ENVIRONMENTAL PROTECTION AGENCY

[OPTS-41010; TSH-FRL 2254-7]

Eleventh Report of the Interagency Testing Committee to the Administrator; Receipt of Report and Request for Comments Regarding Priority List of Chemicals

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The Interagency Testing Committee (ITC), established under section 4(e) of the Toxic Substances Control Act (TSCA), transmitted its Eleventh Report to the Administrator of EPA on November 3, 1982. This report, which revises and updates the Committee's priority list of chemicals, adds eleven designated chemicals and one recommended group of chemicals to the list for priority consideration by EPA in the promulgation of test rules under section 4(a) of the Act. The new chemicals are seven alkyltin compounds; bis(2-ethylhexyl)terephthalate; 1,3-dioxolane; 4-(1,1,3,3-tetramethylbutyl)phenol; tris(2-ethylhexyl) trimellitate; and a group of three carbofuran intermediates. The Eleventh Report is included in this notice. The Agency invites interested persons to submit written comments on the Report, and to attend Focus Meetings to help narrow and focus the issues raised by the ITC's recommendations. Members of the public are also invited to inform EPA if they wish to be notified of subsequent public meeting on these chemicals. EPA also notes the removal of three chemicals from the priority list because EPA has responded to the ITC's prior recommendations for testing of the chemicals.

DATES: Written comments should be submitted by January 3, 1983. Focus meetings will be held on January 11, 12, and 13, 1983.

ADDRESSES: Send written submissions to; Document Control Officer (TS-793), Office of Pesticides and Toxic Substances, Environmental Protection Agency, Rm. E-409, 401 M St., SW., Washington, DC 20460.

Submissions should bear the Document Control Number OPTS-41010. The public record supporting this action, including comments, is available for public inspection in Rm. E-107 at the address noted above from 8:00 a.m. to 4:00 p.m. Monday through Friday, except legal holidays. Focus meetings will be held at Waterside Mall, in Rm. 3906, 401 M St., SW., Washington, DC. If you plan to attend one of the Focus Meetings and/or wish to be informed of subsequent public meetings on these chemicals, please notify the Industry Assistance Office at the address listed below.

FOR FURTHER INFORMATION CONTACT: Douglas G. Bannerman, Acting Director, Industry Assistance Office (TS-799), Office of Toxic Substances, Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460, Toll Free: (800-424-9065), In Washington, DC: (554-1404), Outside the USA: (Operator-202-554-1404).

SUPPLEMENTARY INFORMATION:

I. Background

Sec. 4(a) of TSCA (Pub. L. 94-469, 90 Stat. 2003 *et seq.*; 15 U.S.C. 2601 *et seq.*) authorizes the Administrator of EPA to promulgate regulations requiring testing of chemical substances and mixtures in order to develop data relevant to determining the risk that such substances and mixtures may present to health and the environment.

Sec. 4(e) of TSCA established an Interagency Testing Committee to make recommendations to the Administrator of EPA of chemical substances and mixtures to be given priority consideration for the promulgation of test rules under sec. 4(a). Sec. 4(e) directs the Committee to revise its list of recommendations at least every six months as it determines to be necessary. The ITC may "designate" up to 50 substances and mixtures an any one time for special consideration by the Agency. For such designations, the Agency must within 12 months either initiate rulemaking under sec. 4(a) or issue in the **Federal Register** its reasons for not initiating rulemaking. The ITC's Eleventh Report was received by the Administrator on November 3, 1982, and follows this Notice. The report designates 11 substances for consideration and response by EPA within 12 months and recommends one group of substances for consideration which is not subject to the 12 month requirement.

II. Written and Oral Comments and Public Meetings

EPA invites interested persons to submit detailed comments on the ITC's new recommendations. The Agency is interested in receiving information concerning additional or ongoing health and safety studies on the subject chemicals as well as information relating to the human and environmental exposure to these chemicals. A notice is published elsewhere in today's **Federal Register** adding the 11 substances designated in the ITC's Eleventh Report to the TSCA section 8(d) rule. The section 8(d) rule requires the reporting of unpublished health and safety studies on the listed chemicals. The nondesignated carbofuran intermediates will be separately proposed for addition to the section 8(d) rule.

Focus Meetings will be held to discuss relevant issues pertaining to the chemicals and to narrow the range of issues/effects which will be the focus of the Agency's subsequent activities in responding to the ITC recommendations. The Focus Meetings will be held January 11, 12, and 13, 1983, at Waterside Mall, 401 M St., SW., Washington, DC, Room 3906. These meetings are intended to supplement and expand upon written comments submitted in response to this notice. In addition to discussing concerns and data, the Focus Meetings will explore the issues of negotiated testing versus issuance of a test rule. The schedule for the Focus meetings is the following: January 11, 9:00 a.m.—alkyltin compounds, 1:00 p.m.—bis(2-ethylhexyl) terephthalate and tris(2-ethylhexyl) trimellitate; January 12, 9:00 a.m.—1,3-dioxolane, 1:00 p.m.—4-(1,1,3,3,-tetramethylbutyl) phenol; January 13, 9:00 a.m.—carbofuran intermediates. Persons wishing to attend one or more of these meetings should call the Industry Assistance Office at the toll free number listed above.

After consideration of the data pertaining to each chemical, and any additional information provided in the written comments and the Focus Meetings, EPA will hold public meetings on each chemical after preliminary decisions have been made on the types of testing that are needed. These meetings will be several months in the future, but separate notices of these meetings will not be published later. Therefore, anyone wishing to attend these later meetings should contact EPA now at the address given for the Industry Assistance Office in order to be notified in advance of the public meetings.

All written submissions should bear the identifying Docket No. OPTS-41010.

III. Status of List

In addition to adding the 11 designations and one recommendation to the priority list, the ITC's Eleventh Report notes the removal of one chemical, chlorendic acid, from the list since the last ITC report because EPA has responded to the Committee's prior recommendation for testing of the chemical. Subsequent to the ITC's preparation of its Eleventh Report, EPA responded to the ITC's

recommendations for two additional chemicals. The three chemicals removed and the dates of publication of EPA's responses in the Federal Register are: chlorendic acid, October 12, 1982 (47 FR 44878); 4-chlorobenzotrifluoride, November 8, 1982 (47 FR 50555); and tris(2-chloroethyl)phosphite, November 1, 1982 (47 FR 49466). The current list contains 42 designated substances or categories of substances and two recommended categories of substances.

Dated: November 15, 1982.

Edwin L. Johnson,

Acting Assistant Administrator for Pesticides and Toxic Substances.

Eleventh Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency

Summary

Section 4 of the Toxic Substances Control Act of 1976 (TSCA, Public Law 94–469) provides for the testing of chemicals in commerce that may present an unreasonable risk of injury to health or the environment. It also provides for the establishment of a Committee, composed of representatives from eight designated Federal agencies, to recommend chemical substances and mixtures (chemicals) to which the Administrator of the U.S. Environmental Protection Agency (EPA) should give priority consideration for the promulgation of testing rules.

Section 4(e)(1)(A) of TSCA directs the Committee to recommend to the EPA Administrator chemicals to which the Administrator should give priority consideration for the promulgation of testing rules pursuant to section 4(a). The Committee is required to designate those chemicals, from among its recommendations, to which the Administrator should respond within 12 months by either initiating a rulemaking proceeding under section 4(a) or publishing the Administrator's reason for not initiating such a proceeding. Every 6 months, the Committee makes those revisions in the TSCA section 4(e) Priority List that it determines to be necessary and transmits them to the EPA Administrator.

As a result of its deliberations, the Committee is revising the TSCA section 4(e) Priority List by the addition of 11 chemicals and 1 group, and the removal of 1 chemical. In this report, for the first time, the Priority List is being divided into two parts: part A contains those recommended chemicals and groups designated for response by the EPA Administrator within 12 months, and part B contains chemicals and groups that have been recommended to be considered by EPA for testing-rules promulgation, without being designated for response within 12 months. Although TSCA does not establish a deadline for EPA response to nondesignated chemicals and groups (part B of the Priority List), the Committee anticipates that the EPA Administrator will respond in a timely manner.

The entries being added to the Priority List are presented, together with the types of testing recommended, in the following Table 1.

TABLE 1.—ADDITIONS TO THE SECTION 4(E) PRIORITY LIST

Chemical/group	Recommended studies
A. Designated for response within 12 months:	
Monomethyltin tris(isooctyl mercaptoacetate). Dimethyltin bis-(isooctyl mercaptoacetate).	Chemical Fate: Mobility of the compounds from manufacturing and disposal sites; hydrolysis and biodegradation; identification of persistent degradation products.
Monobutyltin tris-(isooctyl mercaptoacetate). Dibutyltin bis-(isooctyl mercaptoacetate). Dibutyltin bis-(lauryl mercaptide). Dibutyltin dilaurate. Dibutyltin bis-(isooctyl maleate).	Environmental Effects: Acute and chronic toxicity to fish and aquatic invertebrates; toxicity to aquatic plants; bioconcentration.
Bis(2-ethylhexyl)terephthalate	Health Effects: Mutagenicity; chemical disposition and metabolism; subchronic effects. Environmental Effects and Chemical Fate: Acute and chronic toxicity to fish and aquatic invertebrates; toxicity to plants; bioconcentration; chemical fate.
1,3-Dioxolane	Health Effects: Mutagenicity; chemical disposition and metabolism; 90-day inhalation toxicity.
4-(1,1,3,3-Tetramethylbutyl)phenol.	Health Effects: Short-term tests including mutagenicity. Environmental Effects and Chemical Fate: Acute and chronic toxicity to fish and aquatic invertebrates; toxicity to plants; bioconcentration; chemical fate.
Tris(2-ethylhexyl)trimellitate	Health Effects: Chemical disposition and metabolism. Environmental Effects and Chemical Fate: Acute and chronic toxicity to fish and aquatic invertebrates; toxicity to plants; bioconcentration; chemical fate.
B. Recommended, but not designated for response within 12 months:	
Carbofuran intermediates	Environmental Effects and Chemical Fate: Acute toxicity to fish and aquatic invertebrates; chemical fate with particular emphasis on monitoring studies.

TSCA Interagency Testing Committee

Statutory Member Agencies and Their Representatives

Council on Environmental Quality
Gordon F. Snow, Member
Department of Commerce
Bernard Greifer, Member
Environmental Protection Agency
Joseph Seifter, Member (Deceased)
Carl R. Morris, Member[1]
Arthur M. Stern, Alternate[2]
National Cancer Institute
Elizabeth K. Weisburger, Member and Chairperson
Richard Adamson, Alternate
Jerrold Ward, Alternate
National Institute of Environmental Health Sciences
Dorothy Canter, Memnber
National Institute for Occupational Safety and Health
Vera W. Hudson, Member
Herbert E. Christensen, Alternate
National Science Foundation
Winston C. Nottingham, Member
Occupational Safety and Health Administration
Patricia Marlow, Member

Liaison Agencies and Their Representatives

Consumer Product Safety Commission
Arthur Gregory
Lakshmi Mishra
Department of Agriculture
Fred W. Clayton
Homer E. Fairchild
Department of Defense
Arthur H. McCreesh
Department of the Interior
None
Food and Drug Administration
Winston deMonsabert, Vice Chairperson
Allen H. Heim
National Toxcology Program
Dorothy Canter

Committee Staff

Martin Greif, Executive Secretary
Norma Williams, ITC Coordinator

Support Staff

Alan Carpien—Office of the General Counsel, EPA
Jon Cooper—Office of Toxic Substances, EPA
Joan Lefler[3]—Office of Toxic Substances, EPA

Notes

(1) Dr. Morris had previously served as an Alternate and was appointed to full-Member status on August 12, 1982, replacing Dr. Joseph Seifter.

(2) Dr. Stern was appointed as an Alternate on August 12, 1982.

(3) Ms. Lefler was appointed on June 14, 1982.

The Committee acknowledges and is grateful for the assistance and support given to it by the staff of Dynamac Corporation (technical support contractor) and numerous personnel of the EPA Office of Toxic Substances.

Chapter 1—Introduction

1.1 *Background.* The TSCA Interagency Testing Committee (Committee) was established under section 4(e) of the Toxic Substances

Control Act of 1976 (TSCA, Public Law 94–469). The specific mandate of the Committee is to recommend to the Administrator of the U.S. Environmental Protection Agency (EPA) chemical substances and mixtures in commerce that should be given priority consideration for the promulgation of testing rules to determine their potential hazard to human health and/or the environment. TSCA specifies that the Committee's recommendations shall be in the form of a Priority List, which is to be published in the **Federal Register**. The Committee is directed by section 4(e)(1)(A) of TSCA to designate those chemicals on the Priority List to which the EPA Administrator should respond within 12 months by either initiating a rulemaking proceeding under section 4(a) or publishing the Administrator's reason for not initiating such a proceeding.

Every 6 months, the Committee makes those revisions in the section 4(e) Priority List that it determines to be necessary and transmits them to the EPA Administrator.

The Committee is comprised of representatives from eight statutory member agencies, five liaison agencies, and one national program. The specific representatives and their affiliations are named in the front of this report. The Committees chemical review procedures and prior recommendations are described in previous reports (Refs. 1 through 11).

1.2 *Committee's previous reports.* Ten previous reports to the EPA Administrator have been issued by the Committee and published in the **Federal Register** (Refs. 2 through 11). Fifty-three entries (chemicals and groups of chemicals) were designated by the Committee for priority consideration by the EPA Administrator. Eighteen entries were removed after EPA responded to the Committee's recommendations for testing, and one was removed by the Committee for further consideration (Ref. 10).

1.3 *Committee's activities during this reporting period.* This report covers activities of the Committee between April 1, 1982, and September 30, 1982.

The Committee has continued to review chemicals from its third scoring exercise (see Ref. 2 for methodology) and began reviewing chemicals selected in its fourth scoring exercise. The alkyltin compounds group, which was removed from the Priority List in its ninth report (Ref. 10) for additional consideration by the Committee, has been studied further. Recommendations for the testing of seven designated alkyltin compounds are included in this report.

The Committee made direct contact with approximately 100 manufacturers of the chemicals being reviewed to request information that would be of value in its deliberations. Response by the industry continues to be excellent.

During this reporting period, the Committee has evaluated data on 50 chemicals for priority consideration. Eleven chemicals and one group have been added to the section 4(e) Priority List; 16 were deferred from further consideration at this time. The remaining chemicals are still under study.

1.4 *The TSCA section 4(e) Priority List.* Section 4(e)(1)(B) of TSCA directs the Committee to: ". . . make such revisions in the [priority] list as it determines to be necessary and . . . transmit them to the Administrator together with the Committee's reasons for the revisions." Under this authority, the Committee is revising the Priority List by adding 11 chemicals and 1 group: monomethyltin tris(isooctyl mercaptoacetate), dimethyltin bis(isooctyl mercaptoacetate), monobutyltin tris(isooctyl mercaptoacetate), dibutyltin bis(isooctyl mercaptoacetate), dibutyltin bis(lauryl mercaptide), dibutyltin dilaurate, dibutyltin bis(isooctyl maleate), bis(2-ethylhexyl) terephthalate, 1,3-dioxolane, 4-(1,1,3,3-tetramethylbutyl)phenol, tris(2-ethylhexyl) trimellitate, and carbofuran intermediates. The testing recommended for these chemicals and the rationales for the recommendations are presented in Chapter 2 of this report.

One chemical, chlorendic acid, has been removed from the Priority List because the EPA Administrator has responded to the Committee's prior recommendation for testing of the chemical.

With the 12 recommendations and 1 removal noted in this report, 46 entries now appear on the section 4(e) Priority List (Table 2).

TABLE 2.—THE TSCA SECTION 4(E) PRIORITY LIST OCTOBER 1982

1A. Chemicals and Groups Designated for Response Within 12 Months

Entry	Date of designation
1. Acetonitrile	Apr. 1979.
2. Acrylamide	Apr. 1978.
3. Alkyl epoxides	Oct. 1977.
4. Aniline and bromo-, chloro-, and/or nitroanilines.	Apr. 1979.
5. Antimony (metal)	Do.
6. Antimony (sulfide)	Do.
7. Antimony trioxide	Do.
8. Aryl phosphates	Apr. 1978.
9. Biphenyl	Apr. 1982.
10. Bis(2-ethylhexyl) terephthalate	Oct. 1982.
11. Chlorinated benzenes, mono- and di-	Oct. 1977.
12. Chlorinated benzenes, tri-, tetra-, and penta-.	Oct. 1978.
13. 4-Chlorobenzotrifluoride	Oct. 1981.
14. Cresols	Oct. 1977.
15. Cyclohexanone	Apr. 1979.
16. Dibutyltin bis(isooctyl maleate)	Oct. 1982.
17. Dibutyltin bis(isooctyl mercaptoacetate).	Do.
18. Dibutyltin bis(lauryl mercaptide)	Do.
19. Dibutyltin dilaurate	Do.
20. 1,2-Dichloropropane	Do.
21. Dimethyltin bis(isooctyl mercaptoacetate).	Do.
22. 1,3-Dioxolane	Do.
23. Ethyltoluene	Apr. 1982.
24. Formamide	Do.
25. Glycidol and its derivatives	Oct. 1978.
26. Halogenated alkyl epoxides	Apr. 1978.
27. Hexachloro-1,3-butadiene	Oct. 1977.
28. Hexachlorocyclopentadiene	Apr. 1979.
29. Hydroquinone	Nov. 1979.
30. Isophorone	Apr. 1979.
31. Mesityl oxide	Do.
32. 4,4'-Methylenedianiline	Do.
33. Methyl ethyl ketone	Do.
34. Methyl isobutyl ketone	Do.
35. Monobutyltin tris(isooctyl mercaptoacetate).	Oct. 1982.
36. Monomethyltin tris(isooctyl mercaptoacetate).	Do.
37. Pyridine	Apr. 1978.
38. Quinone	Nov. 1979.
39. 4-(1,1,3,3-Tetramethylbutyl)phenol	Oct. 1982.
40. Toluene	Oct. 1977.
41. 1,2,4-Trimethylbenzene	Apr. 1982.
42. Tris(2-chloroethyl) phosphite	Oct. 1981.
43. Tris(2-ethylhexyl) trimellitate	Oct. 1982.
44. Xylenes	Oct. 1977.

1B. Other Recommended Chemicals and Groups

Entry	Date of recommendation
1. Carbofuran intermediates	Oct. 1982.
2. Trimethylbenzenes	Apr. 1982.

The Committee has divided its section 4(e) Priority List into two parts; namely, Table 1A, Chemicals and Groups Designated for Response Within 12 Months, and Table 1B, Other Recommended Chemicals and Groups. The cumulative list of entries removed from the Priority List is presented in Table 3.

Table 3.—Cumulative Removals From the TSCA Section 4 (e) Priority List October 1982

Chemical/group	EPA responses to committee recommendations	
	Federal Register citation	Publication date
1. Alkyl phthalates	46 FR 53775-53777	Oct. 30, 1981.
2. Alkyltin compounds	46 FR 5456-5463	Feb. 5, 1982.[1]
3. Benzidine-based dyes	46 FR 55005-55006	Nov. 5, 1981.
4. Benzyl butyl phthalate	46 FR 53775-53777	Oct. 30, 1981.
5. Butyl glycolyl butyl phthalate	46 FR 54487	Nov. 2, 1981.
6. Chlorendic acid	47 FR 44878-44879	Oct 12, 1982.
7. Chlorinated naphthalenes	46 FR 54491	Nov. 2, 1981.
8. Chlorinated paraffins	47 FR 1017-1019	Jan. 8, 1982.
9. Chloromethane	45 FR 48524-48564	July 18, 1980.
10. 2-Chlorotoluene	47 FR 18172-18175	Apr. 28, 1982.
11. o-Dianisidine-based dyes	46 FR 55005-55006	Nov. 5, 1981.
12. Dichloromethane	46 FR 30300-30320	June 5, 1981.
13. Diethylenetriamine	47 FR 18386-18391	Apr. 29, 1982.
14. Fluoroalkenes	46 FR 53704-53708	Oct. 30, 1981.
15. Hexachloroethane	47 FR 18175-18176	Apr. 28, 1982.
16. Nitrobenzene	46 FR 30300-30320	June 5, 1981.
17. Phenylenediamines	47 FR 973-683	Jan. 8, 1982.
18. Polychlorinated terphenyls	46 FR 54482-54483	Nov. 2, 1981.
19. o-Tolidine-based dyes	46 FR 55005-55006	Nov. 5, 1981.
20. 1,1,1-Trichloroethane	46 FR 30300-30320	June 5, 1981.

[1] Removed by the committee for reconsideration.

References

(1) Preliminary List of Chemical Substances for Further Evaluation. Toxic Substances Control Act Interagency Testing Committee, July 1977.

(2) Initial Report to the Administrator, Environmental Protection Agency, TSCA Interagency Testing Committee, October 1, 1977. Published in the Federal Register of Wednesday, October 12, 1977, 42 FR 55026–55080. Corrections published in the Federal Register of November 11, 1977, 42 FR 58777–58778. The report and supporting dossiers were also published by the Environmental Protection Agency, EPA 560–10–78/001, January 1978.

(3) Second Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, April 1978. Published in the Federal Register of Wednesday, April 19, 1978, 43 FR 16684–16688. The report and supporting dossiers were also published by the Environmental Protection Agency, EPA 560–10–78/002, July 1978.

(4) Third Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, October 1978. Published in the Federal Register of Monday, October 10, 1978, 43 FR 50630–50635. The report and supporting dossiers were also published by the Environmental Protection Agency, EPA 560–10–79/001, January 1979.

(5) Fourth Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, April 1979. Published in the Federal Register of Friday, June 1, 1979, 44 FR 31866–31889.

(6) Fifth Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, November 1979. Published in the Federal Register of Friday, December 7, 1979, 43 FR 70664–70674.

(7) Sixth Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, April 1980. Published in the Federal Register of Wednesday, May 28, 1980, 45 FR 35897–35910.

(8) Seventh Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, October 1980. Published in the Federal Register of Tuesday, November 25, 1980, 45 FR 78432–78446.

(9) Eighth Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, April 1981. Published in the Federal Register of Friday, May 22, 1981, 46 FR 28138–28144.

(10) Ninth Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, October 1981. Published in the Federal Register of Friday, February 5, 1947, FR 5456–5463.

(11) Tenth Report of the TSCA Interagency Testing Committee to the Administrator, Environmental Protection Agency. TSCA Interagency Testing Committee, April 1982. Published in the Federal Register of Tuesday, May 25, 1982, 47 FR 22585–22596.

Chapter 2—Recommendations of the Committee

2.1 *Chemicals recommended for priority consideration by the EPA Administrator.* As provided by section 4(e)(1)(B) of TSCA, the Committee is adding the following 11 chemicals and 1 group of chemicals to the section 4(e) Priority List: monomethyltin tris (isooctyl mercaptoacetate), dimethyltin bis(isooctyl mercaptoacetate), monobutyltin tris(isooctyl mercaptoacetate) dibutyltin bis(isooctyl mercaptoacetate), dibutyltin bis(lauryl mercaptide), dibutyltin dilaurate, dibutyltin bis(isooctyl maleate), bis(2-ethylhexyl) terephthalate, 1,3-dioxolane, 4-(1,1,3,3,-tetramethylbutyl)phenol, tris(2-ethylhexyl) trimellitate, and carbofuran intermediates. The recommendation of these chemicals is being made after considering the factors identified in section 4(e)(1)(A) and other available relevant information, as well as the professional judgment of Committee members.

The 11 recommendations designated for response within 12 months are presented in section 2.2 of this report. Section 2.3 contains one recommendation with no designated time limit for response by the EPA Administrator.

2.2 *Chemicals designated for response within 12 months with supporting retaionales.*

2.2.a *Alkyltin Compounds.*

Summary of recommended studies. It is recommended that seven specific alkyltin compounds,

Monomethyltin tris(isooctyl mercaptoacetate),
dimethyltin bis(isooctyl mercaptoacetate),
monobutyltin tris(isooctyl mercaptoacetate),
dibutyltin bis(isooctyl mercaptoacetate),
dibutyltin bis(lauryl mercaptide),
dibutyltin dilautate, and
dibutyltin bis(isooctyl maleate),

be tested for the following:

A. Chemical Fate:

Mobility of the compounds from manufacturing and disposal sites.

Hydrolysis and biodegradation.

Identification of persistent degradation products.

B. Environmental Effects:

Acute and chronic toxicity to fish and aquatic invertebrates.

Toxicity to aquatic plants.

Bioconcentration

Background

In the Seventh ITC Report (EPA, 1980), it was recommended to the EPA Administrator that the alkyltin compounds category be given priority

consideration for the promulgation of testing rules.

The category was defined in terms of the following generic formula:

R_nSnY_{4-n}

where:

R represents an alkyl group containing one to eight carbon atoms covalently bonded to the tin atom.

n represents the number of alkyl groups covalently bonded to the tin atom; n can have a value between 1 and 4.

Y represents a singly charged anion or anionic organic group bonded to the tin atom,

Sn is the chemical sysmbol for the element tin.

Thirty-three category members were identified in the ITC report as being either commercially important or of possible commercial significance.

Based on information that EPA gathered, analyzed, and presented to the Committee subsequent to the ITC recommendation, the Committee concluded that the alkyltin compounds category, as defined in the Seventh ITC Report, was too broad to be considered as a single category from the standpoint of chemistry, exposure, or effects. As a result, in the Ninth ITC Report (EPA, 1982a), the Committee removed the alkyltin compounds category from the Priority List and committed itself to submitting a revised recommendation within 12 months.

The Committee has reexamined the 33 alkyltin compounds identified in the Seventh ITC Report plus additional alkyltins in commerce identified by EPA (EPA, 1981) and industry (ORTEP, 1982). Based on a review of all available information on these compounds, particularly the level of production and type of use, the Committee is designating seven alkyltin compounds for priority consideration and deferring the remainder.

Physical and Chemical Information

Available physical and chemical information on the seven designated alkyltin compounds is given in Table 4.

TABLE 4—PHYSICAL AND CHEMICAL PROPERTIES OF SEVEN ALKYLTIN COMPOUNDS

Chemical	CAS No.	Structural formula	Solubility	Vapor pressure [1]	Description
Monomethyltin tris(isooctyl) mercaptoacetate).	54849-38-6	$CH_3Sn(SCH_2C(O)OC_8H_{17})_3$		1.0×10^{-6} mmHg	Liquid.
Dimethyltin bis(isooctyl mercaptoacetate)	[2]26636-01-1	$(CH_3)_2Sn(SCH_2C(O)OC_8H_{17})_2$	Insoluble in water; soluble in organic	2.3×10^{-6} mmHg	Clear liquid.
Monobutyltin tris(isoocytyl mercaptoacetate).	25852-70-4	$C_4H_9Sn(SCH_2C(O)OC_8H_{17})_3$			Liquid.
Dibutyltin bis(osooctyl mercaptoacetate)	[3]25168-24-5	$(C_4H_9)_2Sn(SCH_2C(O)OC_8H_{17})_2$	Insoluble in water; soluble in organic		Yellow liquid.
Dibutyltin bis(lauryl mercaptide)	1185-81-5	$(C_4H_9)_2Sn(SC_{12}H_{25})_2$			Clear, pale liquid.
Dibytyltin dilaurate	[4]77-58-7	$(C_4H_9)_2Sn(OC(O)C_{11}H_{23})_2$	Insoluble in water	Melting solid [4]	Liquid or low.
Dibultyltin bis(isooctyl maleate)	[5]25168-21-2	$(C_4H_9)_2Sn(OC(O)CHCHC(O)OC_8H_{17})_2$	Insoluble in water; soluble in polar		White powder.

[1] Carstab Corp. (1982). [2] Solvents. [3] Soluble in benzene and acetone. [4] Melting point at 27° C. [5] Organic solvents.

NOTE.—The log P octanol/water partition coefficient is > 6 for all of the above chemicals (estimated by the method of Leo et al., 1971).

Rationale for Recommendations

I. *Exposure information*—A. *Production/use/disposal information.* The designated alkyltin compounds are each produced in excess of 500,000 pounds per year. Table 5 presents the production data on the recommended compounds assembled from three separate sources:

- Public portion of TSCA Inventory, reporting 1977 production levels (EPA, 1982b).
- Midwest Research Institute report on organotins (MRI, 1979).
- Recent Organotin Environmental Program (ORTEP) submissions, reporting current production levels (ORTEP, 1982).

The seven compounds are among the principal alkyltins used as stabilizers in polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC), and together they constitute 59 percent of the total alkyltin stabilizer production in the United States (ORTEP, 1982). Some of the compounds are also used as catalysts and sitelimited intermediates. A major use of the PVC and CPVC that is stabilized by these alkyltins is for water pipe, including pipe used to transport potable water (ORTEP, 1982).

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Table 5--Production Data on Designated Alkyltins

Chemical	Production (millions of pounds) TSCA Inventory[a]	MRI (1979)	ORTEP (1982)	Percentage Used As Stabilizer (%)	Comments
Monomethyltin tris(isooctyl mercaptoacetate)	0.1-1	5	1.5	100	Always sold as a mixture with dimethyltin bis(isooctyl mercaptoacetate); 1 part monomethyltin to 3 parts dimethyltin
Dimethyltin bis(isooctyl mercaptoacetate)	0.1-1		4.6	100	"
Monobutyltin tris(isooctyl mercaptoacetate)	0.1-1	10	0.5	57[b]	Always sold as a mixture with dibutyltin bis(isooctyl mercaptoacetate)
Dibutyltin bis(isooctyl mercaptoacetate)	0.1-1		6.6	68[b]	Sold in purified form and as a mixture with monobutyltin tris (isooctyl mercaptoacetate)
Dibutyltin bis(lauryl mercaptide)	0.02-0.2	1.2	0.62	97	3% used as catalyst (ORTEP, 1982)
Dibutyltin dilaurate	0.02-0.2	5	0.5	14	28% used as catalyst[b] (ORTEP,1982)
Dibutyltin bis(isooctyl maleate)	0.1-1	---	0.53	97	3% used as catalyst (ORTEP, 1982)

[a]Public portion (EPA, 1982b).
[b]Remainder is used as site-limited intermediates or in unspecified uses.

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B. *Chemical fate information.* There is evidence that alkyltin species released to the environment will be transformed by abiotic and biotic processes. The transformation products may include oxides, hydroxides, methylated species, and complexes with sulfur-containing ligands (Hallas et al., 1982; Guard et al., 1981; MRI, 1979). The mixtures of tin species present in a given environment may change with environmental conditions. Some products may be volatile like tetramethyltin. Other species may adsorb to clay and sediments in a manner analogous to trialkyltins (Hallas et al., 1982; Guard et al., 1981; MRI, 1979). Still others, which may be charged or neutral, are likely to be soluble (Heron and Sproule, 1958). The specific environmental behavior of the seven designated compounds is not known.

The major types of abiotic transformation of alkyltins are ligand exchange with other metals and nonmetals (Abel, 1973; Parker and Carman, 1977) and hydrolysis to form hydrous oxides; i.e., hydrated oxides (Cotton and Wilkinson, 1980; Mazaev et al., 1976). The nature of the "hydrous oxides" depends mainly on pH (Tobias, 1978).

Of these abiotic processes, the formation of hydrous oxides is of greater concern. Alkyltin hydrous oxides may behave in a manner analogous to tributyltin oxide, which has been shown to persist for months in soil environments (M&T Chemicals, as cited in MRI, 1979). The seven designated alkyltin compounds are expected to form hydrous oxides.

C. *Evidence for environmental exposure.* The seven chemicals can be released to the environment through three possible routes. They may leach from pipes and other plastic materials both in use and at disposal sites, may be dischcarged incidental to their use as catalysts, and may be discharged in waste streams from manufacturing (Boettner et al., 1982; ORTEP, 1982). In one plant studied, it has been found that about 10–20 pounds per day of total tin (80 percent as "organotin") leaves its treatment ponds and is discharged to the environment (M&T Chemicals, 1982).

Alkyltins have been detected at various concentrations in diverse areas of aquatic and terrestrial environments (Table 6). The largest concentrations of alkyltins, at 0.3–22. ppm, have been detected in soil and plants near one manufacturing facility. Nearby bodies of water were found to contain total tin at concentrations up to 0.01 mg/L (MRI, 1979).

TABLE 6—ALKYLTINS IN THE ENVIRONMENT

Sample source	Location	Chemical species	Concentration	Reference
Water	Chesapeake Bay	Total organotin	0–900 mg/L	Jackson et al. (1982).
Water	Carollton, KY	Total tin	0–0.01 ppm	M&T Chemicals (1974).*
Water	Tampa, FL	Methyltins	0.22–7.4 ppt	Braman & Tompkins (1979).*
Water	Lake Michigan; CA coast and bays	Methyltins and butyltins	0–1600 ppt for dichlorodibutyltin	Hodge et al. (1979).
Water	Great Lakes area	Butyltins	0–18.69 ppm	Maguire et al. (1982).
Subsurface water	Great Lakes area	Methyltins	0.40 ppb for dimethyltin	Maguire et al. (1982).
Water	Reading, OH	Total tin	<1.0–4.4 ppb	Battelle Labs (1977*).
Water	Avondale, LA	Total tin	<1.0 ppb	Battelle Labs (1977*).
Water	Bavaria, W. Germany	Total tin	16.6–69 ppm	Schramel et al. (1973*).
Chemical plant effluent	Taft, LA	Total organotin	4–250 ppm	Argus Chemical (1977).
Surface microlayer	Great Lakes area	Butytins	0–2600 ppb for dibutyltin	Maguire et al. (1982).
Soil	Reading, OH	Total tin	15–120 ppb	Battelle Labs (1977).*
Soil	Avondale, LA	Total tin	<10 ppb	Battelle Labs (1977).*
Sediment	Bavaria, W. Germany	Total tin	8–580 ppm	Schramel et al. (1973).*
Air	Reading, OH	Total tin	<0.1 μg/m³	Battelle Labs (1977).*
Air	Avondale, LA	Total tin	<0.1 μg/m³	Battelle Labs (1977).*
Water plants	Bavaria, W. Germany	Total tin	13–3,100 ppm	Schramel et al. (1973).*
Plants	Carrollton, KY	Total organotin	1.4–27.3 ppm	M&T Chemicals (1974).*
Fish, meat, and liver	Bavaria, W. Germany	Total tin	<1 ppm	Schramel et al. (1973).*
Human urine	Unspecified	Methyltin	<0.02–0.32 ppb	Braman & Tompkins (1979).*
Coral, seashells	Unspecified	Methyltins	~1 ppb	Braman & Tompkins (1979).*
Water, soil, plants, fish, invertebrates	St. Lucia Island, Caribbean	Total tin	0–44 ppb	Sherman & Carlson (1980).

*As cited in MRI (1979).

II. *Health considerations.* A review of recently available human exposure information has revealed that worker and general population exposure to alkyltin compounds is low in nonpesticide uses. Industry reports that closed systems are used for alkyltin manufacturing and processing (CTET, 1972; MRI, 1979; ORTEP, 1982). Although the general population is exposed to alkyltin leachate from potable water pipe that has been stabilized with alkyltins, recent leaching studies indicates that the concentrations of alkyltins in drinking water leachates are low (Boettner, 1982; MRI, 1979; Park and Van Hoang, 1980; Parris and Perry, 1982). Consequently, because of the apparent lack of human exposure to the alkyltin compounds in commerce, including the seven designated alkyltins, the Committee is deferring the alkyltin compounds from recommendations for health effects testing at this rule.

III. *Environmental considerations*—A. *Short-term (acute) effects.* No studies on the short-term effects of the seven designated alkyltin compounds have been found for either aquatic animals or plants. A review of the literature indicates that there is a diversity of toxicity data on related alkyltin compounds. Alkyltin compounds have been found to be toxic to fish at concentrations under 1 μg/L and to invertebrates at 100 μg/L (MRI, 1979). These data indicate that the biological activity of a number of the organotins studied is high. The seven designated alkyltins compounds (including their degradation products) are expected to exhibit similar biological activity.

B. *Subchronic/chronic effects.* No studies on the long-term effects of the seven designated alkyltin have been found for either aquatic animals or plants.

C. *Other effects (physiological/behavioral/ecosystem processes).* No studies on the physiological, behavioral, or ecosystem effects of the seven designated alkyltins have been found. In studies of tributyltin oxide with yearling rainbow trout (*Salmo gairdneri*) and with *Tilapia rendalli*, loss of positive rheotaxis and other behavioral changes were observed. At 1.17 mg/L, agitation,

air gulping, etc., followed by convulsions and death, were observed. At a lower concentration (11.7 μg/L), the fish showed signs of weakness and loss of positive rheotaxis (Chliamovitch and Kuhn, 1977).

D. *Bioconcentration.* No measurements of the bioconcentration of the seven designated alkyltin compounds have been found. The logarithms of the octanol/water partition coefficent (estimated by the method of Leo et al., 1971) were greater than 6 for these compounds. By the method of Veith et al. (1980), the bioconcentration factors were calculated to be in excess of 300 for each of these chemicals.

White coral and seashells taken from ocean waters containing 4.2–12 ng/L (as total tin) were found to accumulate tin at concentrations on the order of 1 ppb, indicating bioaccumulation factors between 100 and 200. Analysis of the coral revealed that 30 percent of the accumulated tin was organotin (Braman and Tompkins, 1979).

In addition to bioconcentration through lipid materials as predicted by octanol/water partition coefficients, bioconcentration through complexation by biological ligands has also been proposed for alkyltins (Carty, 1978).

E. *Reasons for specific environmental recommendations.* Organotins have been found in diverse areas of the aquatic and terrestrial environments. The seven designated alkyltin compounds constitute a substantial portion of the alkyltin production for uses subject to TSCA, and may enter the environment through leaching in their use as stabilizers in plastic materials, as catalysts, and through manufacturing wastes. The highest concentrations of organotins occur near manufacturing sites. Based on a simple dilution model, the 10–20 pounds per day of tin released as organotins from one manufacturing site would be sufficient to exceed predicted environmental effects levels of approximately 1 μg/L if stream flows are less than 500 ft^3/second. Depending on the precise chemical species formed under local environmental conditions, these materials or their degradation products are expected to be presistent.

Chemical fate testing for these compounds is recommended to better characterize their transport, transformation, and persistence in aquatic and soil environments under relevant redox and pH conditions. The recommended testing includes: studies to evaluate mobility from manufacturing and disposal sites, hydrolysis and biodegradation studies, and studies to identify the major persistent degradation products.

The seven designated alkyltin compounds have not been tested for environmental effects. Some alkyltin compounds have been shown to be toxic at concentrations near 1 μg/L. Acute and chronic toxicity testing in fish and aquatic invertebrates and toxicity testing in aquatic plants are recommended for the seven designated alkyltin compounds and their degradation products because of their exposure potential and insufficient toxicity data.

Because of high calculated octanol/water partition coefficients, the seven alkyltin compounds are expected to bioconcentrate in the fatty tissues of aquatic organisms. Furthermore, the alkyltin compounds may bioconcentrate through additional mechanisms. The potential for bioconcentration also raises concern for possible food-chain transport. Therefore, it is recommended that testing be conducted to determine the chemical fate and the bioconcentration of the seven alkyltin compounds and their identified, persistent degradation products.

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2.2.b *Bis(2–Ethylhexyl) Terephthalate*

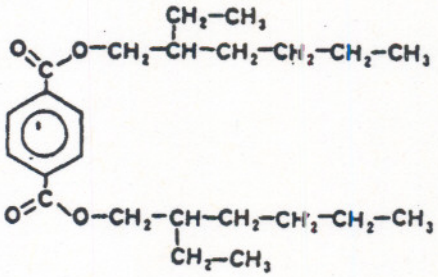
Summary of recommended studies. It is recommended that bis(2–ethylhexyl) terephthalate be tested for the following:

A. *Health Effect.*
- Mutagenicity.
- Chemical disposition and metabolism.
- Subchronic effects.

B. Environmental Effects and Chemical Fate:
- Acute and chronic toxicity to fish and aquatic invertebrates.
- Toxicity to plants.
- Bioconcentration.
- Chemical fate.

Physical and Chemical Information.

CAS Number: 6422–86–2.
Structural Formula:



Empirical Formula: $C_{24}H_{38}O_4$.
Molecular Weight: 390.56.
Melting Point: −48° C.
Boiling Point: 400° C at 760 mmHg.
Specific Gravity: 0.9835 at 20° C.
Solubility: Water, 0.004 g/l at 20° C.
Log Octanol/Water Partition Coefficient: >6 (estimated; Leo et al., 1971).

Description of Chemical: Clear, odorless liquid of low volatility.

Rationale for Recommendations

I. *Exposure information*—A. *Production and use information.* U.S. production of bis(2–ethylehexyl) terephthalate (EHT) was reported in the TSCA Inventory to be between 1 million and 10 million pounds in 1977 (EPA, 1982). The compound is used as a plasticizer with polyvinyl chloride (PVC) resins, but is is also compatible for use with acrylics, cellulose acetate, butyrates, cellulose nitrate, polyvinyl butyral, styrene polymers, oxidizing alkyds, and nitrile rubber (Eastman Kodak Co., 1982). It is often used when phthalate plasticizers are in short supply (CEH, 1977). The terephthalate would probably migrate out of PVC, similar to the situation with phthalate plasticizers. For bis(2–ethylhexyl) phyhalate (DEHP, di-sec-octyl phthalate), the isomer of EHT, the ACGIH (1981) has set the TLV–TWA at 5 mg/m^3 and the TLV–STEL at 10 mg/m^3.

B. *Chemical fate information.* No studies on environmental transport or persistence of EHT were found. However, the chemical is expected to behave in a manner similar to its isomer, DEHP, and thus to enter and persist in the aquatic environment.

No data were found on the quantity of EHT that is likely to be released to the environment. However, data do exist concerning potential sources of release and environmental occurrences of the structurally analogous dialkyl phthalates, which are believed to have plasticizer use patterns similar to those anticipated for EHT. It has been estimated that about 1.4-2.6 percent of the total volume of plasticizers used during processing operations is released in water effluents (A.D. Little, Inc., 1979). Other data show that the phthalates also may be released from end-use plastic articles as a result of their use and disposal (Mathur, 1974; Versar, Inc., 1979). Regardless of the stage of their life cycles at which dialkyl phthalates enter the environment, their environmental distribution appears to be ubiquitous; i.e., they have been found in the air, bodies of water, biota (Peakall, 1975; Mayer et al., 1972; Giam et al., 1979a), and in soils and sediments (Jungclaus et al., 1978; Brownlee and Strachan, 1977; Giam et al., 1978b; Schwartz et al., 1979).

EHT is predicted to have a low water solubility based on its structural relationship to the dialkyl phthalates and its octanol/water partition coefficient, which is estimated to be greater than 6. This suggest that it will strongly sorb to sediments and soils. The fact that the dialkyl phthalates are readily sequestered in aquatic systems by organic residues and solid surfaces (Jungclaus et al., 1978; Brownlee and Strachan, 1977; Giam et al., 1978b; Morita et al., 1974; Schwartz et al., 1979) provides support for such sorption when EHT is released to frash or marine water.

Significant portions of these soils and sediments are expected to be anaerobic. In anaerobic systems, EHT biodegrades at a rate similar to that of long-chain dislkyl phthalates, which is over 30 days (Syracuse Research Corp., 1979; Johnson and Lulves, 1975; Saeger and Tucker, 1976). The 20-day BOD reported for EHT is 0.16 g/g. This indicates that a significant portion of this chemical is expected to persist in the environment. Further evidence for slow biodegradation rates of dialkyl phthalates is provided by monitoring studies that show that phthalates accumulate in sediments (Schwartz et al., 1979; Jungclaus et al., 1978).

II. *Biological effects of concern to human health*—A. *Biochemical information.* No biochemical data on EHT have been found. However, its isomer DEHP may undergo some hydrolysis to the monoester in the mammalian gastrointestinal tract (Lake et al., 1976 and 1977; Rowland et al., 1977). This monoester and the 2-ethylhexanol can undergo further transformation in the organism.

B. *Carcinogenicity.* No data on the carcinogenic activity of EHT have been found, although the phthalate isomer DEHP caused hepatocellular carcinomas in both sexes of Fischer rats and B6C3F1 mice (NTP, 1982).

C. *Mutagenicity.* No data on the mutagenic activity of EHT have been found, although DEHP and terephthalic acid (TPA), a possible metabolite of EHT, were negative in the Salmonella assay (NTP, 1980 and 1982).

D. *Teratogenicity, Embryotoxicity, and Fetotoxicity.* No data on the teratogenic, embryotoxic, and fetotoxic activity of EHT have been found.

E. *Toxicity.* Direct contact of undiluted EHT with the skin of guinea pigs for 24 hours produced slight irritation but without absorption. Repeated application for 10 days caused a moderate effect on guinea pig skin, but it did not sensitize guinea pigs. The compound was slightly irritating to the eyes of rabbits. The oral LD_{50} in both rats and mice was found to be greater than 3,200 mg/kg. Feeding EHT to rats at 1 percent of the diet for 10 days did not affect food intake, weight gain, behavior, hematology, serum chemistry, liver and kidney weights, or

histopathologic findings (Eastman Kodak Co., 1982).

TPA led to bladder stones in male Fischer-344 rats after they were fed 3, 4, or 5 percent TPA in the diet for 2 weeks; however, bladder stones were not observed at the 1.5 percent level. The effect was much lower in female rats (Chin et al., 1981). Physicochemical factors were apparently involved (Heck, 1981). However, no tumors or toxic effects were noted in rats fed TPA for 2 years at levels below 1 percent (Gross, 1974).

F. *Reasons for health effects recommendations.* Analogous to its isomer DEHP, EHT would be expected initially to hydrolyze to 2-ethylhexyl alcohol during metabolism. The latter compound caused hepatic peroxisome proliferation (Moody and Reddy, 1978). TPA, a possible metabolite of EHT, caused bladder stones at levels of 3 percent or more in the diet. Thus, studies on the metabolic disposition of EHT are needed to determine the relative levels of these toxic metabolites that are formed. Subchronic experiments to determine whether EHT causes peroxisomal proliferation are also needed.

III. *Environmental considerations.*—A. *Acute toxicity.* EHT was acutely toxic (96-hour LC_{50}) to *Daphnia* at <100 mg/L (Brokaw, 1982). DEHP has shown acute toxicity at 2 mg/L to *Daphnia* (Hirzy et al., 1978; Sugawara, 1974), so its isomer EHT may be toxic at concentrations very much lower than 100 mg/L.

EHT was acutely toxic (LC_{50}) to the fathead minnow at a concentration greater than 1,000 mg/L (Brokaw, 1982). This is similar to the toxicity seen for DEHP to the fathead minnow and other species. It appears that dialkyl phthalates are metabolized by vertebrates (including fish) to monoalkyl phthalates (Mayer and Sanders, 1973; Stalling et al., 1973; Mayer, 1976; Melancon and Lech, 1976).

B. *Subchronic/chronic effects.* No studies on the long-term effects of EHT have been found. However, dialkyl phthalates were found to be hazardous to aquatic invertebrates and juvenile fish at concentrations as low as μg/L (Johnson et al., 1977; Mayer and Sanders, 1973; Mayer et al., 1977; Mehrle and Mayer, 1976).

C. *Other effects (physiological, behavioral, ecosystem processes).* No studies on the physiological, behavioral, or ecosystem effects of EHT have been found.

D. *Bioconcentration and food-chain transport.* EHT is expected to have a large bioconcentration potential because of its estimated octanol/water partition coefficient and its structural similarity to dialkyl phthalates. Significant amounts of DEHP were accumulated by aquatic plants and invertebrates confined in a model ecosystem and exposed for time periods ranging from 4 to 13 days. Bioconcentration factors of 21,000–100,000 have been measured (Metcalf et al., 1973). In other studies, bioconcentration factors of 350–28,000 were measured (Mayer and Sanders, 1973; General Electric Co., 1978; Streufert, 1978; Sanborn et al., 1975).

E. *Reasons for environmental effects recommendations.* EHT is expected to be released and persist in the aquatic environment, especially in sediments. The potential problems that could result from accumulation of the chemical in sediments include: (1) toxic effects on benthic invertebrates (e.g., shellfish) that live on or in sediments; (2) bioaccumulation of the substances and, possibly, resultant toxic effects in fish (e.g., catfish) that feed off the sediments and the benthic invertebrates; and (3) resuspension of the sediments through natural (e.g., storms, changing currents) or human (e.g., dredging) activities, which would result in redistribution of EHT in the aquatic environment. In addition to the above factors, sediments close to the surface (e.g., near coastal areas) are breeding grounds for commercial and game fish (Odum, 1971). This situation creates additional opportunities for contamination of the food chain and for manifestation of toxic effects in juvenile fish growing in such areas.

Chemical fate testing is recommended to better characterize the transformation and persistence of EHT in the aquatic environment.

Studies of its acute and chronic toxicity to fish and aquatic invertebrates and its toxicity to plants are recommended because of the potential for exposure to the chemical and insufficient toxicity data. Available acute toxicity data do not appear to be adequate. Because of its relatively high estimated octanol/water partition coefficient, EHT is expected to bioconcentrate in the fatty tissues of living organisms. This potential for bioconcentration also increases concern as to the effects of food-chain transport of the chemical. For these reasons and the expected environmental entry routes, it is recommended that testing be conducted to determine the bioconcentration of EHT.

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2.2.c *1,3-Dioxolane*

Summary of recommended studies. It is recommended that 1,3-dioxolane be tested for the following:

A. Health Effects:

Mutagenicity.

Chemical disposition and metabolism.

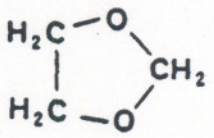
90–Day inhalation toxicity.

Physical and Chemical Information

CAS Number: 646–06–0.

Synonym: Glycol methylene ether.

Structural Formula:



Empirical Formula: $C_3H_6O_2$.

Molecular Weight: 74.09.

Melting Point: −93° C (Rosso and Carbonnel, 1971).

Boiling Point: 74° C at 760 mmHg.

Vapor Pressure: 70 mmHg at 20° C.

Specific Gravity: 1.065.

Log Octanol/Water Partition Coefficient: −0.31 (estimated; Leo et al., 1971)

Description of Chemical: Volatile, colorless liquid that is soluble in water and polar organic solvents. Like most acetals, it is stable in neutral or slightly basic solution but can be hydrolyzed in strong acid (Hawley, 1977; Salomaa and Kankaanpera, 1961; Kankaanpera, 1969).

Rationale for Recommendations

I. *Exposure information*—A. *Production/use/disposal information.* U.S. production of 1,3-dioxolane was reported to be between 1 and 10 million pounds in 1977 (EPA, 1982). The chemical is manufactured by the reaction of formaldehyde with ethylene glycol (Hawley, 1977). Approximately 90 percent of 1,3-dioxolane is used as a stabilizer for 1,1,1,-trichloroethane, at a concentration of 0.5 percent. The remainder of 1,3-dioxolane is used as a reaction solvent in the production of several pharmaceuticals (Ferro Corp., 1982).

According to the National Occupational Hazard Survey, approximately 10,600 workers are potentially exposed to 1,3-dioxolane (NOHS, 1982). Persons exposed to 1,1,1-trichloroethane would also be exposed to 1,3-dioxolane, but at a much lower level. 1,1,1-Trichloroethane is used as a solvent for cleaning precision instruments and for metal degreasing; it is also used as a pesticide (Hawley, 1977). Although no information is available on the environmental release of 1,3-dioxolane, release would occur through the same routes as those for 1,1,1-trichloroethane; i.e., it is likely to be in wastewater discharges and atmospheric emissions where 1,3-dioxolane-stabilized 1,1,1-trichloroethane is found. The chemical was identified in the water at the junction of the San Jacinto and Trinity Rivers in Texas at a concentration of 1 μg/L (STORET, 1982).

B. *Chemical fate information.* No studies on the environmental transport

or persistence of 1,3-dioxolane were found. However, since the compound has a high vapor pressure and is water soluble, it will probably partition mainly into the atmosphere and in bodies of water. In the atmosphere, free radical oxidation is expected to be rapid. The time for the disappearance of 50 percent of the structural analog 1,4-dioxane by photodecomposition under simulated atmospheric conditions was found to be 3.4 hours, while that of the analog 1,3,5-trioxane was 4.7 hours (Dilling et al., 1976). In water, 1,3-dioxolane should not hydrolyze under environmental conditions. However, the chemical has the potential for photo-oxidation in natural waters where humic matter acts as a photosensitizer (Zepp and Baughman, 1978). 1,3-Dioxolane will also react with chlorine to form 2-chloroethyl formate (Jonas et al., 1968). The compound is not expected to bioconcentrate because of its water solubility and estimated low partition coefficient (Veith et al., 1980).

II. *Biological effectsof concern to human health*—A. *Short-term (acute) effects.* It has been reported that the oral LD_{50} of 1,3-dioxolane in rats is 3 g/k (Smyth et al., 1949); the dermal LD_{50} in rabbits is 8,480 mg/kg (RTECS, 1981); and the inhalational LC_{50} in mice is 34,320 ppm (Lomonova and Vinogradova, 1975). The chemical is an eye irritant to guinea pigs and rabbits (Sanderson, 1959; Smyth et al., 1949).

B. *Other effects.* Although inhalation studies with exposures of up to 50 days or 5 months have been conducted, insufficient data have been provided to enable an evaluation of the results (Lomonova and Vinogradova, 1975). No information was found on the carcinogenicity, mutagenicity, teratogenicity, embryotoxicity, or fetotoxicity of 1,3-dioxolane.

C. *Health effects recommendations.* Concern exists as to the possible human health effects of 1,3-dioxolane because of its potential for widespread exposure. Aside from acute effects data, insufficient information was found in the published literature on its toxicologic potential. A battery of short-term mutagenicity tests is recommended to ascertain the chemical's genotoxic potential. Chemical disposition and metabolism studies, preferably by the inhalation route, are recommended to determine the uptake, distribution, and excretion of the chemical and to identify its potential metabolites. Finally, a 90-day inhalation toxicity study with histopathology is recommended to evaluate the toxicologic potential of 1,3-dioxolane, particularly with respect to target organs. Upon completion of the recommended studies, all generated data should be evaluated along with other relevant information to determine whether additional testing should be performed.

III. *Environmental considerations.* 1,3-Dioxolane is not expected to persist, bioconcentrate, or present an acute hazard to the environment. Therefore, no environmental effects testing is recommended.

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2.2.d *4-(1,1,3,3-TETRAMETHYLBUTYL)PHENOL*

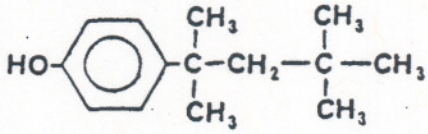
Summary of recommended studies. It is recommended that 4-(1,1,3,3-tetramethylbutyl)phenol be tested for the following:

A. Health Effects:
Short-term tests including mutagenicity.

B. Environmental Effects and Chemical Fate:
Acute and chronic toxicity to fish and aquatic invertebrates.
Toxicity to plants.
Bioconcentration.
Chemical fate.

Physical and Chemical Information

CAS Number: 140–66–9
Synonyms: 4-(Diisobutylphenol)
DIBP
p-tert-Octylphenol
Structural Formula:



Empirical Formula: $C_{14}H_{22}O$.
Molecular Weight: 206.
Melting Point: 81–84° C.
Boiling Point: 290° C.
Specific Gravity: 0.940 at 25° C.
Solubility: In water, slightly soluble; in organic solvents, soluble in tetrahydrofuran.
Log Octanol/Water.
Partition Coefficient: 3.7 (estimated; McLese et al., 1981).
Description of Chemical: White to light tan flakes, depending on purity.

Rationale for Recommendations

I. *Exposure information*—A. *Production and use information.* U.S. production of DIBP in 1977 was reported in the TSCA Inventory to be in excess of 12 million pounds (EPA, 1982). Based on the consumption of 30 million pounds of diisobutylene (CEH, 1980), a chemical feedstock for the production of DIBP, the 1978 production of DIBP has been estimated to be 55 million pounds.

The principal use of DIBP is in the manufacture of an oil-soluble, phenolic resin that goes into the production of varnishes, drying oils, and paints. This resin is also used in brake and clutch linings and special printing inks.

Another use of DIBP is in the production of a nonionic surfactant (detergents, wetting agents, oil emulsifiers, and textile scouring agents), and a sulfide of DIBP is used in vulcanized rubber, antiflex cracking agents, fungistats, and plasticizers.

DIBP has a potential for limited release from several processes. It can be released in aqueous waste streams during its manufacture or in the production of phenolic resins. DIBP can also be released in fugitive, gaseous emissions from condensers, vacuum lines, sample ports, and vents during manufacture (EPA, 1977). Finally, DIBP can be present as an impurity in manufactured oils, paints, varnishes, etc. For instance, the phenolic resin products can contain 1 percent unreacted phenol (NIOSH, 1978); based on similarities in chemical processes, DIBP would be expected to be present at similar concentrations in resins. The nonionic surfactants are also expected to contain small amounts of unreacted DIBP as an impurity (CTET, 1972a and 1972b).

Human exposure to DIBP by inhalation and skin absorption has been identified in the workplace of factories producing this substance (Hara and Nakajima, 1969; Malten et al., 1971).

B. *Chemical fate information.* DIBP is a relatively nonreactive, nonvolatile, and nonwater-soluble chemical (Schenectady Chemicals, Inc., 1981). It is expected to resist biodegradation because of its highly branched alkyl chain (Webley et al., 1959). DIBP apparently undergoes little degradation or sorption at sewage treatment plants or at drinking water treatment plants. For example, it was reported that water initially containing 400 μg/L DIBP was discharged after sewage treatment with a concentration of 200 μg/L (Sheldon and Hites, 1979), and water entering a water treatment plant in Philadelphia, Pennsylvania, was found to contain 0.4 μg/L DIBP, which was distributed in drinking water at 0.01 μg/L (Sheldon and Hites, 1978).

C. *Evidence for environmental exposure.* DIBP has been identified at a concentration of 5 mg/L in the wastewater of an industrial plant at River Mile 104 of the Delaware River (Sheldon and Hites, 1979).

NIOSH (1978) reported that concentrations of DIBP in the workplace air of a phenol resin plant were found to be less than 1 ppm. However, it was believed that workers were exposed to DIBP principally through the skin, which occurred in the plant's belt transport and bagging areas. This finding by NIOSH was corroborated by Ikeda et al. (1978).

II. *Biological effects of concern to human health*—A. *Acute toxicity.* In acute oral toxicity studies of DIBP, the estimated LD_{50} for mice was found to be 3,210 mg/kg (Kel'man et al., 1967) and, for rats, 2,160 mg/kg (Marhold, 1972) and 4,600 mg/kg (Kel'man et al., 1967). In rabbits, DIBP was found to be moderately irritating to the skin and severely irritating to the eyes (Marhold, 1972).

B. *Subchronic and chronic toxicity.* No studies on the subchronic and chronic effects of DIBP have been found.

C. *Mutagenicity, teratogenicity, and reproductive effects.* No studies on the mutagenicity, teratogenicity, or reproductive effects of DIBP have been found.

D. *Metabolism.* Williams (1959) reported that, in general, alkylated phenols were conjugated by sulfuric acid and glucuronic acid. Ikeda et al. (1978) found that these conjugates were excreted rapidly with a biologic half-life of about 4 hours. Since conjugation if DIBP would not appreciably increase its water solubility, the excretion of DIBP would be expected to be slower than that of simple alkylated phenols.

E. *Observations in humans.* Leukoderma (a depigmentation effect) has been reported following exposure to DIBP (Hara and Nakajima, 1969; Malten et al., 1971; Ikeda et al., 1970). However, the observations were somewhat obscured by the fact that DIBP was not the only alkylphenol that could have produced the effect. Whether or not the effects observed were due to DIBP or other alkylphenol compounds is not as important as the observed effects produced by other, more thoroughly studied substances of this family such as p-tert-butylphenol. Babanov and Chumakov (1966) reported that p-tert-butylphenol caused occupational vitiligo in nearly 15 percent of the workers employed for 2 years and in 40 percent of the workers employed for 2–13 years in resin production. Furthermore, Rodermund et al. (1975) reported that this butyl compound had produced liver and thyroid effects as well as general malaise in three workers. The systemic nature of the activity of p-tert-butylphenol suggests that the other members of the alkylphenol family that produce leukoderma would also produce systemic effects that have not been well defined in the worker population exposed to them.

F. *Other effects.* Skin papillomas were induced in mice receiving a single application of 9,10-dimethyl-1,2-benzanthracene (initiator) solution followed by twice-weekly applications of DIBP for 12 weeks (Boutwell and Bosch, 1959). In studies designed to elicit a depigmentation effect (leukoderma), mice were exposed to DIBP by oral, subcutaneous, and dermal routes of administration for periods of 2–7 months (Hara and Nakajima, 1969; Gellin et al., 1979); rabbits were exposed dermally for 20 weeks (Hara and Okumura, 1962 (unpublished), as cited in Malten et al., 1971); and guinea pigs were exposed orally and dermally for up to 10 months (Malten et al., 1971; Gellin et al., 1979). The leukodermal effect was observed, but no papillomas were produced. Neither the dose nor the length of time of administration was adequate to determine whether the substance could produce tumors or other toxic effects.

G. *Reasons for health effects recommendations.* The leukodermal action of DIBP indicates a profound effect on the biochemical and physiological processes in the dermal cells of several species. Thus, short-term tests, including mutagenicity, are recommended to investigate the toxicologic mechanisms of DIBP. The need for further testing will be determined by the results of these recommended studies.

III. *Environmental considerations*—A. *Short-term (acute) effects.* In acute toxicity studies, the 96-hour LC_{50} and the lethal threshold concentration of DIBP in the shrimp *Crangon septemspinosa* were found to be 1.1 and 1.0 mg/L, respectively (McLeese et al., 1981).

B. *Long-term subchronic/chronic effects.* No studies on the long-term effects of DIBP have been found for either aquatic animals or plants.

C. *Other effects (physiological/behavioral/ecosystem processes).* No studies on the physiological, behavioral, or ecosystem effects of DIBP have been found.

D. *Bioconcentration and food-chain transport.* Based on its estimated log P of 3.7 (McLeese et al., 1981), the bioconcentration factor for DIBP is calculated to be 331, which indicates a potential for bioconcentration.

E. *Reasons for environmental effects recommendations.* DIBP may enter aquatic systems through its uses in the production of resins and as an impurity in oils, paints, varnishes, etc. DIBP is expected to persist in the aquatic environment. It has been detected in the environment at 5 mg/L. This concentration exceeds the LC_{50} value of 1.1 mg/L for shrimp. Therefore, DIBP may present a risk to the aquatic environment. Studies of its acute and chronic toxicity to fish and aquatic invertebrates and its toxicity to plants are recommended because of the potential for exposure to the chemical and insufficient toxicity data.

Furthermore, DIBP is expected to bioconcentrate in aquatic organisms and may be transported through the food chain because of its relatively high estimated log octanol/water partition coefficient. For these reasons and the expected environmental exposure, it is recommended that DIBP be tested for bioconcentration.

Chemical fate testing is recommended to better characterize the transport, transformation, and persistence of DIBP in the aquatic environment.

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2.2.e *TRIS(2-Ethylhexyl) Trimellitate.*

Summary of recommended studies. It is recommended that tris(2-ethylhexyl) trimellitate be tested for the following:

A. Health Effects: Chemical disposition and metabolism.

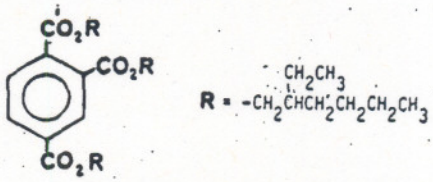
B. Environmental Effects and Chemical Fate:

Acute and chronic toxicity to fish and aquatic invertebrates
Toxicity to plants
Bioconcentration
Chemical fate

Physical and Chemical Information

CAS Number: 3319–31–1.

Structural Formula:



Empirical Formula: $C_{33}H_{54}O_6$.
Molecular Weight: 546
Melting Point: −35° C
Boiling Point: 278–284° C at 3 mmHg
Specific Gravity: 0.992
Log Octanol/Water Partition Coefficient: >6 (estimated; Leo et al., 1971)

Description of Chemical: Clear liquid with a mild odor

Rational for Recommendations

I. *Exposure information*—A. *Production/use/disposal information* U.S. production of tris(2-ethylhexyl) trimellitate was reported to be more than 2.2 million pounds in 1977 (EPA, 1982). The current annual U.S. production is estimated to be less than 15 million pounds (U.S. Steel Corp., 1982). The chemical is manufactured by reacting 2-ethylhexanol with trimellitic anhydride. The predominant use of tris(2-ethylhexyl) trimellitate is as a plasticizer for polyvinyl chloride (PVC) used to coat wire and cable for electrical applications. This use is based on the fact that the chemical does not bake out of PVC (Bell Laboratories, 1982). Tris(2-ethylhexyl) trimellitate has also been reported to have applications in pool liners, furniture, shower curtains, outerwear, infant pants, garden hose, vehicle seats, and weatherstripping (A.D. Little, Inc., 1982; Union Camp Corp., 1976). Like the phthalate esters, tris(2-ethylhexyl) trimellitate is extractable from PVC resins with oil and soapy water (Bell Laboratories, 1982).

The entire class of trimellitate ester plasticizers, which had a U.S. production volume of 26 million pounds in 1977 (CEH, 1979), accounts for 1 percent of the market of plasticizers for PVC. The trimellitates combine the processibility, compatibility, and water extraction resistance that are normally associated with the phthalate plasticizers. In addition, they provide the lower volatility typical of many of the lower weight polymeric plasticizers (Finney, 1981). It is expected that the applications of trimellitate esters will increase in the future because of their low volatility (Finney, 1981; Battelle, 1980).

No estimates of the number of workers exposed to tris(2-ethylhexyl) trimellitate were found. One manufacturer reports that the tris(2-ethylhexyl) trimellitate it manufactures is produced in a closed system with minimal exposure to employees and that three to four workers are required to operate the batch process (Ralston, 1982).

The same manufacturer reports that release of the chemical to the environment during production is minimal. Because of the chemical's low vapor pressure, no release to the atomsphere is expected. A small amount of product is disposed of in a filter cake sent to a landfill. Plant effluents are treated in an alkaline medium prior to

release. Since tris(2-ethylhexyl) trimellitate is degradable, it is expected that very little of the chemical is released in the plant effluent (Ralston, 1982). No additional information was found regarding the release of tris(2-ethylhexyl) trimellitate during production or use.

B. *Chemical fate information.* No studies on environmental transport or persistence of tris(2-ethylhexyl) trimellitate were found. However, the chemical is expected to behave similarly to the alkyl phthalates and thus to enter and persist in the aquatic environment.

No data were found on the quantity of tris(2-ethylhexyl) trimellitate that is likely to be released to the environment. However, data do exist concerning potential sources of release and environmental occurrences of the structurally analogous dialkyl phthalates, which are believed to have plasticizer use patterns similar to those anticipated for tris(2-ethylhexyl) trimellitate. It has been estimated that about 1.4–2.6 percent of the total volume of plasticizers used during processing operations is released in water effluents (A.D. Little, Inc., 1,979) Other data show that the phthalates also may be released from end-use plastic articles as a result of their use and disposal (Mathur, 1974; Versar, Inc., 1979). Regardless of where, in their manufacture, use, and disposal cycles at which dialkyl phthalates enter the environment, their environmental distribution appears to be ubiquitous; i.e., they have been found in air, bodies of water, biota (Peakall, 1975; Mayer et al., 1972; Giam et al., 1978a), and in soils and sediments (Jungclaus et al., 1978; Brownlee and Strachan, 1977; Giam et al., 1978b; Shartz et al. 1979).

Tris(2-ethylhexyl) trimellitate is predicted to have a low water solubility based on its structural relationship to the dialkyl phthalates, and its log octanol/water partition coefficient is estimated to be greater than 6 (Leo et al., 1971). This suggests that it will strongly sorb to sediments and soils. The fact that the dialkyl phthalates are readily sequestered in aquatic systems by organic residues and solid surfaces (Jungclaus et al., 1978; Brownlee and Strachan, 1977; Giam et al., 1978b; Morita et al., 1974; Schwartz et al., 1979) provides support for such sorption when tris(2-ethylhexyl) trimellitate is released to fresh or marine water. Significant portions of these soils ans sediments are expected to be anaerobic.

In anaerobic systems, tris(2-ethylhexyl) trimellitate is expected to biodegrade at a rate similar to that of long-chain dialkyl phthalates, which is over 30 days (Syracuse Research Corp., 1979; Johnson and Lulves, 1975; Saeger and Tucker, 1976). Further evidence for slow biodegradation rates of dialkyl phthalates is provided by monitoring studies showing that phthalates accumulate in monitoring showing that phthalates accumulate in sediments (Schwartz et al., 1979; Jungclaus et al., 1978).

II. *Biological effects of concern to human health*—A. *Short-term (acute) effects.* The oral LD_{50} of tris(2-ethylhexyl) trimellitate was found to be greater than 3,200 mg/kg in both rats and mice. The chemical has been shown to be slightly irritating in skin sensitivity tests in guinea pigs; however, there was no evidence of skin absorption in guinea pigs treated with 24 mg/kg of the compound. tris(2-ethylhexyl) trimellitate has also been shown to cause slight eye irritation in rabbits. In inhalation studies with the compound, three groups of rats were exposed for 6 hours to 210, 2,640, and 4,170 mg/m^3, respectively. The two higher doses produced severe irritation and were lethal to all animals, whereas the lowest dose produced only minor irritation and no deaths (Eastman Chemicals. 1982).

B. *Other effects.* No information was found on the mutagenicity, pharmacokinetics, carcinogenicity, or reproductive effects of tris(2-ethylhexyl) trimellitate. However, the structural analog di(2-ethylhexyl) phthalate (DEHP) has been demonstrated to induce hepatocellular carcinomas and adenomas in both sexes of Fischer-344 rats and $B_6C_3F_1$ mice (NTP, 1982b). DEHP, which appears to be rapidly eliminated form the body, is initially metabolized to mono(2-ethylhexyl) phthalate (MEHP) and 2-ethylhexanol (Kluwe, 1981).

Studies conducted to date suggest that DEHP is both teratogenic and fetotoxic in rats and mice (Singh et al., 1972; Nakamura et al., 1979; Shiota et al., 1980). Moreover, exposure of male rodents to DEHP produced testicular atrophy, seminiferous tubular degeneration, and possible infertility (Oishi and Hiraga, 1979; Kluwe, 1981).

DEHP was not found to be mutagenic in a Salmonella microsomal assay (NTP, 1981; Schad, 1981). It was weakly positive for induction of chromosomal aberrations and negative for induction of sister chromatid exchanges in cultured Chinese hamster ovary cells. It was also negative in the Drosophila sex-linked recessive lethal assay (NTP, 1981).

DEHP has been shown to induce hypolipidemia and hepatic peroxisomal proliferation in rats and mice (Reddy et al., 1976), which has led to the suggestion that these effects play a role in the chemical's observed carcinogenicity (Kluwe, 1982). In a chemical class study, DEHP, di(2-ethylhexyl) adipate (DEHA), di(2-ethylhexyl) sebacate, 2-ethylhexanol, 2-ethylhexanoic acid, and, to a lesser extent, 2-ethylhexyl aldehyde induced hypolipidemia and peroxisomal proliferation, whereas adipic acid, diethyl phthalate, hexanol, and hexanoic acid did not (Moody and Reddy, 1978). This suggests that the 2-ethylhexyl moiety may be important in inducing these effects. The toxic potential of the 2-ethylhexyl moiety is further suggested by the observed carcinogenicity of DEHA in mice (NTP, 1982a).

C. *Health effects recommendations.* Concern exists as to the possible human health effects of tris(2-ethylhexyl) trimellitate because of its structural relationship to DEHP, the presence of the 2-ethylhexyl moiety in the molecule, and projections as to its increasing usage.

Analogous to DEHP, tris(2-ethylhexyl) trimellitate would be expected to metabolize initially to 2-ethylhexanol and di(2-ethylhexyl) trimellitate in the intestine following oral administration with the free carboxylic acid, probably occurring in the four position. However, tris(2-ethylhexyl) trimellitate has a molecular weight of 546 as compared with a molecular weight of 390 for DEHP. Therefore, it is possible that the molecule will be too large to enter the bile salt micelles on which the enzyme that is responsible for catalyzing the hydrolysis of the ester linkage acts (Albro and Latimer, 1974). Moreover, because of its size, tris(2-ethylhexyl) trimellitate or its initial metabolite may be poorly absorbed from the intestine. Chemical disposition studies with identification of metabolites are necessary to determine if the compound undergoes metabolism in the intestine and if it or any potential metabolites are absorbed from the intestine. If the above-mentioned studies demonstrate the absorption and/or metabolism of tris(2-ethylhexyl) trimellitate, then additional studies should be undertaken to ascertain its potential for reproductive and subchronic effects including hepatic peroxisomal proliferation and hypolipidemia.

III. *Environmental considerations*—A. *Short-term (acute) effects.* No studies on the short-term effects of tris(2-ethylhexyl) trimellitate have been found. The structurally analogous DEHP is toxic to *Daphnia* and brine shrimp (Hirzy et al., 1978; Sugawara, 1974).

B. *Long-term (subchronic/chronic effects).* No studies on the long-term effects of tris(2-ethylhexyl) trimellitate

have been found. However, dialkyl phthalates have been found to be hazardous to aquatic invertebrates and fish at concentrations as low as 3 ug/L (Johnson et al., 1977; Mayer and Sanders, 1973; Mayer et al., 1977; Mehrle and Mayer, 1976).

C. *Other effects (physiological, behavioral, ecosystem processes).* No studies on the physiological, behavioral, or ecosystem effects of tris(2-ethylhexyl) trimellitate have been found.

D. *Bioconcentration and food-chain transport.* Tris(2-ethylhexyl) trimellitate is expected to have a large bioconcentration potential because of its relatively high estimated octanol/water partition coefficient and its structural similarity to dialkyl phthalates, which have bioconcentration factors as high as 107,000 (Metcalf et al., 1973; Mayer and Sanders, 1973; General Electric Co., 1978; Streufert, 1978; Sanborn et al., 1975).

E. *Reasons for environmental effects recommendations.* Tris(2-ethylhexyl) trimellitate is expected to be released and persist in the aquatic environment, especially in sediments. The potential problems that could result from accumulation of the chemical in sediments include: (1) toxic effects on benthic invertebrates (e.g., shellfish) that live on or in sediments; (2) bioaccumulation of the substances and, possibly, resultant toxic effects in fish (e.g., catfish) that feed off the sediments and the benthic invertebrates; and (3) resuspension of the sediments through natural (e.g., storms, changing currents) or human (e.g., dredging) activities, which would result in redistribution of tris(2-ethylhexyl) trimellitate in the aquatic environment. In addition to the above factors, sediments close to the surface (e.g., near coastal areas) are breeding grounds for commercial and game fish (Odum, 1971). This situation creates additional opportunities for contamination of the food chain and for manifestation of toxic effects in juvenile fish growing in such areas.

Chemical fate testing is recommended to better characterize the transformations and persistance of tris(2-ethylhexyl) trimellitate in the aquatic environment.

Available acute toxicity data do not appear to be adequate. Studies of its acute and chronic toxicity to fish and aquatic invertebrates are recommended because of the potential for exposure to the chemical and insufficient toxicity data.

Because of its relatively high estimated octanol/water partition coefficient, the chemical is expected to bioconcentrate in the fatty tissues of living organisms. This potential for bioconcentration also increases concern as to the effects of foodchain transport of the chemical. For these reasons and the expected environmental entry routes, it is recommended that testing be conducted to determine the bioconcentration of tris(2-ethylhexyl) trimellitate.

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2.3 *Chemical group recommended for priority consideration with supporting rationale.*

2.3a *Carbofuran Intermediates*

Summary of recommended studies. It is recommended that three carbofuran intermediates (identified below and in Table 1) be tested for the following:

A. Environmental Effects and Chemical Fate:

Acute toxicity to fish and aquatic invertebrates

Chemical fate with particular emphasis on monitoring studies.

Physical and Chemical Information

The physical and chemical properties of the following three carbofuran intermediates are shown in Table 7.

- Methallyl 2-nitrophenyl ether
- 7-Nitro-2,2-dimethyl-2,3-dihydrobenzofuran
- 7-Amino-2,2-dimethyl-2,3-dihydrobenzofuran.

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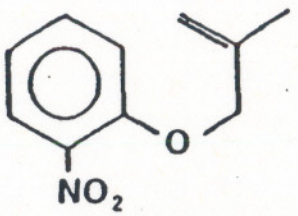
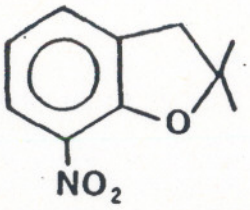
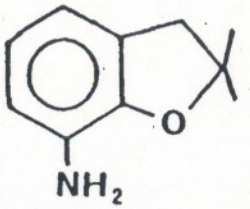
Table 7--Physical and Chemical Properties of Three Carbofuran Intermediates

Parameter	Methallyl 2-nitrophenyl ether	7-Nitro-2,2-dimethyl-2,3-dihydrobenzofuran	7-Amino-2,2-dimethyl-2,3 dihydrobenzofuran
CAS No.:	13414-54-5	13414-55-6	68298-46-4
Structural Formula:			
Synonym:	1-(2-Methyl-2-propenyl)oxy-2-nitrobenzene	N/A[a]	N/A[a]
Empirical Formula:	$C_{10}H_{11}NO_3$	$C_{10}H_{11}NO_3$	$C_{10}H_{13}NO$
Molecular Weight:	193	193	163
Log Octanol/Water Partition Coefficient[b]	2.0	1.9	0.9
Description:	Liquid	Solid melting at 65-67° C	Liquid

[a]No information available.
[b]Estimated according to the method of Leo et al. (1971).

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Rationale for Recommendations

I. *Exposure information*—A. *Production/use/disposal information.* U.S. production of each one of the three carbofuran intermediates was between 10 million and 50 million pounds in 1977 (EPA, 1982). These compounds are intermediates consumed onsite in the manufacture of carbofuran, a pesticide. However, these chemicals are released to the aquatic environment in wastewater; average wastewater volume is 1.4 million gallons per day and contains 0.5–1.5 mg/L of each of the three intermediates after treatment (Fekete, 1982a). According to the manufacturer of carbofuran, these wastes are scheduled to be treated by a metropolitan waste treatment plant after a hookup in late 1982 or early 1983. Additional wastes containing the three carbofuran intermediates are present in a sludge that is incinerated or placed in a hazardous waste landfill; as a result, the sludge could also be a source of environmental exposure for the three chemicals.

The sole manufacturer of carbofuran produces these intermediates in a closed system in a single plant; thus, the opportunity for occupational exposure is minimal (FMC, 1981).

B. *Chemical fate information.* No studies on the environmental transport or persistence of the three carbofuran intermediates were found. Although these compounds are expected to biodegrade, no data on biodegradation rates have been found.

II. *Biological effects of concern to human health.* The health effects of the three carbofuran intermediates are not well characterized. However, due to the lack of significant human exposure, no health effects testing is recommended.

III. *Environmental considerations*—A. *Short-term (acute) effects.* In screening experiments with goldfish, the 48- and 96-hour LC_{50} values for the three carbofuran intermediates ranged from 6.5 to 75 mg/L (Fekete, 1982b).

B. *Long-term (subchronic/chronic) effects.* No studies on the long-term effects of the three carbofuran intermediates have been found.

C. *Other effects (physiological/behavioral/ecosystem processes).* No Studies on the physiological, behavioral, or ecosystem effects of the three carbofuran intermediates have been found.

D. *Bioconcentration and food-chain transport.* Based on their estimated octanol/water partition coefficients (see Table 1), little bioconcentration is expected for the three carbofurans.

E. *Reasons for specific environmental recommendations.* The three designated carbofuran intermediates are released at a rate of 1.4 million gallons per day in an effluent containing 0.5–1.5 mg/L of each of these chemicals. LC_{50} values for goldfish are 6.5–75 mg/L. However, goldish are not normally considered a sensitive species, and other species of fish and invertebrates may have LC_{50} values at significantly lower concentrations. Thus, the three carbofuran intermediates are being released to the environment at concentrations that may exceed anticipated environmental effects levels.

Chemical fate testing, principally environmental monitoring, is needed to better characterize the nature of the dispersion, concentration, and persistence of the three carbofuran intermediates in the environment. Acute toxicity testing to fish and invertebrates is recommended to characterize more precisely the toxicity of these carbofuran intermediates.

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