B.4 MIREX CHEMICAL PROFILE

Description

Mirex is a man-made chemical formerly used as a pesticide in the United States to control fire ants, especially in the southern United States. Because of its selectiveness and effectiveness against ants, mirex was also used to control ant populations in the western United States as well as in South America and South Africa. The other major use of mirex was as a flame retardant in plastics, rubber, paint, paper, and electrical goods from 1959 to 1972. As a flame retardant, mirex was marketed and sold under the trade name Dechlorane. Under the authority of USEPA, all pesticides uses of mirex were canceled in 1977, and it is no longer produced commercially in the U.S.

Mirex is a snow-white crystalline solid, odorless and fire resistant. In the environment it degrades to photomirex, when exposed to sunlight. Photomirex, like mirex, has harmful health effects. Mirex does not easily dissolve in water or evaporate into the air.

Sources and Sectors

Because mirex is not a naturally occurring chemical, all environmental contamination can be attributed to historical uses.

Known and suspected sources include:

- Hazardous waste sites associated with manufacture, transfer or use
- Historical applications as a pesticide
- Non-pesticide uses of products containing mirex (e.g., fireworks, automotive and electrical products containing the fire retardant Dechlorane)

Exposure and Health Effects

Humans may be exposed to mirex through skin contact, inhalation, and ingestion of contaminated food or water. In general, most current exposures occur through consumption of contaminated food, particularly fish. Mirex is not broken down in the body and very little is excreted in urine and feces. The majority of mirex ingested is transported into the bloodstream and accumulated in body fat. Once it is stored in body fat, it can take several weeks to months to leave the body. Mirex has been shown to enter breast milk from the bloodstream of nursing mothers.

Short-term exposures to mirex can result in trembling, tiredness, weakness, and diarrhea. Harmful effects associated with long-term exposures can include damage to the stomach, intestines, liver, kidneys, eyes, thyroid gland, nervous system, skin, and reproductive system. Mirex is also considered a probable carcinogen and may increase the chance of miscarriage in pregnant women.

Sensitive Subpopulations and Geographic Areas

Mirex was used as a pesticide in the southern and western U.S. Production and use as a fire retardant was documented to occur in the Eastern Great Lakes Basin (Ontario, Michigan, Ohio and New York).

Environmental Impacts

Mirex breaks down slowly in the environment and may persist for years in soil, aquatic sediment, and water. It has been found in soils throughout the U.S. as a result of historical applications, with a half life in soils of up to ten years. Mirex binds easily to soil and sediment particles and therefore is not found to any great extent in surface water or groundwater. Nor does it evaporate to any great extent from surface water or soil. Due to its hydrophobic nature and low vapor pressure, atmospheric transport is unlikely. Although mirex was detected in surface waters of Lakes Huron, Erie, and Ontario in the 1980s, recent monitoring programs in the Great Lakes have not detected measurable quantities of mirex in surface waters.

In aquatic systems, mirex tends to accumulate in sediments. In Lake Ontario and its tributaries, mirex has been measured at various depths in sediment cores, with peak concentrations corresponding to the mid-1960s, likely as the result of increased production and use during that time period. In addition, mirex is bioaccumulative and has been measured in aquatic and avian species.

Short-term exposures to elevated concentrations of mirex can result in weight loss and effects on liver function and reproduction in wildlife. At higher concentrations, it is lethal to fish and birds. Long-term ecological exposure may affect wildlife through impaired reproductive performance and liver function, and skin abnormalities. Mirex has also caused reduction of germination and emergence in several plant species. Mirex has a high bioconcentration factor, resulting in high concentrations in aquatic organisms.

Current Regulations and Programs

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

<table>
<tr><th colspan="7">Table 1. Current Regulations and Programs</th></tr>
<tr><td rowspan="5">Standards and Regulations</td><th>CAA</th><th>CWA</th><th>FIFRA</th><th>RCRA</th><th>SARA / EPCRA</th><th>CERCLA</th></tr>
<tr><td>No specific regulations targeting releases to air</td><td>No specific regulations targeting releases to water

§304(a) Federal Water Quality Standards for Human Health: existing, value not available</td><td>1977– All pesticide uses canceled</td><td>Mirex-containing substances are not subject to hazardous waste regulations or treatment standards</td><td>Reporting to TRI not required</td><td>No spill reporting requirements</td></tr>
<tr><td colspan="6">Great Lakes Initiative 1995 and Great Lakes Water Quality Agreement, 1987 (concentrations in ng/L)
Human Carcinogenic: NA
Human Noncarcinogenic: NA
Aquatic Life
Acute: NA
Chronic: NA
Wildlife: NA</td></tr>
<tr><td colspan="6">Ambient Water Quality Criteria: AWQC (40CFR 131) (concentrations in ng/L)
Aquatic Life
Freshwater: NA
Saltwater: NA
Human Health: NA</td></tr>
<tr><td colspan="6">U.S. Food and Drug Administration Action Levels
Fish-fillet: 0.1 mg/kg</td></tr>
<tr><td>Policy and Programs</td><td colspan="6">– 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 Lake Erie and Lake Ontario 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
– 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) (at some stations)
– Found in a few National Priorities List (NPL) hazardous waste sites
– National Oceanic and Atmospheric Administration’s (NOAA) Mussel Watch Program
– Clean Sweeps Programs: Collection of remaining stores of mirex</td></tr>
</table>

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.5 TOXAPHENE CHEMICAL PROFILE

Description

Toxaphene, one of the most widely-used pesticides in the U.S. from 1947 to 1980, is a man-made mixture of more than 670 chemicals. In its original form, it is a yellow to amber waxy solid that smells like turpentine. Toxaphene tends to evaporate when in solid form or when mixed with liquids and will not burn.

Toxaphene was primarily used in the southern states to control pests on cotton crops. It was also used to a lesser extent on other crops, livestock and poultry, and to remove unwanted fish stocks from lakes. In fact, toxaphene was one of the world's most widely used pesticides in the 1970s.

Sources and Sectors

Due to its persistence in the environment, much of the toxaphene currently found in the environment can be attributed to historical sources. Atmospheric transport is thought to be a significant source of toxaphene in many areas where it was not commonly applied as a pesticide.

Known and suspected sources include:

- Historical applications
- Atmospheric transport
- Hazardous waste sites associated with manufacture, transfer, or use

Exposure and Health Effects

Humans may be exposed to toxaphene through skin contact, inhalation, and ingestion of contaminated food or water. In general, most current exposures occur through either consumption of contaminated food or exposures to soils that were historically contaminated. In the body, toxaphene is rapidly broken down and removed through urine and feces within a few weeks. It has not been shown to accumulate in humans to any appreciable degree.

Short-term exposure to very high concentrations of toxaphene may result in restlessness, tremors, vomiting, diarrhea, convulsions, seizures, spasms, and hyperexcitability or death. Long-term health effects associated with concentrations more typically found in the environment can include liver and kidney damage, central nervous system effects, possible immune system suppression, and cancer. In addition, toxaphene has been classified by EPA as a probable human carcinogen based on animal studies of mammalian species exposed to chronic doses.

Sensitive Subpopulations and Geographic Areas

Toxaphene was primarily used in the southern U.S. for pest control. It was also used in the Great Lakes region for control of unwanted fish stocks in small inland lakes. Concentrations in these areas remain elevated.

Environmental Impacts

Toxaphene has been demonstrated to be present throughout the environment, including water, sediment, soil, biota, and air. Toxaphene is very persistent and will remain in surface soils anywhere from a few months to several years. Evaporation from surface soils may be a significant source of toxaphene to the atmosphere. Toxaphene can be transported unchanged in the atmosphere over long distances. It does not readily dissolve in water and, therefore, concentrations in surface water and groundwater are typically low. However, of surface water measurements from areas around the world, the highest concentrations were found in Lake Superior in the United States. Concentrations in soils and sediments are typically higher. In aquatic systems, toxaphene is typically found primarily in sediments due to its strong tendency to bind to particles. In Great Lakes sediments, concentrations as high as 45 ppb have been reported. The presence of this compound in recent samples is generally believed to be associated with past releases during its use as a pesticide. Toxaphene also bioaccumulates in the food chain, and elevated concentrations have been measured in aquatic species.

Acute exposures to toxaphene are typically lethal to mammalian, aquatic, and avian species. Chronic exposures to toxaphene have been associated with effects such as a shortened lifespan, reproductive problems, reduced fertility, and changes in appearance or behavior. In addition, damage to the liver, kidneys, adrenal glands and the immune system have been noted. Studies have also attributed cancer of the thyroid gland to toxaphene exposure. Birth defects have also been noted in fetuses exposed prenatally. There is also limited evidence that toxaphene may have some effects on the endocrine system at chronic doses.

Current Regulations and Programs

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

Table 1. Current Regulations and Programs

Standards and Regulations	CAA	CWA	FIFRA	RCRA	SARA / EPCRA	CERCLA
	§112(b): Designated a HAP; subject to NESHAPS and compliance with MACT standards	§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 (water and organism): 0.73 ng/L	1982 - Most uses canceled 1990 - Remaining pesticide uses canceled 1993 - Food tolerances revoked	Subtitle C: Toxaphene-containing substances are classified acute hazardous wastes (261.33); subject to hazardous waste regulations and ground water monitoring requirements (40CFR 264.94) Universal treatment standards for toxaphene 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))	§103: Spills of toxaphene >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	0.068
Human Noncarcinogenic	NA
Aquatic Life	
Acute	NA
Chronic	NA
Wildlife	NA

Ambient Water Quality Criteria: AWQC (40CFR 131) (concentrations in ng/L)

Aquatic Life	
Freshwater	220.73
Saltwater	
Human Health (water and organism)	

U.S. Food and Drug Administration Action Levels

Fish-fillet	5 mg/kg

Table 1. Current Regulations and Programs	
Policy and Programs	– 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 Lake 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 – 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) (at some stations) – 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 – Cause of fish consumption advisories in Lake Superior – Clean Sweeps Programs: Collection of remaining stores of toxaphene

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

APPENDIX C
SUPPORTING TABLES ON SUPERFUND SITES CONTAMINATED WITH PESTICIDES

Table 1: Superfund Sites* with Pesticides

This table Includes sites on the final NPL, excluding sites that are military installations or drum reconditioners. Also, only disposal areas that contained pesticides as a major type of contaminant were included. Sites are classified as pesticide manufacturers or pesticide formulators based on descriptions of the past operations. The assigned category doesn't always match the brief description in Table 1.

*sites are listed by state

State	Location	Site Name	Brief description
PESTICIDE MANUFACTURERS (also see Table 2 below)			
AL	Bucks	1. Stauffer Chemical Co.	Ag chem manufacturing facility, currently Zeneca, active manufacturing. Contamination: ponds, swamp, groundwater
AL	McIntosh	2. Ciba-Geigy Corp.	Ag chem manufacturing, including DDT, then other herbicides, insecticides and other chemicals. Contamination: shallow aquifer, deep aquifer and soil at 11 waste management areas. Look at other RODs
AL	Limestone/ Morgan Cos.	3. Triana/Tennessee River	DDT manufactured 1947-1970. Manufacturing, handling and disposal practices lead to discharge of DDT residues through drainage system into creek/ river system. Contaminated surface water and sediment.
AR	Jacksonville	4. Vertac, Inc.	Herbicide and pesticide manufacturing facility, including Agent Orange. Extensive on-site and off-site contamination, including dioxins, PCBs, pesticides, phenols, inorganics. Contamination: soil, sediment, sludge, debris
CA	Torrance	5. Montrose Chemical Co.	Operations included formulation, grinding, packaging, and distributing DDT. Contamination: on- and off-site soils, surface water, and sediments via storm water run-off and aerial emissions. (No ROD)
CO	Commerce City	6. Sand Creek Industrial Site	1960s, pesticide manufacturing operations began by the Colorado Organic Chemical Co. Fires in 1968 and 1977 and improper storage practices led to release of high levels of organophosphates, chlorinated hydrocarbons, and thermally altered pesticides. Contamination of soil, onsite buildings and tanks.
FL	Clermont	7. Tower Chemical Co.	Abandoned manufacturing facility; manufactured, formulated and stored various pesticides. Soil and ground water are contaminated with DDT, pesticides and metals.
GA	Fort Valley	8. Woolfolk Chemical Works, Inc.	Produce and package of organic and inorganic insecticides, including arsenic and lead-based products, DDT, lindane, and toxaphene. Contaminated buildings, soil, debris, ground water, and surface water.

State	Location	Site Name	Brief description
IL	Marshall	9. Velsicol Chemical Corp.	From 1930s-87, used for production of disposal practices for petroleum derivatives including resins, solvents, and pesticides, including chlordane manufacturing. Contaminated soil, sediments, and ground water.
MI	St. Louis (Gratiot County)	10. Velsicol Chemical Corp.	From 1936 until 1978, produced various chemical compounds and products including DDT . On-site (54 acres) groundwater and sediments in a river bordering the site are contaminated with DDT and other chlorinated compounds.
NJ	Franklin Twp.	11. Myers Property	Pesticides manufactured by several companies 1928-1959. Contaminated gw, soil, buildings, surface water, and wetlands.
NJ	Newark	12. Diamond Alkali	Used for chemical manufacturing by numerous companies for more than 100 years. Beginning in mid-1940s, began production of DDT and phenoxy herbicides. Primary contaminants of concern affecting soil, structures, gw and air include dioxin and DDT.
PA	Lock Haven	13. Drake Chemical	Site purchased in 1962 by Drake Chemical; manufactured small batches of intermediate chemicals for producers of dyes, pharmaceuticals, cosmetics, textiles and pesticides, including the herbicide Fenac, a major contaminant.
PA	State College	14. Centre County Kepone Site (Ruetgers-Nease Corp.)	Since 1958, produced a variety of organic chemicals, including intermediates used in the soap and detergent industry, metal plating, pharmaceuticals and ag chem industries. Major contaminants include kepone and mirex.
		PESTICIDE FORMULATORS	
AL	Montgomery	T.H. Agriculture & Nutrition	Sales, packaging, and storage facility for water treatment and plating chemicals; store and distribute agricultural and industrial chemicals, chemical blending and distributing.
CA	Arvin	Brown & Bryant, Inc.	Pesticide mixer and custom applicator facility. Contamination: former waste pond and a former sump area. Groundwater, surface and sub-surface soils.
CA	Richmond	United Heckathorn	No chemicals were manufactured. In the past, nearly all operations were DDT processing, including mixing, blending, grinding, and packaging. Contamination: DDT everywhere, soil, buildings, channels, canals, sediment, etc.

State	Location	Site Name	Brief description
CO	Commerce City	Woodbury Chemical Co.	Operated a pesticide manufacturing facility from late 1950s to 1965 when the facility was destroyed by fire. Fire rubble and debris contaminated with organochlorine pesticides were disposed on an adjacent empty lot, which is the designated site. Significant contamination is limited to the rubble piles, but also contaminated soils, sediment (on and off site), and gw.
FL	Orlando	Chevron Chemical Co. (Ortho Division)	Chevron Chemical Co. - chemical blending facility for pesticides and other crop sprays, including chlordane, lindane, dieldrin and aldrin. Also (1978-86), Central Florida Mack Trucks Service Center - overhauling truck engines, starters, generators and front/rear ends. Contaminated soil and ground water. (No ROD)
FL	Tampa	Helena Chemical Co.	From 1967-81, facility received bulk shipments of various agricultural chemicals that were then formulated into liquid fertilizers and nutritional products. Since 1981, used to store, repackage, and distribute liquid pesticides; formulate on a demand-basis. Pesticides and pesticide-constituents detected in on- and off-site ground water and soil. (No ROD)
FL	Tampa	Stauffer Chemical Co.	Manufactured pesticides from 1951-86, including chlordane, alpha-, beta-, and gamma-BHC, and toxaphene. These & other compounds have been detected in soil, ground water and/or air samples. (No ROD)
FL	Princeton	Woodbury Chemical	Pesticide formulator, toxaphene spill. Contaminated soil removed for off site disposal. Deleted from NPL in 1995.
GA	Albany	T.H. Agriculture & Nutrition	Since the 1950s, used as a formulation and packaging plant for agricultural chemicals. Contamination: buildings, debris, soil, ground water. GW clean-up standards for pesticides.
GA	Tifton	Marzone Inc./Chevron Chemical Co.	Pesticide formulating facility from 1950-83, then used for general storage and plant seedling distribution. Contaminated soil and ground water.
IA	Council Bluffs	Aidex Co.	Abandoned pesticide formulation facility. Contamination of soil and onsite ground water resulted from handling, storing and disposing of pesticide formulation process waste and post-firefighting operations. Significant concentrations of OPs, OCs, and triazines.
MO	Cape Girardeau	Kem-Pest Laboratories	Contamination resulted from the manufacture of pesticide products from 1965-77. Contamination: soil, sediment in drainage channels and ground water.

State	Location	Site Name	Brief description
NC	Aberdeen	Geigy Chemical Corp.	1947-67, site changed hands numerous times, but was always used for pesticide mixing and formulation, not manufacturing. 1985-89, used as pesticide and fertilizer distribution center. Soil and ground water contaminated with aldrin, dieldrin, toxaphene, DDD, DDE, and DDT. Specific clean-up levels for these.
NC	Statesville	Farmers Cooperative Exchanges (FCX)	1940-86, operated as an agricultural distribution center that formulated, repackaged, warehoused, and distributed farm chemicals (pesticides and fertilizers), and milled and sold field grains. 5,000-10,000 pounds of DDT, DDE and chlordane improperly disposed in trenches. Soil and gw. Specific clean-up levels for pesticides. (See other RODs)
NC	Washington	Farmers Cooperative Exchanges (FCX)	1945-85, used as a farm supply distribution center that repackaged and sold pesticides, herbicides, and tobacco-treating chemicals. Five source areas of contamination related to improper pesticide handling and disposal practices. Soil and gw. Specific clean-up levels for pesticides.
NJ	Edison Twp	Chemical Insecticide Corp.	1958-70 produced and stored pesticide formulations at the property resulting in soil, surface water and gw contamination. Wide variety of contaminants. Specific clean-up levels for DDT
SC	Fairfax	Helena Chemical Co.	Pre-1960 to 1978, used for the production of liquid and powdered insecticides. Site-related pesticides in the soils, sediment, debris, gw and surface water.
TN	Arlington	Arlington Blending & Packaging	1971-1978, formulated and packaged various pesticide and other chemical formulations. Contamination from spills and leaks soaking into soil and flooring and migration off site via surface runoff; also discharge of process water. Soil, debris and gw contamination.
UT	Salt Lake City	Wasatch Chemical	Active chemical production, storage and distribution facility. 1957-1986, used for production, packaging, storage and distribution of various chemical products, including industrial chemicals, acids, solvents, pesticides and fertilizers. Contaminated soil, sludge, and gw.
WA	Yakima	FMC Corp. (Yakima Pit)	Former pesticide formulation facility. 1951-1986, manufactured pesticide dusts and liquids. Contaminated soil and debris. Hot spots of DDT and other pesticides in the former disposal pit.

State	Location	Site Name	Brief description
OTHER TYPES OF FACILITIES			
AS	Taputimu	Taputimu Farm	(Pesticide storage) Taputimu Farm is a facility owned by the government of American Samoa and is the territory's primary repository of unused and out-dated agricultural chemicals and pesticides. Has plywood walls and corrugated metal roof.
GA	Brunswick	Hercules 009 Landfill	(Landfill) Permitted in 1975 for disposal of toxaphene-contaminated wastewater sludge from manufacturing. Six disposal cells (7 acres) estimated to contain 33,000 cubic yards of 1% toxaphene content (about 800,000 lbs of toxaphene). Contaminated soils on site.
IA	Hospers	Farmers' Mutual Coop	(Pesticide retail) Active grain storage facility. Since 1908, used site for purchasing and storing of grain and ag chemicals (pesticides and fertilizers); also grain fumigation. Contamination: shallow ground water. Treatment standards for some pesticides.
NC	Aberdeen	Aberdeen Pesticide Dumps	(Disposal area) Trenches contain about 12 million pounds of pesticide wastes. Contaminated soil and debris.
NE	Hastings	Hastings Ground Water Site	(Grain storage) Currently owned by Farmland Industries, who acquired property through a merger with Far-Mar-Co. Current and previous owners used various chemicals on-site for fumigation of stored grain. Soil and gw contaminated with carbon tet and EDB.
NY	Shelby	FMC Dublin Road	(Disposal area) 1933-68 used to dispose of coal ash, cinders, lab wastes, chemical and pesticide residuals, and building debris. FMC purchased site in 1974. Pesticide, organics, arsenic and lead contamination in soil, sediment, gw and surface water. Specific clean-up levels for pesticides.
PA	Harrison Twp	Lindane Dump	(Disposal area) Used for waste disposal from 1850-1980. Material disposed included lindane filter cake residuals and waste sulfuric acid containing DDT.
TN	Gallaway	Gallaway Ponds Site	(Disposal area) Low ridge that has been extensive mined for sand and gravel, producing a landscape doted with water-filled its up to 50 feet deep. Disposal of hazardous materials at the site for an undetermined period of time, including small glass bottles holding quality control samples from pesticide blending operations. Primary contaminants include pesticides, chlordane and toxaphene.

State	Location	Site Name	Brief description
TX	Crystal City	Crystal City Airport	(Aerial application) Site is a municipal airport. Several private aerial pesticide application companies conducted business there until 1982. Highly contaminated soil from pesticides left by companies no longer in operation. Major contaminants include DDT, toxaphene and arsenic.
WV	Near Leetown	Leetown Pesticide Site	(Mixing/loading sites) Three most contaminated areas are a former pesticide pile area (Miller Chemical Co.), the former Jefferson Orchard mixing area, and the former Crimm Orchard packing shed. Soil contaminated with unidentified pesticides.
WOOD TREATMENT FACILITIES			
CA	Weed	J. H. Baxter & Co.	Continues to be used for wood treatment operations and lumber product manufacturing. Contamination: soil, sediment, ground water and surface water.
FL	Gainesville	Cabot/Koppers	Inactive Cabot Carbon property - pine tar and charcoal generation. Currently operation Koppers portion of site has been wood preserving operation since 1916. Soil (on- and off-site) and ground water contamination.
IN	Indianapolis	Carter Lee Lumber Co.	Currently storage for a commercial lumber yard. 1940-1985, operated a small quantity batch-load wood preserving operation immediately off-site. EPA determined no threat to human health/environment.
LA	Slidell	Bayou Bonfouca	Abandoned creosote works facility; operated since 1904 under ownership of various creosote companies. Contaminated sediments, soil, and groundwater.
MD	Hollywood	Southern Maryland Wood Treating	1965-75, operated as a pressure treatment facility for wood preservation. Currently, part of site is a retail outlet for pretreated lumber and crab traps. Contaminated soil, surface water, sediments and debris.
NY	Sydney	GCL Tie and Treating	Site has been used for wood preserving; there was a release of about 30,000 gallons of creosote.
SC	Charleston	Koppers Co., Inc.	Used for wood treatment from 1940-1978 and a phosphate plant, followed by other operations including the cleaning, repair and refurbishing of military ships.
TN	Jackson	American Creosote Works	Early 1930s-1981, wood preserving operations using creosote and PCP. Contamination of sludges, site structures, debris and tanked liquids.
UT	Salt Lake City	Utah Power & Light/American Barrel	Inactive coal gasification and wood treating plant; assumed also a drum reconditioning facility. Creosote pole treating operations occurred 1927-1958. Pesticide contamination (other than creosote) from drum operations.

State	Location	Site Name	Brief description
VA	Richmond	Rentokil Virginia Wood Preserving Division	Former wood treating facility. 1957-1990 onsite wood treatment operations used products such as CPC, fuel oil, chromium zinc arsenate, copper chromated arsenate (CCA), fire retardant and xylene. Contaminated soil, sediment, debris, sludge, gw and surface water.
WA	Bainbridge Island	Wyckoff Co./Eagle Harbor	1903-1959 operated a shipyard resulting in releases of metals and organics. 1905-1988 wood treating operations conducted involving pressure treatment with creosote and PCP. Contamination of subtidal/intertidal sediment, soil and gw.

Table 2: Pesticide Manufacturing Facilities that are or were Superfund Sites

To the extent possible, the location, name, site description, primary contaminants, the extent of contamination (which media, buildings, debris, etc), and the selected treatment options are identified for each site.

1. Stauffer Chemical Co., Bucks, Alabama	
Site	- Active pesticide manufacturing facility; different owner/operator now. - Unknown quantity of sludges and solid wastes placed in two waste disposal sites until 1974.
Contamination	- Soil, ground water, ponds, swamp/wetlands, sediment, fish, sludges. - Thiocarbamates. - Mercury, carbon tetrachloride.
Clean-up Approach	Three long-term remedial phases: (1) Ground water: intercept and treatment system with surface water discharge. Treatment option(s) not specified, but thermal desorption and vapor extraction are under consideration. (2) Four solid waste management units: Maintain cap on two units; no further action required at one; bioremediation (design underway) on the other unit. (3) Swamp: dig up the areas of highest contamination and cap the area where the material is placed.
2. Ciba-Geigy Corp., McIntosh, Alabama	
Site	- Pesticide manufacturer. Originally produced DDT only, then added other pesticides and chemical products. - Wastes were managed on-site; there are 11 former disposal areas.
Contamination	- Soil, ground water, surface water, sediment, sludges. - DDT, lindane, and other pesticides. - Heavy metals including chromium and mercury. Volatile organic compounds (VOCs) including chlorobenzene, toluene, and phenols.
Clean-up Approach	Four long-term remedial phases: (1) Ground water: Pump, treat in plant's on-site biological wastewater treatment system, discharge into river. (2) Deep aquifer and soil: Excavate the soil and sludges from the 11 former disposal sites. Some will undergo on-site thermal treatment; some will undergo stabilization/solidification followed by placement in an on-site land vault. For areas deeper than 20 feet: in-situ soil flushing and bioremediation; and extraction wells. (3) Wetlands and dilute ditch: Excavate contaminated media, continue bioremediation and ecological studies; highly contaminated materials will be thermally treated on-site. (See #2.) (4) Bluff line: Excavate contaminated soil; Some will undergo on-site thermal treatment; some will undergo stabilization/solidification followed by placement in an on-site land vault.
3. Triana/Tennessee River, Limestone/Morgan Cos., Alabama	
Site	- Company manufactured DDT from 1947 to 1970; plant was closed and demolished in 1971. - Manufacturing, handling, and disposal practices led to discharge of DDT residues through the drainage system into the Tennessee River tributary system. - An estimated 475 tones of DDT residues accumulated in the sediment of the tributary system.
Contamination	- DDT.

Clean-up Approach	- Bypassing and burying on-site the most heavily contaminated channel area; continue fish, water, and sediment monitoring; isolate DDT from nearby population and environment.
4. Vertac, Inc., Jacksonville, Arkansas	
Site	- Several owners; produced 2,4,5-T from 1948-1979; produced Agent Orange in the 1960's; produced 2,4-D and 2,4.5-TP (Silvex) in the 1970's. - All manufacturing ceased in 1986. - Inadequate waste disposal methods and production controls, e.g., untreated wastewater discharged directly to creek and on-site landfills and burial areas.
Contamination	- Soil, ground water, sediment, fish, buildings, debris, drummed waste. - Dioxin. - 2,4-D; 2,4,5-T; herbicide production wastes. - Chlorinated benzene, chlorinated phenols.
Clean-up Approach	Four phases: (1) Off-site areas: Dewater and cap aeration basin and sludge drying beds; excavation and on-site landfilling of sludge, sediment, and soils from sewer line and off-site areas. (Completed 1997). (2) Above-ground components: Demolish buildings and equipment and dispose in on-site landfill. Off-site incineration of trash, pallets, and process vessel waste. (3) Soils, foundation, and underground utilities: Excavation and on-site landfilling of dioxin-contaminated soils. (Completed 1997). (4) Ground water: Extraction wells to eliminate eastward component of ground water flow; French drain to restrict westward movement; prohibit water supply wells in area. (All but water restrictions completed by 1998.)
5. Montrose Chemical Co., Torrance, California	
Site	- Manufactured DDT from 1947-1982. - On-site disposal for chemical raw materials, DDT and waste products; on-site settling and recycling pond. - Another Superfund site is immediately adjacent and ground water contamination from the two sites has merged.
Contamination	- Soil, ground water, surface water, sediments. - DDT and monochlorobenzene (raw material for making DDT).
Clean-up Approach	- In 1985, installed an asphalt cap over some of the contaminated soil. - Soil remedy depends on whether residents will be permanently relocated (i.e., on future land use) and ground water remedy. - Ground water: a joint feasibility study is being conducted by both Superfund sites.
6. Sand Creek Industrial Site, Commerce City, Colorado	
Site	- Delisted from National Priorities List in December 1996. - Colorado Organic Chemical Company (COC) is one of four known sources of contamination on the site. The others include an oil refinery, acid pits, and a landfill. - COC began manufacturing pesticides in the 1960's. - Fires in 1968 and 1977 and improper storage practices resulted in the release of high levels of contaminants.
Contamination	- Soil, ground water, and drummed waste. - Organophosphate pesticides, thermally-altered pesticides - Chlorinated hydrocarbons

Clean-up Approach	Several long-term phases: (1) Initial steps: removed waste drums and contaminated soil and fenced the COC facility. (Completed in 1984) (2) COC facility: removed tanks and drums containing pesticides and solvents and transported them to approved disposal facilities. Also placed a synthetic cap to prevent erosion and vapor emissions. (Completed in 1988). (3) Tanks and buildings: demolished the tanks and buildings and disposed at an approved facility. (Completed in 1990) (4) Soils: Surface soils were treated using Low Temperature Thermal Treatment (using activated carbon). Subsurface soils were treated using Soil Vapor Extraction. (Completed in 1990) (5) Landfill gas: Installed a methane gas extraction and treatment system in 1991 and 1992; operation will continue. (6) Ground water: Removed more than 20,000 pounds of liquid floating on the ground water in two localized areas. (Completed by 1995) Will monitory ground water semi-annually.
7. Tower Chemical Co., Clermont, Florida	
Site	- Abandoned pesticide manufacturing facility; manufactured, produced, and stored various pesticides from 1957 to 1981. - Discharged acidic wastewaters into an unlined percolation/evaporation pond; burned and buried wastes on-site; the wastewater pond overflowed into an adjacent swamp.
Contamination	- Soil, ground water, surface water, sediments, drummed waste. - DDT and other pesticides. - Copper and VOCs, including ethyl benzene.
Clean-up Approach	- Ground water: remove and treat approximately 100 million gallons and discharge to surface water; treatment method not specified. - Soil: excavate and incinerate about 9,000 cubic yards of soil. - Other: decontaminate storage tanks and concrete pads.
8. Woolfolk Chemical Works, Inc., Fort Valley, Georgia	
Site	- Throughout the site's history (several companies), the facility has been used for the production of organic and inorganic insecticides (including arsenic- and lead-based products) and other pesticides. During the 1950's, began to produce DDT, lindane, toxaphene, and other chlorinated organics. - Currently, there is an active pesticide formulator operating.
Contamination	- Soil, ground water, buildings. - Dioxin contamination is limited to a building and the soils beneath it. - Pesticides including chlordane, DDT, lindane, and toxaphene. - Heavy metals including lead and arsenic; VOCs and semi-volatiles.
Clean-up Approach	Four long-term remedial phases: (1) Ground water: pump and treat; treatment method is not specified. (2) Site redevelopment: try to redevelop a portion of the site; reuse some of the properties for a public library and other local organizations; no residential use or ground water use. (3) On-site areas: Evaluating remedy for four areas of concern. (4) Off-site areas: Clean and monitor eight homes where arsenic and lead were detected.
9. Velsicol Chemical Corp., Marshall, Illinois	

Site	- Pesticide and chemical manufacturing facility from mid-1930's to 1987, when operations ceased. - Produced chlordane from mid-1940's through 1987. - Wastes were disposed in on-site impoundments/ponds; accidental and intentional off-site releases of wastes.
Contamination	- Soil, ground water, ponds, sediment, fish. - Pesticides. - VOCs including benzene and cadmium.
Clean-up Approach	(1) Soil and sediments: Excavate, consolidate on-site, stabilize with cement and fly ash, and cap with clay. (Completed 1994) (2) Ground water: Construct ground water collection drain followed by either deep well injection or treatment with activated carbon prior to off-site discharge. (Treatment system built in 1994)
10. Velsicol Chemical in Gratiot County, St. Louis, Michigan	
Site	- Chemical and pesticide (DDT) manufacturing facility from 1936 until 1978
Contamination	- On-site groundwater and sediments in the Pine River (bordering the site on three sides) are contaminated with DDT and other chlorinated compounds. - Total DDT levels in the Pine River and the St. Louis Impoundment were extremely high and not decreasing over time (max. conc. = 32,000 ppm total DDT) - Original estimate of total DDT plus metabolites to be remediated (Fields analysis): 538,730 lbs
Clean-up Approach	- 54 Acre site: containment system consisting of a slurry wall around the site and a clay cap (water level requirements included) - In 1998 U.S. EPA signed an Action Memorandum for a time-critical removal action at the Site, including dredging/excavating sediments containing 3,000 ppm total DDT or greater (the hot spots), treatment of the sediments with a stabilizing/drying agent and disposal of the sediments off-Site. - Estimated quantity of DDT plus metabolites removed through 1999: 430,000 lbs
10. Myers Property, Franklin Township, New Jersey	
Site	- Former pesticide and industrial chemical manufacturing facility. - Site used intermittently by several companies from 1928 to 1959 to manufacture pesticides including DDT and industrial chemicals. - Improper handling of the chemicals and wastes resulted in on-site contamination.
Contamination	- Soil, ground water, wetland, surface water, buildings, debris, drummed waste. - Pesticides, including DDT. - VOCs, Semi-volatile organic compounds (SVOCs), metals including arsenic, and dioxins.
Clean-up Approach	(1) Buildings: dismantle and remove five buildings and various surface debris. (Completed in 1998) (2) Soils and sediments: Excavate and use a combination of low-temperature thermal treatment and chemical dechlorination for treating pesticides, dioxins, and other organics. Developing a plan to treat arsenic-containing soils because soil washing treatment was unsuccessful. (3) Ground water: pump and treat system will be designed once the area of contamination is more fully defined.
11. Diamond Alkali, Newark, New Jersey	
Site	- Pesticide manufactured from 1951 to 1969; began production of DDT and phenoxy herbicides in mid-1940's. - The way the site became contaminated is not specified.

Contamination	- Soil, ground water, sediments, debris. - Dioxin. - Pesticides, including DDT. - VOCs.
Clean-up Approach	(1) Immediate actions: property secured with a fence and guard service; cover exposed soils with geofabric; remove contaminated soil and debris from other properties and store on-site in shipping containers. (Completed) (2) Interim remedy: construct a slurry wall and flood wall around the area; install a cap; pump and treat ground water to reduce migration of contamination. Treatment method was not specified. (3) Long-term remedy: reevaluate remedy periodically; may modify to make more permanent and protective of human health and the environment.
12. Drake Chemical, Lock Haven, Pennsylvania	
Site	- From 1960's to 1981, manufactured chemical intermediates for pesticides and other organic chemicals. - Site includes two lined wastewater treatment lagoons and two unlined lagoons. - Chemical sludge and contaminated soils cover or underlay al of the open area on the site.
Contamination	- Soil, ground water, surface water, sediments, leachate stream. - Fenac (herbicide). - Organic compounds.
Clean-up Approach	- Leachate stream: reshape surface contours to manage water infiltration; seed area. (Completed in 1987) - Buildings, lagoons and other structures: removal to an approved facility. (Completed in 1989) - Soils and sediment: excavation and on-site incineration. - Ground water: pump and treat. Treatment method not specified.
13. Centre County Kepone Site (Ruetgers-Nease Corp), State College, Pennsylvania	
Site	- Active chemical manufacturing plant. - Produced Kepone (chlordecone) in 1958, 1959, and 1963 and Mirex (dodecachloropentacyclodecane) in 1973 and 1974. - Process wastes were disposed on-site in a spray irrigation field, a concrete lagoon, and two earthen lagoons and were stored on-site in drums. Concrete lagoon leaked.
Contamination	- Soil, ground water, surface water, sediments, fish. - Kepone and Mirex. - Various VOCs.
Clean-up Approach	(1) Initial actions: excavate and remove contaminated material from lagoons, remove drums, excavate topsoil from the drum storage area, dispose of the material in a landfill. (2) Long term remedy: extract and treat ground water (treatment method not specified); excavate soils and sediments and dispose off-site; surface water system improvements; monitor ground and surface water, sediments, and fish tissue; fencing.

APPENDIX D
ADDITIONAL INFORMATION ON THE MINNESOTA PESTICIDE COLLECTION PROGRAM

Summary of PBT Level 1 Pesticides Collected in Minnesota

Prepared by Nancy Fitz, USEPA, December 30, 1999

This document summarizes the data on the quantity of persistent, bioaccumulative and toxic (PBT) Level 1 pesticides collected at waste pesticide collection and disposal programs (a.k.a. "Clean Sweeps") in Minnesota from the late 1980's through 1998. The Level 1 PBT pesticides include aldrin, chlordane, DDT, dieldrin, mirex and toxaphene. This information was provided to the U.S. EPA Office of Pesticide Programs by Joe Spitzmueller of the Minnesota Department of Agriculture in May 1999.

Currently, Minnesota has the most comprehensive data in the U.S. on the quantities of specific pesticides collected by a state waste pesticide collection program. The Washington Department of Agriculture is compiling the historical data for its program, but this information is not available yet. Minnesota provided information on the quantity of 55 different pesticides collected per year from 1990 through 1998.[1] In addition, the amount of each pesticide collected before 1990 is also included. Tables 1 and 2 provide the information for the six Level 1 PBT pesticides.[2]

Table 1 provides the weight (in pounds) of each pesticide. DDT is the third most commonly collected pesticide in Minnesota and 52,653 pounds (over 26 tons) were collected through 1998. Chlordane (19,357 pounds) and toxaphene (15,519 pounds) are ranked 16 and 25, respectively. Aldrin (4195 pounds) and dieldrin (3142 pounds) were less common and are ranked 44 and 46, respectively. These data are presented in Figure 2. This figure shows that the amount of these pesticides – particularly DDT and chlordane – is increasing over time. While this is true, it's important to note that the total amount of pesticides collected each year in Minnesota is also increasing with time, as shown in Table 1 and Figure 1.

Therefore, it is also useful to consider the amount of each pesticide collected per year as represented by the percent of the total quantity of pesticides collected that year. This data provides a more accurate picture of the trends over time, since it is not dependent on the number of collection events held or the amount of money available to dispose of the pesticides. Table 2 provides the amount of each pesticide, in terms of the percent of the total amount of all pesticides, collected per year and overall. The overall percent is calculated using the total amount of that pesticide collected through 1998 and the total amount of all pesticides collected through 1998 (e.g., 52,653 pounds of DDT compared to 1,541,475 pounds of all pesticides). This data is presented in Figure 3. This figure shows that the amount of the Level 1 PBT pesticides – as a fraction of the total amount of pesticides collected – are generally decreasing over time.

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[1] If you would like the data on all 55 pesticides, please contact Nancy Fitz at 703-305-7385 or fitz.nancy@epa.gov.

[2] No data were reported for mirex.

Chlordane is a slight exception, since it shows a gradual increase over the past few years. Despite chlordane's upward trend from 1995 through 1998, however, only the 1998 value is greater than the overall percent.

Table 1: Amount of PBT Level 1 Pesticides (Pounds) Collected in Minnesota [1]

Rank	Pesticide	<1990	1990	1991	1992	1993	1994	1995	1996	1997	1998	Total
3	DDT	808	3,648	2,715	6,159	5,668	4,305	3,172	6,335	11,681	8,162	52,653
16	chlordane	888	614	260	562	1,686	6,422	1,055	1,073	2,241	4,556	19,357
25	toxaphene	1,005	1,886	190	2,216	2,105	3,490	900	1,332	1,395	1,000	15,519
44	aldrin	191	31	370	15	1,600	91	899	66	633	299	4,195
46	dieldrin	9	242	47	63	352	1,154	610	42	268	355	3,142
	All pesticides	32,396	34,098	35,751	53,843	135,104	183,568	237,261	208,220	308,701	312,533	1,541,475

Note: (1) No data were reported for mirex.

Table 2: Amount of PBT Level 1 Pesticides (Percent of Total) Collected in Minnesota [1]

Rank	Pesticide	<1990	1990	1991	1992	1993	1994	1995	1996	1997	1998	Total	Max	Min	Med
3	DDT	2.49	10.70	7.59	11.44	4.20	2.35	1.34	3.04	3.78	2.61	3.42	11.44	1.34	3.41
16	chlordane	2.74	1.80	0.73	1.04	1.25	3.50	0.44	0.52	0.73	1.46	1.26	3.50	0.44	1.15
25	toxaphene	3.10	5.53	0.53	4.12	1.56	1.90	0.38	0.64	0.45	0.32	1.01	5.53	0.32	1.10
44	aldrin	0.59	0.09	1.03	0.03	1.18	0.05	0.38	0.03	0.21	0.10	0.27	1.18	0.03	0.15
46	dieldrin	0.03	0.71	0.13	0.12	0.26	0.63	0.26	0.02	0.09	0.11	0.20	0.71	0.02	0.12

Note: (1) No data were reported for mirex.

Figure 1: Amount of All Pesticides Collected (Pounds) per Year in Minnesota

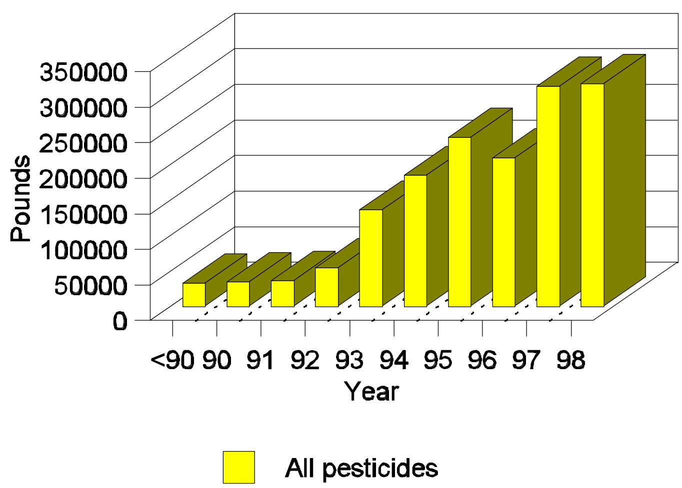


Figure 2. Amount of PBT Pesticides Collected (Pounds per Year in Minnesota

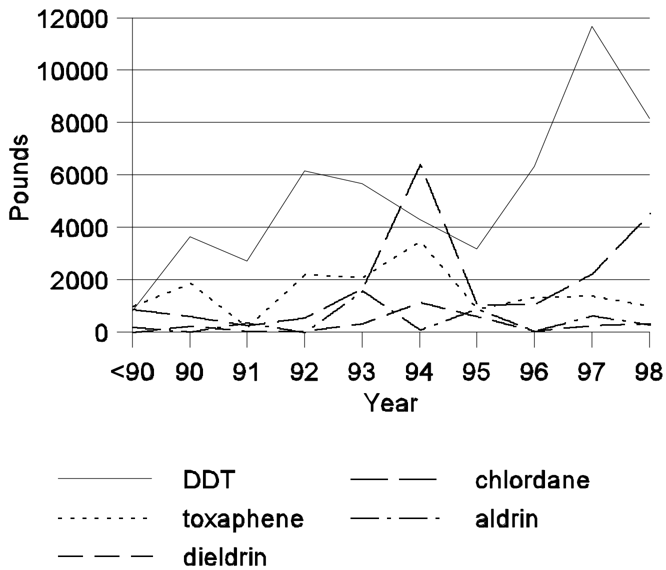
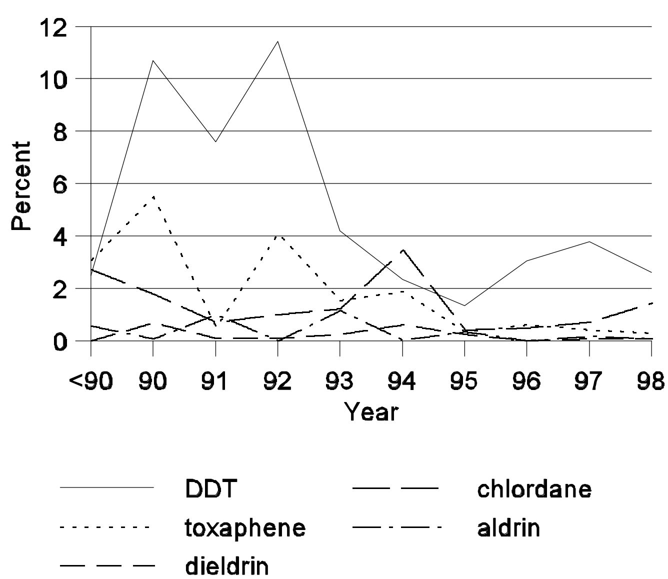


Figure 3. Amount of PBT Pesticides Collected (Percent of Total) per Year in Minnesota



APPENDIX E
RELEVANT GPRA GOALS

GPRA objectives in EPA's 1997 Five Year Strategic Plan are currently in the process of being revised in the Draft 2000 Strategic Plan; therefore, some of the goals relevant to the Level 1 pesticides listed below may change. Revised objectives in the Draft 2000 Strategic Plan are now undergoing external review separate for this Draft PBT Action Plan for the Level 1 pesticides.

Goal 2: Clean and Safe Water

- By 2005, protect human health so that 95% of the population served by community water systems will receive water that meets drinking water standards, consumption of contaminated fish and shellfish will be reduced, and exposure to microbial and other forms of contamination in waters used for recreation will be reduced;

Goal 4: Preventing Pollution and Reducing Risk

- By 2005, public and ecosystem risk from pesticides will be reduced through migration to lower-risk pesticides and pest management practices, improving education and at-risk workers, and forming "pesticide environmental stewardship" partnerships with pesticide user groups:

  - By 2005, human exposure to pesticide use will be reduced, including reducing (by 50% from 1995 levels) the number of workers suffering adverse health effects caused by acute pesticide poisoning; reducing (by 50% from 1995 levels) consumer and commercial use of pesticides with significant neurotoxic effects; providing all pesticide handlers, farm workers and applicators using pesticides adequate training in the safe handling, use and *disposal of pesticides [emphasis added]*; and reducing use (by 50% from 1995 levels) in the U.S. of pesticides with high potential to leach into and persist in groundwater. *[Note: While this goal and sub-objective deal with pesticides that are currently registered and used (unlike the Level 1 pesticides), the goal and sub-objective are included here because they include the GPRA connection to pesticide disposal. Because one of the actions of this plan is to support waste pesticide collection and disposal programs, this GPRA connection to pesticide disposal is included.]*

Goal 5: Better Waste Management and Restoration of Contaminated Waste Sites

- By 2005, EPA and its partners will reduce or control the risk to human health and the environment at over 375,000 contaminated Superfund, RCRA, UST and brownfield sites.

- By 2005, over 282,000 facilities will be managed according to the practices that prevent releases to the environment, and EPA and its partners will have the capabilities to successfully respond to all known emergencies to reduce the risk to human health and the environment.

- By 2005, 90% of existing hazardous waste management facilities will have approved controls in place to prevent dangerous releases to air, soil, and groundwater (compared to the universe baseline from 1996).

- By 2005, reduce hazardous waste combustion facility emissions of dioxins and furans by 90%, particulate matter by 50% and acid rain gases by 50% from levels emitted in 1994.

Goal 6: Reduction of Global and Cross-Border Environmental Risks

- By 2005, consistent with international obligations, the need for upward harmonization of regulatory systems, and expansion of toxics release reporting, reduce the risks to U.S. human health and ecosystems from selected toxics (including pesticides) that circulate in the environment at global and regional scales;

Goal 7: Expansion of Americans' Right to Know About their Environment

- By 2005, EPA will improve the ability of the public to reduce exposure to specific environmental and human health risks by making current, accurate substance-specific information widely and easily accessible.

    - By 2005, pesticide, TSCA, water and other environmental information and *tools* will be available to all communities and citizens, through the Internet, outreach efforts, and consumer confidence reports, to help them make informed choices about their local environment, including where to live and work, and what potential exposures are acceptable; and to assess the general environmental health of themselves and their families.

Goal 8: Sound Science, and Greater Innovation to Address Environmental Problems

- Incorporate innovative approaches to environmental management into EPA programs, so that EPA and external partners achieve greater and more cost-effective public health and environmental protection;

Goal 9: A Credible Deterrent to Pollution and Greater Compliance with the Law

- Promote the regulated communities' voluntary compliance with environmental requirements through compliance incentives and assistance programs.