

cc: E. H. Harrison
D. R. Bishop
R. G. Potter

Monsanto

SPECIALTY CHEMICALS DIVISION

MONSANTO INDUSTRIAL CHEMICALS CO.
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166
Phone: (314) 694-1000

March 24, 1976

PCB
File

Mr. C. M. Timm, Director
Surveillance & Analysis Div.
U. S. Environmental Protection Agency
Region V
230 South Dearborn St.
Chicago, IL 60604

Dear Mr. Timm:

Confirming my conversation with Mr. Marcyn, I will appear on your panel to discuss PCBs. I plan to arrive on the morning of May 19th and leave after lunch.

If there is any information you need, please let me know.

Sincerely yours,

J. Coleman Weber

J. Coleman Weber
Manager, Product Acceptability

mh





UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604



MAR 19 1976

Mr. J. C. Weber
Monsanto Company
800 North Lindbergh Blvd.
St. Louis, MO 63166

Dear Mr. Weber:

A few days ago, Chester A. Marcyn of our Environmental Emergency Section discussed with you in a phone conversation the possibility that your company might provide the services of a panelist for one of our sessions at the coming Hazardous Materials Pollution Control Symposium. Any treatment of the subject of polychlorinated biphenyls would be incomplete today without opinions expressed by a representative of the Monsanto Company and we would be pleased to see such representation.

Featured in the sessions will be the elements of field response techniques including neutralization, cleanup, and disposal of various materials. As you know, the symposium to be held in Chicago on May 18, 19, and 20, 1976 is co-sponsored by the U.S. Coast Guard and the U.S. Environmental Protection Agency. These presentations have been well received in the past and we expect a good turnout of Federal, State, and local agency people as well as industry representatives.

The program has essentially been established according to the enclosed draft agenda. Program scheduling and other arrangements can be discussed with Mr. Marcyn by writing or calling 312-353-5813.

It is hoped that you will soon name your choice for panelist for our symposium. We are looking forward to working with you on this essential environmental task.

Sincerely yours,

Christopher M. Timm, Director
Surveillance & Analysis Division

ACM CC851C



(DRAFT COPY)

HAZARDOUS MATERIALS POLLUTION CONTROL
SYMPOSIUM
FIELD RESPONSE

MAY 18, 19, 20, 1976
SHERATON-O'HARE NORTH MOTOR HOTEL
CHICAGO, IL (ROSEMONT)
co-sponsored by
U.S. ENVIRONMENTAL PROTECTION AGENCY REGION V
U.S. COAST GUARD DISTRICTS TWO AND NINE

Tuesday Morning, May 18

8:30 - 9:00 Registration

9:00 - 9:20 Introduction and Welcome
George R. Alexander, Regional Administrator,
U.S. Environmental Protection Agency, Region V,
Chicago, IL
RADM J. S. Gracey, Commandant, U.S. Coast
Guard District Nine, Cleveland, OH

HAZARDOUS SUBSTANCES AND REGULATIONS

Moderator: Chester A. Marcyn, Environmental Emergency
Section, U.S. EPA Region V, Chicago, IL

9:20 - 9:45 Hazardous Substances Pollution - The National Scene
Kenneth E. Biglane, Director, Oil and Special
Materials Division, U.S. EPA, Washington, DC

9:45 - 10:25 Status of the Federal Hazardous Substances Regulations
Henry D. VanCleave, Oil and Special Materials
Division, U.S. EPA, Washington, DC

10:25 - 10:45 B R E A K

10:45 - 11:15 The U.S. Coast Guard and Hazardous Cargo Transport
Cmdr. Robert E. Ettle, U.S. Coast Guard
District Nine, Cleveland, OH

11:15 - 11:45 State Regulations on Hazardous Materials
Delbert D. Haschemeyer, Office of Legal
Affairs, Illinois Environmental Protection
Agency, Springfield, IL

11:45 - 1:15 L U N C H



ACM 008511

Tuesday Afternoon, May 18

Panel: HAZARDOUS MATERIALS IN RAILROAD ACCIDENTS

Moderator: Alfred C. Smith, Michigan-Ohio District
Office, U.S. EPA Region V, Cleveland, OH

1:15 - 1:55 Handling of Railroad Cars in Derailments
Art Proefrock, Hulcher Emergency Service, Inc.
Virden, IL

1:55 - 2:25 Panelists
Gene Schlaf, Illinois Central Gulf Railroad,
Chicago, IL
Ed Pritchard, Federal Railroad Administration,
Chicago, IL
C. D. Bossard, Bureau of Explosives, Chicago, IL

2:25 - 2:45 Discussion

2:45 - 3:05 B R E A K

Panel: PESTICIDE AND MIXED CHEMICAL FIRES

Moderator: Dr. Mitchell Wrich, Air and
Hazardous Materials Division,
U.S. EPA Region V, Chicago, IL

3:05 - 3:35 Some Recent Plant Fires in Ohio
Alfred C. Smith, Michigan-Ohio District
Office, U.S. EPA Region V, Cleveland, OH

3:35 - 4:05 Panelists:
Dr. John Jordan, Air and Hazardous
Materials Division, U.S. EPA Region V, Chicago, IL
Joseph Palatini, Pennwalt Corp., Delaware, OH
Dr. Donald P. Morgan, Iowa University College
of Medicine, Iowa City, IA
Curtis Golden, Air and Hazardous Materials
Division, U.S. EPA Region V, Chicago, IL

4:05 - 4:30 Discussion

Wednesday Morning, May 19

Panel: ACRYLONITRILE AND VINYL CHLORIDE

Moderator: Anthony Rutter, Indiana District Office,
U.S. EPA Region V, Evansville, IN

8:30 - 9:00

Experiences with Acrylonitrile Spills
George Moein, U.S. EPA Region IV,
Atlanta, GA

9:00 - 9:30

Panelists

~~Donald Goodwin~~, National Air Pollution Center,
Research Triangle Park
Gene Schlaf, Illinois Central Gulf Railroad,
Chicago, IL
Byron Denenberg, MDA Scientific, Inc.
Park Ridge, IL

9:30 - 10:00

Discussion

10:00 - 10:20

B R E A K

Panel: POLYCHLORINATED BIPHENYLS

Moderator: Dr. Billy Fairless, Central Regional
Laboratory, U.S. EPA Region V, Chicago, IL

10:20 - 10:50

PCB Perspectives

Karl E. Bremer, Surveillance and Analysis
Division, U.S. EPA Region V, Chicago, IL

10:50 - 11:20

Panelists

George Moein, U.S. EPA Region IV, Atlanta, GA
Donald Heaton, Food and Drug Administration,
Region V, Chicago, IL
(To be named), Monsanto Company, St. Louis, MO

J C W E B E R

11:20 - 11:45

Discussion

11:45 - 1:15

L U N C H

Wednesday Afternoon, May 19

Panel: PHENOL - CRESOL - CRESOTE

Moderator: Samuel Mason, Michigan-Ohio District
Office, U.S. EPA Region V, Cleveland, OH

Wednesday Afternoon, May 19 (Cont.)

- 1:15 - 1:45 Phenol: Its Treatment and Removal
 William M. Throop, Environmental Sciences
 Division, Envirex Co., Milwaukee, WI
- 1:45 - 2:15 Panelists
 Richard Kramkowski, National Institute of
 Occupational Safety and Health, DHEW,
 Region V, Chicago, IL
 Charles J. Rogers, NERC, U.S. EPA, Cincinnati, OH
 (To be named), Koppers Co., Pittsburgh, PA
- 2:15 - 2:45 Discussion
- 2:45 - 3:05 B R E A K
- Panel: LIQUEFIED GASES: AMMONIA, CHLORINE
 Moderator: Russell Diefenbach, Environmental
 Emergency Section, U.S. EPA Region V,
 Chicago, IL
- 3:05 - 3:35 Experiences with Chlorine
 Fritz Zorn, Chlorex Committee, Chlorine Institute,
 Inc. and BASF Wyandotte Corp., Wyandotte, MI
- 3:35 - 4:05 Panelists
 George W. Feldmann, E.I. DuPont Co., Wilmington, DE
 (To be named), Illinois Fertilizer & Chemical
 Association, Inc., St. Anne, IL
 Byron Denenberg, MDA Scientific, Inc.,
 Park Ridge, IL
 Jack Coblentz, Illinois Environmental Protection
 Agency, Springfield, IL

Thursday Morning, May 20

DATA SOURCES - PROTECTION - COUNTERMEASURES

Moderator: Clarence Oster, Minnesota-Wisconsin
District Office, U.S. EPA Region V,
Minneapolis, MN

- 8:30 - 8:50 Protective Suits for Handling Hazardous Materials
LTJG Keith R. Nicholson, U.S. Coast Guard,
Washington, DC
- 8:50 - 9:10 Field Response Experiences
(To be named), Tech Escort Center,
Aberdeen Proving Grounds, MD
- 9:10 - 10:00 The CHRIS Data System in Spill Situations
LT Richard Harding, U.S. Coast Guard,
Washington, DC
- 10:00 - 10:20 B R E A K
- 10:20 - 10:50 EPA - sponsored Development of Containment Devices
Dr. Joseph Laforanara, EPA Industrial
Environmental Research Laboratory, Edison, NJ
- 10:50 - 11:25 Response to Spills on Large Water Bodies or
Busy River Systems
Stanley W. Whitebloom, Metropolitan Sanitary
District of Greater Chicago, Chicago, IL
- 11:25 - 11:45 Predicting the Hazards of Organics at the
Air-Water Interface
W. Brock Neely, Dow Chemical U.S.A.,
Midland, MI
- 11:45 - 1:15 L U N C H
Thursday Afternoon, May 20
- 1:15 - 1:40 Transfer and Disposal of Hazardous Materials
Robert Meier, Waste Management, Inc., Oakbrook, IL
- 1:40 - 2:05 The Role of the Contractor in Spill Response
David Usher, President, Oil Spill Control
Association of America, Southfield, MI
- 2:05 - 4:30 Presentation of Available Equipment and Supplies:
An Open Forum

February 21, 1974

Dr. Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs
Office of the Assistant
Secretary of Commerce
U.S. Department of Commerce
Main Commerce Building
14th Street & Constitution Avenue, N.W.
Washington, D.C. 20230

Dear Dr. Galler:

Your letter to Mr. Warren Easley dated January 15, 1974 was forwarded to me to respond with comments relating to the proposed effluent standard for polychlorinated biphenyls (PCBs).

With regard to the five points listed, we have the following information to offer:

1. Can the proposed standards be met by existing technology?

No. There is evidence to indicate that polychlorinated biphenyls can be removed from water by absorption or adsorption by particulate matter such as clays and soils. In fact, currently-used analytical methodology utilizes this characteristic. Further studies will be required to determine the best method for disposal of the contaminated solid waste which would result. A detailed manufacturing process, engineering design, capital cost and manufacturing cost have not been completed or determined. The cost would be substantial. There is no "turn key" technology available to industry.

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ADM CC8516

Dr. Sidney R. Galler
February 21, 1974
Page 2.

2. If the technology to meet standards applicable to your operation(s) exists, please describe any potential problems you foresee in applying the technology within the proposed time period.

Assuming the technology discussed in (1) above could be made available, we estimate 24 to 30 months may be required for the design, procurement, installation and demonstration of the facilities. The situation, as it relates to Monsanto's polychlorinated biphenyl-producing unit, is further complicated because of the yet-unknown requirements which will be imposed for the local and regional waste treatment systems which are now being planned. We do not know specifically the situation as it would pertain to the users of chlorinated biphenyls and we suggest they be contacted for their views.

3. Describe the manner and extent to which meeting the standards would impact upon your energy requirements.

If the adsorption technology proves effective, large quantities of solid material containing polychlorinated biphenyls will be generated. Disposal of this waste will require incineration which will consume a considerable amount of fuel. The quantity cannot be determined until pilot studies are completed.

4. If the standards are to be met, describe the anticipated economic and social impact as reflected in the following:

- a. Plant closings.
- b. Employee layoffs.
- c. Projected increase in capital and operating costs as reflected in finished product cost.
- d. Termination in manufacture or consumption of products.

Dr. Sidney R. Galler
February 21, 1974
Page 3

If practical technology remains unavailable, the low effluent standard proposed cannot be met. This could lead to forced termination of the manufacture and use of polychlorinated biphenyls. Monsanto's PCB operations directly utilize 25 employees with an additional 30 in supporting service functions. In addition, the unit which supplies the intermediate raw material involves 47 employees who would also be laid off if no alternative use of the material can be developed. The current users of polychlorinated biphenyls, electrical capacitor and transformer manufacturers and their customers, will also be affected and we believe the extent of the economic and social impact would be considerable. Representatives of the capacitor and transformer manufacturers and the power distribution industry can provide more specific information and should be contacted.

Sincerely,

W. B. Papageorge
Manager, Product Acceptability
Functional Product Groups

WBP/bt

cc: Mr. K. W. Easley
Washington, D.C.

ACM C06518



OFFICE OF THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

January 15, 1974

Dr. Warren Easley
Monsanto Company
1101 16th Street, N.W.
Room 604
Washington, D. C. 20036

Dear Dr. Easley:

Section 307 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) requires the Environmental Protection Agency (EPA) to publish a list of toxic pollutants and to propose effluent standards for such pollutants. In accordance with this requirement, EPA published on September 7, 1973, a list which includes aldrin, dieldrin, endrin, benzidine, cadmium, cyanide, DDT, DDE, DDD, mercury, polychlorinated biphenyls, and toxaphene. The law requires EPA to review and revise this list from time to time. On December 27, 1973, EPA proposed effluent standards for these toxic pollutants. A copy of the proposed standards is enclosed. EPA has established a 90-day period for comments.

In addition to any comments which you may submit to EPA, this Office is interested in obtaining your views on the proposed standards, particularly with regard to the compounds listed which your company produces or consumes. We are requesting your views so that they may be considered in formulating comments which the Department of Commerce plans to provide to EPA within the prescribed 90-day period.

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ACM C08519

We would, in particular, like to have you address the five points listed below. Please include the maximum amount of specific quantitative information to support your views.

1. Can the proposed standards be met by existing technology?
2. If the technology to meet standards applicable to your operation(s) exists, please describe any potential problems you foresee in applying the technology within the proposed time period.
3. Describe the manner and extent to which meeting the standards would impact upon your energy requirements.
4. If the standards are to be met, describe the anticipated economic and social impact as reflected in the following:
 - a. Plant closings.
 - b. Employee layoffs.
 - c. Projected increase in capital and operating costs as reflected in finished product cost.
 - d. Termination in manufacture or consumption of products.
5. Are there any other points you wish to make regarding the inclusion of compounds on the list? Please support your position with health effects or other relevant data.

We recognize that developing this information may take considerable time and effort; however, in order for us to effectively consider any information you develop, we must receive your response by February 18, 1974.

If you also file comments with EPA on the proposed standards,
we would appreciate receiving a copy of the letter.

Sincerely,

Sidney R. Galler
Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure: EPA - Notice of Proposed Rule Making (40 CFR Part
129) Toxic Pollutant Effluent Standards

*W. J. -
We will be looking forward
to receiving your report
Fred Stein*



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D C 20460

NOV 21 1979

OFFICE OF TOXIC SUBSTANCES

Mr. W.R. Corey
Director, TOSCA Administration
Monsanto Company
800 N. Lindbergh Boulevard
St. Louis, MO 63166

NOV 21 1979

This letter is to acknowledge receipt of your petition for exemption(s) from the Processing and Distribution in Commerce Bans on PCBs as provided in 40 CFR 761 (See 44 FR 31558, May 31, 1979). Acceptance of this petition does not mean the Environmental Protection Agency (EPA) has decided to grant your exemption request(s), nor does it mean that EPA is expressing any opinions on the merits of your petition.

At this time we cannot respond to each petition individually as to its completeness due to the large number of petitions received. Processing of petitions that fail to respond to the questions identified in 44 FR 31560 will be delayed. Therefore, we refer you to the "Processing and Distribution in Commerce Exemption Procedural Rules," on page 31560 of the Federal Register of May 31, 1979, to verify that you have submitted a complete petition and that it conforms to the procedural requirements.

While your petition is being evaluated you may continue the processing and/or distribution in commerce activity or activities for which you have petitioned for exemption. As stated in 44 FR at 31559, May 31, 1979:

Any person who petitions EPA by July 1, 1979 to continue processing or distribution in commerce after July 1, 1979 may continue his activity until EPA rules on his petition.

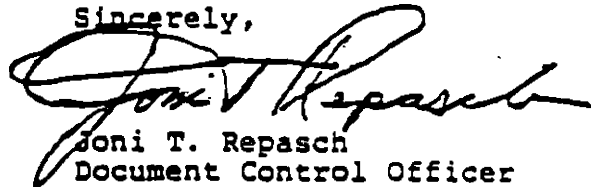
ADM CC8522

PLAINTIFF'S
EXHIBIT

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Attached to this letter is a checklist indicating materials which the Agency has recieved from you as of this date. The Agency will contact you by separate letter if any additional information is required to assist us in our review, or if your petition contains questions directed at the Agency concerning factual or legal matters. If you have any questions about this letter, please contact Peg Velie at (202) 755-0920.

Sincerely,



Joni T. Repasch
Document Control Officer

Checklist

Your correspondence regarding this exemption has been filed in the Official Rulemaking Record for Section (6) TSCA, OTS Docket No. 066002.

- ☒ Petition for exemption, Dated June 28, 1979
- ☐ Verification of continuing need for petition for exemption, Dated _____
- ☐ Additional data on original petition, Dated _____
- ☐ Correction to petition for exemption, Dated _____
- ☐ Withdrawal of petition for exemption, Dated _____
- ☐ Confidential Information, Dated _____

Monsanto

Monsanto Company
800 N. Lindbergh Boulevard
St. Louis, Missouri 63165
Phone: (314) 694-1000

June 28, 1979

Document Control Officer (TS-793)
Office of Toxic Substances
U. S. Environmental Protection Agency
401 M Street, S. W.
Washington, D. C. 20460

Attention: Docket Number OTS/066002 (PCB/PDE)²

Re: Petition for Exemption from PCB Processing Prohibition

Dear Sirs:

Monsanto Company hereby petitions for exemption from the polychlorinated biphenyl (PCB) processing prohibition under section 6(e)(3)(A)(41) of the Toxic Substances Control Act (TSCA). This request is made pursuant to section 750.31 of the Interim Procedural Rules for Processing and Distribution in Commerce Exemptions as published in the Federal Register, Volume 44, Number 106, dated May 31, 1979, beginning on page 31560.

This petition specifically requests an exemption for a period of one year in order to continue using phthalocyanine pigments for the coloring of plastic materials in our plastics processing facilities at Springfield, Massachusetts; Addyston, Ohio; Muscatine, Iowa; and Pensacola, Florida. Attached is a summary sheet providing the required information on our Company, the location of sites needing exemption, and the estimated consumption of phthalocyanine pigments and amount of PCB contained therein at each site.

The plastic products in which phthalocyanine pigments are used contain far less than 50 ppm PCB because of the dilution that occurs when the pigment is mixed with the plastic materials being colored. It is our understanding that pigment producers have efforts underway to develop alternative processes for manufacturing phthalocyanine pigments without PCB contamination, and that changes are expected over a period of a year or two. We contend, therefore, that granting of this petition would not

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Document Control Officer (TS-793)
June 28, 1979
Page Two

result in "an unreasonable risk of injury to health or environment," and that good faith efforts are being made "to develop a chemical substance which does not present an unreasonable risk of injury to health or environment" as stipulated, respectively, under sections 6(e)(3)(B)(i) and 6(e)(3)(B)(ii) of TOSCA.

In the meantime, we must continue to use the phthalocyanine pigments now distributed in commerce, as substitute colorants are not available. The concentration of these pigments in our plastic materials ranges from the low parts per million (ppm) to about the two percent level. Our inability to use these pigments would affect approximately 200-300 million pounds of plastics production at our plants, and would result in either a curtailment of production or alternately severe economic dislocation.

We believe that the above fulfills the information requirements as described in section 750.31(d) of the Interim Procedural Rules, and justifies granting this petition for exemption from the PCB ban.

Sincerely yours,

W. R. Corey
Director
TOSCA Administration

Attachment

bcc: W. R. Corey
N. B. Galluzzo
R. H. Schlattman

ACM CC8526

MONSANTO COMPANY

ESTIMATED 1980 PIGMENT/PCB VOLUME

<u>Monsanto Location</u>	<u>Pounds, Dry Basis</u>	
	<u>Phthalocyanine</u>	<u>PCB</u>
Monsanto Company Headquarters 800 N. Lindbergh Blvd. St. Louis, MO 63166 (314) 694-1000	--	--
Springfield Plant 730 Worchester Street Indian Orchard, MA 01151	7,000	1.40
Port Plastics Plant Addyston, OH 45001	18,300	3.66
Muscatine Plant P.O. Box 473 Muscatine, IO 52761	900	0.18
Pensacola Plant P.O. Box 12830 Pensacola, FL 32575	4,000 30,200	0.80 6.04

- Notes:
1. Both phthalocyanine blues and greens are included.
 2. The average PCB content of the phthalocyanine pigments is assumed to be 200 ppm.
 3. The pigments are introduced into a closed processing system for coloring the plastics materials.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
National Environmental Research Center
Research Triangle Park, North Carolina 27711

29 August 1975

Mr. Elmer P. Wheeler
Manager, Environmental Health
Medical Department
Monsanto Company
800 N. Lindbergh Blvd.
St. Louis, Missouri 63166

Dear Elmer:

Enclosed are copies of recent papers concerning PCBs and DDT.
I would appreciate your comments particularly with regard to collective
and analysis techniques and possible sources of PCBs. Is it plausible
that the PCBs are formed from irradiation of DDT?

Best regards.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "James R. Smith".

James R. Smith
Criteria and Special Studies Office

Enclosures

ACM. CC6526



**COASTAL WATER
RESEARCH PROJECT**

Annual Report for the Year Ended 30 June 1975

Southern California Coastal
Water Research Project
1500 East Imperial Highway
El Segundo, California 90245
(213) 622-3030

INPUTS OF DDT AND PCB

With the support of the U.S. Environmental Protection Agency, we have continued our investigation of the input rates of chlorinated hydrocarbons into the waters off southern California. The main routes are municipal wastewaters, surface runoff, aerial fallout, direct industrial discharge, antifouling paint application, and ocean current advection. During the past year, we have concentrated our efforts on quantifying the inputs via the first four routes.

One of the principal goals of this research has been to determine the concentrations and emissions of chlorinated hydrocarbon contaminants from the major municipal wastewaters discharged to the Bight. During the 2 years of the study, we have analyzed a number of 1-week effluent composites from each of southern California's six largest outfall systems, which account for approximately 95 percent of the submarine discharge of such wastewaters. Detailed intercalibration programs on split samples have been conducted with laboratories at the University of California and the University of Washington, and at the major sanitation districts responsible for routine monitoring.

One of our major conclusions from these intercalibrations is that the determinations of DDT compounds in Joint Water Pollution Control Plant (JWPCP) final effluent (once the dominant source of chlorinated hydrocarbons) made by the County Sanitation Districts of Los Angeles County have been in good agreement (± 20 percent) with those of the other laboratories since the beginning of that monitoring effort in 1971. This is important in light of the fact that the JWPCP annual mass emission rate decreased from approximately 22,000 kg in 1971 (a mean effluent concentration of 42 $\mu\text{g/l}$) to 1,400 kg in 1974 (a mean concentration of 3.0 $\mu\text{g/l}$): Because of the rapid changes, occasional surveys by outside laboratories such as ours could provide only a coarse evaluation of the effect of control efforts in reducing coastal inputs that have been dominated by this discharge. The agreement between the DDT determinations of the other major sanitation agencies and those of outside

laboratories was not as good, but the DDT levels in these effluents were generally quite low (less than 0.3 $\mu\text{g/l}$, except for Hyperion's 7-mile sludge, which was an order-of-magnitude higher). The only other chlorinated hydrocarbon pesticide we have observed in local wastewaters is Dieldrin; typical concentrations now appear to be on the order of 0.1 $\mu\text{g/l}$ or lower.

The situation for the polychlorinated biphenyls is less satisfactory. These industrial materials often are a complex mixture of synthetic organic compounds that are difficult to identify and quantify by gas chromatography. For 1254 PCB, which has an average 54 percent chlorination, some degree of agreement on analytical data is now being reached between the outside laboratories and the monitoring agencies. However, major discrepancies still exist, and these must be resolved before confidence can be placed in this part of the effluent monitoring programs. The most significant recent finding is that 1242 PCB appears to be the dominant known polychlorinated biphenyl in most of the local municipal wastewaters. Effluent levels of 1242 PCB range from 0.1 to 8.0 $\mu\text{g/l}$, and Hyperion sludge contains 70 $\mu\text{g/l}$.

In contrast to DDT compounds, PCB's are widely discharged from submarine outfalls along the southern California coast. A comparison of estimated 1974 mass emission rates for total DDT and PCB compounds in the major municipal wastewaters to the Bight is given in Table 1. This comparison shows that approximately 90 percent of the DDT compounds released with municipal wastewaters during 1974 came from the JWPCP discharge off Palos Verdes Peninsula, in spite of the fact that control efforts instituted by the Los Angeles County Sanitation Districts in 1970 resulted in a 93 percent decrease in DDT waste emissions between 1971

Table 1. Estimated 1974 annual mass emission rates of total DDT and total PCB discharged to the Bight via major municipal wastewaters.

Discharger	Flow (mgd)	Total DDT (kg/yr)	Total PCB (kg/yr)
Oxnard, Ventura County	10	4	5
Hyperion, Santa Monica Bay			
5-mile effluent	340	56	160
7-mile sludge	5	17	790
Total	350	73	950
JWPCP, Palos Verdes Peninsula	350	1,440	1,300
Orange County Sanitation Districts, Orange County	170	54	2,100
Point Loma, San Diego	100	14	1,100
Total, Southern California Bight	980	1,600	5,500

Table 2. Estimated 1972-73 annual mass emission rates of chlorinated hydrocarbons carried into southern California coastal waters via storm and dry weather runoff.

Type	Volume (10 ⁶ cu m)	Total DDT (kg/yr)	Dieldrin (kg/yr)	PCB 1254 (kg/yr)
Storm	574	313 - 318	61.6	241 - 274
Dry Weather	127	7.1 - 7.2	4.9	7.3 - 7.6
Total	701	320 - 325	66.5	248 - 282
Dry Weather	18.1%	2.2%	7.4%	2.6 - 3.1%

and 1974. Emission of PCB compounds via these sources was much more uniform off Los Angeles, Orange, and San Diego Counties; the highest mass emission rate estimate (2,100 kg/yr, off Newport Beach) was only about two times the lowest (950 kg/yr, into Santa Monica Bay). PCB's now constitute the major chlorinated hydrocarbon contaminant found in municipal wastewaters discharged to the Bight, amounting to approximately three and one-half times the input of DDT compounds (5,500 vs. 1,600 kg/yr, respectively). Other chlorinated pesticide inputs via this route appear to be relatively minor; Dieldrin is the only other pesticide we have observed, and its estimated 1974 mass emission rate from municipal wastewaters appears to be less than 100 kg/yr.

Because pesticides are often widely dispersed following application in the field, surface runoff is generally assumed to be one of the dominant modes of chlorinated hydrocarbon transport to the sea. To determine the importance of such inputs in southern California during Water Year 1971-72, we conducted an intensive sampling of storm runoff in four major channels flowing into the Bight. During the following year, we limited our efforts to one of the largest of these channels, sampling the Los Angeles River over four storm periods. We also conducted two seasonal samplings of dry weather flow from ten channels widely spaced throughout the Bight.

On the basis of very satisfactory agreement obtained between Los Angeles River storm runoff results for the 2 years, we have used the 1971-72 flow-weighted mean concentrations in storm runoff to obtain Bight-wide mass emission rates for Water Year 1972-73. The results for this year, which was not unusually wet or dry, are summarized in Table 2. These data indicate that, although dry weather flow from the coastal plain constituted approximately 20 percent of the total surface runoff during 1972-73, it accounted for only about 3 percent of the mass emissions of chlorinated hydrocarbons

via this route. Thus, most of the surface transport of these synthetic organic contaminants to the sea takes place during the few stormy days of the year that occur in southern California.

In addition to surface runoff, aerial fallout is a potentially-important mode for transport of chlorinated hydrocarbons to coastal waters. A technique of collecting dry fallout particles on glass plates sprayed with a hexane/mineral oil mixture has been used to determine the amount of aerial inputs to the Southern California Bight. Details of this fallout survey are presented in the following article. Our studies of chlorinated hydrocarbon inputs to the Southern California Bight via six routes during 1973-74 have produced the results summarized in Table 3. This summary indicates that submarine discharge of municipal wastewaters is still the largest known source of chlorinated hydrocarbons entering the marine ecosystem from the coastal plain. Although there has been a dramatic decrease in the DDT contribution of this wastewater during the last 3 years, it is still seen to be about one-half the total coastal input, excluding ocean current advection. However, the data indicate that aerial fallout is also an important route of entry for DDT and that surface runoff appears to be of secondary importance.

Municipal wastewaters are also the dominant known source of polychlorinated biphenyls. Of the 5,500 kg estimated to have been discharged via these wastewaters during 1974, approximately 80 percent was characterized as 1242 PCB and 20 percent as 1254 PCB. All of the large municipal systems make a significant contribution to this total, and it is important that more reliable monitoring data for PCB's be obtained in the future.

Table 3. Estimated annual mass emission rates of chlorinated hydrocarbons via six routes to the Southern California Bight.

Route	Year	Total DDT (kg/yr)	Dieldrin (kg/yr)	Total PCB (kg/yr)
Municipal Wastewater	1974	1,600*	80	5,550
Direct Industrial Discharge (San Pedro Bay)	1973	20	5	50
Antifouling Paint	1973	<1	<1	<1
Surface Runoff	1973	320	70	≤ 800**
Aerial Fallout	1973-74	1,300	—	1,500†
Ocean Currents	1973	7,000	—	4,000†

*90 percent from J/A/PCP.

**1,254 PCB: 300 kg/yr.

†1254 PCB only.

Only 1254 PCB was detected in the aerial fallout samples, and a preliminary estimate of this input is about 1,500 kg/yr. We do not yet have a corresponding value for the lighter polychlorinated biphenyls such as 1242 PCB. However, it appears that surface runoff contains more 1242 than 1254 PCB; thus, the aerial fallout contribution of the lighter polychlorinated biphenyls may also be significant.

Surface runoff carries almost the same amounts of total DDT and 1254 PCB to the coastal waters (about 300 kg/yr, each). Thus, preliminary estimates for the aerial fallout inputs of these contaminants (1,300 and 1,500 kg/yr, respectively) are in good agreement with the relative amounts found in runoff.

An investigation of the importance of vessel antifouling paints as a potential source of chlorinated hydrocarbons (particularly PCB's) has demonstrated that, by 1973, this was a completely insignificant mode of input, although it may have been an important source in the past.

Our survey of approximately 40 industrial effluents being discharged directly into San Pedro and San Diego Harbors has produced no evidence that such discharges presently constitute a significant source of chlorinated hydrocarbons to the local marine waters.

In conclusion, it appears that inputs of PCB compounds to the Southern California Bight from the adjacent coastal plain are several times larger than those of DDT compounds. In contrast to DDT, the major PCB inputs are broadly distributed along the coast; thus, it may be considerably more difficult to obtain significant reductions in the quantities of PCB reaching the local marine ecosystem.

AERIAL FALLOUT OF DDT

The comparison of chlorinated hydrocarbon inputs presented in the previous article indicates that, during 1973 and 1974, aerial fallout contributed almost as much DDT and its residues to the coastal ecosystem as did municipal wastewater, the largest single source of the pesticide. In light of the decreasing concentrations of DDT in the municipal effluents, it appears that aerial transport will be the dominant input route of the future. Thus, with the support of the U.S. Environmental Protection Agency, we have investigated the fallout rates of chlorinated hydrocarbons onto the Bight in considerable detail over the last 2 years.

Utilizing a glass plate and mineral oil collection technique first developed by Dr. Vance McClure (National Marine Fisheries Service, Tiburon, California), approximately 1,000 samples were taken in replicate 1-week collections made during two 13-week periods at 14 coastal stations and 6 island stations between Point Conception and the U.S./Mexico border. These samples have yielded a large body of data on several DDT compounds in dry aerial fallout, at levels free of apparent chromatographic interferences or significant contributions from analytical blanks.

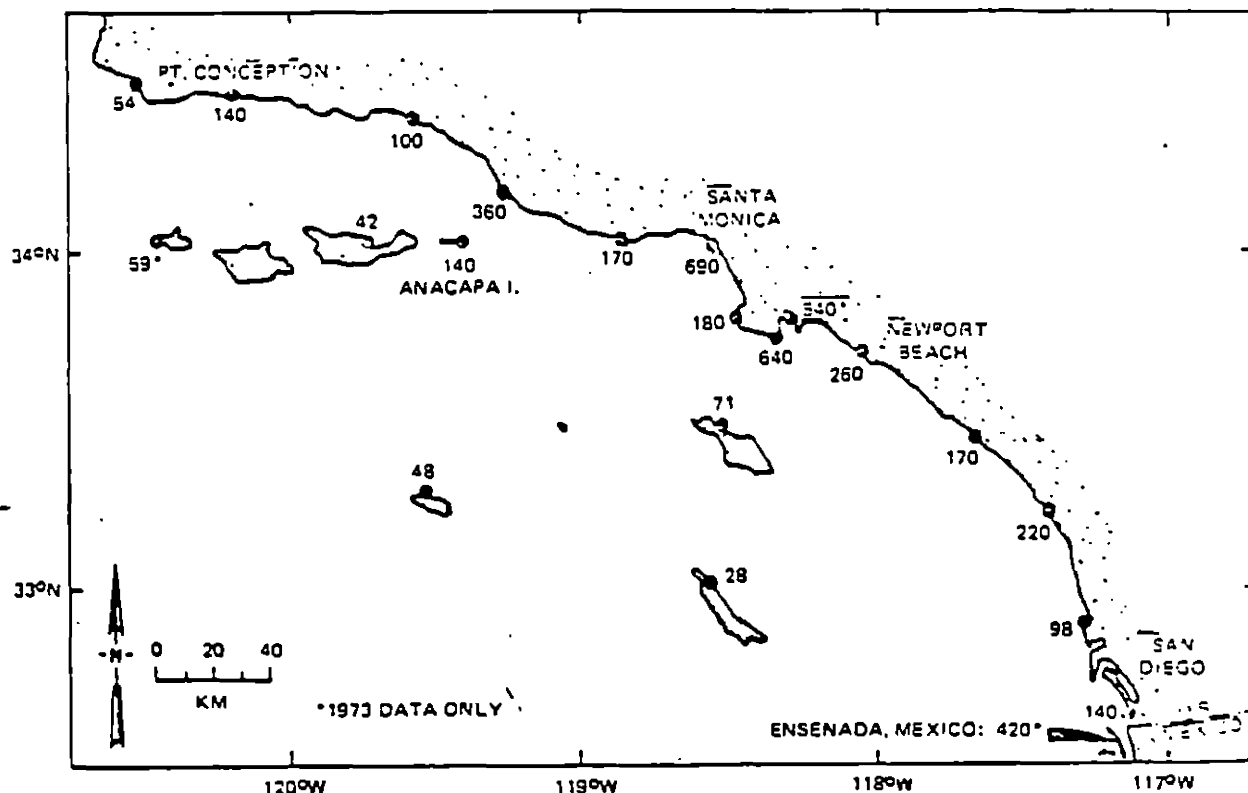
The results for p,p'-DDT, and p,p'-DDE (plus p,p'-DDD for the second survey) have been converted to estimated mean daily fluxes (10^{-9} g/sq m/day) for each sampling, applying a collection efficiency factor of 50 percent. The Wilcoxon signed-rank test was used to determine if there was any statistically significant difference between the two seasonal values of total DDT fallout onto the Bight. None was demonstrated at 95 percent confidence level; therefore, the weekly data for the individual components were averaged over the entire 26-week collection period. Figure 1 presents the resultant mean for total DDT. The average ratio of p,p'-DDT to o,p'-DDT observed in the Bight was 2.5 to 1, and these two isomers constituted approximately 70 percent of the "total" measurable flux of DDT compounds onto the Bight. In contrast, p,p'-DDE is the principal component

observed in JWPCP wastewater and in the ocean bottom sediments around the site of this major discharge: Approximately three-quarters of the total DDT is made up of p,p'-DDE in the surface sediment samples.

Northern Baja California is often used as a control zone in Project studies; thus, during the first seasonal collection, a few weekly samples also were taken by student volunteers at the Institution for Oceanographic Investigations, Universidad Autonoma de Baja California, in Ensenada, Mexico. The results indicated that one of the highest coastal flux values for total DDT observed in the Bight during summer 1973 occurred at Ensenada. This is an agricultural region of the Baja California peninsula, and these higher fallout values appear to reflect greater or more recent local usage of DDT than to the north.

One of the most striking results of this Bight-wide survey was that, with the exception of the Ensenada results, the total DDT fallout values generally increased toward Los Angeles. This was surprising, as the major agricultural areas of the coastal plain lie to the north and south of this highly-urbanized region. Because the results of this research had indicated that dry aerial fallout was a relatively important source of DDT compounds to the Bight, the project conducted its own fallout survey within the Los Angeles Basin to further investigate this finding.

Figure 1. Average flux of total DDT (10^{-9} g/sq m/day) in dry aerial fallout, 1973-1974.



Between 26 April and 24 May 1974, we sampled 24 stations during 4 successive weeks. Because of the past history of dramatic DDT pollution of the Bight, apparently as a result of waste discharges from Montrose Chemical Company, four stations were established within a few blocks of this industrial plant in the city of Torrance. Four sites also were established around the sanitary landfill in Rolling Hills Estates on the Palos Verdes Peninsula, operated by the County Sanitation Districts of Los Angeles County. It is reported that this landfill received DDT wastes from the Montrose plant up until about 1972. In addition, four sites were established around a private sanitary landfill owned by Ben K. Kazarian and located near the city of West Covina where the Montrose wastes are now taken.

In this survey, both the DDT constituents and 1254 PCB were clearly identified at levels at least an order of magnitude above those found in process blanks. The results showed two regions of relatively high DDT fallout, located in the vicinity of the Montrose plant and the Rolling Hills sanitary landfill. The highest of the values in each region generally occurred at the south or southeast stations. As the prevailing coastal winds are from the northwest, this suggests two separate sources. Wind data for the interior of the Basin are being analyzed to further investigate this subject.

In light of the large gradients in DDT fallout rates that were observed, and the implications regarding the sources, the survey was repeated during 2 weeks in September 1974; two additional stations were included in the pattern around the Montrose plant. The September DDT data were similar to those of the previous spring and indicate little seasonal effect.

The occurrence of an occasional anomalous value can strongly bias a small-sample mean, so for this basin study, we assumed the median of the six weekly values to be most representative of the fallout flux at a given station. These values for total DDT and 1254 PCB are illustrated in Figures 2 and 3, respectively.

The data presented above indicate an apparent relationship between the DDT fallout distribution and the location of a major manufacturing facility and one of its past waste disposal sites. However, the level of DDT in the dry aerial fallout around the present disposal site (the Kazarian landfill) is not any higher than levels at other Basin stations. As the two principal constituents of the pesticide itself are p,p'-DDT and o,p'-DDT, we examined these two products of the manufacturing process in greater detail. We found a considerably larger value for the ratio of p,p'-DDT to o,p'-DDT around the two regions of highest fallout (10 sites) than in the rest of the Basin

(15 sites); median values for the two groups are 5.0 and 3.2, respectively. This ratio may be an indication of the relative "freshness" of the DDT constituents collected on our fallout plates. Similarly, the para and ortho isomers together constitute the largest percentage of total measurable DDT at these 10 sites; median percentages for the two groups are 85 percent and 63 percent. This too

Figure 2. Median flux of total DDT (10^{-9} g/sq m/day) in dry aerial fallout collected during 6 weeks of 1974.

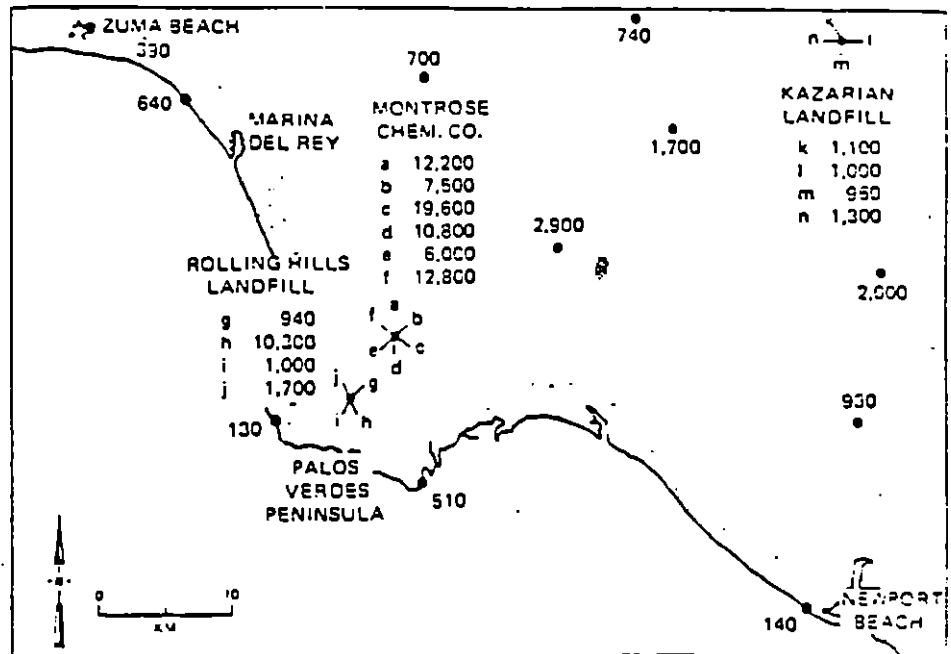
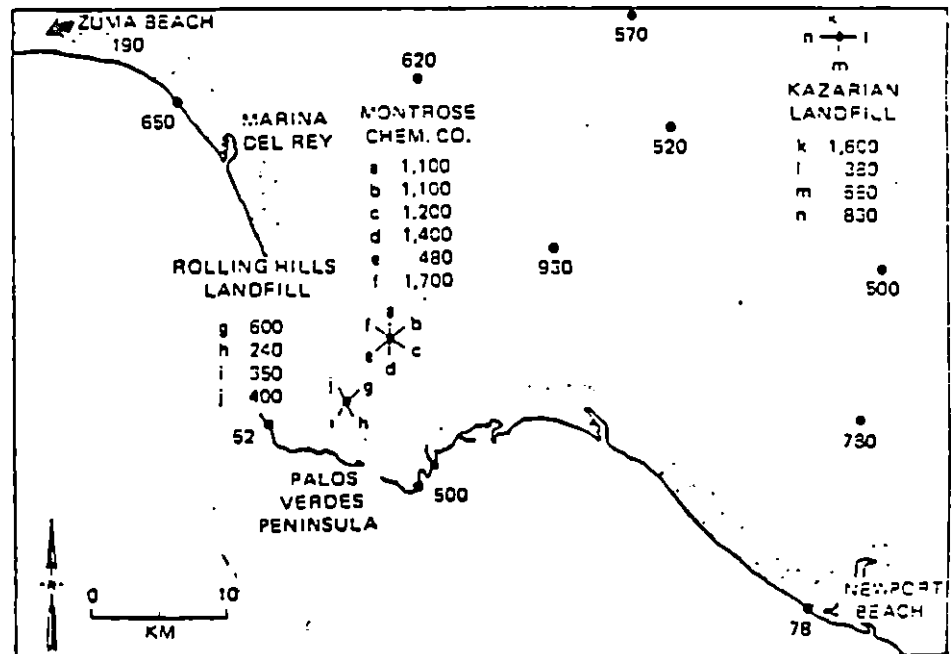


Figure 3. Median flux of 1254 PCB (10^{-9} g/sq m/day) in dry aerial fallout collected during 6 weeks of 1974.



may be related to effects of "weathering." Finally, to determine if the relatively high DDT fallout values around the manufacturing plant and its past waste depository could be due merely to higher deposition of particulates, we have normalized the values against 1254 PCB, which is not manufactured by Montrose Chemical Co. Distinctively higher values for this ratio are observed around the plant and the Rolling Hills landfill (median: 6.0) than in the rest of the basin (median: 1.2). Thus, it appears that the gradients in DDT fallout values we have observed do indicate two regions that are potentially important sources of DDT compounds to the Los Angeles Basin and the adjacent Southern California Bight.

Two methods were used to calculate the amount of total DDT falling onto the basin annually. The first involved a strict linear interpolation between data points. For those stations where there were two or more sampling sites, the median flux was used to represent the station. It should be noted that in the case of the Rolling Hills landfill, one site has a significantly higher flux than the other three sites. As this value is the median of six weekly values, and this site had the highest weekly flux reported for the entire Basin study, it appears that the site represents a secondary source of DDT. However, the median flux of $1,400 \times 10^{-9}$ g DDT/sq m/day is a more representative value for that station. Because the location of sampling sites and the high values at Montrose bias the fallout estimate of 2.2 metric tons/yr derived from our contours, we consider this to be an upper limit. The median flux for the entire Basin, 930×10^{-9} g/sq m/day, was used to estimate a lower limit. The fallout estimate calculated using this value is 0.5 metric tons/yr, resulting in an estimated range of 0.5 to 2.2 metric tons/yr.

One of the most important aspects of these findings is that there still may be a significant release of DDT wastes to the southern California environment from the manufacture of this pesticide in Los Angeles County, even though the discharge of liquid wastes to the County sewer system has been stopped. During 1974, the average level of total DDT in JWPCP final effluent was 3.0 μ /l, which alone exceeds the level allowed by the California State Water Resources Control Board "Ocean Plan" (2 μ g/l on a 50 percent occurrence basis) for total identifiable chlorinated hydrocarbons in such wastewaters. The corresponding mass emission rate for total DDT was 1,400 kg/yr. We have estimated that a similar quantity (1,300 kg) of DDT compounds fell onto the coastal waters annually during 1973-74. A significant fraction of this material may have emanated from DDT wastes produced during manufacture of the pesticide in Los Angeles County, either directly from the plant or from its original land waste disposal site. Thus, a unified con-

trol plan to reduce marine inputs of this pollutant would require that attention also be paid to these potential sources of DDT to the atmosphere in Los Angeles Basin.

AERIAL FALLOUT OF DDT
IN SOUTHERN CALIFORNIA

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Submitted to:
Bulletin of Environmental Contamination and Toxicology

DDT and its metabolites are among the most serious contaminants yet identified in the marine environment (Risebrough et al., 1967; DeLong et al., 1973; McDermott et al., 1974). In past years, very large quantities of DDT wastes were released into the JWPCP* sewer system of the County Sanitation Districts of Los Angeles County, (MacGregor, 1974). These wastes, apparently produced by Montrose Chemical Company (during the manufacture of this pesticide) were subsequently discharged via the JWPCP submarine outfalls off Palos Verdes Peninsula to the marine ecosystem of the Southern California Bight (Figure 1).

During the last 3 years we have investigated the input rates of DDT and other chlorinated hydrocarbons to the Bight via a number of different routes (Young et al., 1974; Risebrough et al., 1974). Here we report the results for one of the routes, dry aerial fallout. In view of the very low rainfall in southern California, approximately 30 cm/yr, dry aerial fallout dominates aerial inputs along this section of the Pacific Coast.

Utilizing a glass plate and mineral oil collection technique first developed by Dr. Vance McClure (National Marine Fisheries Service, La Jolla, California), approximately 1,000 samples were taken in replicate 1-week collections made during two 13-week periods** at 14 coastal stations and 6 island stations between Point Conception and the U.S./Mexico border. These samples have

* Joint Water Pollution Control Plant

**July-September 1973 and March - June 1974

yielded a large body of data on several DDT compounds in dry aerial fallout, at levels free of apparent chromatographic interferences or significant contributions from analytical blanks.

MATERIALS AND METHODS

The collection device for sampling dry aerial fallout was a piece of cleaned window glass (0.1 square meter) sprayed with a mixture of pharmaceutical mineral oil (Squibb brand) diluted by five parts pesticide-grade hexane. A pair of cleaned plates wrapped in aluminum foil were taken to the collection site, unwrapped, and placed on a horizontal surface above the ground. Generally this was the roof of a one-story structure located on or near the beach but removed from obstructions with large profiles which might cause excessive turbulence. Every effort was made to isolate the sampling plates from nearby painted surfaces, especially if the paint was flaking. If this was impossible, samples of the potentially contaminated material were taken for analysis.

Once the plates were unwrapped and in place, they were sprayed with a very light coat of the diluted mineral oil using a TLC sprayer (Chromatosprayer brand). The criterion followed was to apply enough oil so that the plate would trap small particles but not larger objects such as insects and feathers. Usually, spraying from a distance of about 0.3 meter for a period of about 5 seconds was sufficient. After the hexane evaporated, this left roughly 0.3 ml of oil on the plate.

At the end of the one week sampling period, a cleaned piece of teflon, cut with a straight edge, was used to scrape the mineral oil and fallout particles from the plate. The oil was transferred from the edge of the teflon strip to the inner rim of a pointed, graduated pyrex centrifuge tube. After several minutes of scraping, the plate was re-sprayed with diluted mineral oil and rescraped; this procedure was repeated for a third scraping. (Tests have indicated that this three-step process recovers more than 95% of the fallout material.) Then, the sample tube was covered with aluminum foil under a screw cap and returned to the laboratory. Before leaving the site the scraped sampling plates were re-sprayed to begin the next sampling period.

Aerial fallout samples were processed through a "clean-up column" before being analyzed by gas chromatography. The clean-up column was a disposable 5 ml pipet packed with specially prepared and activated silica gel. MCB Silica Gel (SX-144-6) 100-200 mesh was washed with a 1:1 solution of methanol/benzene. Three milliliters of solution were used per one gram of adsorbent. After rinsing, the silica gel was dried in a Rotovapor and activated at 180° overnight and then stored under hexane. The column was packed by inserting a plug of silane treated glass wool, adding several mls of hexane and slurring the silica gel with a pipet. Using the markings on the 5 ml pipet as a guide, adsorbent was added until the volume of the compacted bed was $1.7 \text{ ml} \pm 0.1 \text{ ml}$. A vibrator was held against the column briefly to compact the adsorbent.

The fallout samples came into the laboratory in centrifuge tubes containing up to 1 ml of mineral oil. The slides of the tube were washed down with enough hexane to bring the volume to 3 mls. The sample was then introduced into the column using a pipet to transfer it from the centrifuge tube. The initial elution was with 1.7 ml of hexane to remove the mineral oil from the column; this fraction was discarded. The DDT compounds were then eluted with 5.7 ml of 20% benzene/hexane. Dilutions of this fraction were made to appropriate volumes for analysis by electron capture gas chromatography.

RESULTS AND DISCUSSION

The results for p,p'-DDT, o,p'-DDT, and p,p'-DDE (plus p,p'-DDD for the second survey) have been converted to estimated mean daily fluxes (10^{-9} g/sq m/day) for each sampling, applying respective collection efficiency factors of 60, 64, 36 and 63 percent. The Wilcoxon signed-rank test was used to determine if there was any statistically significant difference between the two seasonal values of total DDT fallout onto the Bight. None was demonstrated at the 95 percent confidence level; therefore, the weekly data for the individual components were averaged over the entire 26-week collection period. Figure 1 presents the resultant mean for total DDT.

The average ratio of p,p'-DDT to o,p'-DDT observed in the Bight was 2.5 to 1, and these two isomers constituted approximately 70 percent of the "total" measurable flux of DDT compounds onto the Bight. In contrast, we have observed that approximately

three-quarters of the total DDT in ocean bottom sediments around the site of the JWPCP outfalls is made-up of p,p'-DDE and the principal components of the wastewaters discharged are p,p'-DDE and p,p'-DDD.

During the first seasonal collections a few weekly samples also were taken in Ensenada, Mexico. The results indicated that one of the highest coastal flux values for total DDT observed in the Bight during summer 1973 occurred at Ensenada. This is an agricultural region of the Baja California peninsula, and these higher fallout values appear to reflect greater or more recent local usage of DDT than to the north.

One of the most striking results of this Bight-wide survey was that, with the exception of the Ensenada results, the total DDT fallout values generally increased toward Los Angeles. This was surprising, as the major agricultural areas of the coastal plain lie to the north and south of this highly-urbanized region. Because the results of our research had indicated that dry aerial fallout was a relatively important source of DDT compounds to the Bight, we conducted a fallout survey within the Los Angeles Basin to further investigate this finding.

Between 26 April and 24 May 1974, we sampled 24 Basin stations during 4 successive weeks. Because of the past history of dramatic DDT pollution of the Bight, apparently as a result of waste discharges from Montrose Chemical Company, four stations were established within a few blocks of this industrial plant located in a suburb of Los Angeles. Four sites also were established around the sanitary landfill in Rolling Hills Estates on the Palos Verdes Peninsula,

operated by the County Sanitation Districts of Los Angeles County. It is reported that this landfill received DDT wastes from the Montrose plant up until about 1972. In addition, four sites were established around a private sanitary landfill owned by Ben K. Kazarian and located near the city of West Covina where the Montrose wastes are now taken.

In this survey, the DDT constituents were clearly identified at levels at least an order of magnitude above those found in process blanks. The results showed two regions of relatively high DDT fallout, located in the vicinity of the Montrose plant and the Rolling Hills sanitary landfill. The highest of the values in each region generally occurred at the south or southeast stations. As the prevailing coastal winds are from the northwest, this suggests two separate sources.

In light of the large gradients in DDT fallout rates that were observed, and the implications regarding the sources, the survey was repeated during 2 weeks in September 1974; two additional stations were included in the pattern around the Montrose plant. The September DDT data were similar to those of the previous spring and indicate little seasonal effect.

The occurrence of an occasional anomalous value can strongly bias a small-sample mean, so for this basin study, we assumed the median of the six weekly values to be most representative of the fallout flux at a given station. The values for total DDT are illustrated in Figure 2.

The data presented above indicate an apparent relationship between the DDT fallout distribution and the location of a major manufacturing facility and one of its past waste disposal sites. However, the level of DDT in the dry aerial fallout around the present disposal site (the Kazarian landfill) was not any higher than levels at other Basin stations. As the two principal constituents of the pesticide itself are p,p'-DDT and o,p'-DDT, we examined these two products of the manufacturing process in greater detail. We found a considerably larger value for the ratio of p,p'-DDT to o,p'-DDT around the two regions of highest fallout (10 sites) than in the rest of the Basin (15 sites); median values for the two groups were 5.0 and 3.2, respectively. This ratio may be an indication of the relative "freshness" of the DDT constituents collected on our fallout plates. Similarly, p,p'-DDT and o,p'-DDT together constituted the largest percentage of total measurable DDT at these 10 sites; median percentages for the two groups were 85 percent and 63 percent. This too may be related to effects of "weathering." Finally, to determine if the relatively high DDT fallout values around the manufacturing plant and its past waste depository could be due merely to higher deposition of particulates, we normalized the values against 1254 PCB, which is not manufactured by Montrose Chemical Co. Distinctively higher values for this ratio were observed around the plant and the Rolling Hills landfill (median: 6.0) than in the rest of the basin (median: 1.2). Thus, it appears that the gradients in DDT fallout values we have observed do indicate two regions that are potentially important sources of DDT compounds to the

Los Angeles Basin and the adjacent Southern California Bight.

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One of the most important aspects of these findings is that there still may be a significant release of DDT wastes to the southern California environment from the manufacture of this pesticide in Los Angeles County, even though the discharge of liquid wastes to the County sewer system has been stopped. During 1974, the average level of total DDT in JWPCP final effluent was 3.0×10^{-6} g/l which alone exceeded the level allowed by the State of

California Water Quality Control Plan for Ocean Waters of California (State Water Resources Control Board, 1972) for total identifiable chlorinated hydrocarbons in such wastewaters (2×10^{-6} on a 50 percent occurrence basis). The corresponding mass emission rate for total DDT was 1.4 metric tons/yr. From the results of our two seasonal surveys, we estimate that a similar quantity (1.3 metric tons/yr) of DDT compounds fell onto the coastal waters annually during 1973-74. A significant fraction of this material may have emanated from DDT wastes produced during manufacture of the pesticide in Los Angeles County, either directly from the plant or from its original land waste disposal site.

• Thus, a unified control plan to reduce marine inputs of this pollutant would require that attention also be paid to these potential sources of DDT to the atmosphere in Los Angeles Basin.

ACKNOWLEDGEMENTS

We thank Project members M. Westbrook, J. Johnson, M. Moore, and P. Smokler for participating in the field collections, E. Berkhisér and I. Szpila for assisting in the laboratory analyses, and L. Schweizer and C. Moffatt for assisting in data reduction. We gratefully acknowledge the following individuals for their assistance in obtaining samples from the various islands off southern California: San Miguel Island, Dr. R. de Long (National Marine Fisheries Service, Seattle); Santa Cruz Island, L. Laughlin (Channel Island Field Station, University of California, Santa Barbara); Anacapa Island, William and Mark Connally (Island Packers, Co., Ventura) and Superintendent W. Ehorn

(National Park Service, Channel Island National Monument, Ventura; San Nicolas Island, Chief R. Anderson (U.S. Navy, San Nicolas Island); Santa Catalina Island, Dr. R. Given (Santa Catalina Marine Laboratory, University of Southern California, Los Angeles); and San Clemente Island, Lt. Commander Kay (U.S. Navy, San Clemente Island). We also thank G.C. Barragan (Universidad Autonoma de Baja California, Ensenada) for collecting the Ensenada, Mexico samples. This research was conducted under a research grant (R801153) from the U.S. Environmental Protection Agency. Contribution number 46 of the Southern California Coastal Water Research Project.

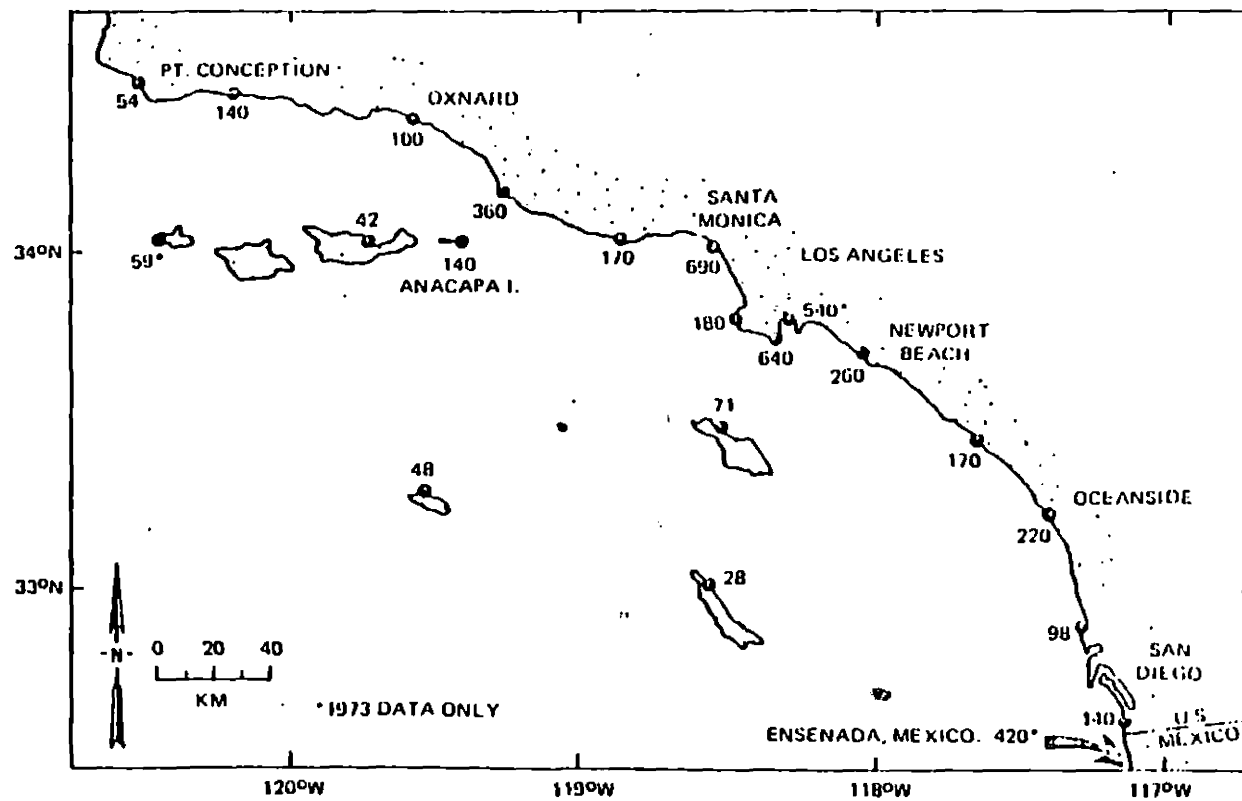
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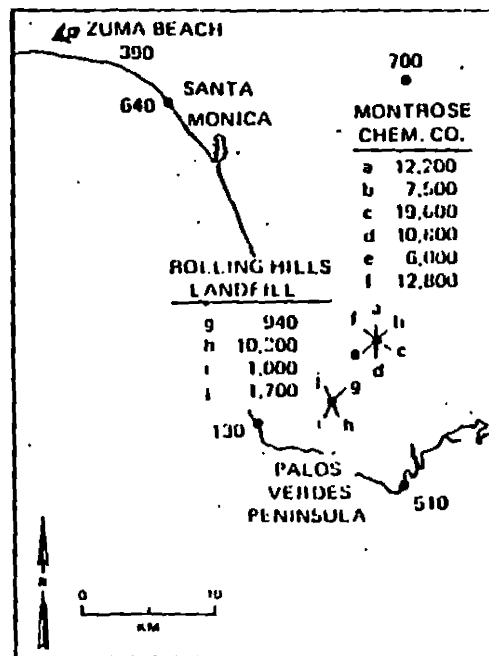
FIGURE CAPTIONS

Figure 1. Average flux of total DDT (10^{-9} g/sq m/day) via dry aerial fallout collected in the Southern California Bight during 1973-74.

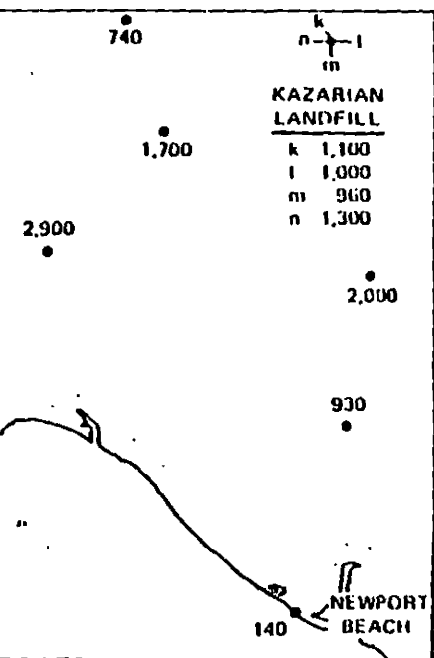
Figure 2. Median flux of total DDT (10^{-9} g/sq m/day) via dry aerial fallout collected in the Los Angeles Basin during 6 weeks of 1974.



ACM C08553



ACM 008554



The Monsanto Company's voluntary decision to discontinue the manufacture and sale of Polychlorinated biphenyls (PCB's) by October 31, 1977 represents a major step toward eliminating the use of this substance and its associated threat to human health and the environment. I welcome this development and commend the Monsanto Company on its decision.

A year ago EPA undertook a series of activities designed to examine and deal with the PCB problem which had become one of national dimensions. In December I announced a PCB action plan to focus the efforts of government and industry on solving this problem. I indicated then that although the government had no comprehensive regulatory authority to deal with the problem, our national goal should be to phase out all uses of PCBs as rapidly as possible. I am gratified by the cooperation of industry -- both manufacturer and user -- that has led to the Monsanto decision.

Since last December, EPA has been working with Monsanto, the major manufacturers of transformers and capacitors, and other Federal agencies to encourage the development of safe and environmentally acceptable alternatives.

Environmental contamination will continue to be a problem due to the millions of pounds of PCBs already in landfills, soils, river and lake sediments, in our air and water, and in wildlife and human tissue. This contamination will be there for years, moving into life systems, including humans. The problems still need to be addressed vigorously by government and industry. However, the Monsanto decision is a significant step in dealing with the total problem of PCB contamination.

*EPA Press Statement
Oct 5, 1976*



ATTN:
RO-ED

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

April 24, 1972

MEMORANDUM

TO: All Regional Administrators

FROM: Assistant Administrator for Enforcement
and General Counsel

SUBJECT: Policy on PCB's

Until further notice, the following policy should be followed by the Permit Program with respect to processing of permits for sources of Polychlorinated Biphenyl discharges. It is understood, of course, that by reason of the District Court injunction in Kalor v. Resor, no permit may be actually issued at the present time.

It is the policy of the Environmental Protection Agency that all discharges to the aquatic environment involving Polychlorinated Biphenyls (PCB's) be restricted to the lowest possible level. The goal of the policy is to achieve levels in the environment sufficiently low that fish and other aquatic organisms will not be damaged, that accumulations in edible fish will not exceed the FDA guidelines of 5 parts per million in the edible portion. To implement this policy, we will restrict knowing discharges to the lowest achievable level by placing all present dischargers on an implementation schedule which will seek to bring about no discharge from known sources of contamination as rapidly as possible. It must be recognized that there are reservoirs of PCB's in sewer systems and in waterways as a consequence of previous use. We should anticipate a decline over the next several months of PCB discharges from these sources as the sources are gradually cleaned out.

At the present time, the Monsanto Company is the sole U.S. manufacturer and the manufacturers of capacitors and transformers are the only users. Monsanto sells to no one else. We believe that there are less than 50 individual plants involved in these uses. In addition to these sources, there are known residues in paper that is recycled, therefore, some residues in waste from pulp mills can be anticipated. These, too, should decline over the next several months. PCB's were used in heat transfer systems,

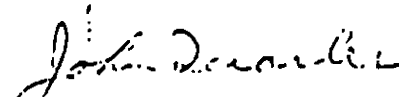
ADM CC8556

- 2 -

as hydraulic fluids, in cutting oils, etc., in the past, but Monsanto has stopped sales for these purposes and has reclaimed as much as possible from these users. It is anticipated that by the end of 1972, amounts reaching the environment from former users should be greatly reduced or near zero.

The desired limit in water is 0.01 parts per billion. Our best indicator of PCB contamination in various waters, however, will be residues in fish or in other aquatic organisms.

Excerpts from two briefing memoranda prepared by the Office of Research are attached. The interagency task force report will be provided to you as soon as it becomes available (it is now at the printers).


John R. Quarles, Jr.

Attachments

February 4, 1972

A. J. C. M. A.
RG-ED-72-70

Briefing Memorandum -- PCB's (Prepared by the Office of Research)

For the last several months there has been an interagency task force on PCB's. It is now drawing together a document for publication. While there are many gaps in information about sources, occurrence, and effects of PCB's there is enough known that we probably should consider some actions in EPA at this time. The salient facts follow:

Amounts Manufactured

Monsanto is the sole manufacturer of PCB's in the United States. In 1970 its domestic sales were about 36,000 tons in a number of different grades. That was approximately twice the amount manufactured in 1969. 1971 expected sales were down to about half the 1970 figure. While formerly used as a dielectric fluid in transformers and capacitors, as a hydraulic fluid and lubricant where fire retardant characteristics are important, as a plasticizer, as an additive to paints, pesticides and numerous other products, and in encapsulating for carbonless carbon paper most uses have now been eliminated by Monsanto. Continued use is expected only in some transformers and capacitors.

Sources to the Environment

Air. There are no reliable data on PCB concentrations in air. Four measurements have been made that suggest presence in three different cities. There is also a reference to the presence of PCB's below quantifiable levels in precipitation in Great Britain. In this country, the Geological Survey of Interior has looked for PCB's in precipitation samples in Florida but they are not certain of their results. Certainly PCB's are not present in levels as high as 0.1 of a part per billion (ppb). Through the Pesticide Air Monitoring Program some samples will be combined and analyzed for PCB's and we will have some quantitative information within a month or so. The point for now is that PCB's in air are below levels that would cause us to need to regulate. We do need to learn about PCB's in air as a transport mechanism.

Sources in air probably include open burning at dumps and possibly unburned particulates from incinerators. Vaporization is known to occur from plastics. Complete incineration is not likely to result in PCB residues in air.

ADM CC8558

Water. PCB's enter the aquatic environment from both industrial and municipal sewer outfalls. The usual treatment of municipal sewage (for long combined industrial-municipal) results in PCB's being present in both sludge and liquid effluent. The total amount of municipal effluent ranges from less than 1 ppb to a few tens of ppb. Some industrial outfalls contain hundreds of ppb. The estimate of the total input to the aquatic environment by Dr. Sarofim of Harvard is 4,000 tons per year. I think that number may be high, particularly with the decreased use of PCB's. Furthermore, Dr. Sarofim's estimate includes accidental discharges.

Dumps. Dr. Sarofim estimates the largest amount of PCB's ends up in dumps -- 20,000 tons in 1970. So long as the dumps are not burned, there probably is relatively little transfer to other parts of the environment.

Effects of PCB's

PCB's have been shown experimentally to kill shrimp and some fish at concentrations as low as 1 ppb in water. The Food and Drug Administration has established a guideline of 5 ppm in fish. Japanese experience with the Yushu incident suggests that a total intake of 1/2 gram was enough to cause overt symptoms in man.

Concentration Factors. Fish, shrimp, and crabs are known to concentrate PCB's from levels in water by factors of up to 75,000 with exposure levels as low as 0.1 ppb for fish and .06 for shrimp.

Recommendations

EPA should establish guidelines for PCB's in water of 0.01 ppb which will be sufficiently low that concentrations in fish should not exceed 5 ppm. 0.01 ppb is 1/500,000 of 5 ppm, and thus this concentration should not result in PCB levels in fish as high as the 5 ppm guideline of FDA. The 0.01 ppb level is sufficiently low that fish and other aquatic organisms should not be damaged.

In operational terms, we should limit PCB discharges under the 1990 permit procedures. The allowable discharge should not be more than an amount that will result in .01 ppb in the receiving water at mean annual flow, assuming uniform mixing. After Monsanto's sales restrictions become fully effective, there will be relatively few plants that discharge PCB's in substantial quantity. These will principally be electrical manufacturing concerns that manufacture capacitors and transformers. Electrical utilities may also be sources if they refill their own transformers. (PCB's are manufactured in other countries. So far as we know, they are not imported, except as components of plastics, electrical equipment, etc. With Monsanto's restrictions on sales in the U.S., there may be a desire to import the materials for uses that Monsanto does not provide for.)

Monsanto, as the sole U.S. manufacturer, will be another company requiring effluent permits. At least for a while, some paper companies may have relatively high PCB residues from recycled paper, but these concentrations should diminish since PCB's are no longer used in carbonless carbon paper, the principal source in recycled paper.

EPA should encourage reduction in use of PCB's wherever there are acceptable substitutes. When there are no acceptable substitutes, and when it is used in closed systems, we should encourage adequate industrial sanitation to minimize leakage to the environment.

We should sample sewage sludges from time to time now that PCB use is decreasing and should consider prohibiting dumping of such sludges at sea if the PCB levels do not drop. We should also prohibit dumping of PCB-containing industrial wastes in the oceans.

March 27, 1972

Recommendations on PCB Policy
(prepared by The Office of Research)

Background:

Polychlorinated Biphenyls (PCB's) are chemical compounds that have been widely used--as flame-proof dielectric fluids in transformers and capacitors; as plasticizers in plastics, sealants, caulking compounds, etc.; as pesticide extenders; as lubricants, heat transfer and hydraulic fluids; and even as ingredients in heat shields on air to air missiles. About 1,000,000,000 pounds have been produced in the United States since 1950 by Monsanto. There are no other producers of PCB's in the United States, but PCB's are produced in a number of foreign countries including Great Britain, France, Germany, and Japan.

Adequate replacements for PCB's exist for all uses except for use in flame proof capacitors and transformer fluids. Monsanto has voluntarily withdrawn PCB's from the market except for the capacitors and transformer uses. These uses are in closed systems, and good industrial practice can prevent PCB's from these uses reaching the environment. Worn out capacitors are disposed of as solid waste, and presumably present only minimal threat to the environment because they are sealed and little if any is believed to leak into landfills. There may be a possibility for using other disposal methods with large capacitors.

There is no existing legal authority for control of manufacture, import, or use of PCB's. Passage of the Toxic Substances Control Act would, of course, make such regulation possible. It is possible that Monsanto's voluntary restrictions will result in import of PCB's, or of other companies manufacturing PCB's in this country (patent protection has expired long since).

The intent of the proposed EPA policy is to use the authorities that we do have to regulate the controllable sources of PCB's to the water environment. It is important to note that we do not believe it is necessary to regulate PCB's in air--in fact, we don't have adequate methods for measuring them in air, even if we did want to regulate.

We have already taken some actions to control PCB's; i.e., required pesticide registrants to reformulate their products to eliminate PCB's, either as inert or active ingredients; and included PCB's in our list of hazardous materials in the proposed regulation under section 12a of PL 660 now awaiting OMB "coordination."

Other Federal Agencies are taking or have taken actions to control PCB's. FDA has established interim guidelines of 5 ppm in foods, and these guidelines are monitored by FDA and USDA in the case of poultry products and meat.

EPA has proposed regulations prohibiting PCB-containing recycled pulp in food packaging materials, and a temporary (one-year) tolerance of PCB's in all packaging materials. FDA has prohibited the use of PCB's in food processing plants.

Public Questions

1. How will the proposed EPA policy be announced?

The Interagency Task Force report will be released with a news release that includes statements about Federal actions taken and proposed. At present, it includes statements consistent with the proposed EPA policy.

In addition, when the EPA order is issued, an EPA news release should be issued specifying in detail and explaining the EPA actions.

2. How will it be enforced?

Permits for the electrical industry (and PCB manufacturers) will specifically prohibit discharge of PCB's (technically possible to achieve this level of control). The electrical industry is not the sole legitimate user of PCB's.

Monitoring data from fish, shellfish, and water will be examined to locate locations with high PCB content. These areas can then be subjected to follow-up studies to determine sources, and enforcement actions under the RCRA Act initiated where warranted. As noted in the background paper, PCB's will continue to reach the environment (in decreasing amounts) from secondary sources such as recycled pulp, and from undetected or unknown leaks from equipment in which PCB's are used as heat transfer and hydraulic fluids until the change over to replacements is completed. By the end of 1977, there should be drastic reductions in PCB's in use in systems where they could be expected to reach the environment (unless new supplies become available through import or new manufacturers).

Areas with known high levels of PCB discharge can be monitored closely to assure rapid decrease in PCB discharge levels--Dayton, Ohio and New Bedford are examples of such areas.

3. What are the other options?

The options considered were:

--No action by EPA, assuming that the Monsanto restriction would be sufficient to achieve acceptable environmental levels of PCB.

--Including PCB's as a hazardous air pollutant and a hazardous material under PL 660.

--Enforcement actions under the Refuse Act on the basis

that no permits nor discharge of PCB's and hence no knowing discharges of PCB's will be permitted.

--Revising the States to include PCB in the water quality standards as they are revised, and using the usual conference procedures, etc. for enforcement. The revised "Green Book" is expected to include recommendations on allowable levels of PCB's consistent with the proposed policy.

--Using the construction grant program to require municipalities to enact regulations that prohibit discharge of PCB's (and other hazardous materials) to the sewer system of which the grant project is a part.

--Prohibition of discharge of PCB's by users of PCB's.

The policy proposed was based on the following facts:

1. PCB use has been severely restricted by Monsanto (the sole U.S. manufacturer), and PCB's reaching the environment will be negligible.
2. The electrical industry will be the sole legitimate user of PCB's. It is technologically possible to use PCB's here without contaminating the environment.
3. PCB's are on the list of hazardous materials proposed under the water pollution law.
4. Occurrence of PCB's in air is at very low levels, and is not believed to pose environmental problems. Furthermore, PCB uses that contributed PCB's to the air have been largely eliminated (pesticide use, use in plastics, etc.). Some may reach the air from inadequate incineration of PCB-containing materials.
5. PCB's are present in some plastics, paints, sealers, carbon-less carbon paper and other manufactured products. As stocks of these materials are used up and disposed of or recycled, some PCB's will reach the environment. The amounts should decrease rapidly, since PCB's are no longer sold for such uses. PCB's have been used in heat transfer systems and as hydraulic fluids, lubricants, and cutting oils. Monsanto has not only withdrawn PCB's for these uses, but has actively worked with users to have the substances replaced immediately. Monsanto accepts the used materials for disposal by high temperature incineration.

The recommended policy was intended to provide immediate action that would "back up" Monsanto's voluntary restrictions, and at the same time would recognize the inevitable nature of some PCB residues. It would

distinguished between legitimate uses and secondary sources of contamination. It would indicate a goal for allowable levels in water. It would not preclude additional actions later if these appear necessary (for example, dealing with PCB discharges to municipal systems if PCB levels do not decline as fast as we expect).

ECONOMIC IMPACT OF TOXIC STANDARDS

I. SUMMARY

The main conclusions of the economic analysis are the following:

1. The proposed cyanide standards will have impact on more than four-fifths of the electroplating industry if they must be met within one year. If 2-3 years were allowed, the impact would still be about 800 small platers, affecting 4000 employees.
2. Large, integrated steel mills can probably meet the cyanide standard within a year, but non-integrated mills may not be able to meet the standards in that time-frame. If 2-3 years are allowed, these non-integrated mills can probably meet the proposed standards, although the industry continues to have difficulty attracting capital for pollution control.
3. The proposed benzidine regulations may have some impact on the textile dyeing industry. Little is known about the amount of benzidine in discharges from the industry; some evidence indicates that levels may exceed the acute limit. On the other hand, there is evidence that insignificant amounts of benzidine reach the dyers' effluents. We are presently continuing our efforts to collect additional data pertaining to this problem.

The economic impact analysis of the standards for the other toxic substances is hampered by a lack of information on the presence or absence of these substances in the wastewaters of each category. From the information available, the impact does not appear to be large. The difference between the HATS Standards and the Water Quality Standards is not substantial. Some other industrial segments may need more than one year for compliance, but the available information does not indicate which categories will require more time.

II. ECONOMIC ANALYSIS OF SELECTED INDUSTRY CATEGORIES (MERCURY, CADMIUM, AND CYANIDE)

The three pollutants - mercury, cyanide, and cadmium - generally affect the same industry categories. Assessing the economic impact requires looking at each category rather than each pollutant because the total costs of the toxic standards are more economically relevant than each pollutant's cost component.

Chlor-Alkali (Mercury Cell)

All mercury discharges are less than 1.6 pounds per day and cadmium discharges are less than 10 pounds per day so that the Standards are currently being met. No economic impact is expected.

Electroplating

Only those electroplaters which currently meet the proposed cyanide standards could comply within one year. We have no data on the number of electroplaters affected, but we estimate that a sizable proportion (more than 80%) do not currently comply.

Additional time allowed would enable many electroplaters to build the necessary treatment facilities. However, many small independent platers will still be affected by the standards. Our analysis indicates that more than 800 independent platers will close, affecting more than 4,000 employees. Some employment will be created in the large plating shops although not all displaced workers will regain employment.

Lumber and Wood Products

All mercury discharges are less than 1.6 pounds per day indicating that the proposed Standards are already being met. No economic impact is expected.

Non-Ferrous Metals (Bauxite)

All mercury and cadmium discharges will meet the standards by July 1, 1975 in compliance with the proposed Standards. No economic impact is expected.

Petroleum Extraction

Currently our data indicates that all mercury and cadmium discharges are less than the proposed Standards. No economic impact is expected.

Petroleum Refining

Most, if not all, refineries currently comply with the proposed Standards. Thus, no major economic impact is expected.

Pulp and Paper

Ninety percent of the pulp and paper mills reporting to the RAPP currently meet the 1.6 pound per day Standards for mercury. The remaining 10% are suspected to exceed 1.6 pounds only after inclusion of wastes from chlor-alkali plants that are run at the pulp and paper mills. These mills will not be impacted if the pulp and paper mills and the associated chlorine production are each regulated separately. If this is done, then no economic impact is expected to result from the implementation of these standards.

Steel

Although we can find no large, integrated steel mills which will have difficulty achieving the proposed cyanide standard, our data indicates that some non-integrated steel mills currently are not in compliance with these proposed regulations. Further, few if any of these facilities could meet this standards within a year, due to lead time requirements for constructing necessary treatment facilities.

Additional time would make facility construction possible. Dilution of the waste stream is a possibility, but the costs have not been estimated. If treatment facilities are installed, the costs of treatment for toxics will be on a par with BPT costs for Best Practicable Technology (effluent guidelines). The industry's major problem, however, will be its ability to attract new capital for investment in pollution control, as well as new plant and equipment.

Other Categories of Sources

Some major industrial categories, such as coal and metal mining, could discharge significant amounts of mercury and cadmium. However, our feeling is that most sources currently meet the proposed Standards. In general, treatment facilities cannot be constructed within one year, so that compliance would be difficult if significant treatment is required.

III. ECONOMIC ANALYSIS OF OTHER TOXIC POLLUTANTS (PCB'S, BENZIDINE, AND THE PESTICIDES)

PCB'S

The discharge of PCB's from the one PCB manufacturing location in the United States has been stopped. Discharges from electrical equipment manufacturers are suspected to be small and readily controllable. Utilities are considered to experience only non-point source discharges. In summary, the economic impact is expected to be minor.

Benzidine

No measurements have been made of benzidine levels in the wastewaters of benzidine manufacturers, dye manufacturers, or dyers and finishers. Trace levels may be present in all of these wastes so that treatment may be required. Because the textile industry is very cost sensitive, serious economic problems could result if treatment is necessary. Little is known about the extent of the discharge problem or the feasibility of using benzidine substitutes.

The Pesticides

The primary source of pesticides in the environment comes from their application to crops. However, pesticide manufacturers and formulators discharge some relatively small amounts of these toxic pesticides. By and large, manufacturers can comply with the standards; but small pesticide formulators may meet the standards by discontinuing production of the toxic pesticides. Because most of these facilities formulate many pesticides, the high costs of installing treatment facilities for only a few of their formulations would make continued sale of the toxic pesticides undesirable. Hence, usage of the toxic pesticides will shrink to only the most essential purposes. In general, the economic impact will fall on the pesticide user, if good substitutes are unavailable.

IV. CONCLUSIONS FROM THE ECONOMIC ANALYSIS

Two issues have surfaced in the economic analysis: compliance time, and economic impact. Generally, for mercury, cadmium, and cyanide, the standards cannot be met within one year if treatment is necessary, due to construction lead times. Large scale dilution may in some cases require more than one year.

More is known about mercury, cadmium, and cyanide than the other toxic substances, even though large gaps exist in our data. For example, verified data on concentration and daily load of mercury, cadmium, and cyanide exist for only a few of the industrial categories. On the other hand, analysis of the economic impact of standards for the other toxic substances is hampered by a lack of data on waste characteristics.

Consulting Engineers

2767 12th Avenue South
Nashville, Tennessee 37204
(615) 297-3549

November 10, 1973

Mr. John Savage
Economic Analysis Division
Environmental Protection Agency
Room 3662
401 M. Street, SW
Washington, D. C. 20460

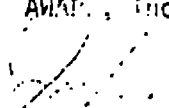
Dear John:

Enclosed is our preliminary report concerning the removal of cadmium, mercury, and cyanide from industrial wastestreams. These results should not be taken as final judgments especially with respect to the removal of any complex forms of these substances. The presence of complexes, especially in the case of cyanide, will have considerable effect on the cost-effectiveness of various treatment processes.

In order to finish this report as quickly as possible, a complete discussion of the technology involved has not been included. I will be happy to discuss further details with you.

Sincerely yours,

AMAP, Inc.


John H. Koon, M. S.
Project Manager

JHK/cc

Enclosure

ADM CC8570

**COST-EFFECTIVENESS RELATIONSHIPS FOR THE REMOVAL
OF CADMIUM, MERCURY, AND CYANIDE FROM INDUSTRIAL WASTESTREAMS**

Preliminary Analysis

**For
Economic Analysis Division
Environmental Protection Agency
Washington, D. C.**

**By
John H. Koon, Project Manager
Y. Argaman, Project Engineer
Cheryl D. Magee, Project Engineer
Carl E. Adams, Jr., Project Consultant**

**ASSOCIATED WATER AND AIR RESOURCES ENGINEERS, INC.
2907 12th Avenue South
Nashville, Tennessee 37204**

November, 1973

ADM C08571

COST-EFFECTIVENESS RELATIONSHIPS FOR THE REMOVAL
OF CADMIUM, MERCURY, AND CYANIDE FROM INDUSTRIAL WASTESTREAMS

Scope of the Investigation

The objective of this work was to estimate the cost of removing cyanide, mercury, and cadmium from industrial wastes and to obtain estimates of the residual concentrations which can be obtained using best available treatment. Because estimates were assembled from readily available literature data and from communication with researchers and equipment manufacturers, the values used in this report cannot be taken as the most accurate estimates available. Considerable more time in evaluating data from all sources would be required to arrive at final judgements. Treatment costs were obtained from industrial waste treatment cost relationships, costs for municipal wastewater treatment processes, and from the best judgement of equipment manufacturers. In many cases it was necessary to use attainable effluent concentrations given by researchers and equipment manufacturers without having access to the detailed conditions under which the results were obtained.

Several assumptions were made regarding the wastestream to be treated. These conditions may be enumerated as follows:

1. Waste flow = 3 mgd.
2. Influent concentrations of the species of concern = 2 mg/l.
3. Waste constituents to be removed can not be isolated in more concentrated streams. Therefore, it was assumed necessary to

-treat the entire waste flow.

4. The wastestream would contain some suspended solids and organic constituents not removed in upstream treatment processes.
5. The effect of complexing agents could not be thoroughly considered due to lack of applicable information.

Analytical Limits of Detection

In order to add perspective to the residual concentrations of these toxic substances reported, the limits of detection for each constituent were reviewed. Briefly, the findings are as follows:

1. Mercury. The flameless atomic absorption procedure recommended by the EPA is capable of detecting mercury at the 0.01 ppb level; EPA, however, recommends that 0.2 ppb be set as the practical detection limit for mercury in natural waters.
2. Cadmium. The detection limit for cadmium in water when determined by flame atomic absorption at 228.8 nm is about 40 ppb, using the Boling burner as recommended in Standard Methods (13th Ed). An adaptation known as the Delves cup method, which involves analysis of evaporated samples; permits detection limits for blood samples (and presumably for wastewater samples) of approximately 2 ppb. Methods based on atomic fluorescence and neutron activation are capable of detection limits several orders of magnitude lower, but their suitability for wastewater analysis has not been established.
3. Cyanide. The most sensitive practical methods for cyanide are colorimetric. The procedure suggested by Standard Methods involves conversion

of cyanide from a distilled sample to cyanogen chloride, which then reacts with a pyridine-pyrazolone reagent to form a blue dye. The latter is determined spectrophotometrically at 620 nm. Standard Methods gives the effective range as 1 - 5 µg in the wastewater; this would correspond to 40 - 200 ppb, depending on how the sample was prepared. A five-fold increase in sensitivity is said to be achieved by extracting the dye with butyl alcohol.

Treatment Processes

Treatment processes which were considered for the removal of each ion are discussed below. This discussion is limited to process parameters which have the greatest effect on treatment performance.

A. Cadmium

1. Precipitation. Precipitation of $\text{Ca}(\text{OH})_2$ by lime treatment at pH 11 is expected to reduce the cadmium concentration from 2.0 mg/l to about 0.2 mg/l. The lime dose, which depends on the waste alkalinity, was estimated at 400 mg/l. The effluent pH was readjusted to 7 - 8 by recarbonation. Sludge production was estimated at 500 mg/l.

2. Precipitation and Filtration. The precipitated and settled effluent was applied to a granular media filter where the cadmium concentration is further reduced from 0.2 mg/l to about 0.02 mg/l. This removal was based on data from the treatment of municipal wastes containing similar cadmium concentrations. No specific data for the treatment of industrial wastes was available.

3. Ion Exchange. Cadmium can be removed to less than 10 ppb with ion exchange. A resin which is selective for cadmium or a mixed bed resin can be used. However, the mixed bed process is more practical. There are several types of resins which could be utilized including carboxylic acid resins and chelating resins. In this case, a chelating resin may be better because of the low salt splitting capacity. The degree of removal and the type of resin utilized is dependent on the complex being removed.

4. Reverse Osmosis. Generally, 97 to 99 percent rejection of cadmium can be obtained by reverse osmosis in a single-stage process. However, in this application, because of the low influent concentration assumed, i.e., 2 ppm, imperfections in the membrane, would result in a lower percent rejection. Because of the higher surface area and wider operational pH range, hollow fiber membranes would be recommended.

5. Activated Carbon. Cadmium levels of <50 ppb are obtainable by the use of activated carbon. Although these low levels are achievable, the carbon loading is very low, i.e., 3 lb Cd/100 lb carbon. A residence time of 35 to 40 minutes is required for good removal.

B. Mercury

1. Lime Precipitation. Precipitation of mercuric oxide by lime treatment at pH 11 is expected to reduce the mercury concentration from 2 mg/l to 0.4 mg/l. The lime dose was estimated at 400 mg/l for waste with 200 mg/l alkalinity as CaCO_3 . The effluent pH must be readjusted to 7 - 8 by recarbonation. Sludge production was estimated at 500 mg/l.

2. Sulfide Precipitation and Precoat Filtration. Precipitation of mercuric sulfide by adding a sulfide source such as sodium hydro-sulfide followed by precoat filtration can reduce mercury concentrations from 2.0 mg/l to 0.03 mg/l. This information was obtained from an existing pilot plant treating a chlor-alkali industrial waste. In the absence of other sulfide consuming compounds, the sulfide dose was estimated to be 10 mg/l in excess of the stoichiometric requirement, i.e., about 18 mg/l of NaHS for 2 mg/l mercury. The excess sulfide was then precipitated as FeS by adding ferrus sulfate (about 75 mg/l).
3. Ion Exchange. Mercury can be removed to approximately 10 ppb by ion exchange. Again, as in the case of cadmium, the type of resin employed depends on the metal complex to be removed and the other constituents in the wastewater.
4. Reverse Osmosis. A 95 to 97 percent rejection of mercury can be obtained by a single-stage reverse osmosis system assuming the mercury is in the proper form. The complexed metal or free ion is rejected; however, organic mercury would not be rejected. Again, this percent rejection may be lower, due to membrane imperfections at these low levels. The hollow fiber membrane would also tend to give better results in this application because of the larger specific surface and wider pH range.
5. Activated Carbon. Mercury levels of 1 to 5 ppb have been reported from the treatment of chlor-alkali wastes. However, effluent levels of 34 ppb were obtained in a study with municipal wastes. Again, the

carbon loading is low, i.e., 3 lb Hg/100 lb carbon. The adsorbability of mercury varies significantly with pH with the best results obtained at pH 4 to 6. The adjustment of pH with HCl enhances removals probably due to the precipitation of Hg Cl_2 . The current facilities which utilize activated carbon for mercury removal do so on a "throw-away" basis. When regenerating carbon with heat or hot gases, problems develop with mercury vapors.

C. Cyanides

1. Alkaline Chlorination. Cyanides are completely oxidized to N_2 and carbonates in a two-stage process by adding caustic soda and chlorine. Excess chlorine is reduced by the addition of SO_2 . The process is carried out in a continuous flow system with the chemicals being fed automatically through pH and ORP control units. For a cyanide concentration of 2 mg/l the chemical doses are estimated as follows: Cl_2 - 20 mg/l, NaOH - 25 mg/l, and SO_2 - 5 mg/l. Effluent concentration of cyanide is reported as 0 with the analytical method used. For the present calculations a conservative value of 0.2 mg/l was assumed. (See section on analytical method for a more detailed discussion of detectable limits.)

2. Ion Exchange. Free cyanide can be removed to 10 ppb by the use of a strong base anion exchanger. Again, various resins can be employed. Removals are affected by the presence of cyanide in complexed forms.

3. Activated Carbon. Cyanide can be removed to 50 ppb by the use of activated carbon. The process involved is catalytic oxidation with

CuSO_4 and oxygen which converts the cyanide to CO_2 and N_2 . One disadvantage associated with this process is that copper appears in the effluent in concentrations up to 0.1 ppm. The copper is capable of displacing the majority of the heavy metals which are complexed with cyanide but copper is not capable of displacing the iron. Therefore, any iron which is in the wastewater must be removed prior to the carbon system. Removal of iron was not considered in this investigation. To prevent the formation of metal hydroxides and subsequent filter clogging, the pH of the influent stream must be between 6.5 and 8. While this process appears to be a feasible method for treating cyanide-bearing wastes, the technological success of the process has not been fully established.

4. Ozonation. Cyanide can be removed to less than 10 ppb with ozone alone if the cyanide is not complexed with iron. However, if the cyanide is complexed, pH control and heat or ultraviolet light must be employed in combination with the ozone for adequate cyanide removal.

Treatment Costs

All cost estimates were adjusted to January 1972 levels (EPA Sewage Treatment Plant Index = 175). Allowances were made for engineering, legal, and administrative fees and miscellaneous construction costs. Special conditions assumed for each process are discussed below.

1. Precipitation and Filtration. Costs were estimated for one-stage precipitation processes. Sludge handling was estimated using gravity thickening and vacuum filtration. The sulfide precipitation process

included NaHS addition, filtration through a diatomaceous earth filter, Fe SO_4 addition, flocculation, and sedimentation.

2. Oxidation Processes. Facilities for cyanide removal by alkaline chlorination and ozonation included flocculation basins and chemical feed facilities. For chlorination the conventional two-step process was used which employs pH and ORP controls; additional facilities were added for dechlorination using SO_2 .

3. Reverse Osmosis. Reverse osmosis was used for the removal of cadmium and mercury. Cyanide may be removed if present as CN^- or cyanide complexes; however, it appears that any unionized HCN can pass through membranes. All capital and operating costs were obtained from manufacturers based on "best judgement" estimates of costs to achieve the given residual metals concentrations. Filtration costs were also added for pretreatment in all cases. Because cost data are not from independently reported sources, the adequacy of membrane cleaning and replacement costs cannot be determined. It is possible that higher costs might be obtained upon application of this process to specific wastestreams; however, no basis exists for increased costs in this investigation.

4. Ion Exchange. Ion exchange costs were estimated from manufacturer's data using the "0.6 rule" to make adjustments in plant capacities. Pretreatment included activated carbon and filtration, although this pretreatment might not be necessary for all wastes. Due to lack of

data and the complexity of selecting operating parameters, these costs are speculative.

5. Activated Carbon. Metal removal results and costs using activated carbon were estimated from one reported investigation as interpreted by two carbon manufacturers. Acid washing of spent carbon was included to restore the metals capacity of the carbon. An additional 10 percent was added to O&M costs to cover the purchase of acid. No costs were added for thermal regeneration to destroy organics which would adsorb to the resin. However, it was assumed that carbon would be completely replaced twice per year. Costs for the catalytic destruction of cyanide were based on the process developed by Calgon Corporation. No facilities for iron removal prior to this process were assumed. When iron is present, this process might not be feasible. Although the treatment costs using activated carbon in all cases are attractive, it is felt that the technical feasibility of these processes has not been proven and therefore, that costs are somewhat speculative. Attainable effluent levels for mercury which have been reported varied from 1 - 5 ppb to 54 ppb. This range is indicated in the cost-effectiveness relationship. However, the lower residual values are subject to question.

Cost effectiveness relationships are shown in Figure 1 - 3.

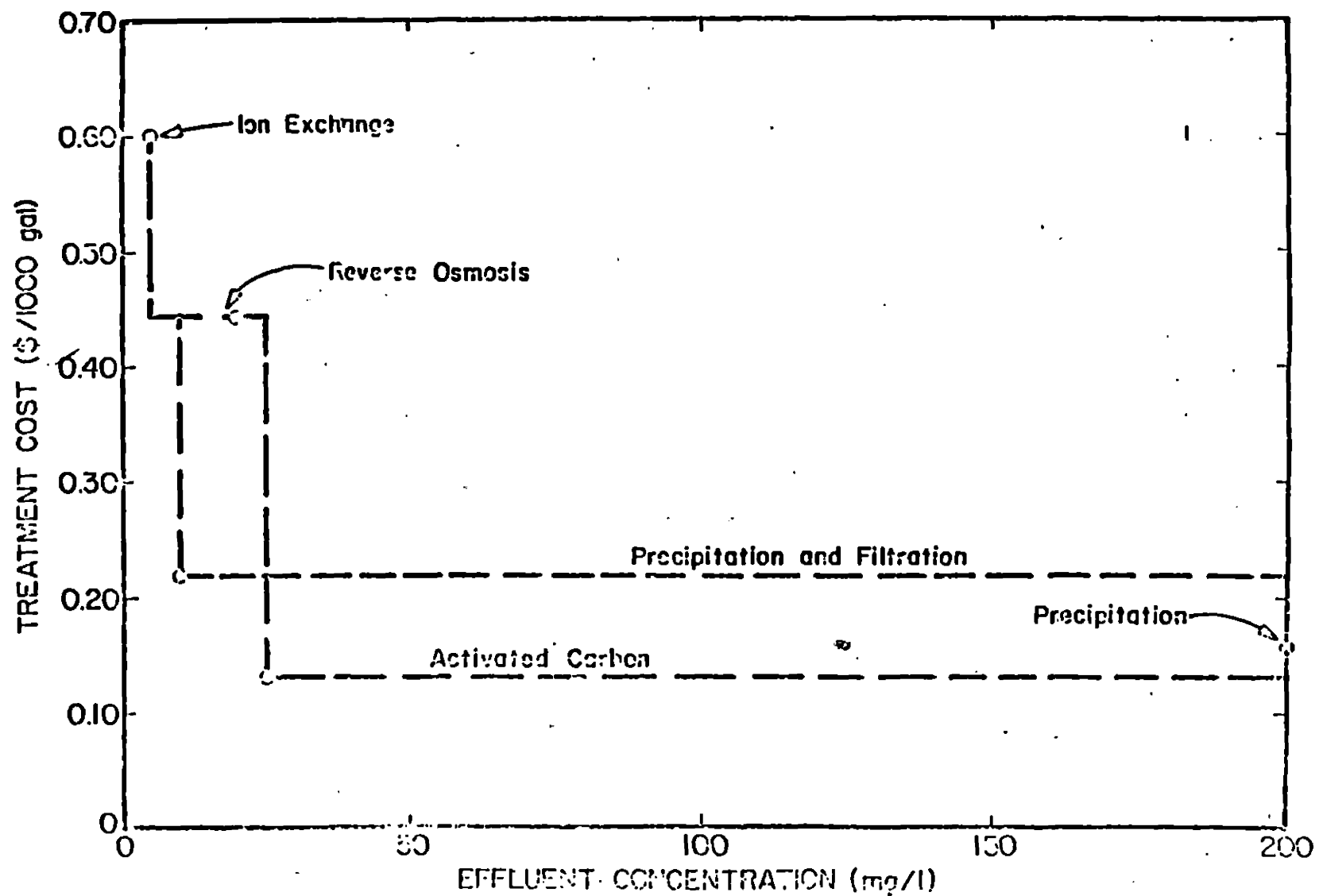


FIG. 1. COST-EFFECTIVENESS RELATIONSHIP FOR CADMIUM REMOVAL

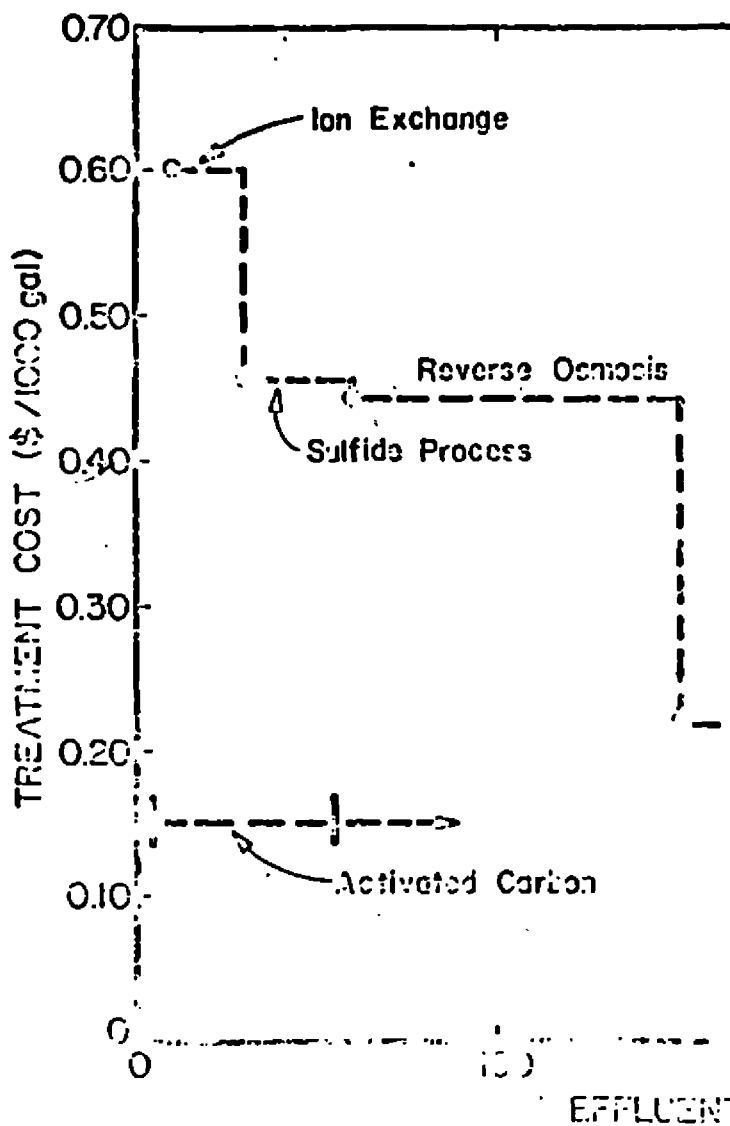
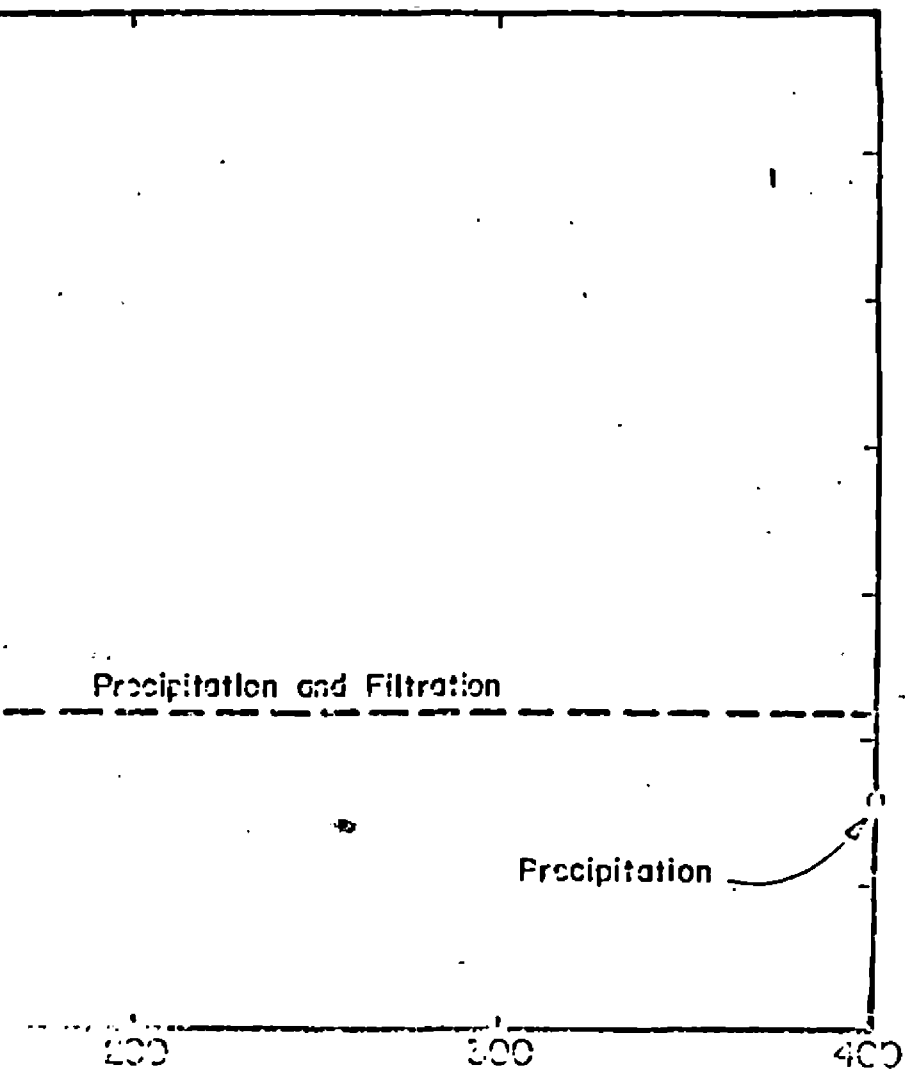


FIG. 2. COST-EFFICIENCY AND TREATMENT



CONCENTRATION (mg/l)

RELATIONSHIP FOR MERCURY RE -

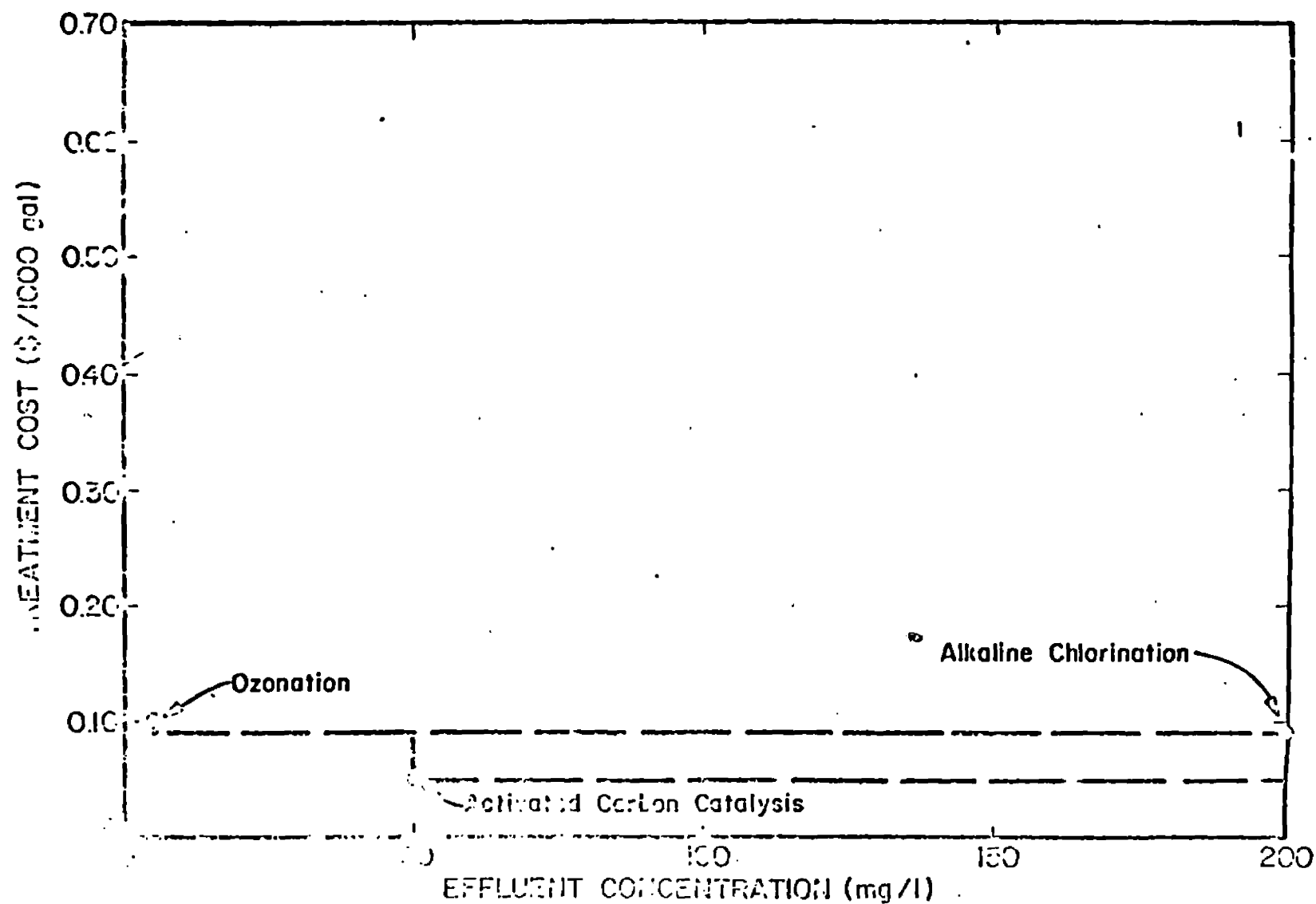


FIG. 3. COST-EFFECTIVENESS EVALUATION FOR CHLORIDE REMOVAL

ENVIRONMENTAL PROTECTION AGENCY

SUPPORT DOCUMENT/

DRAFT VOLUNTARY ENVIRONMENTAL IMPACT STATEMENT

for

Polychlorinated Biphenyls (PCBs)
Manufacturing, Processing, Distribution in Commerce and Use
Ban Regulation (Section 6(e) of TSCA)

Prepared by

Office of Toxic Substances

Approved by

John P. DeKany
John P. Dekany, Deputy
Assistant Administrator for the
Office of Chemical Control

May 1978

ACM 008569



FOR INFORMATION, *RCR Regulation*

Processing, Distribution June 7 1978

in Commerce and Use

San Regulation

Proposed Rule—Support Document/Voluntary
Draft Environmental Impact Statement
Environmental Protection Agency
(40 CFR Part 791)

ADM CCESRC

VOLUNTARY DRAFT ENVIRONMENTAL IMPACT STATEMENT

SUMMARY SHEET

(Check One)

(X) Draft.

() Final Environmental Statement.

Environmental Protection Agency

Office of Toxic Substances

1. Name of Action. (Check One)

(X) Administrative Action.

() Legislative Action.

2. Description of Action.

This proposed rule is designed to implement Section 6(e) of TSCA prohibiting the manufacturing, processing, distribution in commerce, and use of PCBs, and to provide several limited exceptions to these general prohibitions for activities which will not present an unreasonable risk of injury to health or environment. The use of PCBs has been extensive throughout the United States, and therefore, its impact is expected to be nationwide.

3. Summary of Environmental Impact and Adverse Environmental Effects.

PCBs are a significant environmental pollutant occurring throughout the biosphere. They pose a significant risk to the health of man and numerous other living things. A number of adverse effects on living organisms has been demonstrated, including but not limited to, bioaccumulation, biomagnification, and cancer in laboratory animals. PCBs are extremely persistent in the environment circulating among the three environmental compartments (air, water, and land); additional release of PCBs in the environment will eventually result in widespread exposure and increased risks.

Handwritten note: ? PCB study?

4. Alternatives Considered.

a. No Action.

7 { Section 6(e) of TSCA specifically bans the manufacturing, processing, distribution in commerce, and use of PCBs. EPA's discretion with respect to these prohibitions is to establish and clarify certain definitions and to provide exceptions to the prohibitions.

b. Action Through Other Statutes or Regulatory Bodies.

7 { This alternative was rejected because it was determined that using other statutes administered by EPA (i.e., Clean Air Act, Federal Water Pollution Control Act, Safe Drinking Water Act, or Resource Conservation and Recovery Act) was inappropriate because they could not provide the comprehensive coverage necessary to implement Section 6(e). This is also true of attempting to utilize statutes administered by other regulatory agencies or state governments. Furthermore, there is a strong case that EPA is required by TSCA to use Section 6(e) of TSCA to implement, and grant exceptions to, the explicit prohibitions mandated by Section 6(e).

c. Action Under Section 6(e) of TSCA

There are numerous alternatives considered within the authority of Section 6(e) of TSCA. Please refer to Chapters IV and VI for details.

5. Federal Agencies That Participated on EPA's PCB Work Group:

Department of Commerce (DOC)
Department of Defense (DOD)
Department of Transportation (DOT)
Department of Interior (DOI)
Federal Railroad Administration (FRA-DOT)
General Services Administration (GSA)
National Institute for Occupational Safety and Health (NIOSH)
Tennessee Valley Authority (TVA)

6. On or about May 26, 1978 the draft statement was officially filed with the Director, Office of Federal Activities, EPA and was made available to the public. Copies can be obtained from the Industry Assistance Office, Office of Toxic Substances (TS-793), Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, (800) 424-9065, in Washington, D.C., 544-1404. The official record of rulemaking, including the draft EIS, is located in Room 520, East Tower, Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, (202) 755-1188. It will be available for viewing and copying from 9 a.m. to 4 p.m., Monday through Friday excluding holidays.



EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D C 20460

TO: PARTICIPANTS IN THE NOVEMBER 1975
NATIONAL CONFERENCE ON PCBs

We will be sending you a copy of the Proceedings of the National Conference on PCBs as soon as they are available, hopefully within one month. In the interim, you may be interested in Mr. Train's recent Congressional testimony concerning the PCB problem and the need for toxic substances legislation.

Sincerely,

Glenn E. Schweitzer
Glenn E. Schweitzer, Director
Office of Toxic Substances

Enclosure



ACM CC8593