

LIST OF ACRONYMS

AOC:	Area of Concern
ATSDR:	Agency for Toxic Substances and Disease Registry
BNS:	Great Lakes Binational Toxics Strategy
CAA:	Clean Air Act
CDC:	Center's for Disease Control and Prevention
CEC	North American Commission for Environmental Cooperation
CERCLA:	Comprehensive Environmental Response, Compensation, and Liability Act
CWA:	Clean Water Act
FAO:	UN Food and Agriculture Organization
FDA:	U.S. Food and Drug Administration
FIFRA:	Federal Insecticide, Fungicide, Rodenticide Act
FSIS:	Food Safety Inspection Service
GLNPO	Great Lakes National Program Office
GPRA	Government Performance and Results Act of 1993
IADN:	Integrated Atmospheric Deposition Network
IJC:	International Joint Commission
LRTAP	UNECE Long-Range Transboundary Air Pollution (LRTAP) protocol
MCL:	Maximum Contaminant Level (Drinking water standard)
NAFTA	North American Free Trade Agreement
NHANES	National Health and Nutrition Examination Surveys
NLFWA:	National Listing of Fish and Wildlife Advisories
NPL:	National Priority List (Superfund)
OAQPS:	EPA's Office of Air Quality Planning and Standards
OIA:	Office of International Activities
OPP:	EPA's Office of Pesticide Programs
OPPT:	EPA's Office of Pollution Prevention and Toxic Substances
OPPTS:	EPA's Office of Prevention, Pesticides and Toxic Substances
ORD:	EPA's Office of Research and Development
OSWER:	EPA's Office of Solid Waste and Emergency Response
OW:	EPA's Office of Water
PBT:	Persistent Bioaccumulative Toxic
POP:	Persistent Organic Pollutant
RCRA:	Resource Conservation and Recovery Act
SARA/EPCRA:	Superfund Amendment Reauthorization Act /Emergency Planning and Community Right-to-know Act
SDWA:	Safe Drinking Water Act
SMOC:	Sound Management of Chemicals Initiative
TCLP:	Toxicity Characteristic Leachate Procedure

TMDL: Total Maximum Daily Load
TRI: Toxic Release Inventory
TSCA: Toxic Substances Control Act
UNECE United Nations Economic Commission for Europe
UNEP United Nations Environment Program
USDA:U.S. Department of Agriculture

REFERENCES

- Anthony, R.G., A.K. Miles, J.A. Estes and F.B. Isaacs. 1999. Productivity, diets, and environmental contaminants in nesting bald eagles from the Aleutian Archipelago. *Environmental Toxicology and Chemistry*. 18(9): 2054-2062.
- Cohen, M. 1997. The Transport and Deposition of Persistent Toxic Substances to the Great Lakes: I. The Capability of Specific Persistent Toxic Substances to be Subjected to Long Range Atmospheric Transport. Final Draft Report to the International Joint Commission's International Air Quality Advisory Board, December 1997.
- De Vault, D.S., R. Hesselberg, P.W. Rodgers, and T.J. Feist. 1996. Contaminant trends in lake trout and walleye from the Laurentian Great Lakes. *J. Great Lakes Res.* 22(4): 884-895.
- FAO. 2000. United Nations Food and Agriculture Organization. Access (May, 2000): <http://www.fao.org/ag/agp/agpp/Pesticid/Disposal/default.htm>.
- FDA. 1998. Pesticide Program: Residue Monitoring 1998. Food and Drug Administration.
- Florida Department of Environmental Protection. 1996. Agricultural Mix/Load Site Assessment. Agricultural Source and Water Well Management Section.
- Greenpeace Research Laboratories. 2000. Recipe for Disaster: A review of persistent organic pollutants in food. (Authors: M. Allsopp, B. Erry, R. Stringer, P. Johnston, and D. Santillo). Department of Biological Sciences. University of Exeter, UK.
- Hillery, B.R. et al. 1998. Atmospheric deposition of toxic pollutants to the Great Lakes as measured by the Integrated Atmospheric Deposition Network. *Environmental Science and Technology*. 32(15): 2216-2221.
- Hoff, R.M. et al. 1996. Atmospheric Deposition of Toxic Chemicals to the Great Lakes: A Review of Data through 1994. *Atmospheric Environment*. 30(20): 3505-3527.
- IADN. 1998. Technical Summary of Progress under the Integrated Atmospheric Deposition Program 1990-1996. Integrated Atmospheric Deposition Network (IADN), U.S./Canada IADN Steering Committee.
- Illinois Department of Agriculture. 1993. Agricultural Facility Site Contamination Study. Per U.S. EPA Region 5, D. P. Macarus, 11/30/99.
- Lewis, R.G., Bond, A.E., Johnson, D.E., Hsu, J.P. 1988. Measurement of atmospheric concentrations of common household pesticides: a pilot study. *Environmental Monitoring Assessment*. 10: 59-73.

- NOAA. 1998. Chemical Contaminants in Oysters and Mussels, NOAA's State of the Coast Report. (T. O'Connor). National Oceanic and Atmospheric Administration. Silver Spring, MD. Access: http://state-of-coast.noaa.gov/bulletins/html/ccom_05/ccom.html.
- NYSDEC. 1997. Annual Report of the Wildlife Pathology Unit, Fiscal Year 1996/1997. New York State Department of Environmental Conservation. (Ward B. Stone). Delmar, NY.
- Pardio, V.T. et al.. 1998. DDT and Its Metabolites in Human Milk Collected in Veracruz City and Suburban Areas (Mexico). *Bulletin of Environmental Contamination and Toxicology*. 60: 852-857.
- Smith, D. 1999. Worldwide Trends in DDT Levels in Human Breast Milk. *International Journal of Epidemiology*. 28(2): 179-188.
- USDA. 1998. Pesticide Data Program: Annual Summary Calendar Year 1998. United States Department of Agriculture. Agricultural Marketing Service, Science & Technology.
- USDHHS. 1998. Toxicological Profile for Toxaphene. U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, Division of Toxicology/Toxicology Information Branch. Atlanta, GA.
- USEPA. 2000. Great Lakes Binational Toxics Strategy: The Level 1 Pesticides in the Binational Strategy (*The Great Lakes Pesticides Report*), Final Draft. U.S. Environmental Protection Agency. March 1, 2000 Final Draft.
- USEPA. 2000b. Analysis of Aged In-home Carpets to Determine the Distribution of Pesticide Residues and their Potential Availability for Human Exposure. Report No. EPA/600/R-00/030. Research Triangle Park: U.S. Environmental Protection Agency, National Exposure Research Laboratory, May 2000.
- USEPA. 1999a. Factsheet: Update - National Listing of Fish and Wildlife Advisories (EPA-823-F-99-005). U.S. Environmental Protection Agency, Office of Water. July, 1999
- USEPA. 1999b. December 1998 Update: National Listing of Fish and Wildlife Advisories (NLFWA). U.S. Environmental Protection Agency, September 1999. Access: <http://fish.rti.org/>.
- USEPA. 1998. Great Lakes Areas of Concern (website 5/27/98). U.S. Environmental Protection Agency. Access (1998): <http://www.epa.gov/glnpo/aoc>.

USEPA. 1997. Deposition of Air Pollutants to the Great Waters. Second Report to Congress. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC. 235 pp.

Whitmore, R.W., Immerman, F.W., Camann, D.E., Bond, A.E., Lewis, R.G., Schaum, J.L. 1994. Non-occupational exposure to pesticides for residents of two U.S. cities. Archives of Environmental Contamination and Toxicology 26: 47-59.

APPENDIX A
TEMPLATES OF SUPPORTING TABLES

LIST OF KEY CONTACTS

Name	Organization	Phone
Michael McDavit	USEPA/OPP	(703) 308-0325
Mark Wilhite	USEPA/OPP	(703) 308-8586
David Macarus	USEPA-Region 5/GLNPO	(312) 353-5814
Paul Matthai	USEPA/OPPT	(202) 260-3385

APPENDIX B CHEMICAL PROFILES

Information included in these profiles was primarily drawn from the following three sources:

U.S. Department of Health and Human Services, Public Health Service. 1999. Agency for Toxic Substances and Disease Registry Toxicological Profiles, CRC Press LLC.

U.S. Environmental Protection Agency. 2000. Great Lakes Binational Toxics Strategy: The Level 1 Pesticides in the Binational Strategy (*The Great Lakes Pesticides Report*), Final Draft. U.S. Environmental Protection Agency. March 1, 2000.

U.S. National Library of Medicine. 1999. Hazardous Substances Data Bank (HSDB), (August, 1999).

B.1 ALDRIN/DIELDRIN CHEMICAL PROFILE

Description

Aldrin and dieldrin are similar compounds which were both used for crop protection against various soil dwelling pests as well as for termite infestation. Both were produced in the U.S. until 1974; current manufacture and use have been discontinued. Dieldrin is a primary degradation product of aldrin.

Sources and Sectors

Known and suspected sources include:

- ! Atmospheric transport
- ! Contaminated soils from historical applications
- ! Contaminated building materials from termiticide application
- ! Hazardous waste sites associated with manufacture, transfer, or use

Exposure and Health Effects

Humans are exposed to aldrin and dieldrin through water, food, and soil. Contaminated fish are a main source of exposure through food. Both aldrin and dieldrin are fat-soluble and will accumulate in the bodies of humans and animals. Aldrin is converted to dieldrin in the human body, which is then slowly excreted. Detectable levels of dieldrin were found in more than 80 percent of breast milk samples collected from 1,436 women in the United States (Savage et al., 1981 as cited by ATSDR). Possible short-term health effects include headache, dizziness, nausea, vomiting, irritability, confusion, ataxia, and general malaise. Large doses can cause death. Long-term health effects of both aldrin and dieldrin can include adverse neurological and behavioral effects.

In addition, dieldrin is thought to cause reproductive problems and is considered an endocrine disruptor. Both aldrin and dieldrin are probable human carcinogens. Recent studies have linked elevated exposure to dieldrin with breast cancer. Concentrations of dieldrin in the waters of the Great Lakes exceed EPA Water Quality Criteria for carcinogenic effects in humans and may pose a potential carcinogenic risk to humans through consumption of fish from these waters.

Sensitive Subpopulations and Geographic Areas

Aldrin was used primarily in the northern Midwest and southeastern states. Dieldrin was used in western, southern, and northeastern states.

Environmental Impacts

Dieldrin has been detected in all environmental media. Aldrin detections are much lower and less frequent, since it is converted rapidly to dieldrin through both chemical and biological processes. Concentrations of dieldrin in surface waters are generally higher than those of many of the other highly persistent organochlorine pesticides, primarily due to its greater preference for the water phase, relative to other compounds in this class. Aldrin and dieldrin, however, still tend to accumulate in biological tissues and are primarily detected as dieldrin. Dieldrin concentrations in fish have exhibited a general pattern of decline in the Great Lakes since the 1970s. Dieldrin has been detected in many remote locations, including the Arctic, indicating long range atmospheric transport.

Short-term exposures to aldrin have been associated with a variety of behavioral and physical effects, including tremors, convulsions, and seizures. Dieldrin results in similar effects, including convulsions, ataxia, dyspnea, and immobility. Long-term effects of dieldrin in mammals may include reproductive effects such as reduced litter size, reduced ovulation rate, and increased resorption of pregnancy.

Current Regulations and Programs

Current regulations and programs targeting aldrin/dieldrin emissions are presented in Table 1.

Table 1. Current Regulations and Programs

	CAA	CWA	FIFRA	RCRA	SARA / EPCRA	CERCLA
Standards and Regulations	No specific regulations targeting releases to air	<p>§307/ CWA Priority: Listed as toxic and priority pollutants; subject to toxic pollutant effluent limitations (40CFR 129) which may be incorporated into any NPDES permit under §304(b) (40CFR 122) and/or general pretreatment (40CFR 403)</p> <p>§304(a) Federal Water Quality Standards for Human Health (water and organism: 0.13 ng/L (aldrin) and 0.14 ng/L (dieldrin))</p>	<p>1974 - All food crop pesticide uses canceled</p> <p>1988 - Tolerances revoked</p> <p>1989 - All remaining pesticide uses for dieldrin canceled</p> <p>1991 - All remaining pesticide uses for aldrin canceled</p>	<p>Subtitle C: Aldrin/dieldrin-containing substances are classified acute hazardous wastes (261.33); subject to hazardous waste regulations</p> <p>Universal treatment standards for aldrin/dieldrin levels in waste (40CFR 268.48)</p>	<p>§313: Releases of aldrin must be reported to TRI (40CFR 372.65)</p> <p>(Jan. 5, 1999 Federal Register proposed reduction of TRI reporting threshold for aldrin to 100 lbs. per year (64FR 687))</p>	<p>§103: Spills of aldrin or dieldrin >1 lb. must be reported to the National Response Center</p>
Standards and Regulations	Great Lakes Initiative 1995 and Great Lakes Water Quality Agreement, 1987 (concentrations in ng/L)					
			<u>Aldrin</u>	<u>Dieldrin</u>		
	Human Carcinogenic		NA	0.0006		
Human Noncarcinogenic		NA	0.41			
Aquatic Life						
Acute			NA	240		
Chronic			NA	56		
Wildlife			NA	NA		
Ambient Water Quality Criteria: AWQC (40CFR 131) (concentrations in ng/L)						
			<u>Aldrin</u>	<u>Dieldrin</u>		
Aquatic Life						
Freshwater			3000	1.9		
Saltwater			1300	1.9		
Human Health (water and organism)			0.13	0.14		
U.S. Food and Drug Administration Action Levels						
Fish-fillet			sum of aldrin and dieldrin <0.3 mg/kg wet wt.			

Table 1. Current Regulations and Programs

Policy and Programs	<ul style="list-style-type: none"> -- Binational Toxics Strategy (BNS) Level 1 substances - International Joint Commission (IJC) Critical Pollutants - Bioaccumulative Chemicals of Concern (BCC) under the Great Lakes Water Quality Guidance - Tier I chemicals under the Canada-Ontario Agreement - Recognized pollutants in Lakes Erie, Michigan, Ontario, and Superior Lakewide Management Plans (LaMPs) - Targeted in Remedial Action Plans (RAPs): effort by IJC, EPA and other groups to restore beneficial uses to Areas of Concern (AOCs) in the Great Lakes - Persistent Organic Pollutants (POP) by Commission for Environmental Cooperation (CEC) Council Resolution #95-5 - Included in the UN ECE Convention on Long-Range Transboundary Air Pollution (LRTAP) protocol - Included in the North American Free Trade Agreement Technical Working Group on Pesticides - Monitored by the Integrated Atmospheric Deposition Network (IADN) (dieldrin only) - Included in CAA §112(m) program, Atmospheric Deposition to Great Lakes and Coastal Waters - Found in a number of National Priorities List (NPL) hazardous waste sites - Included in the National Water Quality Assessment (NAWQA) Program (dieldrin only) - National Oceanic and Atmospheric Administration's (NOAA) Mussel Watch Program - Clean Sweeps Programs: Collection of remaining stores of aldrin/dieldrin
----------------------------	--

CAA: Clean Air Act

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act

CWA: Clean Water Act

FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

NPDES: National Pollutant Discharge Elimination System

RCRA: Resource Conservation and Recovery Act

SARA/EPCRA: Superfund Amendment Reauthorization Act / Emergency Planning and Community Right-to-know Act

TRI: Toxic Release Inventory

B.2 CHLORDANE CHEMICAL PROFILE

Description

Chlordane is a man-made pesticide sometimes referred to as Octachlor® or Velsicol 1068®. It was registered for use as a pesticide in the United States from 1948 to 1988, at which time pesticide uses were canceled due to concern over human cancer risk, evidence of human exposure and accumulation in body fat, environmental persistence, and danger to nonpest wildlife. Chlordane was originally used as a pesticide on field crops such as corn and citrus fruits and was later used to control termites in houses.

Chlordane is a thick, colorless to amber liquid with a mildly irritating smell. Technical chlordane is not a single chemical but a mixture of pure chlordane with more than 140 other related compounds.

Sources and Sectors

All uses of chlordane in the United States were canceled by 1988. The sole manufacturer voluntarily ceased production and export in 1997. Therefore, ongoing sources to the environment are associated with historical applications and releases.

Known or suspected sources include:

- ! Contaminated building materials from termiticide application
- ! Soils to which chlordane was historically applied
- ! Hazardous waste sites associated with manufacture, transfer or use

Exposure and Health Effects

A primary exposure route for chlordane is through contaminated food. Elevated concentrations of chlordane have been the cause of fish consumption advisories in many water bodies. Humans living in homes that were previously treated with chlordane to control termites may also be exposed.

Short-term acute exposure to chlordane may cause eye, nose, mouth and throat irritation, nausea, headaches, confusion, weakness, vision problems, diarrhea, abdominal pain, convulsions, unconsciousness and vomiting. Long-term exposure has been associated with liver and kidney damage, cancer and infertility. Chlordane has been classified as a probable human carcinogen based on studies in mice in which liver cancer was observed at concentrations of 30 to 64 mg/kg/day. Chlordane may also cause behavioral disorders in children who are exposed before birth or while being nursed.

Sensitive Subpopulations and Geographic Areas

Because chlordane was primarily used to control termites, concentrations of the chemical are highest in the southeast portion of the country where termite infestations are a serious problem. An estimated 19.5 million structures were treated with chlordane in the United States. Those living or working in these structures today may be at the greatest risk for exposure.

Environmental Impacts

Chlordane is found in all environmental media including air, soil, water, and sediment. In soils, it binds strongly to particles and is highly persistent, having been shown to remain for over 20 years. It is unlikely to enter groundwater, though it does volatilize from surface soils to some extent. Although the half-life of chlordane in the atmosphere is relatively short, it has been known to travel long distances and has been detected in remote locations such as the Arctic. Chlordane concentrations in air from homes that were previously treated for termite infestation have been found to be 10-1000 times higher than in ambient air, even years after treatment occurred.

In aquatic systems chlordane is typically bound to particles, although low levels of certain chlordane isomers have been detected in waters from the Great Lakes as well as urban harbors and bays. The ultimate fate of chlordane in lakes and oceans is in the bottom sediment. Chlordane also bioaccumulates in both marine and freshwater organisms. Long-term monitoring programs have indicated a decline of chlordane in fish from the mid-1970s through the early 1990s.

Chlordane has been demonstrated to be highly toxic to freshwater invertebrates, and fish. Chronic exposures to chlordane in the environment have been associated with a shortened lifespan, reproductive impairments, reduced fertility, and changes in the appearance or behavior of animals and birds. Chlordane has also been identified as an endocrine disruptor and may cause adverse reproductive or developmental effects.

Current Regulations and Programs

Current regulations and programs targeting chlordane emissions are presented in Table 1.

Table 1. Current Regulations and Programs

	CAA	CWA	FIFRA	RCRA	SARA / EPCRA	CERCLA	
Standards and Regulations	§112(b): Designated a HAP; subject to NESHAPS and compliance with MACT standards	CWA Priority: Listed as a priority pollutant (40CFR 423); subject to NPDES effluent limitations under §304(b) (40CFR 122) and general pretreatment (40CFR 403) §304(a) Federal Water Quality Standards for Human Health (water and organism): 0.21 ng/L	1978 – All use on food crops canceled 1988 – All sales and commercial use stopped	Subtitle C: Chlordane-containing substances are classified toxic hazardous wastes (261.33); subject to hazardous waste regulations and ground water monitoring requirements (40CFR 264) Universal treatment standards for chlordane levels in waste (40CFR 268.48)	§313: Releases must be reported to TRI (40CFR 372.65) (Jan. 5, 1999 Federal Register proposed reduction of TRI reporting threshold to 10 lbs. per year (64FR 687)) §302(a): Emergency planning required when present in quantities >1000 lbs. (40CFR 355)	§103: Spills of chlordane >1 lb. must be reported to the National Response Center	
	Great Lakes Initiative 1995 and Great Lakes Water Quality Agreement, 1987 (concentrations in ng/L)						
				Human Carcinogenic 0.25 Human Noncarcinogenic 1.4 Aquatic Life Acute NA Chronic NA Wildlife NA			
	Ambient Water Quality Criteria: AWQC (40CFR 131) (concentrations in ng/L)						
			Aquatic Life Freshwater 4.3 Saltwater 4 Human Health (water and organism) 0.21				
U.S. Food and Drug Administration Action Levels							
			Fish-fillet NA				

Table 1. Current Regulations and Programs

Policy and Programs	<ul style="list-style-type: none"> - Binational Toxics Strategy (BNS) Level 1 substance - Bioaccumulative Chemical of Concern (BCC) under the Great Lakes Water Quality Guidance - Tier 1 chemical under the Canada-Ontario Agreement - Recognized pollutant in Lakes Erie, Michigan, Ontario, and Superior Lakewide Management Plans (LaMPs) - Targeted in Remedial Action Plans (RAPs): Effort by IJC, EPA and other groups to restore beneficial uses to Areas of Concern (AOCs) in the Great Lakes - Persistent Organic Pollutant (POP) by Commission for Environmental Cooperation (CEC) Council Resolution #95-5 - in the UN ECE Convention on Long-Range Transboundary Air Pollution (LRTAP) protocol - North American Regional Action Plan developed under CEC's Sound Management of Chemicals Program - Included in the North American Free Trade Agreement Technical Working Group on Pesticides - Targeted chemical in the Great Lakes Regional Air Toxic Emissions Inventory Project - Included in the USEPA Cumulative Exposure Project - Monitored by the Integrated Atmospheric Deposition Network (IADN) - Included in CAA §112(m) program, Atmospheric Deposition to Great Lakes and Coastal Waters - Found in a number of National Priorities List (NPL) hazardous waste sites - Included in the National Water Quality Assessment (NAWQA) Program - Cause of fish consumption advisories in the Great Lakes region - National Oceanic and Atmospheric Administration's (NOAA) Mussel Watch Program - Council of Great Lakes Industry BNS Implementation: Search for information regarding the export, storage, and use of chemical intermediates of Level I pesticides - Clean Sweeps Programs: Collection of remaining stores of chlordane
---------------------	---

CAA: Clean Air Act

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act

CWA: Clean Water Act

FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

HAP: Hazardous Air Pollutant

MACT: Maximum Achievable Control Technology

NESHAPS: National Emissions Standards for Hazardous Air Pollutants

NPDES: National Pollutant Discharge Elimination System

RCRA: Resource Conservation and Recovery Act

SARA/EPCRA: Superfund Amendment Reauthorization Act / Emergency Planning and Community Right-to-know Act

TRI: Toxic Release Inventory

B.3 DDT CHEMICAL PROFILE

Description

DDT is a manufactured chemical widely used as a pesticide that does not occur naturally. DDT was one of the most commonly used chemicals for controlling insect pests on agricultural crops after 1945. It was also highly effective in controlling insects that carry such diseases as malaria and typhus. Under the authority of the EPA, all registrations of DDT have been canceled, prohibiting the use of this compound in the U.S. DDT is not currently manufactured in the U.S., although it is not illegal to do so. In other countries, the manufacture and use of DDT for agriculture and disease control programs continues.

Technical DDT is primarily composed of three forms: p,p'-DDT (85%), o,p'-DDT (15%), and o,o'-DDT (trace), all of which are white, crystalline, tasteless, and almost odorless solids. DDE and DDD, similar compounds which are also the breakdown products of DDT in the environment, are found in small amounts as contaminants in technical DDT.

Sources and Sectors

The primary sources of DDT and metabolites to the environment are volatilization to the atmosphere from past manufacture and application sites, and from current manufacture and use abroad.

Known or suspected sources include:

- ! Historical applications
- ! Atmospheric transport
- ! Hazardous waste sites associated with manufacture, transfer, or use
- ! Continued use of Dicofol pesticide (containing DDT impurity)

Exposure and Health Effects

The primary human exposure pathway for DDT is through ingestion of contaminated food or through inhalation. However, small amounts of DDT still present in soils throughout the U.S. as the result of historical applications may represent an additional exposure pathway. DDT is also present in small quantities (<0.1%) in Dicofol, a pesticide currently used in the U.S. and Canada. However, current Dicofol usage data indicates that DDT releases to the environment from this source are likely to be small.

Short-term health effects associated with DDT can include headaches, nausea, excitability, tremors, diarrhea, disturbed gait, seizures and convulsions. Prolonged and repeated exposure can irritate the eyes, skin, nose, and throat. Long-term health effects may include cancer, liver damage, and fertility problems. In the body, DDT is stored in fatty tissue and tends to leave the body very slowly with decreasing exposure. Nursing infants may be exposed to DDT through

breast milk. There is limited evidence that correlations may exist between maternal DDT blood levels and miscarriage in humans. However, the confounding effects of other organochlorine compounds make it impossible to positively attribute the effects to DDT. DDT has been classified by EPA as a probable human carcinogen.

Sensitive Subpopulations and Geographic Areas

Numerous hazardous waste sites throughout the U.S. associated with past manufacture, production, distribution, and disposal contain elevated levels of DDT. These sites can result in localized exposure. Elevated levels of DDT found in the air in Southwestern Michigan are currently being investigated, although the source has not been identified.

Environmental Impacts

Historically, DDT was released to the environment during its manufacture and use as an insecticide. DDT is very persistent in the environment. It has an extremely low solubility in water and therefore tends to bind to soils and sediments. Its persistence, combined with wind and water erosion and the resulting long range atmospheric transport, have made the compound virtually ubiquitous in the environment. DDE and DDD are the initial breakdown products of DDT in the soil environment. Both sister compounds are highly persistent and have chemical and physical properties similar to those of DDT.

DDT reaches surface waters primarily by runoff or atmospheric transport. The reported half-life for DDT in the water environment ranges from a few days for fast-moving environments (where the compound is at or near the surface of the water) to more than 150 years. The main degradation and loss pathways in the aquatic environment are volatilization, photo-degradation, adsorption to water-borne particulates, and uptake by aquatic organisms, which store DDT and DDT metabolites in their tissues. In the atmosphere, DDT can photooxidize to carbon dioxide and hydroxyl radicals. DDT is eventually broken down by sunlight or by microorganisms to form DDE or DDD. The presence of DDT (as opposed to DDE or DDD) in samples far from known sources, however, indicates that DDT's photo-degradation is slow under natural conditions. Both wet and dry deposition are significant mechanisms of removal from the air column.

Oral exposure to DDT is moderately to slightly toxic to mammals. Animal studies suggest that short-term exposure to DDT in food may have a harmful effect on reproduction. It is believed that the reproductive effects associated with DDT may be the result of a disruption in the endocrine system. One well documented example of the impact of DDT in birds was the decline in the bald eagle population, which was attributed to egg shell thinning associated with exposures to DDT and DDE. Long-term exposure in animals affects liver function, reproduction and behavior. Initial degradation products in mammalian systems are DDE and DDD, which are very readily stored in fatty tissues. DDT is also highly toxic to, and bioaccumulates in, aquatic organisms.

Current Regulations and Programs

Current regulations and programs targeting DDT emissions are presented in Table 1.

Table 1. Current Regulations and Programs							
	CAA	CWA	FIFRA	RCRA	SARA / EPCRA	CERCLA	
Standards and Regulations	No specific regulations targeting releases to air	§307 / CWA Priority: Listed as both a toxic and priority pollutant; subject to toxic pollutant effluent limitations (40CFR 129) which may be incorporated into any NPDES permit under §304(b) (40CFR 122) and/or general pretreatment (40CFR 403) §304(a) Federal Water Quality Standards for Human Health: 0.59 ng/L	1972 - All crop production and non-health uses canceled 1986 - Food and feed additives regulations and tolerances revoked 1989 - Remaining uses voluntarily canceled due to failure to renew registration	Subtitle C: DDT-containing substances are classified toxic hazardous wastes (261.33) subject to hazardous waste regulations Universal treatment standards for DDT levels in waste (40CFR 268.48)	§313: Reporting to TRI not required	§103: Spills of DDT >1 lb. must be reported to the National Response Center	
	Great Lakes Initiative 1995 and Great Lakes Water Quality Agreement, 1987 (concentrations in ng/L)						
		Human Carcinogenic		0.15			
		Human Noncarcinogenic		2			
		Aquatic Life					
	Acute		NA				
	Chronic		NA				
	Wildlife		0.011				
Ambient Water Quality Criteria: AWQC (40CFR 131) (concentrations in ng/L)							
	Aquatic Life						
	Freshwater		110.59				
	Saltwater						
	Human Health						
U.S. Food and Drug Administration Action Levels							
	Fish-fillet		5 mg/kg				

Table 1. Current Regulations and Programs

Policy and Programs	<ul style="list-style-type: none"> - Binational Toxics Strategy (BNS) Level 1 substance - International Joint Commission (IJC) Critical Pollutant - Bioaccumulative Chemical of Concern (BCC) under the Great Lakes Water Quality Guidance - Tier I chemical under the Canada-Ontario Agreement - Recognized pollutant in Lakes Erie, Michigan, Ontario, and Superior Lakewide Management Plans (LaMPs) - Targeted in Remedial Action Plans (RAPs): Effort by IJC, EPA and other groups to restore beneficial uses to Areas of Concern (AOCs) in the Great Lakes - Persistent Organic Pollutant (POP) by Commission for Environmental Cooperation (CEC) Council Resolution #95-5 - North American Regional Action Plan developed under CEC's Sound Management of Chemicals Program - Included in the North American Free Trade Agreement Technical Working Group on Pesticides - Monitored by the Integrated Atmospheric Deposition Network (IADN) - Included in CAA §112(m) program, Atmospheric Deposition to Great Lakes and Coastal Waters - Found in a number of National Priorities List (NPL) hazardous waste sites - Included in the National Water Quality Assessment (NAWQA) Program - National Oceanic and Atmospheric Administration's (NOAA) Mussel Watch Program - Council of Great Lakes Industry BNS Implementation: Search for information regarding the export, storage, and use of chemical intermediates of Level I pesticides - Clean Sweeps Programs: Collection of remaining stores of DDT
----------------------------	---

CAA: Clean Air Act
 CERCLA: Comprehensive Environmental Response,
 Compensation, and Liability Act
 CWA: Clean Water Act
 FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

NPDES: National Pollutant Discharge Elimination System
 RCRA: Resource Conservation and Recovery Act
 SARA/EPCRA: Superfund Amendment Reauthorization Act /
 Emergency Planning and Community Right-to-know Act
 TRI: Toxic Release Inventory