous, overly broad, unduly burdensome and is not limited to geographical location. Without waiving this objection, Dow refers the plaintiffs to its Response to Request No. 1.

c. All correspondence between the supplier or your wholesaler and your company;

ANSWER: Dow sold its products to a large number of independent wholesalers and distributors throughout the country during the time period in question. Therefore, Dow objects to this request on the grounds that it is irrelevant, immaterial, overly broad and unduly burdensome.

d. All documents pertaining to your sale of said chemical to your supplier or wholesaler or other entity;

ANSWER: See response to Request 2c.

e. Any complaints received by you regarding the above chemicals or any documents evidencing any dissatisfaction in any way whatsoever with the above chemicals;

ANSWER: See Dow's Response to Plaintiffs' Request for the Production of Documents to Dow, Number 25.

f. All documents forwarded by you dealing with the application of said chemicals, the warnings on such chemicals, or relating to any defects in such chemicals or the use of such chemicals that were sent out at any time whatsoever and not limited to the four years set forth above;

ANSWER: See Dow's Response to Plaintiffs' Request for the Production of Documents to Dow, Number 21.

g. Any manuals, instruction sheets, informational sheets, labels, or other documents pertaining to the use, application, effectiveness, instructions or composition of said chemicals.

ANSWER: See Dow's Response to Plaintiffs' Request for the Production of Documents to Dow, Nos. 21 and 22.

Dated: Uniondale, New York
May 29, 1990

Respectfully submitted,

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IN THE CIRCUIT COURT OF THE 15TH
JUDICIAL CIRCUIT OF FLORIDA, IN
AND FOR PALM BEACH COUNTY.

CASE NO. CL89-97-AD

ROBERT W. MOYER, II and
KIM MOYER, his wife,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY,
CHEVRON CHEMICAL COMPANY
ORTHO AGRICULTURAL CHEMICALS
DIVISION, AGCHEM DIVISION -
PENNWALT CORPORATION,
HELENA CHEMICAL COMPANY
SOUTHERN MILL CREEK PRODUCTS
CO., INC., THE UPJOHN COMPANY,
ASGROW FLORIDA COMPANY, a
subsidiary of the UPJOHN COMPANY,
WOODBURY CHEMICAL COMPANY, FUTURE
HORIZONS, INC., LANDIA CHEMICAL
CO., JLB INTERNATIONAL CHEMICAL,
INC., THE MONSANTO COMPANY,
DIAMOND SHAMROCK, INC.,

Defendants.

THE DOW CHEMICAL COMPANY'S RESPONSE TO
PLAINTIFFS' FIRST SET OF INTERROGATORIES TO DOW

General Objections

The Dow Chemical Company ("Dow") objects to each interrogatory to the extent it seeks information regarding 2,4,5-T since plaintiffs' complaint does not allege exposure to that chemical. Dow also objects to each interrogatory to the extent it requests information relating to products which Dow never manufactured, specifically Diquat and Hydrothal.

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1. Please give the name, official position, address, duties and responsibilities, and longevity with the company of the person or persons answering these interrogatories.

ANSWER: David G. Wilkins
Attorney
DOWELANCO
Indianapolis, Indiana

2. Has Dow Chemical Company ever manufactured 2,4-D, 2,4,5-T, Hydrothal, Silvex or Diquat? If so, please state the following:

ANSWER: See General Objections. Without waiving that objection, Dow states that it has manufactured 2,4-D and Silvex products.

A. Over what period of time and at what location or locations?

Dow objects to this interrogatory on the grounds that it is not reasonably calculated to lead to admissible evidence since the manufacturing location is irrelevant and because it is not limited to a relevant time period. Without waiving these objections, Dow states that it manufactured 2,4-D and Silvex during the 1974-77 time period.

B. Were any of these chemicals ever sold to Orange County, Florida, and if so, please list the dates, quantities sold, and prices of sale.

Dow objects to this interrogatory on the grounds that it is overly broad in that it is not limited to the relevant time period. Without waiving this objection, Dow states that it has no record of having sold any of the listed chemicals/products to Orange County during the years 1974-77.

C. If you did not sell directly to Orange County, Florida, have you sold any one or all of these chemicals to any retailers or wholesalers located within the State of Florida and, if so, please list the names, dates, and quantities of sale.

Dow objects to this interrogatory on the grounds it is overly broad and unduly burdensome and is not limited to a relevant time period.

3. If you have not manufactured 2,4-D, 2,4,5-T, Silvex, Hydrothal, or Diquat, did you ever purchase any of those chemicals for resale?

A. From whom did you purchase these chemicals, giving names of the manufacturer, names of any intermediate supplier, dates of acquisition, amounts purchased, and cost.

B. Did you ever sell said chemicals directly to Orange County, Florida and, if so, give dates of sale, amount of chemical sold, and price of sale.

C. Have you ever sold these chemicals to any other supplier or wholesaler who in turn furnished these chemicals to Orange County, Florida? If so, please state the names of the companies, the amount of chemicals sold, the dates of sale, and the dollar value of sales.

ANSWER: Dow is unaware of ever having purchased Hydrothal or Diquat for purposes of resale.

4. Have you ever published or printed any warnings regarding the use or application of the chemicals 2,4-D, 2,4,5-T, Silvex, Hydrothal and Diquat? If so, please attach copies of said warnings to these Answers to Interrogatories.

ANSWER: Dow objects to this interrogatory on the grounds that it is overly broad and unduly burdensome and is not limited to a relevant time period. Dow further objects on the grounds that plaintiffs have not identified any specific Dow 2,4-D product or Silvex product upon which Dow can respond. Dow reserves the right to supplement these responses when and if plaintiffs identify specific Dow products.

5. Please identify each and every claim, lawsuit and/or dispute in which you have been involved concerning the above chemicals since the year 1967.

a. Please state the caption of every claim, lawsuit and/or dispute listed in the above question along with the case number;

b. Please state where every claim, lawsuit and/or dispute listed above was filed and the date it was filed.

ANSWER: Dow objects to this interrogatory on the grounds that it is overly broad, unduly burdensome, is not limited to a relevant time period and is not reasonably calculated to lead to the discovery of admissible evidence. Dow further objects to this interrogatory to the extent it seeks information concerning chemicals and/or products not manufactured by Dow.

6. Please identify each and every expert witness used in any prior lawsuit who has given either deposition or trial testimony involving the chemicals 2,4-D, 2,4,5-T, Diquat, Silvex and Hydrothal, including their name, address and telephone number.

ANSWER: Dow objects to this interrogatory on the grounds that it is irrelevant, immaterial, overly broad, unduly burdensome, is not limited to a relevant time period, is unintelligible and is not reasonably calculated to lead to the discovery of admissible evidence. Dow further objects to this interrogatory to the extent it seeks information concerning chemicals and/or products not manufactured by Dow.

7. Please identify by name, position, address, telephone number, and length of time of service with your company the following:

a. Each and every person who has ever testified on behalf of your company while an employee with you in any case involving a claim of defect or any other problem with 2,4-D, 2,4,5-T, Silvex, Hydrothal or Diquat. Testimony means by way of deposition or trial testimony.

ANSWER: See response to Interrogatory No. 6.

Dated: Uniondale, New York
May 29, 1990

Respectfully submitted,

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IN THE CIRCUIT COURT OF THE NINTH JUDICIAL CIRCUIT OF FLORIDA, IN AND FOR ORANGE COUNTY.

CASE NO: CI 89-8657
DIVISION: 32 PFEIFFER

ROBERT W. MOYER, II and KIM MOYER, his wife,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY, et al.,

Defendants.

THE DOW CHEMICAL COMPANY'S RESPONSE TO PLAINTIFFS' REQUEST FOR PRODUCTION OF DOCUMENTS TO DEFENDANT, DOW CHEMICAL COMPANY

General Objections

The Dow Chemical Company ("Dow") objects to each of plaintiffs' requests for production of documents to the extent it seeks documents or information related to products which Dow never manufactured, specifically Diquat and Hydrothal. Dow also objects to each request to the extent it seeks information regarding 2,4,5-T on the grounds that plaintiffs' complaint does not allege that plaintiff was exposed to or injured by 2,4,5-T.

1. Any and all letters, memoranda, documents or writings of any character made by DOW CHEMICAL COMPANY toxicologists or other employees relating to any toxicological organic chemical research, inquiries, investigations or studies in connection with the

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formation and/or manufacturing of 2,4-D, Silvex, Hydrothal, Diquat or 2,4,5-T prior to 1978.

ANSWER: Dow objects to this request on the grounds that it is vague, ambiguous, overly broad, unduly burdensome and is not limited to a relevant time period.

2. Any and all letters, memoranda, or other documents related to any organic chemical research, study or experiments with chlorinated Xanthones or chlorinated Phenols prior to 1978.

ANSWER: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous, not understandable, unduly burdensome, not limited to a relevant time period and is not reasonably calculated to lead to the discovery of admissible evidence.

3. Any and all letters, memoranda, reports or other documents regarding any study done in connection with DOW CHEMICAL COMPANY workers who used or were exposed to DOW CHEMICAL COMPANY's 2,4-D, 2,4,5-T, Hydrothal, Diquat, or Silvex prior to 1978.

ANSWER: Dow objects to this request on the grounds that it is irrelevant, immaterial, overly broad, unduly burdensome, not limited to a relevant time period and is not reasonably calculated to lead to the discovery of admissible evidence.

4. Any and all letters, memoranda, reports or other documents relating to any study done by Dr. Holder or other

physicians or toxicologists in connection with DOW CHEMICAL COMPANY workers who used or were exposed to DOW CHEMICAL COMPANY's 2,4-D, 2,4,5-T, Hydrothal, Diquat or Silvex between 1967 to the present.

<u>ANSWER</u>: Dow objects to this request on the grounds that it is irrelevant, overly broad, unduly burdensome and not confined to a relevant time period. Without waiving these objections, Dow is unaware of any studies by Dr. Holder currently in its possession which are responsive to this request and which pertain to the products involved in this case.

5. Any documents relating to or referring to the identity, occurrence, concentration, or potential toxicity of any contaminants or impurities that may have been present in DOW CHEMICAL COMPANY's 2,4-D products, 2,4,5-T products, Silvex products, Hydrothal products, or Diquat products or in DOW CHEMICAL COMPANY's 2,4-D acid raw material, 2,4,5-T raw material, Diquat raw material, Hydrothal raw material or Silvex raw material, from 1967 to present.

<u>ANSWER</u>: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous, not confined to a relevant time period, uses undefined terms, is unduly burdensome and is not calculated to lead to the discovery of admissible evidence because plaintiffs have no means of showing that the Dow product(s) the plaintiff was allegedly exposed to, if any, contained contaminants or impurities.

6. Any documents relating to or referring to the identity, occurrence, concentration, or potential toxicity of any contaminants or impurities that may have been present in DOW CHEMICAL COMPANY's 2,4-D products, 2,4,5-T products, Hydrothal products, Diquat products or Silvex products or raw materials from 1967 to the present.

ANSWER: See Dow's Response to Request No. 5.

7. All of DOW CHEMICAL COMPANY Toxicology files relating to 2,4-D, 2,4,5-T, Hydrothal, Diquat and Silvex, between 1967 and the present.

ANSWER: Dow objects to this request on the grounds that it is overly broad and unduly burdensome and not confined to a relevant time period.

8. Any and all letters, memoranda, reports or other documents resulting from research, inquiries, investigations or studies, which reveal contaminants or impurities in DOW CHEMICAL COMPANY's 2,4-D, 2,4,5-T, Hydrothal, Diquat or Silvex which occurred during the manufacturing or other process between 1967 and 1977.

ANSWER: *See* Dow's Response to Request No. 5.

9. Any and all letters, memoranda, reports or other documents in connection with DOW CHEMICAL COMPANY's 2,4-D,

2,4,5-T, Hydrothal, Diquat or Silvex which relate to impurities in the manufacturing or other process which impurities include but are not limited to polychlorinated aromatic hydrocarbons and hydrocarbon impurities including but not limited to 2,3,7,8, Tetrachlora Xanthone during the years 1967 and 1977.

ANSWER: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous, unintelligible, not confined to a relevant time period and unduly burdensome.

10. Any and all letters, memoranda, reports or other documents in connection with Xancene compound which is part of DOW CHEMICAL COMPANY's 2,4-D, 2,4,5-T, Hydrothal, Diquat or Silvex between 1967 and 1977.

ANSWER: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous, unintelligible, not confined to a relevant time period and unduly burdensome.

11. Any and all letters, memoranda, reports or other documents in connection with research, inquiries, investigations or studies relating to the presence in DOW CHEMICAL COMPANY's 2,4-D, 2,4,5-T, Hydrothal, Diquat and/or Silvex of the substance Octochloro Xanthone between 1967 and 1977.

ANSWER: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous, unintelligible, not confined to a relevant time period and unduly burdensome.

12. Any and all letters, memoranda, reports or other documents relating to the presence of any carcinogen in DOW CHEMICAL COMPANY's 2,4-D, 2,4,5-T, Hydrothal, Diquat and Silvex between 1967 and 1977.

ANSWER: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous, not confined to a relevant time period and unduly burdensome. Dow further objects on the grounds that it makes the assumption that Dow's products are or contain carcinogens, which Dow denies.

13. Any and all letters, memoranda, reports or other documents relating to any carcinogenic effect or propensity in DOW CHEMICAL COMPANY's 2,4-D, 2,4,5-T, Hydrothal, Diquat or Silvex between 1967 and 1977.

ANSWER: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous, not confined to a relevant time period and unduly burdensome. Dow further objects on the grounds that it makes the assumption that Dow's products are or contain carcinogens, which Dow denies.

14. That certain report, document or writing made by or to a Mr. K.L. Krummel relating to organic chemical research, inquiries or investigations in connection with the formation of and/or manufacturing of 2,4-D, dated approximately October 27, 1978.

ANSWER: Dow objects to this request on the grounds that it is not reasonably calculated to lead to the discovery of admissible evidence.

15. That certain report, document or writing made by or to a Mr. K.L. Krummel relating to organic chemical research, inquiries or investigations in connection with the formation of and/or manufacturing of 2,4-D dated approximately 1978.

ANSWER: See Dow's Response to Request No. 14.

16. Any and all letters, memoranda, documents or writings of any character pertaining to the sale of 2,4-D, 2,4,5-T, Hydrothal, Diquat or Silvex to any supplier supplying Orange County, Florida, during the years 1974, 1975, 1976 and 1977.

ANSWER: Dow objects to this request on the grounds that it is overly broad, vague, ambiguous and unduly burdensome. Dow further objects on the grounds that Dow is unaware of the names of persons or entities who purchased Dow's products from independent retailers and wholesalers and cannot respond to the request as phrased. Dow does not have any records in its possession which indicate that Dow sold 2,4-D or Silvex directly to Orange County for the years indicated.

17. All invoices for purchase of said chemicals listed above.

ANSWER: See Dow's Response to Request No. 16.

18. All correspondence between the manufacturer and your company for the chemicals listed above.

ANSWER: This request is not applicable to Dow.

19. All documents pertaining to your sale of the said chemicals to Orange County, Florida.

ANSWER: See Dow's Response to Request No. 16.

20. Any complaints, correspondence or documents of any kind received by DOW CHEMICAL COMPANY regarding 2,4-D, 2,4,5-T, Hydrothal, Diquat or Silvex or any documents evidencing any dissatisfaction in any way whatsoever with the above chemicals.

ANSWER: See Dow's Response to Request No. 16. Dow further objects on the grounds it is not limited to a relevant time period.

21. All documents which you forwarded to any wholesaler, supplier or purchaser of 2,4-D, 2,4,5-T, Hydrothal, Diquat or Silvex regarding the use of such chemicals, the application of such chemicals, the warnings on such chemicals, the labels on such chemicals, or related to any defects in such chemicals that were sent out at any time whatsoever and not limited to the four (4) years set forth above.

ANSWER: Dow objects to the request on the grounds that it is overly broad and unduly burdensome, vague, ambiguous and not limited to a relevant time period. Dow further objects on the grounds that plaintiffs have not identified any specific Dow 2,4-D product or Silvex product upon which Dow can respond. Dow reserves the right to supplement these responses when and if plaintiffs identify specific Dow products.

22. Any and all manuals, instruction sheets, informational sheets, labels, or any documents pertaining to the use, application, effectiveness, instructions or composition of 2,4-D, 2,4,5-T, Hydrothal, Diquat and Silvex.

ANSWER: See Dow's Response to Request No. 21.

23. A list of all employees with names, addresses and telephone numbers who were involved in the manufacturing, distribution or management of the division manufacturing 2,4-D, 2,4,5-T, Hydrothal, Diquat and Silvex during the years 1967 through 1977.

ANSWER: Dow objects to this request on the grounds that it is irrelevant, overly broad, unduly burdensome and not reasonably calculated to lead to admissible evidence. Without waiving these objections, Dow states that Robert Flannery was involved in the sale of Dow's 2,4-D and Silvex products during the years 1974-1977.

24. Any flow charts, diagrams, or systematic representations of the chain of authority or command for the division or section of the division or section of the company responsible for the

manufacturing, distribution or had other responsibility with regard to 2,4-D, 2,4,5-T, Hydrothal, Diquat and Silvex.

ANSWER: Dow objects to this request on the grounds that it is irrelevant, overly broad and unduly burdensome, not limited to a relevant time period and is not reasonably calculated to lead to the discovery of admissible evidence.

25. Any computer lists, letters, memoranda, documents or writings of any character evidencing a list of each and every claim, lawsuit and/or dispute in which DOW CHEMICAL COMPANY has been involved regarding 2,4-D, 2,4,5-T, Hydrothal, Diquat and Silvex listing the following:

a. Please list the caption of every claim, lawsuit and/or dispute as well as the case number requested in this request.

b. Please provide a list that indicates where every claim, lawsuit and/or dispute was filed and the date it was filed.

ANSWER: Dow objects to this request on the grounds that it is irrelevant, immaterial, vague, overly broad, unduly burdensome and is not limited to a relevant time period or factual scenarios to cases involving allegations similar to those of the plaintiffs herein. Without waiving these objections, Dow is currently compiling a list of lawsuits brought between 1974 and 1977 in which Dow was named by the plaintiff as a manufacturer of 2,4-D or Silvex and in which the plaintiffs allegedly experienced a soft tissue sarcoma due to exposure to Dow's product. Dow will produce this list to the plaintiffs in the near future.

Dated: Uniondale, New York
May 29, 1990

Respectfully submitted,

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To
WHW

IN THE CIRCUIT COURT OF THE NINTH JUDICIAL CIRCUIT, IN AND FOR ORANGE COUNTY, FLORIDA

ROBERT W. MOYER, II and KIM MOYER, his wife,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY, et al.,

Defendants.

CASE NO. CI 89 8657

DEFENDANT'S, OCCIDENTAL CHEMICAL CORPORATION, NOTICE OF FILING RESPONSE TO PLAINTIFFS' FIRST SET OF INTERROGATORIES DIRECTED TO OCCIDENTAL

Defendant, OCCIDENTAL CHEMICAL CORPORATION ("OCCIDENTAL"), through its undersigned counsel, hereby notifies all counsel of record of filing its Response to Plaintiffs' First Set of Interrogatories directed to Occidental served contemporaneously herewith.

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished by U.S. Mail this 3rd day of August, 1990 to all counsel on the attached service list.

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Attorneys for Defendant
OCCIDENTAL CHEMICAL CORPORATION

By: ________________________
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IN THE CIRCUIT COURT OF THE NINTH JUDICIAL CIRCUIT, IN AND FOR ORANGE COUNTY, FLORIDA

CASE NO. CI 89 8657

ROBERT W. MOYER, II and
KIM MOYER, his wife,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY,
CHEVRON CHEMICAL COMPANY
ORTHO AGRICULTURAL CHEMICALS
DIVISION, AGCHEM DIVISION -
PENNWALT CORPORATION,
HELENA CHEMICAL COMPANY
SOUTHERN MILL CREEK PRODUCTS
CO., INC., THE UNJOHN COMPANY,
ASGROW FLORIDA, a
subsidiary of the UPJOHN COMPANY,
WOODBURY CHEMICAL COMPANY, FUTURE
HORIZONS, INC., LANDIA CHEMICAL
CO., JLB INTERNATIONAL CHEMICAL,
INC., THE MONSANTO COMPANY,
DIAMOND SHAMROCK, INC.,

Defendants.

_______________________________________/

OCCIDENTAL CHEMICAL CORPORATION'S RESPONSE TO PLAINTIFFS' FIRST SET OF INTERROGATORIES TO OCCIDENTAL

GENERAL OBJECTIONS

Occidental Chemical Corporation ("OCC") objects to each interrogatory to the extent it seek information regarding 2,4,5-T since Plaintiffs' Complaint does not allege exposure to that chemical. OCC also objects to each interrogatory to the extent it requests information relating to products which OCC never

manufactured or resold, specifically, Silvex; 2,4,5-T; Diquat; and Hydrothal.

1. Please give the name, official position, address, duties and responsibilities, and longevity with the company of the person or persons answering these interrogatories.

__ANSWER__: John Endicott
Attorney in Fact for
Occidental Chemical Corporation
Dallas, Texas

2. Has Occidental Chemical Company ever manufactured 2,4-D, 2,4,5-T, Hydrothal, Silvex or Diquat? If so, please state the following:

__ANSWER__: See General Objections. OCC also objects to this interrogatory to the extent it seeks information concerning products manufactured prior to 1974 or after 1977. Without waiving these objections, OCC states that it did not manufacture 2,4-D during the years 1974-1977.

A. Over what period of time and at what location or locations?

__ANSWER__: OCC objects to this interrogatory on the grounds that it is not reasonably calculated to lead to admissible evidence since the manufacturing location is irrelevant and because it is not limited to a relevant time period. Without waiving these objections, see above.

B. Were any of these chemicals ever sold to Orange County, Florida, and if so, please list the dates, quantities sold, and prices of sale.

ANSWER: OCC objects to this interrogatory on the grounds that it is overly broad in that it is not limited to the relevant time period. Without waiving these objections, see above.

C. If you did not sell directly to Orange County, Florida, have you sold any one or all of these chemicals to any retailers or wholesalers located within the State of Florida and, if so, please list the names, dates, and quantities of sale.

ANSWER: OCC objects to this interrogatory on the grounds it is overly broad and unduly burdensome and is not limited to a relevant time period. Without waiving these objections, see above.

3. If you have not manufactured 2,4-D, 2,4,5-T, Silvex, Hydrothal, or Diquat, did you ever purchase any of those chemicals for resale?

ANSWER: See General Objections. OCC also objects to this interrogatory to the extent it seeks information concerning products manufactured prior to 1974 or after 1977. Without waiving these objections, OCC states that during the years 1974-1977 OCC entered into an operating and management agreement with Chemical Land of New Jersey. Under that agreement, Chemical Land manufactured 2,4-D which was sold or shipped to other companies who used that 2,4-D to produce final products bearing OCC's name.

Additionally, OCC's predecessor, Diamond Shamrock Corp., sold products containing 2,4-D during the years 1974-1977.

A. From whom did you purchase these chemicals, giving names of the manufacturer, names of any intermediate supplier, dates of acquisition, amounts purchased, and cost.

ANSWER: See General Objections. OCC also objects to this interrogatory to the extent it seeks information concerning products manufactured prior to 1974 or after 1977. Without waiving these objections, OCC states that it will attempt to determine the source of the chemicals if and when plaintiff specifies a particular OCC product to which he alleges exposure.

B. Did you ever sell said chemicals directly to Orange County, Florida and, if so, give dates of sale, amount of chemical sold, and price of sale.

ANSWER: See General Objections. OCC also objects to this interrogatory to the extent it seeks information concerning products manufactured prior to 1974 or after 1977. Without waiving these objections, and after a diligent search, OCC states that it is unaware of any records in its possession regarding sales of this product to Orange County.

C. Have you ever sold these chemicals to any other supplier or wholesaler who in turn furnished these chemicals to Orange County, Florida? If so, please state the names of the companies, the amount of chemicals sold, the dates of sale, and the dollar value of sales.

ANSWER: See OCC's response to Interrogatory No. 3B.

4. Have you ever published or printed any warnings regarding the use or application of the chemicals 2,4-D, 2,4,5-T, Silvex, Hydrothal and Diquat? If so, please attach copies of said warnings to these Answers to Interrogatories.

ANSWER: OCC objects to this interrogatory on the grounds that it is overly broad and unduly burdensome and is not limited to a relevant time period. OCC further objects on the grounds that plaintiffs have not identified any specific OCC product upon which OCC can base a response. Without waiving these objections, OCC reserves the right to supplement these responses when and if plaintiffs identify a specific OCC product.

5. Please identify each and every claim, lawsuit and/or dispute in which you have been involved concerning the above chemicals since the year 1967.

a. Please state the caption of every claim, lawsuit and/or dispute listed in the above question along with the case number;

b. Please state where every claim, lawsuit and/or dispute listed above was filed and the date it was filed.

ANSWER: OCC objects to this interrogatory on the grounds that it is overly broad and unduly burdensome and is not limited to a relevant time period. OCC further objects on the grounds that plaintiffs have not identified any specific OCC product upon which OCC can base a response. Without waiving these objections, OCC reserves the right to supplement these responses when and if plaintiffs identify a specific OCC product.

6. Please identify each and every expert witness used in any prior lawsuit who has given either deposition or trial testimony involving the chemicals 2,4-D, 2,4,5-T, Diquat, Silvex and Hydrothal, including their name, address and telephone number.

ANSWER: OCC objects to this interrogatory on the grounds that it is irrelevant, immaterial, overly broad, unduly burdensome, is not limited to a relevant time period, is unintelligible and is not reasonably calculated to lead to the discovery of admissible evidence. OCC further objects to this interrogatory to the extent it seeks information concerning chemicals and/or products not manufactured by OCC. Without waiving these objections, OCC reserves the right to supplement this response when and if plaintiffs identify a specific OCC product.

7. Please identify by name, position, address, telephone number, and length of time of service with your company the following:

a. Each and every person who has ever testified on behalf of your company while an employee with you in any case involving a claim of defect or any other problem with 2,4-D, 2,4,5-T, Silvex, Hydrothal or Diquat. Testimony means by way of deposition or trial testimony.

ANSWER: OCC objects to this interrogatory on the grounds that it is overly broad and unduly burdensome and is not limited to a relevant time period. OCC further objects on the grounds that plaintiffs have not identified any specific OCC product upon which OCC can base a response. Without waiving these objections, OCC reserves the right to supplement these responses when and if plaintiffs identify a specific OCC product.

Dated: Orlando, Florida
August 3, 1990

Respectfully submitted,

RIVKIN, RADLER, BAYH, HART & KREMER

By: ______________________________
Joseph J. Ortego
Stanley Pierce
EAB Plaza
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(516) 357-3000

CARLTON, FIELDS, WARD, EMMANUEL,
SMITH & CUTLER, P.A.

By: ______________________________
Daniel C. Johnson
1601 CNA Tower
Post Office Box 1171
Orlando, FL 32802
(407) 849-0300

Attorneys for
OCCIDENTAL CHEMICAL CORPORATION

Monday, June 20, 1994
#206 SOTO - L/D to mail status conf. q-aire to court and defts.

8:30am #209 SCHUMAKER - MSC (Auburn)

Tuesday, June 21, 1994
#208 RICHMOND SPILL - 5wk f/u to file Complaint.

Wednesday, June 22, 1994

Thursday, June 23, 1994

Friday, June 24, 1994

Saturday, June 25, 1994

Sunday, June 26, 1994

Monday, June 27, 1994
#206 SOTO - L/D to personally f/serve status conf. [illegible]

Tuesday, June 28, 1994
#208 RICHMOND SPILL - 4wk f/u to file Complaint

Wednesday, June 29, 1994

Thursday, June 30, 1994

Friday, July 1, 1994
1 #209 SHUMAKER - any witnesses to serve w/subpoenas?

Saturday, July 2, 1994

Sunday, July 3, 1994

Monday, July 4, 1994
STAFF HOLIDAY - INDEPENDENCE DAY

Tuesday, July 5, 1994
#208 RICHMOND SPILL - 3wk f/u to file Complaint.

8:30am #206 SOTO - First Status Conf in D14 in [illegible]

Wednesday, July 6, 1994

Thursday, July 7, 1994

Friday, July 8, 1994
#209 SHUMAKER - ld to send Not to Appear at Trial w/docs; ld to file motions in limine

Saturday, July 9, 1994

Sunday, July 10, 1994

Monday, July 11, 1994
#209 SHUMAKER - ld to submit jury fees = 7/20

1:00pm ATLA - STEP Conference Call.

Tuesday, July 12, 1994
#208 RICHMOND SPILL - 2wk f/u to file Complaint.

Wednesday, July 13, 1994

Thursday, July 14, 1994

Friday, July 15, 1994

Saturday, July 16, 1994

Sunday, July 17, 1994

Monday, July 18, 1994

Tuesday, July 19, 1994
#208 RICHMOND SPILL - 1wk f/u to file Complaint.

#209 SHUMAKER - ld to send Not to Appear at Trial w/out docs; ld to hear I&M.

Wednesday, July 20, 1994
#209 SHUMAKER - ld to post jury fees $150

Thursday, July 21, 1994

Friday, July 22, 1994

Saturday, July 23, 1994
ATLA Annual Convention - Chicago Hyatt Regency

Sunday, July 24, 1994
ATLA Annual Convention-Chicago Hyatt Regency

Monday, July 25, 1994
ATLA Annual Convention-Chicago Hyatt Regency

[illegible] STEP Annual Education Program(?)

Tuesday, July 26, 1994
[illegible] RICHMOND SPILL - [illegible] - L/D to file Complaint.

ATLA A[illegible] Hyatt Regency

Wednesday, July 27, 1994
ATLA Annual Convention-Chicago Hyatt Regency

Thursday, July 28, 1994

Friday, July 29, 1994

Saturday, July 30, 1994

Sunday, July 31, 1994

Monday, August 1, 1994
DISCUSS 14th International Symposium on Chlorinated Dioxins and Related Compounds.

Tuesday, August 2, 1994
8:30am #209 SCHUMAKER - Trial (Auburn)

Wednesday, August 3, 1994

Thursday, August 4, 1994

Friday, August 5, 1994

Saturday, August 6, 1994

Sunday, August 7, 1994

Monday, August 8, 1994

Tuesday, August 9, 1994

Wednesday, August 10, 1994

Thursday, August 11, 1994

Friday, August 12, 1994

Saturday, August 13, 1994

Sunday, August 14, 1994

Monday, August 15, 1994

Tuesday, August 16, 1994

Wednesday, August 17, 1994

Thursday, August 18, 1994

Friday, August 19, 1994

Wednesday, June 1, 1994
8:30am #84 MORRIS - Hearing in D17 - NEED TO CONFIRM INFO WHEN NOTICE COMES FROM COURT.

Thursday, June 2, 1994

Friday, June 3, 1994

Saturday, June 4, 1994

Sunday, June 5, 1994

Monday, June 6, 1994
#209 SHUMAKER - ld to mail Sett Conf Stmt

Tuesday, June 7, 1994

Wednesday, June 8, 1994

Thursday, June 9, 1994

Friday, June 10, 1994
#209 SHUMAKER - ld to file Sett Conf Stmt

Saturday, June 11, 1994

Sunday, June 12, 1994

Monday, June 13, 1994
#209 SHUMAKER - ld to exchange expert info; ld to file discovery motions

1:00pm ATLA - STEP Conference Call.

Tuesday, June 14, 1994
#208 RICHMOND SPILL - 6wk f/u to file Complaint.

Wednesday, June 15, 1994

Thursday, June 16, 1994

Friday, June 17, 1994
#209 SHUMAKER - ld to mail Not of Nonexpert Depo w/out docs

Saturday, June 18, 1994

Sunday, June 19, 1994

Tuesday, May 10, 1994

Wednesday, May 11, 1994

Thursday, May 12, 1994

Friday, May 13, 1994

Saturday, May 14, 1994

Sunday, May 15, 1994

Monday, May 16, 1994

Tuesday, May 17, 1994

Wednesday, May 18, 1994
#84 MORRIS - L/D to mail conference stmt to court and defts.

Thursday, May 19, 1994

Friday, May 20, 1994

Saturday, May 21, 1994

Sunday, May 22, 1994

Monday, May 23, 1994
#84 MORRIS - L/D to personally f/serve conference stmt.

Tuesday, May 24, 1994
#209 SHUMAKER - ld to demand disclosure of experts

Wednesday, May 25, 1994

Thursday, May 26, 1994

Friday, May 27, 1994

Saturday, May 28, 1994

Sunday, May 29, 1994

Monday, May 30, 1994
STAFF HOLIDAY - MEMORIAL DAY.

#209 SHUMAKER - ld to send out closing rogs

Tuesday, May 31, 1994

Saturday, April 23, 1994

Sunday, April 24, 1994

Monday, April 25, 1994
#84 <u>MORRIS</u> - L/D to conduct the arbitration.

Tuesday, April 26, 1994
. 1 #83 <u>STARNES</u> - Call Court at 1:30 for tentative ruling on tomorrow's hearing.

Wednesday, April 27, 1994
9:00am #83 <u>STARNES</u> - Status review in Dept. 17.
10:00am #205 <u>NULES</u> - Depo of John Nules at Diablo Valley Reporting, 2121 N. California Blvd., Suite 310, W.C./930-7388.

2:00pm #205 <u>NULES</u> Depo of Katherine Nules at Diablo Valley Reporting, 2121 N. California Blvd., Suite 310, W.C./930-7388.

Thursday, April 28, 1994

Friday, April 29, 1994
9:30am #210 <u>DUNCAN</u> - hearing PJ's dept

. 1 ATLA-ld to regis for Chicago conv w/discount = 5/6

Saturday, April 30, 1994

Sunday, May 1, 1994

Monday, May 2, 1994

Tuesday, May 3, 1994

Wednesday, May 4, 1994

Thursday, May 5, 1994

Friday, May 6, 1994
. 1 ATLA - ld to register for Chicago conv w/100 discount

Saturday, May 7, 1994

Sunday, May 8, 1994

Monday, May 9, 1994
1:00pm <u>ATLA - STEP</u> Conference Call.

Monday, April 11, 1994
#206 SOTO - 1wk f/u to file Proof of Service on Deft for Summons and Complaint, Ntc. to Plfs., ADR Info sheet, blank stat conf. q-aire, & blank adr stip form.

#205 NULES - our ans to spec rogs due

10:00am #186 TRAMMELL - depo of Terri Trammell (SF)
2:00pm #88 ROBINSON - CMC D2 (Sonora)

Tuesday, April 12, 1994
8:30am #205 NULES - Status Conference in Dept 9.

Wednesday, April 13, 1994
#83 STARNES - L/D to personally f/serve status report to court and defts.

8:00pm ATLA STEP COMMITTEE MEETING - Washington

Thursday, April 14, 1994

Friday, April 15, 1994

#202 MCKENNA - 1wk f/u to file complaint.

#205 NULES - our doc prod due; def's ans to our spec rogs due (to us)

#186 TRAMMELL - Miele's ans to our form rogs due (to us)

#184 MORRIS - SRVUSD's doc prod & ans to rogs due(to us)

Saturday, April 16, 1994

Sunday, April 17, 1994

Monday, April 18, 1994
#206 SOTO - L/D to file Proof of Service on Deft for Summons and Complaint, Ntc. to Plfs., ADR Info sheet, blank stat conf. q-aire, & blank adr stip form.

#205 NULES - def's ans to form rogs due (to us)

Tuesday, April 19, 1994

Wednesday, April 20, 1994

Thursday, April 21, 1994

Friday, April 22, 1994
#202 MCKENNA - SOL L/D to file complaint.

Thursday, March 31, 1994

#184 MORRIS - SRVUSD's writ resp to doc prod due (to us)

(Jeff Cunan on vacation)

Friday, April 1, 1994

#202 MCKENNA - 3wk f/u to f/complaint.

#83 STARNES - 1wk f/u to mail status report to court and defendants.

#205 NULES - L/D to personally f/serve status conference q-aire; our ans to rogs due

#188- V.ROBINSON - med info rec from Drs?

8:30am DR. SANDERS (Oakland)

Saturday, April 2, 1994

Sunday, April 3, 1994

Monday, April 4, 1994

#206 SOTO - 2wk f/u to file Proof of Service on Deft for Summons and Complaint, Ntc. to Plfs., ADR Info sheet, blank stat conf. q-aire, & blank adr stip form.

1 **GHS - 1d to submit paper re ATLA Chicago seminar** (7/24)

Tuesday, April 5, 1994

10:00am #184 - MORRIS - depo of Jason (Murphy's office)

Wednesday, April 6, 1994

Thursday, April 7, 1994

#83 STARNES - L/D to mail status report to court and defts.

Friday, April 8, 1994

#202 MCKENNA - 2wk f/u to file complaint.

Saturday, April 9, 1994

Sunday, April 10, 1994

Tuesday, March 22, 1994
#25 MOSS - L/D for CSAA to personally file and serve Reply to Opp to Motion to Compel Plf to attend IME and Depo in CA.

9:00am #25 MOSS - Motion to compel arbitration in Dept 2.

Wednesday, March 23, 1994
#125 MOSS - ins policy rec from Mackouse?

Thursday, March 24, 1994

(Jeff Cunan on vacation)

~~1 #25 MOSS - Call for tentative ruling.~~

Friday, March 25, 1994
#202 MCKENNA - 4wk f/u to file complaint.

(Jeff Cunan on vacation)

~~9:00am #25 MOSS - Motion to compel Depo and IME of plf in CA, Dept 8B.~~

Saturday, March 26, 1994

Sunday, March 27, 1994
4:14pm flight to St. Louis #407
7:00pm flight to SF #819

Monday, March 28, 1994
#205 NULES - L/D to mail status conference q-aire to court & defts.

(Jeff Cunan on vacation)

1 GHS - 1 wk to submit paper for ATLA Chicago seminar (due 4/4)

Tuesday, March 29, 1994
#184 MORRIS - recs due from San Ramon Reg. Med. Ctr., A.F.E./DMC-WC, Blackhawk CC & Cal High

(Jeff Cunan on vacation)

8:00am #86 TRAMMELL - First Status Conf. in Dept 5.

11:00am #136 JAM - CMC D4 SC Sup

Wednesday, March 30, 1994
#205 NULES - our writ resp to doc prod due

(J[illegible] Cunan on vacation)

Gerson Smoger, Esq.
GERSON SMOGER AND ASSOCIATES
1333 N. California Blvd., Suite [illegible]
Walnut Creek CA 94596
[illegible] -8746

FACSIMILE TRANSMITTAL MEMO

TO: Gerson FAX #: (308) [illegible]

FROM: Patty Harris
Secretary to Gerson H. Smoger

DATE: March 22 199[illegible]

RE: Your Calendar

This transmittal consists of [illegible] pages, including this cover [illegible]

If there are any problems during transmission, please [illegible]

[illegible] Patty

[illegible]

We use a Sharp FO-220 machine. Our Fax number is (510) [illegible]

Enclosures: Leter to Murphy re Cal High subpoena

Thank You.

_____ Please call to confirm receipt of this doc[illegible]

IN THE CIRCUIT COURT OF THE NINTH JUDICIAL CIRCUIT, IN AND FOR ORANGE COUNTY, FLORIDA

ROBERT W. MOYER, II, and KIM MOYER, his wife,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY, et al.,

Defendants.

CASE NO. CI 89 8657

DEFENDANT'S, OCCIDENTAL CHEMICAL CORPORATION, NOTICE OF FILING RESPONSE TO PLAINTIFFS' REQUEST FOR PRODUCTION OF DOCUMENTS TO ALL DEFENDANTS

Defendant, OCCIDENTAL CHEMICAL CORPORATION ("OCCIDENTAL"), through its undersigned counsel, hereby notifies all counsel of record of filing its Response to Plaintiffs' Request for Production of Documents to All Defendants served contemporaneously herewith.

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished by U.S. Mail this 3rd day of August, 1990 to all counsel on the attached service list.

RIVKIN, RADLER, BAYH, HART & KREMER, P.A.
Joseph J. Ortego, Esquire
Stanley Pierce, Esquire
EAB Plaza
Uniondale, NY 11556-0111

CARLTON, FIELDS, WARD, EMMANUEL, SMITH & CUTLER, P.A.
Post Office Box 1171
Orlando, Florida 32802
(407) 849-0300
Attorneys for Defendant
OCCIDENTAL CHEMICAL CORPORATION

By: ______________________
Daniel C. Johnson
Florida Bar No. 522880

AUG 6 1990

427

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Kathleen L. Petrilli, Esquire
Legal Dept. - Pennwalt Corp.
Three Parkway - Pennwalt Bldg.
Philadelphia, PA 19102

Richard D. Schuler, Esquire
Schuler, Wilkerson & Halvorson, P.A.
Suite 4-D, Barristers' Building
1615 Forum Place
West Palm Beach, FL 33401

IN THE CIRCUIT COURT OF THE NINTH JUDICIAL CIRCUIT OF FLORIDA, IN AND FOR ORANGE COUNTY.

CASE NO: CI 89-8657
DIVISION: 32 PFEIFFER

ROBERT W. MOYER, II and
KIM MOYER, his wife,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY,
et al.,

Defendants.

OCCIDENTAL CHEMICAL CORPORATION'S RESPONSE TO PLAINTIFFS' REQUEST FOR PRODUCTION OF DOCUMENTS TO ALL DEFENDANTS

1. If you supplied any 2,4-D, 2,4,5-T, Diquat, Hydrothal or Silvex to Orange County during the years 1974 through 1977, please produce the following:

a. All documents pertaining to your purchase of said chemicals from the manufacturer or intermediate supplier;

b. All invoices for said chemicals;

c. All correspondence between the manufacturer and your company;

d. All documents pertaining to your sale of said chemicals to Orange County, Florida;

e. Any complaints received by you regarding the above chemicals, or any documents evidencing any dissatisfaction in any way whatsoever with the above chemicals;

f. All documents forwarded to you by the manufacturer regarding the above chemicals, the use of such chemicals, the application of such chemicals, the warnings on such chemicals, or related to any defects in such chemicals that were sent to you at any time whatsoever and not limited to the four (4) years set forth above;

g. any manuals, instruction sheets, informational sheets, labels or other documents pertaining to the use, application, effectiveness, instructions, or composition of said chemicals.

ANSWER: Occidental Chemical Corporation ("OCC") objects to this request on the grounds that it is overly broad, unduly burdensome and not reasonably calculated to lead to the discovery of admissible evidence to the extent that it seeks information concerning 2,4,5-T, which plaintiff has not alleged that he was exposed to or injured from in his complaint and to the extent it requests information about Diquat, Hydrothal and Silvex, which OCC never manufactured. Without waiving these objections, OCC states that after a diligent search, it is unaware of any records in its possession indicating it sold products to Orange County during the years 1974-1977.

2. If you are a manufacturer as opposed to a supplier, please produce the following for the years 1974 through 1977 pertaining to 2,4-D, 2,4,5-T, Diquat, Silvex or Hydrothal:

a. All documents pertaining to your manufacturing of said chemicals;

ANSWER: OCC objects to this request on the grounds that it is vague, ambiguous, irrelevant, overly broad and unduly burdensome. Without waiving these objections, see OCC's Response to Request No. 1.

b. All invoices or documents pertaining to the sale of said chemicals;

ANSWER: OCC objects to this request on the grounds that it is irrelevant, ambiguous, overly broad, unduly burdensome and is not limited in respect to time or geographical location. Without waiving this objection, OCC refers the plaintiffs to its Response to Request No. 1.

c. All correspondence between the supplier or your wholesaler and your company;

ANSWER: OCC sold its products to a number of independent wholesalers and distributors throughout the country during the time period in question. Therefore, OCC objects to this request on the grounds that it is irrelevant, immaterial, overly broad and unduly burdensome.

d. All documents pertaining to your sale of said chemical to your supplier or wholesaler or other entity;

ANSWER: See response to Request 2c.

e. Any complaints received by you regarding the above chemicals or any documents evidencing any dissatisfaction in any way whatsoever with the above chemicals;

ANSWER: OCC objects to this request on the grounds that it is overly broad, vague and ambiguous. Without waiving these objections, OCC reserves the right to supplement this response when and if plaintiffs identify a specific OCC product.

f. All documents forwarded by you dealing with the application of said chemicals, the warnings on such chemicals, or relating to any defects in such chemicals or the use of such chemicals that were sent out at any time whatsoever and not limited to the four years set forth above;

ANSWER: OCC objects to this request on the grounds that it is overly broad, vague and ambiguous. Without waiving these objections, OCC reserves the right to supplement this response when and if plaintiffs identify a specific OCC product.

g. Any manuals, instruction sheets, informational sheets, labels, or other documents pertaining to the use, application, effectiveness, instructions or composition of said chemicals.

<u>ANSWER</u>: OCC objects to this request on the grounds that it is overly broad, vague and ambiguous. Without waiving these objections, OCC reserves the right to supplement this response when and if plaintiffs identify a specific OCC product.

Dated: Orlando, Florida
August 3, 1990

Respectfully submitted,

RIVKIN, RADLER, BAYH, HART & KREMER

By: ______________________
Joseph J. Ortego
Stanley Pierce
EAB Plaza
Uniondale, NY 11556-0111
(516) 357-3000

CARLTON, FIELDS, WARD, EMMANUEL,
SMITH & CUTLER, P.A.

By: ______________________
Daniel C. Johnson
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(407) 849-0300

Attorneys for
OCCIDENTAL CHEMICAL CORPORATON

file

IN THE CIRCUIT COURT OF THE NINTH JUDICIAL CIRCUIT, IN AND FOR ORANGE COUNTY, FLORIDA

CASE NO. CI 89 8657

ROBERT W. MOYER, II, et al.,

Plaintiffs,

vs.

DOW CHEMICAL COMPANY, et al.,

Defendants.

_______________________________________/

DEFENDANT'S, OCCIDENTAL CHEMICAL CORPORATION, NOTICE OF SUPPLEMENTAL FILING TO RESPONSE TO PLAINTIFF'S INTERROGATORIES

Defendant, OCCIDENTAL CHEMICAL CORPORATION, through its undersigned attorneys, hereby gives notice of its supplemental filing of the attached Verification which relates to its Answers to Interrogatories previously filed. The undersigned hereby affirms the original Verification has been served to Plaintiff's counsel this date.

CARLTON, FIELDS, WARD, EMMANUEL,
SMITH & CUTLER, P.A.
Post Office Box 1171
Orlando, Florida 32802
(407) 849-0300
Attorneys for Defendant
OCCIDENTAL CHEMICAL CORPORATION

By: ______________________
Daniel C. Johnson
Florida Bar No. 522880

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished by U.S. Mail this 10th day of August, 1990 to all counsel on the attached service list.

____
Attorney

VERIFICATION

I, JOHN ENDICOTT, hereby verify that I have read the foregoing Answer to Interrogatories and state they are true and correct to the best of my knowledge.

John Endicott

JOHN ENDICOTT

Sworn to and subscribed before
me this 6th day of August, 1990.

Joanne Killough

Notary Public - State of Texas

My commission expires:

JOANNE KILLOUGH
Notary Public, State of Texas
My Comm. Expires 2-2-94

LIST OF COUNSEL

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file
cc: Bob Moyer

IN THE CIRCUIT COURT OF THE NINTH
JUDICIAL CIRCUIT OF FLORIDA, IN
AND FOR ORANGE COUNTY

CASE NO: CI 89-8657
DIVISION: 32 PFEIFFER

ROBERT W. MOYER, II and KIM MOYER, his wife,	)
Plaintiffs,	)
vs.	)
DOW CHEMICAL COMPANY, et al.,	)
Defendants.	)

DEFENDANT THE DOW CHEMICAL COMPANY'S
ANSWERS TO PLAINTIFFS' INSURANCE INTERROGATORIES

Defendant The Dow Chemical Company ("Dow") responds to Plaintiffs' Insurance Interrogatories as follows:

1. State whether there is or was in existence any policy of liability insurance which would or might inure to the benefit of the Plaintiff(s) herein, by providing for payment of a part of or all of any judgment rendered in favor of the Plaintiff(s) against any Defendant or against any other person, firm or corporation who is or may be liable to the Plaintiff(s) by reason of the casualty described in the Complaint, and if the answer is "YES", state as follows to EACH such policy of insurance known or believed to exist by you or your attorneys:

(a) The name and address of the insurer on each such policy.

(b) The name and address of each named insured on each such policy.

(c) The limits of liability in such policy as might be applied to any one Plaintiff by reason of any incident and the total limits of liability to all persons by reason of any one incident.

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(d) The relationship, if any, between each named insured on each such policy and any named Defendant in this cause.

(e) The policy number of each such policy.

(f) The name and address of any person, firm or corporation, who is or may be an "additional insured" under such policy by reason of the incident described in the Complaint, and the relationship, if any, between such "additional insured" and any named Defendant in this cause.

(g) Whether or not any insurer has notified any insured that said insurer or any other person, firm or corporation must pay a part of or all of any judgment before the insurer must make any payment; if so, what payment must be made and by whom before the insurer must make payment.

(h) Whether or not any insurer has notified any insured that said insurer claims that there is or may be no coverage under the terms of the policy of insurance involved, and if the answer is "YES", describe the reason given for the claimed lack of coverage or failure thereof as stated by said insurer (identifying same) to said insured (identifying same) and state the date of such notice. NOTE: If such policy defense is withdrawn or waived, this sub-paragraph need not be answered.

(i) Are you protected against the type of risk sued hereon by any:

(1) Reinsurance?

(2) Excess insurance?

(j) If your answer to either of the subdivisions of the proceeding interrogatory is in the affirmative, for each such coverage state:

(1) The name and address of the insurer.

(2) The number of the policy.

(3) The form of insurance.

(4) The effective dates of coverage.

(5) The amount of coverage.

(6) The name and address of the named insured.

(7) The name, address and telephone number of the person(s) or entity that has possession of the policy and the reinsurance or excess insurance clauses.

ANSWER: Please find attached as Exhibit A which is Dow's answer to Plaintiff's interrogatory regarding liability insurance. Additionally, Dow answers as follows:

(d) Dow states there is no relationship between each of the named insured and any named Defendant in this cause.

(f) Dow objects to this interrogatory sub-part on the grounds that it is vague and unintelligible. Dow does not understand this interrogatory sub-part.

(g) No.

(h) No.

(i)(1) No.

(2) Excess. The information is included in Exhibit A.

(j)(1-5) The information requested is listed above

(6) The Dow Chemical Company
2030 Dow Center
Midland, MI 48674

(7) John C. Gorte, Manager, Liability Insurance
The Dow Chemical Company
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Midland, MI 48674
(517) 636-3202

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(904) 224-1585

Counsel for Defendant
The Dow Chemical Company

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Answers to Plaintiff's Insurance Interrogatories has been served upon the following counsel of record this 30th day of May, 1991:

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the Upjohn Company

Alan F. Wagner (ca)

Alan F. Wagner

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STATE OF INDIANA)
) SS:
COUNTY OF MARION)

VERIFICATION

David G. Wilkins, being first duly sworn, deposes and says that he is the Staff Counsel, Legal Division of DowElanco. While he does not have personal knowledge of all the facts recited in The Dow Chemical Company's Answers to Plaintiffs' Insurance Interrogatories in the case of ROBERT W. MOYER, II and KIM MOYER vs. THE DOW CHEMICAL COMPANY, ET AL., the information contained in these Answers have been collected and made available to him by others. These Answers are true to the best of his knowledge and belief based upon the information made available to him, and that, therefore, the statements made in these Answers are verified on behalf of The Dow Chemical Company in this litigation.

David G. Wilkins
Staff Counsel
Legal Division
DowElanco

Sworn to me and subscribed before me in my presence on this 28th day of May, 1991.

Cathy E. Sipole

Cathy E. Sipole, Notary Public
residing in Hamilton County
My Commission Expires October 16, 1994

EXHIBIT A

ANSWER:

1. Yes.

PRIMARY INSURANCE

(a) Name: Self retained
Address: N/A
N/A

(b) Named Insured: Not applicable

(c) Limits: $400,000 each person
Limits: $2,400,000 each occurrence

(e) Number: N/A

(j)(1) Policy period: April 1, 1976 to April 1, 1977

(a) Name: Aetna Casualty & Surety Company
Address: 151 Farmington Ave.
Hartford, CT

(b) Named Insured: The Dow Chemical Company and any Domestic or Foreign Corporation in which it owns or may own, directly or indirectly, more than 50% of the combined voting power. Includes Cordis Dow Corporation.

(c) Limits: $100,000 each person excess of $400,000 each person.
Limits: $100,000 each occurrence excess of $2,400,000 each occurrence

(e) Number: 65XS1902SCA

(j)(1) Policy period: April 1, 1976 to April 1, 1977 effective 10/1/76 policy amended to:

(a) Name: Aetna Casualty & Surety Company
Address: 151 Farmington Ave.
Hartford, CT

(b) Named Insured: The Dow Chemical Company and any Domestic or Foreign Corporation in which it owns or may own, directly or indirectly, more than 50% of the combined voting power. Includes Cordis Dow Corporation.

(c) Limits: $600,000 each person excess of $400,000 each person.
Limits: $100,000 each occurrence excess of $2,400,000 each occurrence.

(e) Number: 65XS1902SCA

(j)(1) Policy Period: April 1, 1976 to April 1, 1977

(a) Name: Dorinco Reinsurance Company
Address: 2030 Willard H. Dow Center
Midland, MI

(b) Named Insured: The Dow Chemical Company, Cordis Dow Corporation and any Domestic or Foreign Corporation in which either owns or may own, directly or indirectly, more than 50% of the combined voting power.

(c) Limits: $400,000 each person
Limits: $2,400,000 each occurrence

(e) Number: 5001

(j)(1) Policy Period: April 1, 1977 to April 1, 1978

(a) Name: Aetna Casualty & Surety Company
Address: 151 Farmington Ave.
Hartford, CT

(b) Named Insured: The Dow Chemical Company and any Domestic or Foreign Corporation in which it owns or may own, directly or indirectly, more than 50% of the combined voting power. Includes Cordis Dow Corporation.

(c) Limits: $600,000 each person excess of $400,000 each person
Limits: $100,000 each occurrence excess of $2,400,000 each occurrence

(e) Number: 65XS1904SCA

(j)(1) Policy Period: April 1, 1977 to April 1, 1978
Effective 1/4/78 policy amended to:

(a) Name: Dorinco Reinsurance Company
Address: 2030 Willard H. Dow Center
Midland, MI

(b) Named Insured: The Dow Chemical Company, Cordis Dow Corporation and any Domestic or Foreign Corporation in which either owns or may own, directly or indirectly, more than 50% of the combined voting power.

(c) Limits: \$1,400,000 each person
Limits: \$3,400,000 each occurrence

(e) Number: 5001

(j)(1) Policy Period: April 1, 1977 to April 1, 1978

(a) Name: Aetna Casualty & Surety Company
Address: 151 Farmington Ave.
Hartford, CT

(b) Named Insured: The Dow Chemical Company and any Domestic or Foreign Corporation in which it owns or may own, directly or indirectly, more than 50% of the combined voting power. Includes Cordis Dow Corporation.

(c) Limits: \$600,000 each person excess of \$1,400,000 each person
Limits: \$100,000 each occurrence excess of \$3,400,000 each occurrence

(e) Number: 65XS1904SCA

(j)(1) Policy Period: April 1, 1977 to April 1, 1978

EXCESS

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be

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included as Insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $124,895,000 each occurrence excess of primary insurance
Limits: $124,895,000 each occurrence excess of primary insurance

(e) Number: HEC4973974

(j)(1) Policy Period: June 11, 1975 to June 11, 1978
Effective 6/11/76 policy amended to:

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign Corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be included as Insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $110,795,000 each occurrence excess of primary insurance
Limits: $110,795,000 each occurrence excess of primary insurance

(e) Number: HEC4973974

(j)(1) Policy Period: June 11, 1975 to June 11, 1978
Effective 9/25/76 policy amended to:

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign Corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be included as Insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $109,720,000 each occurrence excess of primary insurance
Limits: $109,720,000 each occurrence excess of primary insurance

(e) Number: HEC4973974

(j)(1) Policy Period: June 11, 1975 to June 11, 1978
Effective 10/2/76 policy amended to:

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign Corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be included as Insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $109,560,000 each occurrence excess of primary insurance
Limits: $109,560,000 each occurrence excess of primary insurance

(e) Number: HEC4973974

(j)(1) Policy Period: June 11, 1975 to June 11, 1978
Effective 11/24/76 policy amended to:

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

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(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign Corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be included as insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $108,560,000 each occurrence excess of primary insurance
Limits: $108,560,000 each occurrence excess of primary insurance

(e) Number: HEC4973974

(j)(1) Policy Period: June 11, 1975 to June 11, 1978
Effective 12/15/76 policy amended to:

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign Corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be included as Insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $108,720,000 each occurrence excess of primary insurance
Limits: $108,720,000 each occurrence excess of primary insurance

(e) Number: HEC4973974

(j)(1) Policy Period: June 11, 1975 to June 11, 1978
Effective 6/11/77 policy amended to:

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign Corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be included as Insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $107,195,000 each occurrence excess of primary insurance
Limits: $107,195,000 each occurrence excess of primary insurance

(e) Number: HEC4973974

(j)(1) Policy Period: June 11, 1975 to June 11, 1978
Effective 8/3/77 policy amended to:

(a) Name: The Home Insurance Company, et al.
Address: 59 Maiden Lane
New York, NY

(b) Named Insured: The Dow Chemical Company and Dow Corning Corporation and any Domestic Corporation in which either or both owns or may own directly or indirectly 50% or more of the combined voting power, and any Foreign Corporation in which either or both owns or may own directly or indirectly more than 50% of the combined voting power; and Korea Pacific Chemical Company. For the purpose of this insurance, Subsidiary Companies and Corporations owned by Subsidiary Companies and Corporations of the Named Insured shall be included as Insureds if the percentage of ownership is in accordance with the above.

(c) Limits: $106,720,000 each occurrence excess of primary insurance
Limits: $106,720,000 each occurrence excess of primary insurance

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THE DOW CHEMICAL COMPANY

1.005

PROBLEM #

DOW033304

REPORT NO. AIS 57-474

Author	Lab Code Letters		Report No.	Date
M. E. Skelly	ML	AR459	AIS 57-474	Dec. 8, 1964

Title and Summary: Isolation and Identification of Possible Acnegens from the Caustic-Insoluble Portion of the Products from the 2,4,5-Trichlorophenol Process (1).

Possible acnegens in the products from the 2,4,5-trichlorophenol process have been isolated and identified. Skin sensitivity tests on rabbits (performed at the Biochemical Research Laboratory) have positively shown 2,3,7,8-tetrachlorodibenzo-p-dioxin to be by far the most severe skin irritant among the group of compounds identified.

TYPE OF REPORT: Analytical Research PAGES: 13

DISTRIBUTION (COMPLETE REPORT)

MIDLAND CR (3 Copies)

EXECUTIVE RESEARCH

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A. H. Widiger
M. Wright
R. E. Walker

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DOW CHEMICAL CORP. ROLL #4

D

DOW033305

SUMMARY

A distillation residue from the caustic insoluble portion of the 2,4,5-trichlorophenol process shown to cause severe folliculitis in rabbits was fractionated by preparative thin-layer chromatography (TLC). Identification of these separated components was made by elemental analysis, ebulliometric molecular weight, infrared and mass spectra. The major component which comprises approximately 40 percent of the distillation residue (0.6% of the undistilled caustic insolubles) was positively identified as 2,3,7,8-tetrachlorodibenzo-p-dioxin, an extremely toxic compound and known acnegen (2,3). Preparation of this compound by the chlorination of dibenzo-p-dioxin provided unambiguous structure identification. Eight additional possible acnegens were separated, identified, and submitted for tests on rabbits. Solubility studies did not produce a solvent in which the solubility exceeded 0.2 percent. An analytical method, MLW.64.19, has been developed by H. H. Gill for the determination of the acnegen in caustic insoluble samples.

LITERATURE SURVEY ON 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN

Tetrachlorodibenzo-p-dioxin was first prepared by Magatti in 1880 (4). However, the reaction route was somewhat ambiguous. Elemental analysis, solubility characteristics and high melting point did agree with the proposed structure. The literature (C.A.) indicated no further activity in this area until 1957. Sandermann, Stockman, and Casten (5) prepared 2,3,7,8-tetrachlorodibenzo-p-dioxin and reported a melting point of 320°-325°C. They also reported it caused chloracne. Another paper (6) reported this compound was harmful to man and beast. Tomita, Ueda, and Narisada (7) prepared this compound and reported a melting point of 295°C. Occupational chloracne (2) was observed in 31 workers engaged in the production of 2,4,5-trichlorophenol and its transformation to 2,4,5-trichlorophenoxyacetic acid and its esters. The active acnegen was isolated and proved to be 2,3,7,8-tetrachlorodibenzo-p-dioxin. Tetrachloro and trichloro dibenzofurans were also found to be active. A technique (3) for testing the acnegenic potency of 2,3,7,8-tetrachlorodibenzo-p-dioxin on rabbits was described recently. ~~Of particular interest, the authors prepared the acnegen~~ by heating the sodium salt of 2,4,5-trichlorophenol for 30 ~~hours at 350-400°C.~~ After recrystallization, the product had a melting point of 295°-300°C.

PREPARATION OF 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN

The compound was prepared according to the procedure of Sandermann, Stockman, and Casten (5). Eight grams of dibenzo-p-dioxin was dissolved in 75 ml. of chloroform. Trace amounts of ferric chloride and iodine were added and the mixture was chlorinated at 14°C. for two hours. Chlorination was continued for five hours at the boiling point of chloroform. The insoluble product was filtered off and recrystallized four times from anisole.

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DOW CHEMICAL CORP. ROLL #4

12/8/64 - 2

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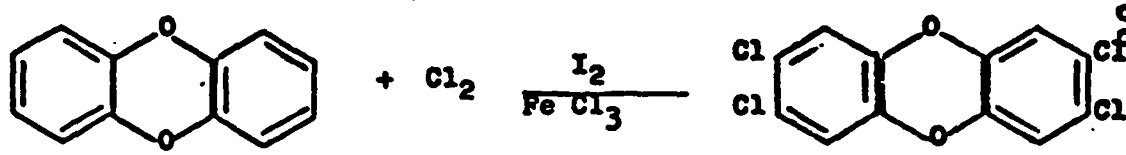


Dibenzo-p-dioxin

2,3,7,8-Tetrachlorodibenzo-p-dioxin

The compound had a melting point of 303-305°C. and gave the analysis shown in Table 1. Purity as estimated by infrared examination was about 95%.

TABLE 1

ANALYTICAL DATA FOR SYNTHESIZED 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN

Analysis	Found	Theoretical
Carbon, %	45.0	44.7
Hydrogen, %	1.34	1.25
Chlorine, %	42.7	44.0
Mass No.	320*	320
Molecular, Wt.	319	321.97
Melting Point	303-305°C.	295°(7)295°-300(3)320-325°(5)
Infrared Examination - agreed with isolated material		

*Mass spectroscopists use 35 for the atomic weight of chlorine

SOLUBILITY OF 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN IN VARIOUS SOLVENTS

Because of the problem in removing 2,3,7,8-tetrachlorodibenzo-p-dioxin from various surfaces and equipment, the solubility of this compound was determined in several solvents. Approximately 15-30 mg. of the compound was placed in each of ten, 10-ml. volumetric flasks. About eight ml. of the respective solvents were added and the solutions placed on a warm steam bath for four hours. They were then allowed to equilibrate at room temperature overnight. All solutions had a solid phase present to exclude the possibility of a super-saturated solution. They were then submitted to H. H. Gill for gas-liquid chromatographic analysis After filtering, one μl. of the saturated solution was injected into a gas-liquid chromatograph and compared with a standard in chloroform. Solubilities are given in Table 2.

Interest was shown in the solubility of the acnegen in the caustic insoluble solution. Therefore a synthetic caustic-insoluble mixture was prepared. In order to have the components completely solublized at room temperature, the 1,2,4-trichlorobenzene concentration had to be higher than normal.

TABLE 2

SOLUBILITY OF 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN in VARIOUS SOLVENTS AT 25°C.

Solvent	Solubility g./100 ml.	Solubility wt. percent
o-Dichlorobenzene	0.18	0.14
Chlorobenzene	.080	.072
Perchloroethylene	.068	.048
Chlorofrom	.055	.037
Benzene	.047	.057
Acetone	.009	.011
Dimethylsulfoxide (a)	<.01	<.01
Methanol	.001	.001
Water	<.0005	<.0005
Caustic-Insolubles (b)	.24	.16

(a) DMS caused detector fouling and a better value could not be obtained However, solubility does not exceed 0.01 percent.
(b) Composition of synthetic caustic insolubles:

44%	1,2,4-trichlorobenzene
38%	2,4,5-trichloroanisole
10%	2,4-dichloroanisole
5%	4,6-dichlororesorcinol dimethyl ether
2%	4,5-dichlorocatechol dimethyl ether
1%	4,5-dichlorohydroquinone dimethyl ether

EXAMINATION OF CAUSTIC-INSOLUBLE RESIDUE 658

Caustic-insoluble residue 658, which produced severe folliculitis on rabbits, was studied initially. TLC examination of the sample on 0.4 mm. silica gel G with 10% chloroform in n-hexane development and iodine detection indicated the presence of one major, two minor, and two trace components.

Three hundred mg. of this sample was then applied to five preparative (1.0 mm. silica gel G) TLC plates. After development with 10% chloroform - hexane solution, three fractions were scraped from the plate. These included a middle fraction (Middle) containing the major component, 2,4,5-trichloro-anisole, and fractions above (Top) and [illegible] The compounds were desorbed from the [illegible] m, filtering, and evaporating to

DOW033308

The residues were taken up with 10-ml. portions of benzene and submitted to K. J. Olson of the Biochemical Research Laboratory for rabbit testing. An additional solution containing 300 mg. of residue 658 in 10 ml. of benzene was also submitted. Therefore, the fraction which contains the acnegen should cause a reaction equivalent to that of the unfractionated sample.

Rabbit tests indicated that the Top fraction caused severe folliculitis on rabbits as did the unfractionated sample. Gas-liquid chromatographic examination of this fraction by H. H. Gill showed the presence of a component having the same retention time as 2,3,7,8-tetrachlorodibenzo-p-dioxin.

THIN-LAYER CHROMATOGRAPHY EXAMINATION OF DISTILLED FRACTIONS OF CAUSTIC INSOLUBLES

H. H. Gill of the Analytical Laboratory, 574 Building, had a 11.3 kg. sample of caustic insoluble sample 667 distilled in the East Analytical Distillation Laboratory. Ten distillation fractions, together with a residue fraction were collected. These distillation fractions were tested on rabbits and found to give a slight to moderate reaction. However, the distillation residue produced an extremely severe reaction.

Distillation fractions 8,9, and 10 were examined by TLC on 0.4 mm. silica gel G with 25% chloroform-hexane development. All three fractions were essentially the same with about seven components visible.

Fraction 8 was separated into its major components by preparative, TLC. Components were identified by their infrared (8) and mass (9) spectra. Their identities are listed in Table 3.

TABLE 3

COMPONENTS IN DISTILLATION FRACTION 8 FROM CAUSTIC INSOLUBLE SAMPLE 667

Component No.	Component Identity
1	4,6-Dichlororesorcinol dimethyl ether
2	2,5-Dichlorohydroquinone dimethyl ether
3	2,3,4-Trichloroanisole
4	2,4,5-Trichloroanisole
5	2,4,5-Trichlorophenol secbutyl ether

Since none of these compounds is known as an acnegen, and fraction 8 caused only a moderate reaction on rabbits, it was concluded that any acnegen was carried over in the distillation.

The distillation residue which had been shown to cause a severe reaction was examined by TLC under the same conditions as fraction 8. Approximately ten components were observed. It was also noted that a considerable amount of this residue was chloroform-insoluble. This insoluble material comprised 41 percent of the residue. After recrystallizing a portion of this residue twice from anisole, the product gave an analysis listed in Table 4. It was concluded that the material was positively 2,3,7,8-tetrachlorodibenzo-p-dioxin. The unrecrystallized product was examined by mass and infrared spectrometry to exclude or indicate the presence of other significant insoluble components. Five to ten percent of mass 316 was found. This component is identified later in this report.

TABLE 4

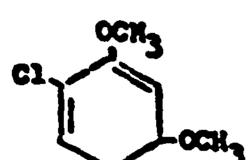
ANALYTICAL DATA FOR CHLOROFORM INSOLUBLE IMPURITY IN DISTILLATION RESIDUE

Analysis	Found	2,3,7,8-Tetrachloro-dibenzo-p-dioxin
Carbon, %	45.2	44.7
Hydrogen, %	1.42	1.25
Chlorine, %	43.5	44.0
Mass No.	320	320
Molecular Wt.	313	321.97
Infrared Examination	Identical	
Melting Point	303-305°C.	303-305°C.

The chloroform-soluble portion of the residue was fractionated by preparative TLC on 1.2-mm. silica gel GF_{254} with 25% chloroform in n-hexane. Final purification of the components was made with 10 to 75% chloroform-hexane solutions. Those components having lower R_f values (distance the component travels divided by the distance the solvent front travels) required higher concentrations of chloroform in n-hexane and vice versa. Because some of the components were contiguous on the TLC plate, several passes were required to obtain pure compounds. In some instances, a near-pure compound by TLC could be recrystallized from chloroform or n-hexane.

Eight components were isolated in this manner. These were submitted to K. J. Olson for rabbit testing at the 0.1% level. Portions of these samples were also sent to L. B. Westover (9) for mass spectrometry analysis, R. A. Nyquist for infrared examination (8), and the Micro Laboratory for elemental analysis and molecular weight determination (ebulliometric). From the analytical results, structures were assigned to the components. Listed below are the structure assignments for the components formerly designated by their R_f values. Purity determinations, in general, were made by gas-liquid chromatography (H. H. Gill).

R_f 0.21



dimethyl ether

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TABLE 5

ACTIVITY OF ISOLATED COMPONENTS ON RABBITS

Compound	No. of Appl.	Days of Exposure	Degree of Folliculitis
4,6-Dichlororesorcinol dimethyl ether	10	14	Moderate (a)
di(x-Dichloro-x-methoxyphenyl) ether	13	20(a)	None (b)
x-Dichloro-x-methoxyphenyl x-trichloro-x-methoxyphenyl ether	6	7	None (b) (f)
x-Tetrachloro-x-methoxydibenzo-p-dioxin	6	7	None (b) (f)
x-Trichloro-x-methoxydibenzo-p-dioxin	10	14	Moderate (c)
2,4,5-Trichlorophenyl x-dichloro-x-methoxyphenyl ether	18	25	None
2,4,5-Trichlorophenyl x-trichloro-x-methoxyphenyl ether	6	7	None (b)
2,3,7,8-Tetrachlorodibenzo-p-dioxin	3	7	Extremely Severe (d)
x-Tetrachlorodibenzo-p-dioxin	8	14	Moderate to Severe (e)

(a) Tested at the 1% level. A standard sample is being rerun to eliminate the possibility that trace impurities may be causing a reaction.

(b) Tests have not been completed.

(c) A repurified sample (R_f0.56-1) is being tested.

(d) Found to be active at the 4×10^{-5} and 4×10^{-6} % level.

(e) Because of the proximity of the 2,3,7,8-tetra-on the TLC plate, this sample contains 1-2% of the very active component. The results of rabbit tests must be considered in view of this.

(f) Purity is about 60%.

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DOW033315

CONCLUSION

Nine components have been isolated from a distillation residue of the caustic insoluble portion of the 2,4,5-trichlorophenol process. The major component (~40%) in this residue has been shown to cause severe folliculitis in rabbits. It has been positively identified as 2,3,7,8-tetrachlorodibenzo-p-dioxin by analysis and comparison of a prepared standard. Eight additional possible acnegens were isolated, identified and tested. They showed varying degrees of activity, however, none were as active as the major component. Solubility studies in nine solvents did not produce one solvent in which solubility exceeded 0.2%.

ACKNOWLEDGEMENT

The author would like to acknowledge the generous help of R. A. Nyquist, L. B. Westover, and G. J. Kallos of the Chemical Physics Research Laboratory for structure determinations, H. H. Gill of the Analytical Laboratory for gas chromatographic analysis, K. J. Olson of the Biochemical Research Laboratory for acnegenic testing, and the Micro Laboratory for the many elemental analyses.

N. E. Skelly
N. E. Skelly

bb

DOW 033316

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Return to Walt

THE DOW CHEMICAL COMPANY

MIDLAND DIVISION
January 26, 1965

MN012332

DOW 1 568569

L. C. Chamberlain
Executive Research
566 Building

cc: K. E. Coulter
W. H. Haberstroh
G. G. Goergen
R. C. Sauers

SUBJECT: TRICHLOROPHENOL RESEARCH

The following is a summary of the problem concerning Trichlorophenol-Chloracne and the various attacks on the problem by currently active research units. I have also included several suggestions for work beyond that immediately planned. If you have suggestions or questions concerning this problem please contact the writer.

Very truly yours,

W. B. Trapp
Benzene Research Laboratory
474 Building

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A&G 007133

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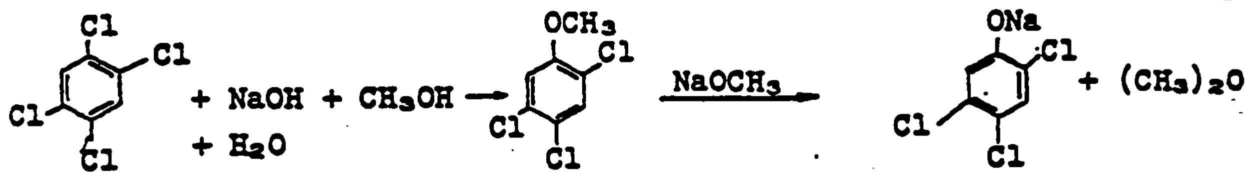
The Problem:

To design a manufacturing process for 2,4,5-Trichlorophenol which is economical and safe particularly from the standpoint of workers' exposure to chloracne exciters.

The Chemistry:

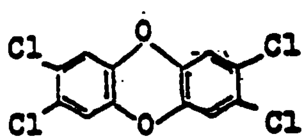


+ NaCl

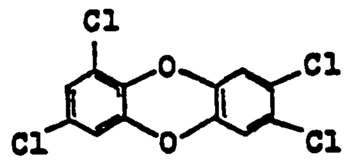
$\Delta H \cong -38$ KCal/mol

$\Delta H \cong +4$ KCal/mol

Known chloracne exciters found as impurties:



2,3,7,8-Tetrachloro-dibenzodioxin



2,3,~~7,9~~ 6,8-Tetrachloro-dibenzodioxin

Conditions which minimize Dioxin formation:

[redacted]

2. Non-aqueous solvent (needs confirmation)

Conditions which favor higher rates of conversion:

1. Higher Temperatures
2. Non-aqueous solvent

However, the disadvantage of the non-aqueous solvent system is the precipitation of NaCl which can plug a tube reactor.

With this information in mind, the following alternatives are seen:

*While we have original Dow data on temperature, this information is also part of the know-how which we have purchased and is subject to a Secrecy Agreement.

I.

II. Continuous Process

A. Aqueous solvent

1. Complete conversion
2. Incomplete conversion
   a) with recycle
   b) separate hydrolysis of anisole

B. Non-Aqueous Solvent

1. Complete conversion
2. Incomplete conversion
   a) recycle
   b) separate hydrolysis of anisole

C. Other solvent systems

Some of the other solvents that have been tried on this reaction include:

It is entirely possible that some other solvent or solubilizer might produce desireable results. Dioxane has not been tried and if stable at high pH and ~150°C., could be interesting.

D. Other miscellaneous variables:

Some other variables which have been studied in the Benzene Research Laboratory include:

1/26/65-3

In order to facilitate the design of a reactor the Benzene Research Laboratory (Widiger, Poffenberger, Neumann and three hourly technicians) is gathering various data (kinetic, phase, calorimetric and analytical) on part II A above, the aqueous solvent continuous system. This is presently viewed by the engineers and plant people as the alternative most likely to succeed the soonest.

Skelly and Gill at 574 Analytical Laboratory have laid some excellent ground work for the analysis of chloracne exciters. We are continuing to work with them to learn more in this area.

The Chemical Physics Laboratory (Ken Bradley, Art Erbel and assistants) is working on II B, the non-aqueous system. Bradley feels that his kinetic and conversion data are nearly complete and that the salt problem can be worked out. The engineers thus far have not viewed this approach with enthusiasm. Bradley also has one or two long range ideas for alternative processes but these are not mature enough to spend time on now.

No one is looking further at II C although the Benzene Research Laboratory expects to do more on this at a later date. If another laboratory would like to take a fresh look at the problem, I would suggest this area.

Anyone getting into this work should be sure to brief himself thoroughly on the potential danger of the chloracne exciters and how they are formed and handled.

W. B. Trapp
1-26-65

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THE DOW CHEMICAL COMPANY

MIDLAND DIVISION
MIDLAND, MICHIGAN

January 28, 1965

MN012332

DOW 1568535

CONFIDENTIAL

Herrn Dr. Hans Merz
Director of Production
C. H. Boehringer Sohn
Ingelheim am Rhein
West Germany

Dear Dr. Merz:

We very much appreciated the opportunity to talk with you yesterday and I have summarized below our understanding of the essential elements of our conversation, as you suggested.

##

At the outset I explained to you that there were four Dow people on three telephones here. I then introduced Mr. Silverstein, Dr. Henry Tolkmith, who would be on hand to handle any necessary translation, and finally, Mr. Dylewski, an engineer concerned with the development of a new process for 2,4,5-Trichlorophenol. We then began with a series of medical questions posed by Mr. Silverstein.

Silverstein:

1. We have isolated and identified a symmetrical and an unsymmetrical isomer of tetrachlorodibenzodioxin. The symmetrical isomer is "2,3,6,7" (German notation) and the unsymmetrical is "2,3,6,8". Limited animal experimentation indicates that the unsymmetrical isomer is much less active. Have you any information on the relative activity of these two isome
   Answer: "No, we stopped research - i

2. Do you have any liver biopsy specime our M.D.'s to study?
   Answer: "No, since we have had no n years.

3. Have the liver function tests or ki used on your chloracne cases been published anywhere.
   Answer: "Do not know".

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4. Did you note any increased incidence of diabetes in your chloracne patients, or did any diabetics with chloracne suffer aggravation of their diabetic condition?
Answer: "No cases of diabetes were found".

5. Did you study catechol amines or ketosteroids in your chloracne cases?
Answer: "Do not know".

Dr. Merz said that he would check further into those questions which were answered above as "Do not know".

- - - - - - - - - -

Dylewski (Engineer): He explained that we are considering a distilled grade of 2,4,5-Trichlorophenol (2,4,5-T) as part of our product requirement.

Dr. Merz reiterated that Boehringer's management had decided not to distill this material because of the danger of the formation of chloracne inciting materials.

Mr. Dylewski was nevertheless interested to hear more about Boehringer's experience with the distillation and thereupon proceeded to describe his proposed procedure and to invite Dr. Merz's comments.

Dr. Merz said that they formerly distilled 2,4,5-T in copper equipment operating with a sump temperature in the range of 130-150°C. Chloracne inciters were formed presumably because of residual cations (Na) in the phenol which produced Na trichlorophenate thus leading to the formation of dioxin compounds. Mr. Dylewski asked if Dr. Merz could name a particular concentration of salt below which it would be safe to operate a distillation. Dr. Merz would not name a tolerable level but suggested that a water extraction could be better affected by use of a retainer solvent such as methylene chloride or chlorobenzol for the 2,4,5-T.

Dr. Merz was asked if he knew what the material of construction of the reactor autoclave was, and he replied,

In closing, Dr. Trapp informed Dr. Merz that we had not yet received the secrecy agreement papers from Boehringer and Dr. Merz said that he would check immediately on this because he was certain that they were completed and had assumed that they had been mailed.

##

Wir danken Ihnen nochmals für Ihre weiterer Unterstützung, Dr. Merz.

mit freundlichen grussen,

Walter B. Trapp

Walter B. Trapp
Assistant Director
Benzene Research Laboratory
474 Building

bc: Hamburg Office (Grote/Kube)
G. A. Griess
S. W. Dylewski
L. Silverstein

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THE DOW CHEMICAL COMPANY

MIDLAND DIVISION
January 28, 1965

K. E. Coulter
Midland Division
Research and Development
566 Building

cc: R. C. Sauers
W. H. Haberstroh

SUBJECT: C. H. BOEHRINGER SOHN CONTRACT

In December, 1964 we agreed verbally with the Boehringer Company to pay them / for process information on 2,4,5-Trichlorophenol. Concerning the terms, they agreed that we would pay them only after we were satisfied that we had solved our problem.

The Boehringer people have been extremely cooperative and genuinely concerned for our problem from the standpoint of the potential for human suffering.

It is my feeling that we have reached a point where we should pay Boehringer either in part or in whole.

Our analyses of their samples show < 10 ppm dioxin and after considerable study of all the data they have furnished I feel that we can be confident that they have provided valid information. Furthermore, I am confident that they will continue to cooperate with us even if we are no longer holding a check over their head.

Therefore, I would suggest that we arrange to pay them either / immediately with the remainder coming along in about six weeks, or the entire / in one shot. Between these alternatives I personally prefer the latter because I see no reason to imply that we feel a need to hold a check over their head in order to get further information if needed. Again, I am completely confident that they will continue to cooperate with us even after being paid in full.

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I suggest that we should tell them when we pay them that we are satisfied that they have provided information that we need for safe operation but that we may still want to consult further with them as our work proceeds.

Please contact me if you have further questions or comments.

Very truly yours,

W. B. ~~Trapp~~
Benzene Research Laboratory
474 Building

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THE DOW CHEMICAL COMPANY

February 5,1965

MN012332

DOW 1568593

Herrn Dr. Hans Merz
Director of Production
C. H. Boehringer Sohn
Ingelheim am Rhein
West Germany

Dear Dr. Merz:

We are pleased to be able to send you approximately 20 g. of a chloracnegen-containing chloroanisole oil which we hope will be useful to you for rabbit experiments. An analysis of this substance shows about 0.8% by weight of 2,3,6,7-(your numbering) tetrachlorodibenzo-p-dioxin. It may be of interest to you that this material caused moderate folliculitis on a rabbit ear after two applications. The material was applied as a 3% (by weight) solution in benzene. Herr Silverstein says that he is confident that a single application would have caused the same result.

The sample, identified as #658 oil, is leaving today via air-mail.

Best personal regards.

Sincerely yours,

Walter B. Trapp
Assistant Director
Benzene Research Laboratory
474 Bldg.

bc: Hamburg Office (Grote/Kube)
G. A. Griess
L. Silverstein

cb

A&G

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TRANSLATION

Dir. Dr. Hans Merz
C. H. Boehringer Sohn
Ingelheim am Rhein
West Germany

Dear Dr. Merz:

We were pleased to learn that our sample of chloranisole oil arrived safely, as reported in your letter of February 23, 1965.

The chemical analyses of your samples of Na Trichlorophenate solution and the Anisole oil have been completed and these results are enclosed. We expect to complete some interesting animal testing on these materials in about two weeks and will send those results as soon as we have them.

I am enclosing a description of our gas chromatotraphy method.

Herr Silverstein has given me a copy of "Toxicological Properties of Trichlorobenzene" for you and this is enclosed also.

Kindest personal regards.

Sincerely,

Walter B. Trapp

DOW 1568557

2/5/65-2

I. GLC ANALYSIS OF Your 2,4,5-Trichlorophenate Solution

The phenate solution was acidified, the resulting oil layer amounting to 17% of the sample. The "lights" shown in the analysis include dichloroanisole, 2,4,5-trichloroanisole and three dichlorodimethoxybenzenes. Any 2,3,6-Trichlorophenol is included in the 2,4,5-Trichlorophenol peak.

DOW 1568558

Component	Weight Percent
"Lights"	2.9
Dichlorophenol	0.8
Water	1.4
2,4,5-Trichlorophenol	91.8
2-Methoxy-4,5-dichlorophenol	0.3
4-Methoxy-2,5-dichlorophenol 5-Methoxy-2,4-dichlorophenol	2.7
2,3,6,7 and 2,3,6,8-Tetrachlorodibenzo-p-dioxin	0.5 p.p.m. (Threshold = 0.2 ppm)

The Anisole Fraction

o-Dichlorobenzene	< 0.1
p-Dichlorobenzene	< 0.1
1,2,4-Trichlorobenzene	21.0
1,2,3-Trichlorobenzene	0.1
1,3,4,5-Tetrachlorobenzene	0.7
Dichloroanisoles	9.1
Trichloroanisole	61.0
Catechol and Hydroquinone - dimethyl ethers	3.3
Resorcinol dimethyl ether	4.8
2,3,6,7 and 2,3,6,8 Tetrachlorodibenzo-p-dioxin	<10 p.p.m. (Threshold = 10 ppm)

II. INFRARED ANALYSIS

This work is in progress and will be forwarded to you later.

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2/5/65-3

ANALYSIS OF CAUSTIC INSOLUBLE OIL AND 2,4,5-TRICHLOROPHENOL FOR COMPOSITION BY GAS-LIQUID CHROMATOGRAPHY

The following analysis may be made on 2,4,5-trichlorophenol by GLC. The following conditions are used:

Column :	12 feet x 1/4 inch SS
Packing	30% Sorbitol in Chromosorb W 80/100 mesh
Temperature:	150°C. on column, 250°C. on injection port
Detector :	Hydrogen flame or thermal conductivity
Sample Size:	Dependent on detector used
Helium or Nitrogen : Flow	Adjusted so that the 2,4,5-trichlorophenol retention time is 16 to 18 minutes.

DOW 1-568559

Using the above conditions, the following components may be determined, if present. They are listed in order of elution.

p-Dichlorobenzene
1,2,4-Trichlorobenzene } as one component
1,2,4,5-Tetrachlorobenzene }
2,5 and 3,4-Dichloroanisole - as one component
2,4,5-Trichloroanisole
2,5-Dichloro-1,4-dimethoxybenzene
4,5-Dichloro-1,2-dimethoxybenzene
2,4-Dichloro-1,5-dimethoxybenzene
Dichlorophenols (2,4-2,5-and 2,6-)
2,4,6-Trichlorophenol
2,3,6-Trichlorophenol
2,4,5-Trichlorophenol
4,5-Dichloro-2-methoxyphenol
2.4-Dichloro-5-methoxyphenol } as one component
2,5-Dichloro-4-methoxyphenol }

2,3,4-T ichlorophenol, if present, a, ears with 2,4,5-trichlorophenol. A representative chromatogram is attached.

Analysis of caustic insoluble oil or anisoles is performed using the following conditions:

Column :	8 feet x 1/8 inch SS
Packing :	20% Carbowax 20M alkaline on Chromosorb P 60/80 mesh
Temperature:	Programmed - 100°C. to 230°C. at 4°C. per minute. 250°C oniinjection port
Detector :	Hydrogen flame or thermal conductivity
Sample Size:	Dependent on dete or used.

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Procedure

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Helium or Nitrogen Flow : Adjusted so that the 2,4,5-trichloro-anisole retention time is about 28 minutes.

Components are eluted in the following order, if present.

m-Dichlorobenzene
p-Dichlorobenzene
o-Dichlorobenzene
m-Chloroanisole
p-Chloroanisole
1,2,4-Trichlorobenzene
1,2,3-Trichlorobenzene
1,2,4,5-Tetrachlorobenzene
2,4-Dichloroanisole
x,x-Dichloroanisole
1,2,3,4-Tetrachlorobenzene
2,4,5-Trichloroanisole
2,5-Dichloro-1,4-dimethoxybenzene } as one component
4,5-Dichloro-1,2-dimethoxybenzene }
4,6-Dichloro-1,3-dimethoxybenzene

A representative chromatogram is included.

The Dow Chemical Company
Midland, Michigan
U.S.A.

DOW 1 568560

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THE DOW CHEMICAL COMPANY

MIDLAND
February 22, 1965

"EXCITER" PROBLEM, MEETING - FEBRUARY 18, 1965

Present: V. K. Rowe — W. H. Gill
~~E. P. Tilsey~~ — L. Silverstein
K. C. Barrons — C. E. Otis
W. L. Corbin — G. E. Lynn
R. C. Hoff — F. C. Amstutz
H. R. Hoyle — E. C. Staehling
D. E. Pletcher

cc: J. D. Doedens

Otis introduced the meeting by indicating that recent information indicates "Exciter" components may be present in Dow 2,4,5-trichlorophenol. Bioproducts is concerned about 2,4,5-T acid, esters, formulations, silvex, ronnel, and Erbon. This meeting is to review status of our knowledge of this subject, potential hazards, possible effect on Dow image, legal implications, and need for possible quarantine. These basic decisions are to be made without consideration of economic impact.

Summarizing past experiences, V. K. Rowe said that Dow had no chloracne problems related to trichlorophenol production for 25 years until process changes were effected in the spring of 1964. Based on research information accumulated over the years, some ideas have been put together regarding the likely compounds which give rise to this problem. The 2,3,7,8-tetrachlorodibenzodioxin has been pretty well established as a possible contaminant. Also, there is no. indication of the possible presence of the 2,3,7,9 deriva[illegible] and two other components designated as "Unknown No. 1" and "Unknown No. 2".

Hoyle said that the rabbit test will detect 4 ppb of the 2,3,7,8-dioxin. VPC will detect 0.2-0.5 ppm of the 2,3,7,8-dioxin in trichlorophenol. Also, VPC will detect about 5.0 ppm of the 2,3,7,8-dioxin in 2,4,5-T acid. (By phone on Feb.19,1965, Hoyle indicated to the writer that it is now felt that VCP will detect 1.0 ppm.)

In samples checked from October, 1961, to the present, no dioxin was found in trichlorophenol samples from 349 bldg. using the animal test. The animal test has indicated some activity in one sample of a filter cake which represented impurities removed in T-acid processing.

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DOW 1 129845

Setting of limits of analytical methods and correlation of VPC and animal test data are not complete.

Eighteen applications at 4 ppb in TCP represents the threshold for animal reaction.

Ten exposures at 0.5 ppm in TCP gives a mild reaction.

One exposure at 40 ppm in TCP gave a positive reaction.

It is encouraging to note that exacting tests have indicated no evidence of liver damage in exposed operators. It was agreed that Rowe should move ahead with contact with U.S. Public Health Service and Department of Agriculture representatives as soon as our scientific data is better correlated. Full cooperation will be offered as regards analytical, testing, and toxicological information. Process details are not to be revealed. Also, contacts are to be made with other companies who manufacture trichlorophenol, namely, Diamond, Monsanto, Hercules, and Hooker. Rowe planned to contact his counterpart in Monsanto on February 19, 1965. Where he does not have established contacts, he will suggest that Low Corbin take care of discussions. Thompson-Hayward do not make trichlorophenol but are aware of and have been in discussion with Dow on this problem.

It was agreed that V. K. Rowe should serve as Dow contact for any inquiries which come to anyone in Dow regarding the "Exciter" problem. Also, Rowe is to serve as a focal point and advise regarding possible hazards which may result from the sale of trichlorophenol derived bioproducts until this situation is fully resolved. Staehling summarized analytical data on process samples of trichlorophenol as follows:

Date	Unknown No.1	2,3,7,9 Dioxin	2,3,7,8 Dioxin	Unknown No. 2	Calc'd as Dioxin 1 + 2
1963: June	<1	<1	<1	6	6
Oct.	3	<0.5	<0.5	14	17
1964: Feb.	2	<1	<1	2	4
June	3	<1	6	4	7
Sept.	25	<1	<1	20	45
Nov.	3	<0.5	0.8	5	8
Dec.	3	<0.5	<0.5	3	6
1965: Jan.7	8	<0.5	0.8	9	17
Feb.8	10	<0.5	<0.5	20	30
Feb.15	3	<1.0	<1	10	13

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DOW 129946

Staehling indicated that there was some evidence that through a process change he could come up with trichlorophenol showing less than 1 ppm of "Unknown No. 1", each of the dioxins, and "Unknown No. 2".

After considerable discussion it was agreed to set a specification of trichlorophenol for bioproducts use to include the designation that none of the dioxins should be present within a sensitivity of 1 ppm and that the specification for the two "Unknowns" should be 10 ppm maximum. This specification should continue until suitable correlation between bio-assay and analytical data are shown to warrant changing the specifications.

Ronnel made from trichlorophenol (sample, 2-8-65) (30 ppm of No. 1 plus No. 2) will be quarantined unless the bio-assay is negative. It was agreed not to use the 2-15 sample of trichlorophenol (13 ppm) for ronnel manufacture.

A pre-shipment sample of Monsanto T-acid showed 10 ppm of the 2,3,7,8-dioxin. Analytical data will be obtained on the shipment received and compared with Dow reference samples before a decision is made whether to use or return the T-acid. (NOTE: Hoyle indicated on Feb. 19, 1965, that this shipment showed 3 to 7 ppm of the dioxin.

It was agreed to meet Feb. 22, 1965, to decide on the disposition of the Monsanto T-acid.

DEP

D. E. Fletcher
Bioproducts Department

DEP/mm

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THE DOW CHEMICAL COMPANY

DOW 1 1295

MIDLAND
February 22, 1965

"EXCITER" PROBLEM, MEETING - FEBRUARY 18, 1965

Present: V. K. Rowe
~~M. F. Falsey~~
K. C. Barrons
W. L. Corbin
R. C. Hoff
H. R. Hoyle
D. E. Pletcher
W. M. Gill
L. Silverstein
C. E. Otis
G. E. Lynn
F. C. Amstutz
E. C. Staehling

cc: J. D. Doedens

Otis introduced the meeting by indicating that recent information indicates "Exciter" components may be present in Dow 2,4,5-trichlorophenol. Bioproducts is concerned about 2,4,5-T acid, esters, formulations, silvex, ronnel, and Erbon. This meeting is to review status of our knowledge of this subject, potential hazards, possible effect on Dow image, legal implications, and need for possible quarantine. These basic decisions are to be made without consideration of economic impact.

Summarizing past experiences, V. K. Rowe said that Dow had no chloracne problems related to trichlorophenol production for 25 years until process changes were effected in the spring of 1964. Based on research information accumulated over the years, some ideas have been put together regarding the likely compounds which give rise to this problem. The 2,3,7,8-tetrachlorodibenzodioxin has been pretty well established as a possible contaminant. Also, there is no. indication of the possible presence of the 2,3,7,9 deriva[illegible] and two other components designated as "Unknown No. 1" and "Unknown No. 2".

Hoyle said that the rabbit test will detect 4 ppb of the 2,3,7,8-dioxin. VPC will detect 0.2-0.5 ppm of the 2,3,7,8-dioxin in trichlorophenol. Also, VPC will detect about 5.0 ppm of the 2,3,7,8-dioxin in 2,4,5-T acid. (By phone on Feb.19,1965, Hoyle indicated to the writer that it is now felt that VCP will detect 1.0 ppm.)

In samples checked from October, 1964, to the present, no dioxin was found in trichlorophenol samples from 349 bldg. using the animal test. The animal test has indicated some activity in one sample of a filter cake which represented impurities removed in T-acid processing.

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Setting of limits of analytical methods and correlation of VPC and animal test data are not complete.

Eighteen applications at 4 ppb in TCP represents the threshold for animal reaction.

Ten exposures at 0.5 ppm in TCP gives a mild reaction.

One exposure at 40 ppm in TCP gave a positive reaction.

It is encouraging to note that exacting tests have indicated no evidence of liver damage in exposed operators. It was agreed that Rowe should move ahead with contact with U.S. Public Health Service and Department of Agriculture representatives as soon as our scientific data is better correlated. Full cooperation will be offered as regards analytical, testing, and toxicological information. Process details are not to be revealed. Also, contacts are to be made with other companies who manufacture trichlorophenol, namely, Diamond, Monsanto, Hercules, and Hooker. Rowe planned to contact his counterpart in Monsanto on February 19, 1965. Where he does not have established contacts, he will suggest that Lew Corbin take care of discussions. Thompson-Hayward do not make trichlorophenol but are aware of and have been in discussion with Dow on this problem.

It was agreed that V. K. Rowe should serve as Dow contact for any inquiries which come to anyone in Dow regarding the "Exciter" problem. Also, Rowe is to serve as a focal point and advise regarding possible hazards which may result from the sale of trichlorophenol derived bioproducts until this situation is fully resolved. Staehling summarized analytical data on process samples of trichlorophenol as follows:

sensitivity – ppm 1.0 1.0

Date	Unknown No.1	2,3,7,9 Dioxin	2,3,7,8 Dioxin	Unknown No. 2	Calc'd as Dioxin 1 + 2
1963: June	<1	<1	<1	6	6
Oct.	3	<0.5	<0.5	14	17
1964: Feb.	2	<1	<1	2	4
June	3	<1	6	4	7
Sept.	25	<1	<1	20	45
Nov.	3	<0.5	0.8	5	8
Dec.	3	<0.5	<0.5	3	6
1965: Jan.7	8	<0.5	0.8	9	17
Feb.8	10	<0.5	<0.5	20	30
Feb.15	3	<1.0	<1	10	13

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Staehling indicated that there was some evidence that through a process change he could come up with trichlorophenol showing less than 1 ppm of "Unknown No. 1", each of the dioxins, and "Unknown No. 2".

After considerable discussion it was agreed to set a specification of trichlorophenol for bioproducts use to include the designation that none of the dioxins should be present within a sensitivity of 1 ppm and that the specification for the two "Unknowns" should be 10 ppm maximum. This specification should continue until suitable correlation between bio-assay and analytical data are shown to warrant changing the specifications.

Ronnel made from trichlorophenol (sample, 2-8-65) (30 ppm of No. 1 plus No. 2) will be quarantined unless the bio-assay is negative. It was agreed not to use the 2-15 sample of trichlorophenol (13 ppm) for ronnel manufacture.

A pre-shipment sample of Monsanto T-acid showed 10 ppm of the 2,3,7,8-dioxin. Analytical data will be obtained on the shipment received and compared with Dow reference samples before a decision is made whether to use or return the T-acid. (NOTE: Hoyle indicated on Feb. 19, 1965, that this shipment showed 3 to 7 ppm of the dioxin.

It was agreed to meet Feb. 22, 1965, to decide on the disposition of the Monsanto T-acid.

DEP

D. E. Pletcher
Bioproducts Department

DEP/am

DFil

THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
March 5, 1965

H. L. Gordon, M. D.
Medical Department
607 Building

cc: Dr. B. B. Holder, Medical Department, 607 Building
Dr. C. G. Kramer, Medical Department, 607 Building
Dr. H. H. Gay, Medical Department, 607 Building
Dr. R. D. Stewart, Medical Research, 607 Building
L. G. Silverstein, Biochemical Research, 1701 Building
H. R. Hoyle, Biochemical Research, 1701 Building
E. M. Adams, Biochemical Research, 1701 Building
V. K. Rowe, Biochemical Research, 1701 Building
K. J. Olson, Biochemical Research, 1701 Building
T35.25-66681-2

DOW 1547766

THE INEFFECTIVENESS OF WASHING AS A PREVENTIVE MEASURE IN THE FORMATION OF FOLLICULITIS IN THE RABBIT EAR FOLLOWING REPEATED APPLICATIONS OF SYMMETRICAL TETRACHLORODIBENZO-DIOXIN

Problem

To examine the effectiveness of washing with soap and water as a prophylactic measure in the control of folliculitis produced in the rabbit ear by repeated applications of various concentrations of symmetrical tetrachlorodibenzodioxin.

Materials Used

0.01% and 0.001% symmetrical tetrachlorodibenzodioxin isolated from caustic insoluble oil.

Vehicle - Benzene
Soap - Dial
Tap Water

Washing Procedure

Ears were thoroughly washed with rich soap lather for 30 seconds and subsequently rinsed in copious amounts of freely flowing tap water, after which they were blotted dry with paper towels.

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Exposure Times Selected For Study

1) Ten seconds (until benzene evaporates), 2) two hours, and 3) four hours.

Experimental Procedure

The effectiveness of washing with soap and water as a prophylactic measure was studied in the lab, by repeatedly applying the solutions described above to rabbit ears -- 0.1 cc/day/ear -- and allowing the material to remain for controlled periods of time before washing. Two animals were used to demonstrate each point represented by a chemical concentration and a particular exposure time. Controls for each chemical concentration and for the solvent were incorporated into the study. 547767

A total of 20 animals were used in this evaluation.

Results and Conclusions

Results of this study indicate that symmetrical tetrachlorodibenzodioxin is a very effective acnegen. Under the conditions of the study, concentrations as low as 0.001% in benzene produced a discernible folliculitis as a result of ten applications. Further, that within 24 hours of the last application a moderate folliculitis developed.

Under the conditions of the experiment it appears that washing with soap and water is quite ineffective as a preventive measure. Immediate, thorough washing with soap and water only slightly delays the formation of folliculitis in the rabbit ear following repeated applications of symmetrical tetrachlorodibenzodioxin. IT IS WHOLLY INEFFECTIVE AS A PREVENTIVE MEASURE.

Summary of Results

Date of first exposure: 2-9-65

Control Animals Not Washed	An. No.	Solution Strength	Days On Expt.	No. Of Expo.	Date on Which Folliculitis 1st Discerned	Ear Appearance On 2/23/65
	655	Benzene only	14	11	None	None
	[illegible]	0.00[illegible]%	[illegible]	[illegible]	2/[illegible]	Moderate fol.
	[illegible]	0.00[illegible]%	[illegible]	[illegible]	2/[illegible]	Moderate fol.

(continued on next page)

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(continued from the preceding page)

	An. No.	Solution Strength	Days On Expt.	No. Of Expo.	Date on Which Folliculitis 1st Discerned	Ear Appearance On 2/23/65
Control Animals Not Washed	430	0.001%	14	10	2/19	Sl.-mod. fol.
	420	0.001%	14	9	2/19	Moderate fol.
	653	0.01%	14	9	2/19	Severe fol.
	648	0.01%	14	9	2/19	Severe fol.
	409	0.01%	14	9	2/17	Severe fol.
	411	0.01%	14	9	2/18	Severe fol.
Washed After 10 Sec.	677	0.01%	14	10	2/22	Moderate fol.
	647	0.001%	14	10	2/22	Moderate fol.
Washed After 2 Hours	657	Benzene only	14	11	None	None
	668	0.001%	14	10	2/23	Slight fol.
	654	0.001%	14	10	2/22	Moderate fol.
	659	0.01%	14	9	2/19	Severe fol.
	661	0.01%	14	9	2/19	Moderate fol.
Washed After 4 Hours	656	0.001%	14	10	2/23	Slight fol.
	675	0.001%	14	10	2/22	Slight fol.
	419	0.01%	14	9	2/18	Severe fol.
	421	0.01%	9	8	2/17	Animal died 2/17

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Signed ______________ C. P. O'Hare

Checked ______________ K. J. Olson

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Biochemical Research Laboratory
1701 Building
411

PROJECT DEVELOPMENT AND APPROVAL

Identification of the toxic factor in 2,4,5 trichlorophenoxyacetic acid (2,4,5T) — O.S.

DOW 1 120905

- [x] [illegible]
- [ ] RADIOLOGICAL HEALTH
- [ ] AIR POLLUTION CONTROL
- [ ] OTHER
- [x] [illegible]
- [ ] FIELD INVEST.
- [ ] EQUIP. DEVEL.
- [ ] ANALYT. METHOD.
- [ ] OTHER
- [ ] CLINICAL
- [ ] DERMAT.
- [ ] TOXICOL.
- [ ] CHEM.
- [x] OTHER Pathology

There have been many reports of people developing chloracne and liver damage from ove exposure to 2,4,5 trichlorophenoxyacetic acid (2,4,5T) in industry. It has been suggested in the literature that the toxic effects were not due to 2,4,5T but to some other contaminant. It is necessary to identify the toxic compound or compounds in commercial 2,4,5T as a means of solving this occupational health problem. (see Append [illegible])

The herbicide 2,4,5T is produced and widely used in large quantities, and several cas of illness have resulted from contact with the compound. If the toxic compound is no 2,4,5T, but some other contaminant, then the manufacturing process must be altered i some way to eliminate the hazardous compound.

The commercially available 2,4,5T will be separated by gel ~~electrophoresis~~ Chromatography into its separate components, and each component will be tested for its acnegenic and liver damaging effect by painting it onto the skins of rabbits. Skin biopsies, blood liver function tests, tests for urinary porphyrins, liver biopsies, autopsies, histology, ar electron microscopy will be done. An available amount of 2,3,7,8 tetrachlorodibenzo-p-dioxin will also be tested orally on dogs, using all the above mentioned tests. [illegible] chemistry of the compounds will be determined by their U-V and infrared absorption spectra.

7. RELATIONSHIP TO OTHER ORGANIZATIONS

None

8. SPECIAL EQUIPMENT, FACILITIES OR PERSONNEL NEEDED

Gel electrophoresis apparatus
International centrifuge

ARE ADDITIONAL PERSONNEL NEEDED ☐ YES ☒ NO

9. ESTIMATED DURATION (Years)	10. OPERATIONS COULD BEGIN
1 year	February 1, 1965

11. ESTIMATED COST (In thousands of $)	TOTAL	1ST YEAR	2D YEAR	3D YEAR	4TH YEAR	5TH YEAR	6TH YEAR
	$16,085	$16,085					

12. PROJECT WILL BE CONDUCTED BY	UNDER GENERAL SUPERVISION OF
David M. Groth	Gunther E. Kraus

APPROVED BY:

[illegible] Pathology Unit	DATE	PROJECT REVIEW COMMITTEE	DATE
Gunther E. Kraus, Sup. Res. Vet.			
CHIEF, [illegible] FIELD [illegible]	DATE	CHIEF, [illegible]	DATE

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DEC 05 1980

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Proposed Method

Chloracne

A. The compound 2,3,7,8 tetrachlorodibenzo-p-dioxin will be given daily to three groups of dogs orally in three different doses, 0.1 μ g/Kg, 1.0 μ g/Kg and 10 μ g/Kg. The compound must first be diluted to a concentration of 10 μ g/cc in 10% ethyl alcohol. Three control dogs who will receive only the diluent will also be used. The mongrel dogs will weigh between 10 and 15 Kg.

The following laboratory tests will be performed twice before administration of the pesticide and at least twice before administration of the pesticide and at least twice weekly after the administration has begun: SGOT, SGPT, BSP, lipase, amylase, BUN, sugar, WBC, hct., hgb., and differential blood counts. Urine will also be collected for analysis of urinary porphyrins.

Liver biopsies will be performed once on each animal before pesticide administration, and on the 1st, 8th, 15th and 22nd days of administration or more often, if the laboratory tests show evidence of extensive liver damage. Some of the biopsies will be processed for electron microscopy, particularly the pre-administration biopsies and the 24 hour biopsies.

Autopsies will be performed on all animals that die, and at 30-60 days of the experime

Tissues, will be submitted for histological evaluation.

B. The commercially available (impure) 2,4,5 trichlorophenoxyacetic acid iso-octyl ester will be separated into its suspected five or more fractions by thin-layer gel electrophoresis. This compound will be obtained from Thompson-Hayward Chemical Company.

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The whole compound and the individual fractions will then be tested for their chloracnegenic properties by diluting them in acteone and painting them on the shaven scalps of rabbits in three divided doses. Total doses of 1 mg, 10 mg, and 100 mg will be used for each compound on each of six rabbits. All six rabbits in each group will have the following lab. tests - SGOT, SGPT, BSP, lipase, amylase, BUN, sugar, WBC, Hct, Hgb and differential blood counts. Urine will be collected for analysis of prophyrins.

On three of the six animals in each group liver biopsies will be performed on the 1st, 8th, 15th and 22nd days of administration.

The blood tests, urinary porphyrins and liver biopsies will be done before administration of the compounds as well as on 10 controls.

Example

	Dose 1	Dose 2	Dose 3	Control
Blood Tests Urinary Porphyrins	3	3	3	5
Blood Tests Liver Biopsies	3	3	3	5

It is anticipated that 28 animals will be used for each compound.

(2)

1-12-65

1. ~~Identification and Evaluation of the Biologically Toxic Compounds Present in the Commercial~~ of the toxic factor(s) Herbicide, 2,4,5 Trichlorophenoxyacetic acid.

2. E.S.

3. Lab Research

4. What is the Problem? For several years 2,4,5 trichlorophenoxyacetic acid (2,4,5T) has been used as a herbicide in large quantities. There have been many reports of people developing chloracne and other reports of serious liver damage secondary to accidental over-exposure to this compound in industry.[1] In 1964 Dr. George Lawton partially evaluated the effects of the commercial 2,4,5T and found it to be a potent chloracnegen as well as a potent hepatotoxin. In 1957 a German dermatologist Dr. Kimmig,[2] published a paper stating that the toxic effects were not due to 2,4,5T, but probably due to some contaminant produced in its manufacture. As yet no one has seperated out the contaminant, but it is thought to be 2,3,7,8 tetrachlorodibenzo-p dioxin. This compound was found by Jones and Krizek[3] to be the most potent chloracnegen known, producing chloracne in doses of 1 microgram. Kimmig found it hepatotoxic in a dog after an oral dose of only 50 micrograms. This compound is probably present in the commercial 2,4,5T in very small amounts, estimated at 0.01%. The problem then is to identify the toxic compound or compounds in commercial 2,4,5T by electrophoretic separation, biologic testing and determination of their U-V absorption spectra

1. Unpublished data.

2. Kimmig, J. and Schulz, K.H.: Occupational Acne Caused by Aromatic Cyclic Ethers. Dermatologica 115: 540-46, 1957.

3. Jones, E.L. and Krizek, H.: A Technic for Testing Acnegenic Potency in Rabbits, J. Invest. Derm. 32: 511, 1962.

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2. 1-12-65

Why is it Important? The herbicide 2,4,5T is produced and widely used in large quantities, and several cases of illness have resulted from contact with the compound. If the toxic compound is not 2,4,5T, but some contaminant, then the manufacturing process might be altered in some way to eliminate the hazardous compo[und]

6. Proposed Method of Attack: The commercially available 2,4,5T will be separated by gel electrophoresis into its separate components, and each component will be tested for its acnegenic and liver damaging effect by painting it onto the skins of rabbits. Skin biopsies, blood liver function tests, tests for urinary porphyri[ns], liver biopsies, autopsies, histology and electron microscopy will be done. An available amount of 2,3,7,8 tetrachlorodibenzo-p-dioxin will also be tested orally on dogs, using all the above mentioned tests. The chemistry of the compounds will be determined by their U-V and infra-red absorption spectra.

7. Relationship to other Organizations: None

8. Special Equipment needed:

Gel Electrophoresis apparatus	$ 421.50
International Centrifuge	1050.00
Gels	30.00
Animals	600.00
Material for blood tests	200.00
	2301.50

No additional personnel needed.

9. Duration 6 months - 1 year.

10. Begin: Feb. 1, 1965

11. Estimated Cost:

		% of time
David Groth, M.D.	3,150	30%
Marcus Key, M.D.	1,650	10%
Karl Zobel, M.S.	2,210	20%
R.E. Kupel,	1,435	10%
Vern Perone	3,175	30%
Biochemistry Technician 65-5	2,165	40%

13,785

Equipment and Supplies $2,200

12. Project Leader: Dr. David H. Groth

$16,085

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APPENDIX

A. WHAT IS THE PROBLEM?

For several years 2,4,5 trichlorophenoxyacetic acid (2,4,5T) has been used as a herbicide in large quantities. There have been many reports of people developing chloracne and other reports of serious liver damage secondary to accidental over-exposure to this compound in industry. In 1965 Dr. George Lawton[1] partially evaluated the effects of the commercial 2,4,5T and found it to be a potent chloracnegen as well as a potent hepatotoxin. In 1957 a German dermatologist, Dr. Kimmig[2], published a paper stating that the toxic effects were not due to 2,4,5T, but probably due to some contaminant produced in its manufacture. As yet no one has separated out the contaminant, but it is thought to be 2,3,7,8 tetrachlorodibenzo-p-dioxin. This compound was found by Jones and Krizek[3] to be the most potent chloracnegen known, producing chloracne in doses of 1 microgram. Kimmig found it hepatotoxic in a dog after an oral dose of only 50 micrograms. This compound is probably present in the commercial 2,4,5T in very small amounts estimated at 0.01%. The problem then is to identify the toxic compound or compounds in commercial 2,4,5T by electrophoretic separation, biologic testing, and determination of their U-V absorption spectra.

THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
March 10, 1965

F. H. Riley, Special Chemicals Sales, ARB
J. C. Tucker, Industrial Chemicals Sales, ARB
R. N. Smiley, International Sales, ARB
J. W. Harris, Chemical Sales, ARB
L. B. Grant, Sales Administration, 47 Building
H. W. Feinauer, Chemicals Department, ARB
C. O. Hutchenreuther, Org. Chem. Prod. Dept., 258 Building
E. C. Staehling, Organic Chem. Products Dept., 172 Building
P. C. Amstutz, Herbicide Section, 441 Building
C. E. Otis, Bioproducts Department, Bioproducts Center
W. P. Palsey, Bioproducts Department, Bioproducts Center
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G. E. Lynn, Bioproducts Department, Bioproducts Center
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~~H. R. Hoyle~~, Biochemical Research Laboratory, 1701 Building
V. K. Rowe, Biochemical Research Laboratory, 1701 Building

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HAZARD OF MONSANTO T ACID

Rabbit ear tests on twelve lots of Monsanto 2,4,5 T acid have shown moderate to severe response in eight cases at ten per cent concentration in ethanol. This confirms VPC analysis for 2,3,7,8-tetrachlorodibenzodioxin which was found in concentrations averaging about 10 ppm.

This material presents a definite hazard which would require all the precautions used in 199 Building and 349 Building to prevent injury, if it is processed at 257 Building.

Dow's involvement in shipping this material to Riverdale and Woodbury also concerns me. There is a definite risk to their employees, especially since they are probably unaware of the problem and are probably taking no precautions.

There is no assurance that their final products will be free of contamination. The available evidence points to the opposite. In my opinion their products should not be sold until animal tests show these products to be free of a significant hazard from the tetrachlorodibenzodioxin and related materials.

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DOW CHEMICAL CORP.
DOW

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F. H. Riley, et al. - 2 - March 11, 195[illegible]

I believe Dow has a definite obligation to advise Riverdale and Woodbury of the problem immediately.

L. G. Silverstein
Biochemical Research Laboratory
1701 Building

LGS/ejl

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THE DOW CHEMICAL COMPA...

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MIDLAND, Michigan
March 29, 1965

copy to Bill Haberstick
on 1-29-69
- OKL.

DOW029959

V. K. Rowe
Biochemical Research Laboratory
1701 Building

cc: F. N. Riley
R. N. Smiley
L. B. Grant
C. O. Hutchenreuther
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K. Y. Hansen
R. C. Hoff
W. J. McCoy
J. D. Doedens
K. C. Barrons
H. R. Hoyle
B. B. Holder, M.D.
S. E. Sadek

REPORT ON THE CHLORACNE PROBLEM MEETING ON 3/24/65

Present: Dr. J. Wilkenfeld and
Mr. Raymond Verhoeze, Hooker Chemical Corporation

Mr. Francis Kennedy and
Dr. Ed Chandler, Diamond Alkali Company

Mr. C. L. Dunn and
Dr. John P. Frawley, Hercules Powder Company

V. K. recapped the Dow situation in terms of the problem and the initial studies by Toxicology and Environmental Research Laboratory regarding the in-plant situation. He expanded this in general terms to the study of end products, ours and other peoples. He made reference to symmetrical tetrachloro-p-dibenzodioxin. He referred to the evidence for unknown acnegens. There were some questions from the group about the unknowns. We (Dow) were not able to answer these questions except to review the evidence for their existence in the process samples and end products.

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Dr. Holder reviewed the medical side of the Dow experience; he said that we now have approximately 60 to 70 cases of individuals with chloracne ranging from two severe cases to some very mild cases that were difficult to diagnose. He showed slides of the more dramatic cases. The slides were exclusively views of the faces of the individuals afflicted. He described in fair detail the appearance of the individuals mentioning the blackheads specifically. He then reviewed the clinical studies that are being made on these people with emphasis on the liver function tests. He mentioned the single liver biopsy that has been taken and studied in which the liver was normal although the man had a rather pronounced case of chloracne. Dr. Holder also mentioned the incidence of fatigue among the afflicted people as being the only other significant finding in these folks. He touched briefly on treatment indicating that various topical treatments were not particularly effective. He described the cycling of this disorder in individuals who had been completely removed from exposure. He mentioned that some fellows are approaching the end of their trouble two or two and one-half years after onset of the skin disorder. He also described "acute chloracne" which is an acute inflammatory condition that appears considerably sooner than the normal chloracne in individuals and appears after pronounced single exposure. The acute chloracne shows up within a few days of exposure. Dr. Holder mentioned five to eight days specifically. There was considerable discussion by the group on the skin disorder itself. The Hooker representatives related experience of skin condition thirty years after exposure. Their cases were more similar to the Dowicide bumps which Dow has experienced in that there were large boils or large bumps rather than the multitude of small blackheads and eruptions which Dow is seeing in the current cases.

Dr. Sadek showed slides of ears and livers of rabbits that had been exposed to the symmetrical tetrachloro-p-dibenzodioxin. He discussed the pathology in detail which I will not attempt to summarize.

V. K. mentioned the studies in which the rabbit ears have been treated with TCBD in benzene or corn oil and then washed with soap and water at various time intervals later. If exposure occurs for very long, washing does little good. He also briefly mentioned the oral studies but without detail. Silverstein described the plant study on washing of contamination from tools and surfaces. This study indicated that benzene, acetone and Chlorothene NU were effective in removing the contaminant from tools and also that detergent and water with scrubbing action could clean up tools and equipment. Some discussion ensued on the use

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of detergent and water and the point was made again that strong scrubbing action was necessary for this approach to be successful.

Harold Gill then discussed the analysis for tetrachloro-p-dibenzodioxin by vapor phase chromatography. He listed the limit of sensitivity on various process materials. He mentioned the oil which he defined as a non-saponifiable mixture of chloro anisoles, tetrachlorobenzene and trichlorobenzene; the limit of sensitivity for TCBD in this material is 10 ppm. The limit is 1 ppm for 2,4,5-trichlorophenol, and for 2,4,5-T Acid, either acetic or propionic. Gill then defined 1 ppm as a very discernible peak. He mentioned that he might estimate 0.5 ppm in some instances but to be conservative the analyst reports <1 ppm if the peak does not measure up to the quite identifiable level of 1 ppm. The analytical problem has not yet been solved for the T-Acid esters. The general procedure used for the T-Acids is to extract the sample (arbitrarily about 20 grams) with chloroform (about 40 milliliters), filter the chloroform to remove solids and wash with an equal volume of N/10 caustic to remove any acidic materials. The chloroform extract then is concentrated by evaporation to one-tenth the original volume; thus, the concentration of the dioxin in the chloroform will be ten times higher than in the original sample. When the analysis is conducted on trichlorophenol, the material is dissolved in N/1 caustic to the extent of 10%, and this solution is then extracted with the chloroform and handled as indicated above.

A question was asked about the utilization of detectors other than the flame ionization which is specified in the Analytical Laboratory write-up for this analysis. Gill has not tried the micro coulometric detector because he is not set up to do so, but he has experimented with electron capture. He stated that theoretically this unit should not provide any greater increase in sensitivity. In actuality he found a slight increase in sensitivity but there are usually too many chlorinated species present which may saturate the electron capture cell whose recovery is too slow to be of practical use. He summarized by saying that the slight increase in sensitivity is not worth the effort to switch from flame ionization to electron capture. A question was asked about how the extraction is performed. Gill stated that it is performed in a wide mouth bottle on a shaker for one hour. (It was not mentioned, but it is the case that this is done at room temperature.) He mentioned that spiked samples have been

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run this way and the recovery ranged from 90 to 100 per cent. The ratio of solvent to the material being extracted on this step is not critical according to Gill. Their standard procedure is 20 grams of sample and 40 milliliters of chloroform. On trichlorophenol samples specifically, 20 grams of phenol is converted to phenate — about 10 per cent concentration in water. The phenate solution is extracted with 20 milliliters of chloroform in a single extraction. The chloroform is then concentrated so that the concentration of the dioxin will be ten times that in the original sample.

The question of volatility of dioxin came up and Harold Gill stated that he found he can distill o-dichlorobenzene away from tetrachlorobenzodioxin. He said that in his opinion the secret was to avoid distilling to dryness.

A member of the group asked if samples of standard TCBD were available. The answer was yes and 100 mg samples were provided to one of the representatives from each company. (A sample had previously been given to Dr. Kelly of Monsanto.) A question of laboratory safety in the analytical work came up and the basic precaution of wearing vinyl gloves was mentioned. Information relative to the gloves we used was provided to the group.

Disposal of contaminated laboratory materials and plant materials was discussed. We mentioned that Dow burns some small amounts of waste. Harold Gill stated that his laboratory study of combustion showed that 99.96 per cent of the dioxin sample was burned at 800°C. We described why we felt that our practice of burning small amounts of dioxin was a safe one.

V. K. then outlined the project in which plant samples and products (not mentioned by name) were spiked with known amounts of the TCBD. The spiked samples were split for the purpose of checking our analytical procedures for recovery and correlating these results with the bio-assay method.

The question of specification, quality control specification that is, was raised and we were asked if we could give levels of dioxin contamination which were permissible limits. V. K. mentioned that at present we are using zero with a confidence of 1 ppm in process samples. There was some discussion on the problem of customers using finished products under far less desirable conditions of health control than we can provide our workmen in our own plant. There seemed to be agreement among the group that we could not afford to sell contaminated products.

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V. K.

Jack
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Jack Peterson then discussed the data from animal experiments using pure symmetrical tetrachlorobenzodioxin. Doses ranging from 2 parts per billion to 1000 parts per million of tetrachlorobenzodioxin in benzene had been administered to the rabbit ear. Dosage in most cases was 0.1 ml per day. Both single and multiple exposures have been studied and multiple exposures administered on a five days per week basis. The significant factors in the study are dose, the number of applications and the days on exposure of the animals. The response which is reported in the gross observation of the condition of the rabbit's ear by the toxicologists. This does not include pathological findings -- there is not enough data in this area to discuss. The level of response ranges from none through very slight, slight, slight to moderate, moderate, moderate to severe, severe, and extremely severe. Jack indicated to the group that there is not a sharp definition between these categories of response and indicated also that there is some difficulty in graphing this type of response. He described the response from single applications to the rabbit ear first: at 100 parts per million there was a severe response in eight days; at 40 parts per million there was a slight response in eleven days; at 20, 10, 7 and 4 parts per million there was no response. These tests were run on single rabbits and without washing the material off. Jack then discussed the multiple application data which he took from his major graph of this data. The important points that he made from this data were first that at the limit of VPC sensitivity a severe response may be produced. In other words, even if the VPC does not detect TCBD, an animal response may still occur. His second important point was that the induction period for response averaged about ten days on the animals in the studies.

There was a brief discussion then about the air samples that were taken in the plant. Silverstein mentioned that some air samples have shown activity on the animals. The degree of response is slight and the number of samples that show activity is small out of the total number taken and the amount of air that must be sampled is very much larger than the amount a man normally breathes in an eight hour day.

The meeting was adjourned. The group then proceeded to the Toxicology Laboratory to view some of the test animals. They were shown responses of varying intensity and these were described. This demonstration appeared to have considerable impact.

L. O. Silverstein
Biochemical Research Laboratory
1701 Building

LOS:sjl

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DOW 029964

A&G 000876

Postscript

All participants seemed to appreciate well the problem and all indicated that they would return home and attempt to convince their management to institute safety specifications (really quality control) for their various products in this area. All agreed that the industry should meet its own responsibility. All were very appreciative of Dow's effort to steer them away from a danger area. Time will tell whether we accomplished our mission, but as of now I feel satisfied with our effort and the reception it received.

VKR

46/505

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

April 1, 1965

Dow Chemical International S.A.
Beethovenstrasse 32
8002 Zurich, Switzerland

Attention Mr. Peter Koopmann
Manager Bio-Products Sales

Dear Peter:

I am enclosing a copy of a letter covering the transmittal of the completed contract and financial settlement to C. H. Boehringer Sohn.

Our agreement with them calls for payment of
to them at such time that we are satisfied that we have solved our chloracne problem, whether we use their know-how or not. It is our judgement in Production and Research that we have reached such a point. Paying them at this time will be a signal to them that we are no longer in trouble.

I have been informed that my choice of words in answering Dr. Doll's letter did not set well with you. I hope that you will accept my personal apology on this. My intent was to emphasize the secrecy agreement as an obvious reason for your lack of information. Let us hope that the entire incident may dissolve away as new problems and business opportunities command our and their attention.

Best personal regards,

Walter

Walter B. Trapp
Benzene Research Laboratory
474 Building

mak

FEB 15

DATE

DIR. DR. O DOLL

C H BOEHRINGER SOHN

~~INGEL HEIM AM RHEIN~~

WEST GERMANY VIA RCA

REGARDING YOUR DISCUSSION WITH KOOPMANN WE REGRET THAT HE WAS NOT AWARE EITHER OF THE SERIOUSNESS OF OUR HEALTH PROBLEM OR OF THE CONSIDERABLE HELP THAT ALL OF YOU AT BOEHRINGER HAVE BEEN TO US. WE HAVE RESTRICTED COMMUNICATION ON THIS WITHIN OUR COMPANY BECAUSE OF OUR SECRECY AGREEMENT AND BECAUSE OF THIS KOOPMANN WAS NOT FULLY INFORMED. WE ARE ANXIOUS TO RECEIVE THE CONTRACT FROM YOU AND ARE PLEASED TO LEARN THAT IT IS READY. WE ARE MOVING AHEAD WITH A SOLUTION OF OUR PROBLEM AND ARE ANXIOUS TO COMPLETE OBLIGATION TO YOU.

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WIRE COMMUNICATION

DOW 1568549

THE DOW CHEMICAL COMPANY

FORM C-7540 PRINTED IN U.S.A. 8 9/60

FILE COPY

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DATE

LETTER OF CONFIRMATION WILL FOLLOW.

CORDIALLYX,

WALTER TRAPP 474

AL

WIRE COMMUNICATION

CONFIDENTIAL

Disclosure Restricted Pursuant To Court Order. "Agent Orange" Product Liability Litigation, MDL No. 381

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Procedure A

THE DOW CHEMICAL COMPANY

FORM C-7540 PRINTED IN U.S.A. 8 9/60

V. K. Rowe

MIDLAND
June 24, 1965

DOW CONFIDENTIAL

MN069799

DOW 747096

Ross Mulholland
Manager
Bioproducts
Dow Chemical of Canada
Sarnia, Canada

2,4,5-TRICHLOROPHENOL, THE "T" ACIDS, AND ASSOCIATED ACNEGENS

I have not been neglecting your request for information to use in discussing the subject problem with Naugatuck and the Co-Op. I have been stymied, however, because the analytical methods have been changed and are in the process of being cleared and reproduced. I expect them any day, but rather than wait longer, I thought I should advise you of the situation. I will send you copies of these methods as soon as they become available.

In regard to the overall problem, we are attempting to do everything possible to avoid the possible occurrence of chloracne in any applications involving the handling or use of trichlorophenol, trichlorophenoxyacetic acid and its derivatives. As you well know, we had a serious situation in our operating plants because of contamination of 2,4,5-trichlorophenol with impurities, the most active of which is 2,3,7,8-tetrachlorodibenzodioxin. This material is exceptionally toxic; it has a tremendous potential for producing chloracne and systemic injury. If it is present in the trichlorophenol, it will be carried through into the T acid and into the esters and hence into formulations which are to be sold to the public. One of the things which we want to avoid is the occurrence of any acne in consumers. I am particularly concerned here with persons who are using the material on a daily, repeated basis such as custom operators may use it. If this should occur, the whole 2,4,5-T industry will be hard hit and I would expect restrictive legislation, either barring the material or putting very rigid controls upon it. This is the main reason why we are so concerned that we clean up our own house from within, rather than having someone from without do it for us. In this way, we can approach the problem in an orderly manner. If the producers and handlers of this material will cooperate, there is no reason why we cannot get this problem under strict control and thereby hopefully avoid restrictive legislation; in other words, let us practice good citizenship. At the present time, we are of the opinion that material containing no tetrachlorodibenzodioxin with a certainty of 1 ppm does not present an appreciable hazard to consumers; likewise, we do not believe that such material constitutes a significant hazard to persons working in

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DOW CONFIDENTIAL

plants handling such phenol, T acid, or T acid esters.

I might add that we are continuing our researches on this particular problem from the standpoint of studying the other impurities which may have the capacity to produce this type of reaction. Also, we are attempting to quantitate the effects of the known acnegens when added to base materials. This work is progressing well, but it will be several months before we have a completed story.

I would urge again that if your big customers such as Co-Op and Naugatuck have particular questions about this problem that you invite them to come to Midland where we will be glad to discuss the matter in detail with them and show them what we have learned. We are not in any way attempting to hide our problem under a heap of sand, but we certainly do not want to have any situations arise which will cause the regulatory agencies to become restrictive. Our primary objective is to avoid this.

I trust that you will be very judicious in your use of this information. It could be quite embarrassing if it were misinterpreted or misused.

V. K. Rowe
Biochemical Research Laboratory
1701 Building
MK 6-2376

VKR/jd

cc: L. Silverstein
C. Otis
Grady Holdeman
F. Amstutz
G. Goergen
H. Hoyle
W. Falsey
V. K. Rowe (2)
T17.4-12-20
Correspondence

P.S. Under no circumstances may this letter be reproduced, shown, or sent to anyone outside of Dow.

VKR

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DOW CHEMICAL CORP.

THE DOW CHEMICAL COMPANY

DOW02010089

MIDLAND DIVISION
October 21, 1965

W. C. Timm

These are the points that I made in the presentation this morning to Ben and Max.

We spent considerable time yesterday with Bechtel reviewing their performance generally and specifically on the Trichlorophenol job. They have gone back to the New York office and will have a review of their estimate on Trichlorophenol completed this Friday, in terms of a three to four months relief on the completion date.

Bechtel sees the situation rapidly worsening with the most problems likely to occur in 1966. Contracts with AFOL expire in May of 1966 and additional costs can be expected at that date.

We challenged Bechtel on their performance generally in the location and specifically on their estimate on this job.

There was no great encouragement by Bechtel on a substantial reduction.

We believe their estimate is high and that there is a good possibility of building this plant for less than and will make an all out effort to do so but the board's decision should be based on the at this time.

Our engineering will be completed by December 1. We have spent now and are spending at the rate of per week.

It is too late to make design changes. Equipment is in route or too far advanced in fabrication to allow changes.

We are now scrutinizing not installing parts of the plant and yet have the capacity in the range of pounds. We will cut back on the installation if the economics are favorable.

I stressed to Ben the seriousness of one more incident in the Trichlorophenol plant and the effect that this would have on our Division's operation generally and our over-all relations with the Union.

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Ben specifically asked what effect the additional costs had on economics of Trichlorophenol and also on 2, 4, 5 T. He asked about the basis of the economics. He asked for a history on the authorization requests and the amounts that we have asked for at various times. He asked how much capital will be written off our books as a result of obsolating our old Trichlorophenol facilities. He asked the effects on costs of this increased expenditure on both Trichlorophenol and 2, 4, 5 T.

Harold Bosscher

ALBERT M. KLIGMAN M.D., PH.D.
HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA
36TH AND SPRUCE STREETS
PHILADELPHIA 4, PA

DEPARTMENT OF DERMATOLOGY

EVERGREEN 2-4600
EXTENSION 481

RECEIVED
JUN 24 1966
Biochem. Res. Lab.

June 22, 1966

DOW
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Mr. V. K. Rowe,
Biochemical Research Laboratory
1701 Building,
The Dow Chemical Company
Midland, Michigan

Dear V. K.:

Now that I have collected the detailed data, it is evident that the tetrachlorodibenzo-p-dioxin study was by no means a tiny or trivial affair. This study was supervised by one of my graduate dermatologists, he kept giving me a negative read-out throughout the many months of study. I personally saw the subjects in the last two groups which received the highest doses.

The skeletal report I sent was further reduced from the very bony summation he gave me. I was hopeful that the report might be sized to the significance of the results. I almost sent you a letter saying, "We did the work you ordered and found nothing". (I guess those happy days are gone).

Wherever the subject could not be followed for six weeks owing to sudden discharge, or to institutional decisions, detailed data are deleted.

I am grieved that so little has been learned, especially since practically the whole grant was spent in laboratory work. This was a discouraging project.

With every good wish, I remain

Very sincerely yours,

A. M. Kligman

Albert M. Kligman, M.D.

AMK:a
Enclosure

DOW CHEMICAL CORP. ROLL #15

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DOW 753445

TETRACHLORODIBENZO-p-dioxin

Method

The subjects were six separate groups of ten healthy adult males. Each group received a different total dose ranging from 0.2 μg. to 8.0 μg. Each group was studied in two phases; the first consisted of a single dose: After a two-week rest, the same total dose was given in equally divided doses. The test material was dissolved in 50/50 chloroform-alcohol; the appropriate volume was placed in a glass cylinder and the solvent evaporated in a stream of flowing air. The site was covered by a 2" gauze square for twenty-four hours. The daily repeated doses were to the same skin site. The applications were made to the forehead on half the subjects and to the mid-back on the remaining half.

One week after the single dose, and 3-4 days after the final daily dose, the following tests were done:

CBC, BUN, SGOT, ALKALINE PHOSPHATASE,

and in the second phase only,

CREATINE CLEARANCE.

The skin was examined weekly for six weeks after the last dose. At the end of each phase, the subjects were examined by an internist for signs of systemic illness.

Results

The treated sites remained normal during the applications and for six weeks thereafter. There was not the slightest evidence of acne, either on the forehead or the back.

DOW 753146

TETRACHLORODIBENZO-p-dioxin

Results ...continued...

No subject developed symptoms which could be related to the treatment. The laboratory values were unaffected.

At the dosage level, the test agent gave no evidence of being acneigenic and was not harmful to the subjects.

Respectfully submitted,

Albert M. Kligman, M.D.

AMK/a

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V.T. [illegible]

MIDLAND
February 15, 1967

William B. Dixon
Bioproducts Department
BPC

cc: W. L. Corbin, BPC
D. E. Pletcher, BPC
J. H. Cowell, BPC
W. J. McCoy, BPC
B. D. Holder, M.D., 607

DOW 751972

THOMPSON CHEMICAL COMPANY, ST. LOUIS, MISSOURI

On February 2, 1967, W. J. McCoy informed me that a Mr. H. S. Buckley of Thompson Chemical had called Dow indicating that they had had an accident associated with the manufacture of trichlorophenol, and that they had some men with what they thought was chloracne. They wondered if we could advise them in regard to medical practice. I contacted Dr. Holder, who then called Mr. Buckley and discussed with him medical aspects of the problem. It is my understanding from Dr. Holder that Mr. Buckley then started talking about the chemistry of this material, and Dr. Holder suggested that he contact me in regard to anything along this line.

On or about February 7 Mr. Buckley called me to see what we knew about chloracne caused by contact with materials associated with the manufacture of trichlorophenol from tetrachlorobenzene. I told him that under certain circumstances, which I did not describe, the caustic insoluble oils could contain considerable amounts of a very highly toxic substance which we had identified as 2,3,7,8-tetrachlorodibenzodioxin. I indicated to him that this material was not only extremely toxic systemically, but it was also an extremely potent chloracnegen. He indicated that they had been distilling some oils or tars containing anisoles when the operation got out of control, and the material either spilled or splashed onto a hot autoclave. He thought that the fumes and vapors of the anisoles had caused their difficulty. I told him I did not think the acne was caused by the anisoles, but rather by other materials present in the anisoles.

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Apparently Mr. Buckley had asked Dr. Holder how to clean up the equipment, etc., and Dr. Holder indicated to him that he must take extreme precautions, including the use of rubber suits and gloves and respirators. He seemed surprised that we would recommend such severe measures, but I reiterated that such precautions were what we believed necessary. He then wanted to know if I thought they could clean up the contaminated equipment with steam. I felt at this point an obligation to tell him that steam was the worst thing he could use, simply because it would volatilize the material, causing it to recrystallize and deposit elsewhere. This was not the way to get rid of it. He suggested scrubbing down the equipment with detergent or solvents. I indicated that this could be done if he made sure that all necessary precautions were taken to prevent contact with the people. I suggested that he assay or take wipe samples of the equipment to determine the degree of contamination. I suggested that this should be done before and after the clean-up. He asked how such assays could be made. I indicated to him that we had developed a method of analysis and also used biological assay employing a rabbit ear. He did not ask me for details of these procedures, so I did not give them to him.

He then asked where he could find information about chloracne, and I volunteered to send him copies of pertinent articles from the published literature which I had, and this has been done.

My conversations with Mr. Buckley were within the framework of our discussion of the problem. The information on the physiological activity was perhaps even less than was given to the other producers of trichlorophenol over a year ago. This was because it was quickly apparent that Mr. Buckley had little understanding of the toxicological aspects of his problem. Had he asked for methods, etc., I would have agreed to send them to him. However, since he did not, I saw no reason to volunteer.

I don't know whether this information is of any value to you, but it will, at least, keep you informed. If you have any questions or suggestions for further action, please do not hesitate to contact me.

V. K. Rowe
Biochemical Research Laboratory
1803 Building

bcc: ~~V. K. Rowe (2)~~
T17.4-23-20
Chloracne file 7 3
Correspondence

DSW

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V.K. Rowe

MIDLAND
February 15, 1967

William B. Dixon
Bioproducts Department
BPC

cc: W. L. Corbin, BPC
D. E. Pletcher, BPC
J. H. Cowell, BPC
W. J. McCoy, BPC
B. D. Holder, M.D., 607

DOW 751972

THOMPSON CHEMICAL COMPANY, ST. LOUIS, MISSOURI

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On or about February 7 Mr. Buckley called me to see what we knew about chloracne caused by contact with materials associated with the manufacture of trichlorophenol from tetrachlorobenzene. I told him that under certain circumstances, which I did not describe, the caustic insoluble oils could contain considerable amounts of a very highly toxic substance which we had identified as 2, 3, 7, 8-tetrachlorodibenzodioxin. I indicated to him that this material was not only extremely toxic systemically, but it was also an extremely potent chloracnogen. He indicated that they had been distilling some oils or tars containing anisoles when the operation got out of control, and the material either spilled or splashed onto a hot autoclave. He thought that the fumes and vapors of the anisoles had caused their difficulty. I told him I did not think the acne was caused by the anisoles, but rather by other materials present in the anisoles.

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I don't know whether this information is of any value to you, but it will, at least, keep you informed. If you have any questions or suggestions for further action, please do not hesitate to contact me.

V. K. Rowe
Biochemical Research Laboratory
1803 Building

bcc: V. K. Rowe (2)
T17.4-23-20
Chloracne file 7
Correspondence

DSW

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THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN
February 3, 1967

DOW 751571

To: V. K. Rowe

cc: W. L. Corbin
D. E. Pletcher
J. H. Gowell

From: W. J. McCoy WJM

THOMPSON CHEMICAL COMPANY, ST. LOUIS, MISSOURI

Mr. M. S. Buckley of Thompson Chemical phoned Howard Sheldon February 2, indicating that he believed they have a severe chloracne problem with some of their employees. He indicated that they already have two men affected and believe that they may have two more employees that appear to be affected as well. They are using Hooker's tetrachlorobenzene to make their trichlorophenol.

Buckley was asking if Dow would have any recommendations for medical treatment for their employees. We do not feel friendly toward this competitor as far as business relationships are concerned but believe that any advice would be in order. If you concur, he would appreciate a phone call and his number is Area Code 314, JE 5-6608.

jk

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THE DOW CHEMICAL COMPANY

CONFIDENTIAL - SUBJECT TO INJUNCTION
D.C., E.D. MI. 4-4-78; DOW, EPA AGREEMENT 9-79

DOW 28610

A&G 000869

9008 Building
Midland, Michigan
December 10, 1969

E. E. Blair
Manager of Research and
Development
Agricultural Department

cc: J. C. Hansen
J. E. Johnson
D. D. McCollister
R. E. Naegele
V. B. Robinson
~~V. K. Rowe~~
~~H. H. Brower~~

The following is a report of the telephone call from Dr. Burger of the Office of Science and Technology, which you referred to me.

Dr. Burger told me that he was aware of the visit that Dr. Johnson had made to Dr. DuBridge concerning the 2,4,5-T problem. Dr. Burger indicated that he was interested in learning more of the details concerning the teratological tests which Dow was going to conduct. He wanted to know the status of the tests. I told him that the rat study would be conducted first and that the rats were on hand and being acclimated. The breeding would start on December 15th, the dosing of the animals about six days later, and the fetuses would be taken from animals sacrificed beginning the week of January 5th. I told him that shortly afterwards some gross observations would likely be available but that the histopathologic examination of the soft tissues and the clearing of the fetuses for observation of skeletal development would take several more weeks. I also indicated that a similar test would be conducted with rabbits and that these could not be started until sometime in January, but that we hoped that the whole job could be finished and reported in April. Dr. Burger was interested in some of the details of the tests including the number of animals to be used. I told him that I would ask our Human Health Laboratories to furnish him with a set of the protocols. I called Dr. Robinson but he is in Washington this week. I did talk to Dr. Molello. He said that Dr. Robinson had the proposed protocols with him in anticipation of a visit

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...y of the National ... Health Science at Raleigh, North ... Indianapolis is going to try to have Dr. Robi get in touch with me and hopefully copies of the protoco. can be mailed from Washington to Dr. Burger. (Dr. Robinson called me later in the day and arrangements were made to have the material typed in the Washington office and delivered to Dr. Burger by messenger.)

Dr. Burger also wanted to know about the sample which we were using. I told him that the sample had been taken from our regular plant production, that it had been assayed by two chemical methods and a bio-assay method and the results showed it meets our specification of containing less than 1 ppm of the symmetrical tetrachlorodibenzo-para-dioxin. He also wanted to know who the producers of 2,4,5-T were. I told him Dow, Monsanto, Hercules and Thompson-Hayward. He then remarked that the sample which Bionetics used was from another source and I said, yes, if it was the same as had been described in the original Bionetics report on carcinogens; since that sample was from Diamond-Alkali, who is no longer in the business of manufacturing 2,4,5-T.

He wanted to know if there would be progress to report during the course of the experimentation and I told him, yes, there would, and he said they would very much like to be kept up-to-date on the progress of the tests. I replied we would be glad to keep his office informed.

Dr. Burger seemed most cordial and interested. He made no mention of the request the NAC Task Force made to FDA to extend the time beyond January 1, 1970, for consideration of the petition proposing tolerances of 2,4,5-T. However, the nature and timing of his inquiry leads one to suspect he is "building a file", hopefully in support of the request.

Dr. Burger's address is as follows:

Dr. Edward J. Burger
Office of Science and Technology
Executive Office of the President
Executive Office Building
Washington, D. C. 20506

His telephone number is (202) 395-3586.

G. E. Lynn
Government Regulatory Relations
Dow Life Sciences

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M. L. Leng

DOW THE DOW CHEMICAL COMPANY

9008 Building
Midland, Michigan
December 10, 1969

DOW JS3835 WN053305

E. H. Blair
Manager of Research and
Development
Agricultural Department

cc: J. C. Hansen
J. E. Johnson
D. D. McCollister
R. E. Naegele
~~V. B. Robinson~~
V. K. Rowe
~~H. H. Brower~~

The following is a report of the telephone call from Dr. Burger of the Office of Science and Technology, which you referred to me.

Dr. Burger told me that he was aware of the visit that Dr. Johnson had made to Dr. DuBridge concerning the 2,4,5-T problem. Dr. Burger indicated that he was interested in learning more of the details concerning the teratological tests which Dow was going to conduct. He wanted to know the status of the tests. I told him that the rat study would be conducted first and that the rats were on hand and being acclimated. The breeding would start on December 15th, the dosing of the animals about six days later, and the fetuses would be taken from animals sacrificed beginning the week of January 5th. I told him that shortly afterwards some gross observations would likely be available but that the histopathologic examination of the soft tissues and the clearing of the fetuses for observation of skeletal development would take several more weeks. I also indicated that a similar test would be conducted with rabbits and that these could not be started until sometime in January, but that we hoped that the whole job could be finished and reported in April. Dr. Burger was interested in some of the details of the tests including the number of animals to be used. I told him that I would ask our Human Health Laboratories to furnish him with a set of the protocols. I called Dr. Robinson but he is in Washington this week. I did talk to Dr. Molello. He said that Dr. Robinson had the proposed protocols with him in anticipation of a visit

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Thursday to Dr. Paul Kotin at the Laboratory of the National Institute of Environmental Health Science at Raleigh, North Carolina. Indianapolis is going to try to have Dr. Robinson get in touch with me and hopefully copies of the protocol can be mailed from Washington to Dr. Burger. (Dr. Robinson called me later in the day and arrangements were made to have the material typed in the Washington office and delivered to Dr. Burger by messenger.)

Dr. Burger also wanted to know about the sample which we were using. I told him that the sample had been taken from our regular plant production, that it had been assayed by two chemical methods and a bio-assay method and the results showed it meets our specification of containing less than 1 ppm of the symmetrical tetrachlorodibenzo-para-dioxin. He also wanted to know who the producers of 2,4,5-T were. I told him Dow, Monsanto, Hercules and Thompson-Hayward. He then remarked that the sample which Bionetics used was from another source and I said, yes, if it was the same as had been described in the original Bionetics report on carcinogens; since that sample was from Diamond-Alkali, who is no longer in the business of manufacturing 2,4,5-T.

He wanted to know if there would be progress to report during the course of the experimentation and I told him, yes, there would, and he said they would very much like to be kept up-to-date on the progress of the tests. I replied we would be glad to keep his office informed.

Dr. Burger seemed most cordial and interested. He made no mention of the request the NAC Task Force made to FDA to extend the time beyond January 1, 1970, for consideration of the petition proposing tolerances of 2,4,5-T. However, the nature and timing of his inquiry leads one to suspect he is "building a file", hopefully in support of the request.

Dr. Burger's address is as follows:

Dr. Edward J. Burger
Office of Science and Technology
Executive Office of the President
Executive Office Building
Washington, D. C 20506

His telephone number is (202) 395-3586.

G. E. Lynn
Government Regulatory Relations
Dow Life Sciences

abc

DOW 383836

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION
WASHINGTON, D.C. 20204

July 9, 1970

D

Pesticide Petition No. 8F0675

DOW 1 120083

Mr. B. D. McCollister
The Dow Chemical Company
Post Office Box 1706
Midland, Michigan 48640

Dear Mr. McCollister:

This refers to Pesticide Petition No. 8F0675 proposing a tolerance of 0.2 ppm for negligible residues of the herbicide silvex on apples, pears, prunes, rice and sugarcane.

We acknowledge your letter of June 29, 1970, indicating analyses of 8 lots of silvex produced by The Dow Chemical Company in 1967, 1968 and 1969 showed no detectable amounts (less than 0.1 ppm) of 2,3,7,8-tetrachlorodibenzo-p-dioxin.

Sincerely yours,

Drew M. Baker Jr.

Drew M. Baker, Jr.
Division of Regulations and
Petitions Control
Office of Compliance
Bureau of Foods and Pesticides

cc:
Pesticides Regulation Division,
ARS, USDA

RECEIVED
JUL 13 1970
REGISTRATION

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18.008

THE DOW CHEMICAL COMPANY

December 9, 1969

600 EXECUTIVE BUILDING
WASHINGTON, D.C. 20005
202 · 296-1010

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DOW 8741194

JL 12/12/69

Dr. Edward J. Burger
Office of Science and Technology
Executive Office of the President
Executive Office Building
Washington, D.C. 20506

Dear Dr. Burger:

Mr. George Lynn of our Company has told me of your inquiry about our research work on 2,4,5-T, soon to be initiated. We appreciate your interest and are pleased to send you outlines of the two projects that are now planned. The studies in rats are scheduled to begin the week of December 15, 1969, and the study in rabbits will follow in January, 1970.

If you should like to inquire about any part of either of these project outlines, I will be glad to discuss them with you. We will appreciate any comments and suggestions that you may have concerning the projects.

My mailing address and telephone number are as follows:

Human Health Research & Development Laboratories
Dow Chemical Company
Box 10
Zionsville, Indiana

Phone: 317-638-2521 Ext. 8218

Thank you again for your interest in this problem.

Sincerely yours,

Virgil B. Robinson

Virgil B. Robinson, D.V.M., Ph.D.,
Head, Department of Pathology & Toxicology

cc: Dr. J. E. Johnson, Dow Chemical Company
Mr. George Lynn, Dow Chemical Company

12/15/69
Copied to:
V. K. Rowe
D. D. McCollister
Chas. Dunn,
Hroulis

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THE DOW CHEMICAL COMPANY

DOW 874195

Department of Pathology & Toxicology
December 9, 1969

PROPOSED PROTOCOL FOR TERATOGENIC STUDY OF 2,4,5-T IN THE RABBIT

Introduction

This study is designed to evaluate teratogenicity of the herbicide 2,4,5-T in the rabbit when administered orally during the period of organogenesis (day 6 through day 18 of gestation).

A. Experimental Procedures

1. Experimental Design

Seventy mature virgin female rabbits will be used in this study. The day of insemination will be considered day 0 of gestation and oral administration of the compound will begin on day 6 and continue through day 18 of gestation. Dosing will be based upon the day 0 body weights and drug levels will be determined by a dose range-finding study in pregnant rabbits. Grouping of animals will be as follows:

Group	Rabbit Number	2,4,5-T (mg/kg)
1	4501 - 4525	Control (Vehicle)
2	4526 - 4540	Dose levels will be deter-
3	4541 - 4555	mined by preliminary dose
4	4556 - 4570	range-finding studies in a
		limited number of rabbits.

2. Test Material

Test compound will be supplied by The Dow Chemical Company, Midland, Michigan. The compound will be prepared for oral administration in an appropriate vehicle. Controls will receive the suspending vehicle.

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PROPOSED PROTOCOL FOR TERATOGENIC STUDY OF 2,4,5-T IN THE RABBIT

DOW 874196

3. Experimental Animals

Sexually mature, virgin female albino rabbits obtained from The Dow Chemical Company, Midland, Michigan will be used.

Rabbits will be individually housed in fiberglass Kirschner cages and conditioned a minimum of three weeks prior to use. Animals will be maintained on a commercial rabbit chow and water throughout the conditioning and testing periods.

4. Insemination

All rabbits will be artificially inseminated. Semen will be collected by means of an artificial vagina and diluted for insemination with physiological saline. Ovulation will be induced by a single 1 mg/kg intravenous injection of pituitary luteinizing hormone* given just prior to insemination.

B. Clinical Observations

1. Pre-delivery

Inseminated does will be observed daily during the gestation period for signs of adverse drug effect. Maternal body weights will be recorded on gestation days 0, 6, 18 and 29.

2. Post-delivery

On gestation day 29, does will be killed by cervical dislocation and fetuses will be removed by caesarean section. At this time each fetus will be examined for external abnormalities and the following data will be recorded:

a. Position of fetuses in utero
b. Number of live fetuses
c. Number of stillborn fetuses
d. Number of resorptions
e. Number of corpora lutea
f. Individual viable kit weight

* Armour-Baldwin Laboratories, Omaha, Nebraska

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PROPOSED PROTOCOL FOR TERATOGENIC STUDY OF 2,4,5-T IN THE RABBIT

DOW874197

In addition, each viable kit will be incubated for twenty-four hours to determine survival rate.

3. Fetal Examination

Following the incubation period all fetuses will be killed, skinned and stored in 95% ethanol. Each fetus will be subjected to gross and low (5X) magnification visceral examination, then cleared and stained with alizarin red for skeletal examination. Histopathologic and other studies will be done as indicated.

C. Test Date:

January, 1970

Daniel J. Thompson, B.S., M.A.
Unit Head

Clifford G. Gerbig, D.V.M.
Veterinary Clinician

Approved by:

James L. Emerson, D.V.M., Ph.D.
Pathologist

Virgil B. Robinson, D.V.M., Ph.D.
Head, Pathology & Toxicology Dept.

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THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

January 15, 1970

Dr. Edward J. Burger
Office of Science and Technology
Executive Office of the President
Executive Office Building
Washington, D.C. 20506

DOW/746131
HN069779

Dear Dr. Burger:

As per your telephoned request of January 14, 1970, I have summarized the data we have dealing with the oral toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin. I have put the data on rats and guinea pigs into tables that I believe will stand by themselves. You will note that these data were developed at different times and that the vehicles used were not always exactly the same. Nevertheless, the data fit well together.

Insofar as rabbits are concerned, I do not have data from which a reliable LD_{50} value can be derived. The best information I can give you is that when 10 rabbits of mixed sex were fed 32 µg/kg of the toxicant administered as a 0.001% solution in 10/90 acetone-corn oil, six of them died. Deaths occurred on days 12, 20, 28, 30, 36 and 39, the other four survived until sacrificed 67 days after feeding.

I trust that these data will serve your purposes. If I can be of any further service, please let me know.

Sincerely yours,

V. K. Rowe
Biochemical Research Laboratory
1803 Building

Enclosures

gf

bcc: I. E. Johnson
G. F. Lynn
D. D. McCollister
V. B. Robinson
V. K. Rowe (2)
Corres.

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2,3,7,8-Tetrachlorodibenzo-p-Dioxin
Single Dose Oral Toxicity
to Male Guinea Pigs

Date of dosing: 4-20-67
Date of sacrifice of survivors: 5-12-67
Preparation fed: 0.005% solution in 50/50 Acetone-Corn Oil
(1 ml = 50µg)

Dose (µg/kg)	Number Dying / Number Fed	Day of Death
252	5/5	4, 7, 7, 8, 8
126	5/5	1, 8, 8, 9, 11
63	5/5	5, 7, 7, 9, 9
31.6	5/5	7, 7, 8, 9, 13
15.8	4/5	7, 7, 8, 9
0 (solvent control)	0/5	—

Date of Dosing 6/26/67
Date of sacrifice of survivors: 7/24/67
Preparation fed 0.001% solution in 10/90 acetone-Corn Oil
(1 ml = 10µg)

Dose (µg/kg)	Number Dying / Number Fed	Day of Death
31.6	5/5	7, 7, 8, 8, 11
15.8	5/5	8, 8, 8, 9, 9
7.95	5/5	6, 9, 10, 10, 12
3.98	5/5	6, 8, 10, 11, 11
2.00	4/5	11, 13, 17, 26, 31
0 (solvent control)	0/5	—

DOW730135

NO 0559

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2, 3, 7, 8-Tetrachlorodibenzo-p-Dioxin
Single-Dose Oral Toxicity to Rats

Sex - Males
Date of Dosing: 3-2[illegible]-67
Date of sacrifice of survivors: 4-21-67
Preparation fed: 0.005% solution in 50/50 Acetone-Corn Oil
(1 ml = 50 µg)

Dose (µg/kg)	Number Dying / Number Fed	Day of Death
500	5/5	4, 12, 13, 13, 16
252	5/5	16, 16, 16, 17, 18
126	5/5	13, 16, 16, 16, 16
63	5/5	16, 16, 14, 19, 26
31.5	5/5	19, 20, 20, 25, 25
0 (solvent control)	0/5	-----

Sex - Males
Date of Dosing: 4-20-67
Date of sacrifice of survivors: 6-2-67
Preparation Fed 0.005% solution in 50/50 Acetone-Corn Oil
(1 ml = 50µg)

Dose (µg/kg)	Number Dying / Number Fed	Day of Death
31.6	5/5	27, 27, 27, 27, 42
15.8	0/5	one was very ill but recovered
7.95	0/5	-------
0 (solvent control)	0/5	--------

LD_{50} for male rats = 22.5 µg/kg (No range calculable)

DOW 7?C137

NO 0555

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2, 3, 7, 8-Tetrachlorodibenzo-p-Dioxin, Cont'd.
Single-Dose Oral Toxicity to Rats

Sex: Females
Date of Dosing: 3-2-67
Date of sacrifice of survivors: 4-14-67
Preparations Fed: 0.005% solution in 50/50 Acetone-Corn Oil (1 ml - 50μg)

Dose (μg/kg)	Number Dying / Number Fed	Day of Death
500	5/5	13, 14, 15, 15, 16
252	5/5	13, 14, 14, 15, 16
125	5/5	14, 14, 18, 21, 21
63	4/5	18, 26, 26, 29
31.6	1/5	43
0 (solvent control)	0/5	------

LD_{50} for female rats (if we assume no deaths at a dose of 15.8 μg/kg) = 44.7 μg/kg (30.4 - 65.6)

DOW 746139

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTES OF HEALTH

NATIONAL INSTITUTE OF
ENVIRONMENTAL HEALTH SCIENCES
P.O. BOX [illegible]
RESEARCH TRIANGLE PARK, N.C. [illegible]
AREA CODE [illegible] TEL: [illegible]

February 10, 1970

Dr. V. K. Rowe
Biochemical Research Laboratory
1803 Building
The Dow Chemical Company
Midland, Michigan 48640

Dear Dr. Rowe:

Thank you very much for your letter of February 6 and the wealth of information you included. Every bit of information was of considerable interest to me, but the Dow Analytical Method MLW-68.11 which you intended to include I did not find in this letter. Please send it to me at the next opportunity.

The data on the toxicity of tetrachlorodibenzo dioxin are quite astonishing and most informative for us who have never used this compound so that we may be better prepared to handle it.

Just now I received a phone call from Dow Chemical Company and the problem of shipment of the dioxin appears to be solved. This should enable us to get the next set of experiments under way shortly. I also learned that we will have the various 2,4-D and 2,4,5-T esters available for our studies at that time.

Thank you again for the information and the samples you are making available for us.

Sincerely yours,

Hans L. Falk

Hans L. Falk, Ph. D.
Associate Director
for Laboratory Research

g.f.
get -10 from
Harold Gill.
VR.
Send 12 Feb
69.

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THE DOW CHEMICAL COMPANY

9008 Building
Midland, Michigan
January 21, 1970

CONFIDENTIAL - SUBJECT TO INJUNCTION
D.C., E.D. MI. 4-4-70; DOW, EPA AGREEMENT 9-79

E. H. Blair
H. E. Brower
W. R. Crummett
J. B. Fernandes
M. E. Getzendaner
J. C. Hansen
T. A. Hymas
J. E. Johnson
E. R. Laning
L. J. Lippie
D. D. McCollister
R. D. Moss
V. B. Robinson
V. K. Rowe
C. S. Williams

Dr. Julius Johnson has asked that I coordinate and keep a record of all samples of 2,4,5-T, 2,4-D and silvex (including derivatives) that are sampled during the current surge of teratological interest to investigators who wish to conduct their own tests. Lou Lippie has been instructed not to release any samples until he has cleared them through me. Lynn will arrange for samples through Jim Fernandes. Jim will initiate all chemical assays. Lynn will initiate bioassays. We will not send any samples until we are certain that they meet Dow specifications.

I have set up a sample record system that includes a record of identification, assays, the methods used and the consignee.

We would prefer to supply only two types of samples:

(1) commercial samples that meet Dow specifications, or

(2) laboratory reference standards of very high purity.

The laboratory reference standards will quite likely have to be specially synthesized, purified and analyzed by several methods to establish identity and purity.

Investigators should be asked to carefully calculate the amounts of the laboratory reference standards (and their derivatives) needed for their tests. They will be limited in supply, as they are difficult to prepare in quantity.

The sample of 2,3,7,8-tetrachlorodibenzo-p-dioxin is quite limited. Only milligram quantities are available. We will

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have V. K. Rowe contact investigators who want to use this compound to work out their specific requirements.

A retainer of up to 500 grams of each sample supplied will be kept by Lou Lippie, Agricultural Research Center, 9001 Building. He will also process all sample orders.

Attached are minutes of a meeting between Fernandez, Getzendaner, and Lynn to discuss assays, etc. concerning this matter.

George Lynn

George E. Lynn
Government Regulatory Relations
Dow Life Sciences

Attachment

abc

76/535

TO: E. H. Blair, [illegible] R. H. [illegible], 574 V. K. Rowe, 1803
W. B. Crummett, 574 J. B. [illegible]andez, 1710 F. L. Dunn, 1803 1.086
G. E. Lynn, 9008
F. C. Leavitt, 1710
CRI (5), 566

THE DOW CHEMICAL COMPANY
MIDLAND MICHIGAN

A&G 001086

ANALYTICAL LABORATORIES

REPORT

DATE April 13, 1970 CHARGE 825-1212-026

AL NUMBER 14-696 PROBLEM 199-0000-906

YOUR NUMBER DESCRIPTION PHYSICAL CONSTANTS FOR 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN AND 2,4,5-T

DOW 122424

MM 001665

The determination of various physical constants for 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) were requested relative to the use of 2,4-D and 2,4,5-T esters (orange herbicide) in Vietnam. The results are summarized below in Table 1.

Table 1

Solubility of 2,3,7,8-Tetrachlorodibenzo-p-dioxin in Various Solvents at 25°C

Solvent	Solubility, g./100 g. solvent or Weight Percent	
o-Dichlorobenzene	0.14	(a)
Chlorobenzene	0.072	(a)
Benzene	0.057	(a)
Chloroform	0.037	(a)
Acetone	0.011	(a)
n-Octanol	0.0048	(b)
Orange Herbicide	0.058	(b, d)
Methanol	0.001	(a)
Water	0.00000002	(b, c)

(a) N. E. Skelly, ALS 57-474, Dec. 8, 1964, 574 Bldg.
(b) New data
(c) Calculated as ppb - 0.2 ppb
(d) Calculated as ppm - 580 ppm

SIGNED N. E. Skelly
N. E. Skelly

PHONE NO. 4997 BLDG. 574

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Table 2

Solubility of 2,4,5-Trichlorophenoxyacetic Acid in Water and n-Hexane at 25°C

Solvent	Solubility, g./100 g. solvent or Weight Percent
Water	0.0044
n-Hexane	0.0022

Partition Coefficients for 2,3,7,8-Tetrachlorodibenzo-p-dioxin

$$\frac{c_{\text{Dioxin (Water)}}}{c_{\text{Dioxin (n-Octanol)}}} = 0.0003^{*}$$

$$\frac{c_{\text{Dioxin (Water)}}}{c_{\text{Dioxin (Benzene)}}} = 0.00010$$

*Calculated value, see "Partition Coefficients" in the Experimental Section

Removal of Herbicide Orange from Corrugated Roof with a Simulated One Inch Rainfall

Orange herbicide spiked with 10 ppm dioxin was applied to a 2 ft x 2 ft piece of corrugated roofing material at the level of that used in Vietnam (24 lbs/acre, 0.27 mg/cm^2). The roofing material was sprinkled with 2.7 gallons (10 liters) of water simulating a one inch rainfall. A multicolored oil film was noted on the surface of the recovered water.

Following chloroform extraction, the Orange herbicide concentration present in the water was found to be (UV determination),

0.125g or .125g./1.08 g. x 100 = 12% of the amount applied

ppm Orange Herbicide in Water - 12.5 ppm

The dioxin level from the added spike would be 1 µg. Since the total sample was only 0.1 g, this was insufficient at present for a dioxin determination.

However, if the dioxin level in Orange herbicide was 1 ppm and the dioxin was removed from the roof in the same ratio (because of extremely poor water solubility, it is more likely to be less) as

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the Orange herbicide, the maximum amount of dioxin that could be theoretically present in the water would be 0.0000125 ppm.

Theoretical Level of Dioxin That Could be Present in Water If Orange Herbicide is Saturated with Dioxin

A saturated solution of dioxin in Orange herbicide was prepared. This was analyzed according to the methods developed by H. H. Gill et. al. As reported in Table 1, the solubility of dioxin in Orange herbicide is 580 ppm. If the dioxin were present in Orange herbicide at the limit of solubility, and if the herbicide was dissolved in the water at the 12.5 ppm level, the amount of dioxin in the water would be 0.0063 ppm. However, this value would exceed the solubility of dioxin in water which is 0.0002 ppm (0.2 ppb).

Experimental

Solubility of Dioxin

Solubility determinations were made by warming the solvent to its boiling point or 100°C, which ever was lower. Mg. amounts of 2,3,7,8-tetrachlorodibenzo-p-dioxin (97%+) was added and the solution was placed on a mechanical shaker overnight. Solutions were allowed to stand a minimum of six hours before they were filtered through cellulose (for aqueous) or avicel (for organic) 0.45 μ Millipore filters.

Concentrations in organic solvents were determined by direct injection into a gas chromatograph. Solubility of the dioxin in water was accomplished by extracting 1400 ml of a saturated solution with 30 ml of benzene. This was evaporated to a volume of 0.4 ml. The extract was then examined by gas chromatography.

Partition Coefficients

Fifty ml of water and an equal volume of the organic immiscible solvent were warmed on the steam bath. Mg. amounts of the dioxin were added and the mixture was placed on a mechanical shaker overnight. The respective layers were allowed to equilibrate for 48 hours. They were then filtered as described previously. The organic phases were analyzed directly by gas chromatography while the aqueous phases were extracted with two ml of chloroform. These chloroform extracts were then analyzed by gas chromatography.

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538

Since the solubility of dioxin in n-octanol is limited (48 ppm) and the solubility of n-octanol in water is poor (300 ppm), there was not sufficient dioxin present in a concentrated extract of the aqueous phase to obtain an absolute dioxin concentration. Therefore, a theoretical partition coefficient was calculated on the basis of the actual concentration of dioxin found in the n-octanol layer and the theoretical amount in the aqueous layer based on dioxin solubility in n-octanol and n-octanol solubility in water. Therefore this value should only be considered an approximation.

The gas chromatography portion of this work was carried out by E. Wilke and B. Roberts of the Gas Chromatography Section for which they deserve considerable credit.

ajg

THE DOW CHEMICAL COMPANY
BIOCHEMICAL RESEARCH LABORATORY

JHNorris 12/1/70 PV

FILE	BC T36.25-84763-3
K NO.	K84763
CHG.	01212-000-029
REF.	FDA-P911
SOURCE	AEPohland
SUB. BY	OAniline
REP'T. BY	JHNorris
CHECKED BY	PJGehring
DATE	12/11/70

CHLORACNE STUDY CONDUCTED ON HEXACHLORODIBENZO-p-DIOXIN

LAB CODE LETTERS AND REPORT NO. BC T36.25-84763-3

INFORMATIVE SUMMARY WITH CONCLUSIONS BASED ON THE SAMPLE RECEIVED. ADDITIONAL INFORMATION INCLUDING THE EFFECTS OF REPEATED EXPOSURE MAY BE REQUIRED AS SPECIFIC USES AND FORMULATIONS ARE DEVELOPED OR IF PROCESS CHANGES OCCUR.

A sample of hexachlorodibenzo-p-dioxin (95% pure) was received from A. E. Pohland of the FDA and submitted to the Biochemical Research Laboratory for evaluation as a chloracnegen.

Two 0.005% solutions of the test material, one in dimethoxyethane and the other in chloroform, were prepared. Each solution was applied to the inner surface of 3 rabbit ears, 5 days per week for 4 weeks at a dose of 0.1 ml/day. Both test solutions produced chloracne responses. All skin contact with the test material should be avoided.

AG 038291

DOW 8008042

DISTRIBUTION

CORPORATE

O. Aniline, 1710

WESTERN DIVISION

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L.A. Colten P.R.L. Wayland

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DOW028637

DOW CHEMICAL U.S.A.

MIDLAND, MICHIGAN 48640

November 8, 1978

Irving J. Selikoff, M.D.
Environmental Science Laboratory
Mt. Sinai School of Medicine
100th Street and 5th Ave.
New York, N.Y. 10029

Dear Dr. Selikoff,

It was good to talk to you yesterday. This letter is to confirm with you that Dow scientists are pleased to accept your invitation to come to Mt. Sinai and present a seminar on phenoxy herbicides on Wednesday, December 20, 1978.

It is my (our) understanding that you wish us to present the scientific data we have on 2,4-D, 2,4,5-T and related substances. The purpose is to acquaint you and your staff with the data so that you will be better able to plan and execute the proposed epidemiologic study in the Pacific Northwest.

The people we have selected to present the seminar are:

John Davidson, Technical Advisor to the Director of Research and Development, Agricultural Chemicals Department.

Bernard Schwetz, Director of Dow's Toxicology Research Laboratory in Health and Environmental Research.

Richard Kociba, Head of Pathology in the Toxicology Research Laboratory.

Benjamin Holder, Medical Director for Dow USA and Director of Biomedical Research in Health and Environmental Research

Warren A. Crummett, Technical Manager of Analytical Laboratories.

V. K. Rowe, Director of Toxicological Affairs, Health and Environmental Sciences (I may come along as moderator or whatever).

You asked if we had any objection to your inviting a few scientific colleagues from such places as NIEHS and NYU. Certainly not.

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DOW 028638

C-8 DOW

I mentioned to you that Walter Melvin, Jr. M.D., M.P.H. and Sc.D. of the Institute of Rural Environmental Health, Colorado State University at Fort Collins might well be willing to contribute. Dr. Melvin is well informed and has had a wealth of human experience in the phenoxy herbicide area. He served with the Air Force for many years and has been directly involved in Viet Nam, with the disposal of the Air Forces' controversial inventory of Agent Orange, with the Seveso incident and presently is engaged in an environmental or epidemiological study of some sort in the Oregon-Washington area.

You asked what papers your people could benefit from reading before the seminar. I suggest the following:

1. Toxicology of Phenoxy Herbicides and Hazard Assessment of their Use in Reforestation by Frank N. Dost, Ph.D.
2. Long-term Hazards of Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans. WHO - IARC Technical Report No. 78/001, a report of the Joint NIEHS/IARC Working Group.
3. Chlorinated Phenoxy Acids and Their Dioxins. Ecology Bulletin No. 27 from Royal Swedish Academy of Sciences, C. Ramel (ed).
4. Embryo Problems Posed by the Seveso Accident. H. Tuchmann-Duplessis, M.D., LeConcours Medical No. 44, Nov. 26, 1977.

I have included copies of the Title page of the first three of these so as to help in identification. There are, of course, hundreds of papers but these reviews will give a good overall perspective and references to specifics. I am enclosing a copy of a translation of number 4 because I did not expect that you had seen it or might not be able to get it in time and I do think it is important.

I hope I have answered all the questions you asked. If you have specific items you would like to have discussed, let me know and I will do our best to include them.

With best personal regards,

VKR

V. K. Rowe, Sc.D.
Director, Toxicological Affairs
Health and Environmental Science
1803 Building
(517) 636-2376

Enclosure

krr

bcc: E. Blair, M. Crummett, J. Davidson, J. Donalds, P. Gehring, B. Holder, R. Kociba, B. Schwetz

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542

P.S. As of now we are planning to take the Dow plane to New York and back on December 20. I will ... ls later.

DOW CHEMICAL CORP. ROLL #3

D

TOXICOLOGY OF CHLORINATED DIBENZO-P-DIOXINS

BY

V. K. ROWE, J. M. NORRIS, B. A. SCHWETZ,
G. L. SPARSCHU, AND P. J. GEHRING

CHEMICAL BIOLOGY RESEARCH
MIDLAND, MICHIGAN

AND

J. L. EMERSON AND C. G. GERBIG

HUMAN HEALTH RESEARCH AND DEVELOPMENT CENTER
ZIONSVILLE, INDIANA

THE DOW CHEMICAL COMPANY

DOW CHEMICAL U.S.A.

January 25, 1979

MIDLAND, MICHIGAN 48640

CO[illegible] - SUBJECT TO [illegible]
D.C., E.D. [illegible] 9-79

E. H. Blair, 2020
W. B. Crummett, 574
J. E. Donalds, 9008
W. M. Gentry, 9001
F. D. Hoerger, 2030
B. B. Holder, 2030
O. K. Jantz, 9008
R. L. Johnson, 2040
G. G. Jones, 9001
M. L. Leng, 9008
M. J. Mintz, 680
W. W. Muelder, 9008
K. D. Moss, 9008
M. G. Norris, 9008
R. D. Olson, 607
E. S. Parsey, 834
B. A. Schwetz, 1803
L. L. Smith, 9008
M. J. Traynor, 2030
A. J. Vogel, 1710
S. J. Vranish, 9008
J. W. Weseloh, 9008
C. S. Williams, 9008

NEW YEAR PLANNING FOR 1979
CHLORINATED DIOXIN ISSUE MANAGEMENT TEAM

Accomplishments

1. Successfully defended the use of 2,4-D, 2,4,5-T and silvex in states where the opposition attempted to pass legislation that would ban or restrict use of these products.

2. Identified local legal counsel in geographic areas of greatest controversy and aided in their becoming sufficiently well informed so they can defend the position of Dow as well as user groups.

3. Supplied a 12 volume document to EPA in response to the risk rebuttal portion of the RPAR on 2,4,5-T. Benefit responses from more than 2,500 users were received and logged in by the EPA Federal Register office.

4. The Dow Midland 2,4,5-T production group demonstrated the ability to consistently produce 2,4,5-T with less than 0.05 ppm TCDD. Progress was made in having Dow 2,4,5-T production facilities outside the U.S.A. produce 2,4,5-T formulations with less than 0.05 ppm TCDD.

5. The long term feeding and reproduction study on rats with 2,4,5-T was completed. The full report was submitted to EPA as part of the 2,4,5-T RPAR risk rebuttal. This, in addition to the TCDD study on rats fulfills Dow's agreement to conduct long-term studies on these two chemicals.

6. The Council for Agricultural Science and Technology (CAST) revised the Phenoxy Herbicide report and an appropriate press conference was held in Washington, D.C. to announce the revision. A favorable news item resulted in U.S. News and World Report.

7. After the minister of health in the State of Victoria, Australia declared a ban on 2,4-D and 2,4,5-T an intensive investigation was conducted. The final favorable report exonerating the chemicals was distributed to user groups all over the world. A similar report resulted from New Zealand after investigations were conducted in that country.

8. Improved analytical methods for 2,3,7,8-TCDD and other chlorinated dioxins resulted in reports to the Michigan DNR and U.S. EPA regarding fish from the Saginaw basin. A preliminary study entitled "Trace Chemistries of Fire" presented the findings of a Task Force from the Michigan Division investigating the probable source of the TCDD found in the fish.

9. Antiherbicide groups in Minnesota, California and British Columbia exerted considerable effort to force some type of legislation to ban or restrict 2,4-D in these areas. To date their efforts have been successfully resisted.

10. Several publications reporting on the health effects resulting from the Seveso, Italy incident appeared. Translations were made of these studies and they were distributed to appropriate people.

11. Preparations were undertaken to gather the necessary information to defend The Dow Chemical Company from the claims of Vietnam veterans regarding Agent Orange.

12. After several years of legal discussion the Charlotte Taylor product liability case involving 2,4,5-T and silvex was settled for $250 to C. Taylor and $250 to her daughter. The initial claim was for $5 million.

DOW 043871

Plans

1. Continue a vigorous defense for the registered uses of 2,4-D, 2,4,5-T and silvex worldwide.

2. Encourage the holding of a scientific conference that would provide a means of bringing together research investigators and presentation of latest findings on 2,4,5-T/TCDD. Such a conference would also serve as a vehicle for the preparation of witnesses for an anticipated hearing as a result of the RPAR decision on 2,4,5-T.

3. Prepare for an anticipated RPAR on silvex. An exposure study for the lawn application of this herbicide is underway.

4. Make the necessary preparations for Dow production and analytical facilities to lower the TCDD specification in 2,4,5-T and silvex containing products worldwide if this becomes necessary.

5. Continue the collaboration with the U.S. Environmental Protection Agency Dioxin Implementation Plan Committee in the analysis of environmental samples of fat and mothers milk for TCDD. Also cooperate with National Forest Products Association on a mothers milk study in the Pacific Northwest.

6. Although it appears that 2,4-D has been removed from the U.S. EPA pre-RPAR list, it could appear again if the antiherbicide forces apply sufficient pressure. In light of this possibility, steps are being taken to gather the necessary information to defend 2,4-D.

H. J. Dishburger
Agricultural Products

J. H. Davidson
Agricultural Products

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87

R & D REPORT

DOW CHEMICAL U.S.A.

RESTRICTED. for use within The Dow Chemical Company only

Laboratory Report Code: HET K-66681-(36) Part I of II

Date Issued: August 20, 1979

DOW044262

Department: Health and Environmental Research/Toxicology Research

1,7,7 | 0,0,0,7,6,0,0

Title: Immunotoxicologic Studies Involving 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) in Mice and Rabbits

35 PAGES IN FULL REPORT

CRI NUMBER

Author(s): R. P. Sharma, R. J. Kociba and P. J. Gehring

Author(s) Signature(s):

Reviewer's Signature: BA Schwetz 13 July 79

This report is: ☐ INTERIM ☒ FINAL and mainly: ☒ NEW ☐ REVIEW

DATA REFERENCES (book and page): NBK-21-1, NBK-21-2, NBK-21-3, NBK-21-4

(Refer also to earlier related reports and publications.)

PATENT STATUS ☐ disclosure submitted ☐ case filed ☒ no patent action required

DESCRIPTIVE SUMMARY WITH CONCLUSIONS:

Male CD-1 mice and New Zealand White rabbits were given orally 0, 0.01, 0.1, 1 and 10 µg/kg/wk of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) for a period up to 8 weeks. The mice were sacrificed at 2, 4 and 8 weeks of exposure. Another group of mice and rabbits was innoculated with an antigenic mixture containing tetanus toxoid and Freunds adjuvant to evaluate the induced immune reactivity. Splenic lymphocytes were cultured in vitro with or without the selective blastogenic agents (phytohemagglutinin and pokeweed mitogen) and the incorporation of ^{3}H-thymidine was measured as an indication of relative blast formation. Lesions attributable to TCDD were found primarily in the liver of mice and to some extent in the thymus of both species. In mice, the thymic changes were pronounced at 4 weeks after TCDD exposure but not at 8 weeks. Exposure of animals to TCDD, even at the lowest level (0.01 µg/kg/wk), caused a marked increase in the thymidine uptake by splenic lymphocytes. The blastogenic response to phytomitogens was decreased at high levels of TCDD exposure. Estimation of serum immunoglobulins indicated an increase at low levels and a marked decrease at high levels of TCDD exposure. TCDD exposure also reduced the serum antitetanus concentrations in both species and reduced the skin reactivity to tuberculin and the antibody producing cells in the popliteal lymph nodes of rabbits. Results indicate that TCDD at low levels of exposure causes an enhancement of immune responsiveness similar to that produced by antigenic substances. Immunosuppression occurs at toxic levels of TCDD exposure and an adaptation to this effect is suggested.

CONFIDENTIAL - SUBJECT TO PROTECTION
D.C. ... AGREEMENT 9-79

THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
March 10, 1965

F. H. Riley, Special Chemicals Sales, ARB
J. C. Tucker, Industrial Chemicals Sales, ARB
R. N. Smiley, International Sales, ARB
J. W. Harris, Chemical Sales, ARB
L. B. Grant, Sales Administration, 47 Building
H. W. Feinauer, Chemicals Department, ARB
C. O. Hutchenreuther, Org. Chem. Prod. Dept., 258 Building
E. C. Staehling, Organic Chem. Products Dept., 172 Building
F. C. Amstutz, Herbicide Section, 441 Building
C. E. Otis, Bioproducts Department, Bioproducts Center
W. P. Palsey, Bioproducts Department, Bioproducts Center
K. Y. Hansen, Bioproducts Sales, Bioproducts Center
G. E. Lynn, Bioproducts Department, Bioproducts Center
R. C. Hoff, Chem. Prod. Qual. Services, 172 Building
W. M. Gill, Bioproducts Department, Bioproducts Center
W. J. McCoy, Bioproducts Sales, Bioproducts Center
M. G. Wiltse, Bioproducts Department, Bioproducts Center
J. D. Doedens, Chemicals Department, ARB
D. E. Fletcher, Bioproducts Department, Bioproducts Center
K. C. Barrons, Bioproducts Department, Bioproducts Center
W. L. Corbin, Bioproducts Sales, Bioproducts Center
~~H. R. Hoyle~~, Biochemical Research Laboratory, 1701 Building
V. K. Rowe, Biochemical Research Laboratory, 1701 Building

DOW_1 172136

HAZARD OF MONSANTO T ACID

Rabbit ear tests on twelve lots of Monsanto 2,4,5 T acid have shown moderate to severe responce in eight cases at ten per cent concentration in ethanol. This confirms VPC analysis for 2,3,7,8-tetrachlorodibenzodioxin which was found in concentrations averaging about 10 ppm.

This material presents a definite hazard which would require all the precautions used in 199 Building and 349 Building to prevent injury, if it is processed at 257 Building.

Dow's involvement in shipping this material to Riverdale and Woodbury also concerns me. There is a definite risk to their employees, especially since they are probably unaware of the problem and are probably taking no precautions.

There is no assurance that their final products will be free of contamination. The available evidence points to the opposite. In my opinion their products should not be sold until animal tests show these products to be free of a significant hazard from the tetrachlorodibenzodioxin and related materials.

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DOW CHEMICAL CORP

DOW 1 129928

F. H. Riley, et al. - 2 - March 11, 1954

I believe Dow has a definite obligation to advise Riverdale and Woodbury of the problem immediately.

L. G. Silverstein
Biochemical Research Laboratory
1701 Building

LGS/ajl

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MK-1560

THE DOW CHEMICAL COMPANY

Copy to Bill Haberstroh on 1-29-69 - OKH.

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MIDLAND, Michigan
March 29, 1965

V. K. Rowe
Biochemical Research Laboratory
1701 Building

cc: F. H. Riley
R. N. Smiley
L. B. Grant
C. O. Hutchenreuther
F. C. Amstutz
W. P. Falsey
G. E. Lynn
W. M. Gill
M. O. Wiltse
D. E. Fletcher
W. L. Corbin
D. D. Irish
J. E. Peterson
J. C. Tucker
J. W. Harris
H. W. Feinauer
E. C. Staehling
C. E. Otis
K. Y. Hansen
R. C. Hoff
W. J. McCoy
J. D. Doedens
K. C. Barrons
M. R. Hoyle
B. B. Holder, M.D.
S. E. Sadek

REPORT ON THE CHLORACNE PROBLEM MEETING ON 3/24/65

Present: Dr. J. Wilkenfeld and
Mr. Raymond Verhoeze, Hooker Chemical Corporation

Mr. Francis Kennedy and
Dr. Ed Chandler, Diamond Alkali Company

Mr. C. L. Dunn and
Dr. John P. Frawley, Hercules Powder Company

V. K. recapped the Dow situation in terms of the problem and the initial studies by Toxicology and Environmental Research Laboratory regarding the in-plant situation. He expanded this in general terms to the study of end products, ours and other peoples. He made reference to symmetrical tetrachloro-p-dibenzodioxin. He referred to the evidence for unknown acnegens. There were some questions from the group about the unknowns. We (Dow) were not able to answer these questions except to review the evidence for their existence in the process samples and end products.

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Dr. Holder reviewed the medical side of the Dow experience; he said that we now have approximately 60 to 70 cases of individuals with chloracne ranging from two severe cases to some very mild cases that were difficult to diagnose. He showed slides of the more dramatic cases. The slides were exclusively views of the faces of the individuals afflicted. He described in fair detail the appearance of the individuals mentioning the blackheads specifically. He then reviewed the clinical studies that are being made on these people with emphasis on the liver function tests. He mentioned the single liver biopsy that has been taken and studied in which the liver was normal although the man had a rather pronounced case of chloracne. Dr. Holder also mentioned the incidence of fatigue among the afflicted people as being the only other significant finding in these folks. He touched briefly on treatment indicating that various topical treatments were not particularly effective. He described the cycling of this disorder in individuals who had been completely removed from exposure. He mentioned that some fellows are approaching the end of their trouble two or two and one-half years after onset of the skin disorder. He also described "acute chloracne" which is an acute inflammatory condition that appears considerably sooner than the normal chloracne in individuals and appears after pronounced single exposure. The acute chloracne shows up within a few days of exposure. Dr. Holder mentioned five to eight days specifically. There was considerable discussion by the group on the skin disorder itself. The Hooker representatives related experience of skin condition thirty years after exposure. Their cases were more similar to the Dowicide bumps which Dow has experienced in that there were large boils or large bumps rather than the multitude of small blackheads and eruptions which Dow is seeing in the current cases.

Dr. Sadek showed slides of ears and livers of rabbits that had been exposed to the symmetrical tetrachloro-p-dibenzodioxin. He discussed the pathology in detail which I will not attempt to summarize.

V. K. mentioned the studies in which the rabbit ears have been treated with TCBD in benzene or corn oil and then washed with soap and water at various time intervals later. If exposure occurs for very long, washing does little good. He also briefly mentioned the oral studies but without detail. Silverstein described the plant study on washing of contamination from tools and surfaces. This study indicated that benzene, acetone and Chlorothene NU were effective in removing the contaminant from tools and also that detergent and water with scrubbing action could clean up tools and equipment. Some discussion ensued on the use

Mr. Paul Hoffman

I talked with the Hercules representative who attended the Dow meeting on the 2,4,5-T problem. He was Dr. Jack Frawley, a toxicologist.

It appears the presentation was the same as the one you and I were given. Representatives of Diamond and Hooker were there. Dr. Frawley stated that Dow told the various companies in private what the content of dioxane was in their 2,4,5-T acid. I gathered that Diamond and Hooker had some but Hercules stated they were told they had none.

It appeared to Frawley that Dow was having this meeting becuase they did not think they could, in conscience, not tell industry about their findings. Hercules also seems to believe that the Public Health Service would be very happy to get into the act, whether or not the chloracne exists in the ultimate user. I must agree with them about this and it would seem almost mandatory that we see if we can first firm up our analytical methods and then devise ways to minimize the presence of this known chloracne agent.

There is also another very good reason for us to do this. Regardless of what we think of the rabbit test, thir dioxane compound must be a potent contaminant. Very conceivably, it can be a potent carcinogen. We, therefore, will never know how close we are to having another epidemic at Nitro, and we certainly don't want to go through that again.

I am going to be out of the country until about April 20, but Dr. Johnson and Mr. Wheeler are quite familiar with the various aspects of this problem and are available for discussions.

R. Emmet Kelly, M. D.

REK/ln

4/24

EXHIBIT

6/24/65

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St. Louis Dr. Paul Hoffman

March 17, 1965

2,3,7,8-Tetrachlorodibenzyl-para-Dioxane

FILE
Destroy
JTG
WWH
MJ
R
HAN
EPJ

Mr. John Stephens
JSTEP

Enclosed is a sample of 2,3,7,8-tetrachlorodibenzyl-para-dioxane.

This was received from Dow Chemical Company, and according to them it is the most toxic compound they have ever experienced. It presumably is toxic by skin contact, as well as by inhalation. According to Dow it is 100 times as toxic as parathion. It is, likewise, capable of causing an incapacitating chloracne.

I would recommend that extreme care be used in handling; that dilutions be made under a hood; and that all equipment be washed out immediately, or disposed of. Even trace amounts of this (200 ppb) have caused chloracne in rabbits, according to Dow.

This is being given to you to calibrate the VPC method of analyzing for this compound in our 2,4,5-T. I wish you would save some of it for me, as we would like to do some biological evaluation also.

Please call me if you have any questions.

R. Emmet Kelly, M. D.

REK/ln
enc.

St. Louis

March 30, 1965

u224.
uM

FILE

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MULHOLLAND
June 24, 1965

DOW CONFIDENTIAL

Ross Milholland
Manager
Bioproducts
Dow Chemical of Canada
Sarnia, Canada

2,4,5-TRICHLOROPHENOL, THE "T" ACIDS, AND ASSOCIATED ACNEGENS

I have not been neglecting your request for information to use in discussing the subject problem with Naugatuck and the Co-Op. I have been stymied, however, because the analytical methods have been changed and are in the process of being cleared and reproduced. I expect them any day, but rather than wait longer, I thought I should advise you of the situation. I will send you copies of these methods as soon as they become available.

In regard to the overall problem, we are attempting to do everything possible to avoid the possible occurrence of chloracne in any applications involving the handling or use of trichlorophenol, trichlorophenoxyacetic acid and its derivatives. As you well know, we had a serious situation in our operating plants because of contamination of 2,4,5-trichlorophenol with impurities, the most active of which is 2,3,7,8-tetrachlorodibenzodioxin. This material is exceptionally toxic; it has a tremendous potential for producing chloracne and systemic injury. If it is present in the trichlorophenol, it will be carried through into the T acid and into the esters and hence into formulations which are to be sold to the public. One of the things which we want to avoid is the occurrence of any acne in consumers. I am particularly concerned here with persons who are using the material on a daily, repeated basis such as custom operators may use it. If this should occur, the whole 2,4,5-T industry will be hard hit and I would expect restrictive legislation, either barring the material or putting very rigid controls upon it. This is the main reason why we are so concerned that we clean up our own house from within, rather than having someone from without do it for us. In this way, we can approach the problem in an orderly manner. If the producers

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December 15, 1964

Dow Chemical Company
Midland, Michigan
U.S.A.

Honored Gentlemen:

During a brief visit with your messers, Dr. Trapp, Lueck and Silverstein we mentioned a scientific report, in which the isolation of chloracne active substances as well as conclusions concerning operating procedures are fully described. Mr. Silverstein showed an interest in this and asked for a copy of this report.

Until now we have disclosed the content of this report to no one outside of our company, as we attach a special value thereto, because the extraordinary danger of the tetrachlorobenzodioxin is not generally known. However, since you have isolated the same material from the by-products (oil) of your Trichlorophenol process we have chosen to turn this report over to you. We would ask you, however, that you commit yourselves to a management policy of strict confidence with respect to this information and that you would disclose it to no one outside of your firm.

We hope that the enclosed report (Experiments on the determination (isolation) of chloracne exciters in the production of 2,4,5-T acid) of Dec. 9, 1956 will be of use to you in the solution of your chloracne problem and we remain

with friendly greetings

C. H. BOEHRINGER SOHN

Signed by

Dr. Kudszus Dr. Merz

Attached papers

Translated by: W.A. Trapp

WN012332

DOW 1568605

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From MONSANTO CHEMICAL COMPANY

At St. Louis, Mo.

: Mr. H.K. Nason-M.O. 317
Mr. R.E. Soden-Nitro
Mr. L.C. Weger-Nitro

Date June 12, 1956

To Dr. R. Emmet Kelly

At Medical Dept.

Reference

Subject CHLORACNE CASES AT BADISCHEN ANILIN DUE TO TRICHLORPHENOL

Nitro

Persons Present: Dr. H. Oettel
Dr. H. T. Hofmann
A. Palm (Ph.D.)
W. Soenksen (Plant Supt., part-time)

On the 17th of November, 1953, Badische was producing a batch of trichlorphenol from tetrachlorbenzene when the process exceeded control pressure and temperatures similar to our incident at Nitro. No one was injured at the time. Within one week, as clean-up was being carried out, the first cases of chloracne developed. Fifteen or sixteen cases (6 serious) developed within the next 1-2 months and additional cases showed up during the next 10-12 months until there was a total of 50-60 cases.

I did not see our most severe Nitro cases nor have I seen photographs of these cases. The photographs of the worst Badische cases show horrible skin eruptions with nearly blister-like welts and some ulceration where infection ensued. Areas involved included the face, neck, arms, and upper half of the body. It is my impression that their severe cases were much worse than ours. In addition to the skin manifestations, their men reported all the additional symptoms as experiences in our workers, i.e, fatigue, vertigo, loss of libido, painful joints, etc.

About ten days following the incident, and after initial clean-up, Dr. Oettel was asked to expose animals to the workroom atmosphere. Rabbits (in open wire cages) were placed in the operating area for 24-48 hours. There were no obvious symptoms which developed in the animals until one week after exposure - when they died. Autopsy showed liver necrosis. Oettel thought there might be virus infection or some other cause for death until he exposed additional animals in the department, others in cages suspended inside the "decontaminated" autoclave, and some in the adjacent department. All died within 1-2 weeks following exposure. Subsequently, animals placed in the cages which had previously been in the department died of liver necrosis.

A thorough systematic investigation has isolated impurities in the trichlorphenol process (or residues) which will cause the same effects in rabbits. Liver necrosis will develop in rabbits at the following doses of the indicated materials:

15-20 mg. of pentachlor naphthalene
1 mg. of chlorinated diphenyl oxide
0.1 mg. of residue from trichlorphenol distillation
0.01 mg. of residue fraction from trichlorphenol (above 230°C)

CONFIDENTIAL
SUBJECT TO PROTECTIVE ORDER

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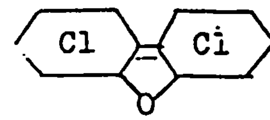
Dr. Oettel believes that the most potent chloracnogen is a compound somewhat similar to chlorinated diphenyl oxide, 

, but probably with additional oxygen atoms in the molecules. He has corresponded with Don Irish at Dow who either reached the same conclusion independently or, in mentioning the potential of chlorinated diphenyl oxide, influenced Oettel's reasoning. Oettel believes, further, that this impurity can show up in the production of any chlorinated phenols and is probably responsible for any chloracne which has been due allegedly to chlornapthalenes, pentachlorphenol, chlorinated biphenyls, etc.

Dr. Oettel has no faith in any animal skin tests for isolating chloracnogens. He was very interested in Kettering's work and was not aware of the publication referred to in Dr. Suskind's first report and which describes the cyclic skin development in new-born rats. (Reference: Parnell, J.P.: Postnatal Development and Functional Histology of the Sebaceous Glands in the Rat, Am. J. Anat., 85:41, 1949). He is convinced that the Bromsulphalein test reported in the attached reprint is significant. In this regard, Badische routinely uses this test on each batch of trichlorphenol which they now purchase from Bayer, and refuses to accept material which fails to pass the animal tests. (I also learned at Bayer that they have experienced chloracne during the production of trichlorphenol but "have now licked the problem" according to Dr. Hansen (chemist - Research Director At Elberfeld).

Badische has been able to reproduce in the laboratory the conditions which lead to the incident such as theirs and ours at Nitro and was quite surprised that we had not been able to do so. I was not given the Nitro process information, i.e., temperatures and pressures, but if I had had this information I am sure that I could have obtained Badische's. One of their chemists, a Dr. Palm, sat in on our discussions and was prepared to go into details. He did mention that "with 3 mols of trichlorphenol, methyl alcohol, and alkali, and a temperature of 180°C" the process gets out of control. His remarks are in quotes because he does not speak English and I'm not certain of his remarks.

Dr. Oettel would be very happy to receive samples of any of our materials for investigation. He would like particularly:

(1) Samples of any of the materials involved in our 1949 incident including tetrachlorbenzene, trichlorphenol, or Na salt and any residues from the autoclave or material cleaned from the equipment and structural members.

(2) Trichlorphenol (or Na salt) from regular production.

(3) Any samples from raw materials, intermediates, and final product which may have been involved in our cases which developed during our normal 2,4,5-T production in the years following the initial incident.

He would be happy to exchange freely any and all information with us and Kettering. It was my suggestion that this be direct with Dr. Suskind to eliminate "third parties." He would routinely send carbons of any correspondence to us and we could request Dr. Suskind to do likewise. It is my opinion that this might save unnecessary duplication of effort and expense. In addition, Kettering might obtain valuable information to further their investigation involving human volunteers.

I left with Dr. Oettel copies of the following:

(1) The five (5) reports from the Industrial Hygiene Foundation which discuss their rabbit ear tests.

(2) Kettering's report - "Clinical and Environmental Survey at Nitro, 1953."

(3) Kettering's report - "Environmental Survey Carried Out In Building 30, Monsanto Chemical Company at Nitro, February 2, 1955."

We reviewed thoroughly Mr. Weger's excellent "History of Chloracne" which he sent to me with covering memo dated May 15, 1956, and which included descriptions of Kettering's reports on their human and animal research. I did not give Dr. Oettel a copy of this account because I did not have permission to do so. As a result of my visit, it may be desirable to edit this report somewhat and add further process information before forwarding this to Badische.

Any specific recommendations are implied in the above narrative account of my visit to Badische and must be based on an agreement that full and complete exchange of information with Badische is desirable and possible.

EPW

Elmer P. Wheeler

EPW:dh

Attachment

CONFIDENTIAL

CONFERENCE AT KETTERING LABORATORY

PRESENT: R. R. Suskind M.D. - Kettering Laboratory Cincinnati, Ohio
H. Oettel M.D. - B.A.S.F. Ludwigshaven, Germany
E. P. Wheeler - Monsanto
L. C. Weger - Monsanto

This conference was arranged to share information between Badische, Monsanto and the Kettering Laboratory on chlor-acne. In the case of both Badische and Monsanto, the incident of chlor-acne followed the violent decomposition of a batch of trichloro-phenate in process. The Monsanto incident occurred March 8, 1949 and the German incident in December, 1953. Both cases were followed in a period of days or weeks by an outbreak of chlor-acne of epidemic proportions.

Following the Monsanto incident Dr. Suskind and the Kettering Laboratory have done extensive studies into the problem. Dr. Suskind reviewed, in some detail, work and studies which were carried out. In the beginning, Dr. Suskind related tests and studies made on four of the more severe acne cases and presented pictures of the individuals involved together with photo micrographs of skin biopses showing acne lesions. Dr. Oettel presented similar photographs and photo micrographs of German cases which compared very closely with those from Monsanto. It appeared that the German cases may have been more severe with regard to the skin disturbances. It was also apparent that the residual scarring was a good deal more pronounced.

Dr. Suskind described in some detail, animal tests continued by skin application and by inhalation using both sodium TCP and 245T on a variety of animals including rabbits, rats (adult and baby), cats, dogs and guinea pigs, etc. While in many of the experimental animals evidence of toxicity was manifest, there was no chlor-acne developed. Dr. Suskind and Dr. Oettel both agreed that the so called "rabbit ear test", as developed and described by Messrs. Adams, Irish, Spencer and Rowe, is unrealistic and non-reproduceable. Since none of the very extensive animal experiments were successful in the production of acne, a decision was made to employ human volunteers in an attempt to find a means of evaluating the acnegenic potential of various process materials.

In the first of these experiments, Halowax 1014 (a known acnegen) was chosen as a control. This was applied as a 20% application in "plastibase" an ointment essentially consisting of 5% Polyethylene in mineral oil. Halowax in this experiment was compared to 245T and both materials were applied to the forearm of the human volunteers and kept in contact with the forearm on a continuous basis. Extensive liver function tests were conducted every other day and the volunteers were examined daily by a qualified physician who was particularly mindful of possible liver changes. In 2 to 3 days, redness developed in the Halowax exposures and in 10 days there were some follicular changes terminating in actual lesions. There was no evidence of skin changes in the 245T exposures. Acne was produced only locally in the sight of exposure in every case, that is, there was no systemic change. (At other hospitals with large scale tests, using Halowax, acne was produced in all cases except people above the age of 70. In no case was there any change in liver functions.)

In a later series of experiments, Dr. Suskind described how three materials submitted by Monsanto were compared with Halowax using the technique described above. The materials from Monsanto were all sodium triphenolate prepared as follows:

1) Normal sodium TCP from a plant operation
2) Sodium TCP made from distilled triphenol
3) Sodium TCP made from trichlorophenol purified by the Diamond Alkali technique (dilution, filtration, precipitation and washing)

In this experiment acne was produced in the Halowax control cases and in the cases exposed to the normal plant produced sodium TCP; no acne developed in the cases exposed to the treated TCP samples in the concentrations used.

Dr. Suskind stated that the evolution of chlor-acne is very similar to Acne Vulgaris. Dr. Oettel and Dr. Suskind agreed that massive doses of Vitamin A (100,000 units per day) are effective in Acne Vulgaris. Vitamin therapy was unsuccessful in the Monsanto cases. Dr. Oettel was of the opinion that treatment was too late and stated that they have found that massive doses given in the very early signs of chlor-acne have often resulted in complete clearing of symptoms in 2 to 3 weeks.

Dr. Suskind stated that there is evidence that people develop acne from inhalation or ingesting of Halowax and Dr. Oettel agreed that acne need not come from percutaneous absorbtion but also may be systemic in origin. Dr. Suskind stated that in the Monsanto cases the skin problem was not disabling but the many other symptoms such as vertigo, aching muscles, dyspnea and headaches were. In close checking the varying secondary symptoms (once termed bizarre) it developed that all of the typical symptoms were common to both the German and Monsanto cases with the exception of dyspnea and intolerance to cold.

Dr. Oettel stated that materials such as Halowax and trichlorophenol are not in themselves acnogenic but that the offending contaminant is an "oxidate". Residues from the Badische decomposition have been extracted and elemental analyses made of the extracts (carbon, hydrogen, chlorine, oxygen). Following this, a series of oxygen bearing, chlorine bearing ring hydrocarbons were synthesized and checked for animal toxicity, using rabbits. Comparative acute toxicity of four of the compounds are as follows:

1) triphlorophenol - greater than 1 gram per kilogram
2) tetrachloro naphthalene - 50 mg per kilogram
3) tetrachloro diphenylene oxide - 0.1 mg per kilogram
4) tetrachloro diphenylene dioxide - 0.005 mg per kilogram

The latter compound (also called tetrachloro diphenyl dioxane) checks more closely by elemental analysis with the extract of the residues from the decomposition. Dr. Oettel is convinced that this is the active agent. They have developed a liver function test for rabbits which involves a micro determination of Bromsulphalein retention. This is used as a control test on purchased trichlorophenol (feeding 1 gram of the sample per kilogram of body weight to each of three rabbits). If there is no more than 5% of BSP retention in 5 days, the material is approved for processing. Dr. Oettel stated positively that there had been no cases of chlor-acne in the 245T synthesis operation.

In a later conversation while returning to St. Louis, it developed that the 1953 decomposition at Badische Works did not occur early in the hydrolysis as in the case of both Monsanto and Diamond Alkali, but was in the stripping of excess methanol following the hydrolysis when the batch was dehydrated and decomposed. The decomposition pressure was relieved through normal pressure relief devices and the autoclave was also left full of a mass of coke so hot that it was "gleaming". Badische has been able to reproduce the decomposition of NA-TCP by dehydration in the presence of iron. (This appears to still leave unexplained the type of decomposition experienced by Monsanto and Diamond Alkali.)

Badische no longer produces TCP but purchases trichloro-phenol from Bayer and uses the BSP test for acceptance or rejection of each lot. Bayer professes to have had no chlor-acne but Dr. Oettel doubts their veracity. Dr. Oettel stated that Boehringer in Ingelheim, Germany had a slight decomposition in sodium TCP production and have had many cases of chlor-acne for many years. Their trichloro-phenol gave high results (positive) by the BSP tests.

Dr. Oettel volunteered to run BSP tests for Monsanto on samples which we might forward to him. Mr. Weger agreed to have responsibility for following up on this work.