
A. Tittabawassee River System Assessment Area Biota Lists

Table A.1. Fish sampled in the TRSAA

Common name (species)	Tittabawassee and Saginaw rivers	Saginaw Bay	TRSAA tributaries
Alewife (<i>Dorosoma cepedianum</i>)	x	x	
Black bullhead (<i>Ameiurus melas</i>)		x	x
Black crappie (<i>Pomoxis nigromaculatus</i>)	x	x	x
Blacknose dace (<i>Rhinichthys atratus</i>)			x
Blackside darter (<i>Percina maculata</i>)			x
Bluegill (<i>Lepomis macrochirus</i>)		x	x
Bowfin (<i>Amia calva</i>) ^a			x
Brook stickleback (<i>Culaea inconstans</i>)			x
Burbot (<i>Lota lota</i>)		x	
Carp (<i>Cyprinus carpio</i>) ^a	x	x	x
Channel catfish (<i>Ictalurus punctatus</i>)	x	x	
Chinook salmon (<i>Oncorhynchus tshawytscha</i>) ^a	x	x	
Common shiner (<i>Notropis cornutus</i>)			x
Emerald shiner (<i>Notropis atherinoides</i>)	x	x	x
Fathead minnow (<i>Pimephales promelas</i>)			x
Freshwater drum (<i>Aplodinotus grunniens</i>)	x	x	
Gizzard shad (<i>Dorosoma cepedianum</i>)	x	x	x
Golden shiner (<i>Notemigonus crysoleucas</i>)			x
Goldfish (<i>Carassius auratus</i>) ^a		x	x
Green sunfish (<i>Lepomis cyanellus</i>)			x
Hog sucker (<i>Hypentelium nigricans</i>)			x
Hornyhead chub (<i>Hybopsis biguttata</i>)			x
Johnny darter (<i>Etheostoma nigrum</i>)		x	
Lake herring (<i>Coregonus artedii</i>)	x	x	
Lake sturgeon (<i>Acipenser fulvescens</i>)	x	x	
Lake trout (<i>Salvelinus namaycush</i>)	x	x	
Lake whitefish (<i>Coregonus clupeaformis</i>)		x	
Largemouth bass (<i>Micropterus salmoides</i>)	x	x	x
Logperch darter (<i>Percina caprodes</i>)	x		
Longear sunfish (<i>Lepomis megalotis</i>)			x

Table A.1. Fish sampled in the TRSAA (cont.)

Common name (species)	Tittabawassee and Saginaw rivers	Saginaw Bay	TRSAA tributaries
Longnose sucker (<i>Catostomus catostomus</i>)			X
Northern pike (<i>Esox lucius</i>)	X	X	X
Northern redhorse (<i>Moxostoma aureolum</i>)			X
Orangespotted sunfish (<i>Lepomis humilis</i>)			X
Pumpkinseed (<i>Lepomis gibbosus</i>)	X	X	X
Quillback (<i>Carpionodes cyprinus</i>)	X	X	X
Rockbass (<i>Ambloplites rupestris</i>)	X		X
Rosy-face shiner (<i>Notropis rubellus</i>)	X		
Round whitefish (<i>Prosopium cylindraceum</i>)		X	
Sculpin (<i>Cottus</i> spp.)		X	
Sea lamprey (<i>Petromyzon marinus</i>) ^a	X		
Shad (<i>Dorosoma cepedianum</i>)	X		
Smallmouth bass (<i>Micropterus dolomieu</i>)	X	X	X
Smelt (<i>Osmerus mordax</i>) ^a		X	
Spotfin shiner (<i>Cyprinella spiloptera</i>)	X		
Spottail shiner (<i>Notropis hudsonius</i>)	X	X	X
Spotted sucker (<i>Minytrema melanops</i>)			X
Steelhead (<i>Oncorhynchus mykiss</i>) ^a	X	X	
Stonecat (<i>Noturus flavus</i>)			X
Trout perch (<i>Percopsis omiscomaycus</i>)		X	
Walleye (<i>Sander vitreus vitreus</i>)	X	X	
Warmouth (<i>Lepomis gulosus</i>)			X
White bass (<i>Morone chrysops</i>)	X	X	
White crappie (<i>Pomoxis annularis</i>)	X	X	X
White perch (<i>Morone americana</i>) ^a		X	
White sucker (<i>Catostomus commersonii</i>)	X	X	X
Yellow bullhead (<i>Ameiurus natalis</i>)			X
Yellow perch (<i>Perca flavescens</i>)	X	X	X

a. Species not native to the region.

Sources: Zillich, 1972; Batchelder, 1973; Dow Chemical, 1987; MDNR, 1990b, 1991d, 1994b, 1994e; PSC, 2002; Zollweg and Hill, 2002; Galbraith Environmental Services, 2003.

Table A.2. Vegetation common to northern mesic forests and wetlands

Ecosystem/species	Vegetation type
Northern mesic forest	
Alternate-leaved dogwood (<i>Cornus alternifolia</i>)	Shrub
Beaked hazelnut (<i>Corylus cornuta</i>)	Shrub
Canada yew (<i>Taxus canadensis</i>)	Shrub
Maple-leaf viburnum (<i>Viburnum acerifolium</i>)	Shrub
Mountain maple (<i>Acer spicatum</i>)	Shrub
Red elderberry (<i>Sambucus pubens</i>)	Shrub
Striped maple (<i>Acer pennsylvanicum</i>)	Shrub
Baneberry (<i>Actaea</i> spp.)	Herbaceous plant
Beech drops (<i>Epifagus virginiana</i>)	Herbaceous plant
Bunchberry (<i>Cornus canadensis</i>)	Herbaceous plant
Coral root (<i>Corallorhiza</i> spp.)	Herbaceous plant
Hairy Solomon's-seal (<i>Polygonatum pubescens</i>)	Herbaceous plant
Indian pipe (<i>Monotropa</i> spp.)	Herbaceous plant
Jack-in-the-pulpit (<i>Arisaema triphyllum</i>)	Herbaceous plant
Sedges (<i>Carex</i> spp.)	Herbaceous plant
Starflower (<i>Trientalis borealis</i>)	Herbaceous plant
Trillium (<i>Trillium</i> spp.)	Herbaceous plant
American basswood (<i>Tilia americana</i>)	Tree
American beech (<i>Fagus grandifolia</i>)	Tree
American elm (<i>Ulmus americana</i>)	Tree
Balsam fir (<i>Abies balsamea</i>)	Tree
Eastern hemlock (<i>Tsuga canadensis</i>)	Tree
Ironwood or hop-hornbeam (<i>Ostrya virginiana</i>)	Tree
Paper or white birch (<i>Betula papyrifera</i>)	Tree
Red maple (<i>Acer rubrum</i>)	Tree
Red oak (<i>Quercus rubra</i>)	Tree
Sugar maple (<i>Acer saccharum</i>)	Tree
White ash (<i>Fraxinus americana</i>)	Tree
White cedar (<i>Thuja occidentalis</i>)	Tree
White pine (<i>Pinus strobus</i>)	Tree
Yellow birch (<i>Betula alleghaniensis</i>)	Tree

Table A.2. Vegetation common to northern mesic forests and wetlands (cont.)

Ecosystem/species	Vegetation type
Wet prairie	
Big blue stem (<i>Andropogon gerardii</i>)	Grass
Blue joint grass (<i>Calamagrostis canadensis</i>)	Grass
Cord grass (<i>Spartina</i> spp.)	Grass
Indian grass (<i>Sorghastrum nutans</i>)	Grass
Bulrushes (Family Typhaceae)	Herbaceous plant
Reed grass (<i>Phragmites</i> spp.)	Herbaceous plant
Rushes (Family Juncaceae)	Herbaceous plant
Sedges (<i>Cyperaceae</i> spp.)	Herbaceous plant
Willows (<i>Salix</i> spp.)	Shrub or tree
American elm (<i>Ulmus americana</i>)	Tree
Black ash (<i>Fraxinus nigra</i>)	Tree
Black oak (<i>Quercus velutina</i>)	Tree
Box elder (<i>Acer negundo</i>)	Tree
Eastern hemlock (<i>Tsuga canadensis</i>)	Tree
Quaking aspen (<i>Populus tremuloides</i>)	Tree
Red maple (<i>Acer rubrum</i>)	Tree
Tamarack (<i>Larix laricina</i>)	Tree
White oak (<i>Quercus alba</i>)	Tree
Lowland conifer swamp	
Black ash (<i>Fraxinus nigra</i>)	Tree
Black maple (<i>Acer nigra</i>)	Tree
Black willow (<i>Salix nigra</i>)	Tree
Butternut (<i>Juglans cinerea</i>)	Tree
Eastern hemlock (<i>Tsuga canadensis</i>)	Tree
Elm (<i>Ulmus</i> spp.)	Tree
Green ash (<i>Fraxinus pennsylvanica</i>)	Tree
Ohio buckeye (<i>Aesculus glabra</i>)	Tree
Sugar maple (<i>Acer saccharum</i>)	Tree
Tamarack (<i>Larix laricina</i>)	Tree
White pine (<i>Pinus strobes</i>)	Tree
White poplar (<i>Populus alba</i>)	Tree
Sources: Albert, 1995; MSU, 2008.	

Table A.3. Bird, reptile, amphibian, and mammal species common to the TRSAA^a

Birds

American robin (*Turdus migratorius*)
Baltimore oriole (*Icterus galbula*)
Bank swallow (*Riparia riparia*)
Belted kingfisher (*Megaceryle alcyon*)
Blue jay (*Cyanocitta cristata*)
Great blue heron (*Ardea herodias*)
Great horned owl (*Bubo virginianus*)
Mallard duck (*Anas platyrhynchos*)
Red tail hawk (*Buteo jamaicensis*)
Spotted sandpiper (*Actitis macularia*)
Turkey vulture (*Cathartes aura*)

Reptiles and amphibians

Blue racer (*Coluber constrictor foxi*)
Blue-spotted salamander (*Ambystoma laterale*)
Bullfrog (*Rana catesbeiana*)
Common map turtle (*Graptemys geographica*)
Common musk turtle (*Sternotherus odoratus*)
Common snapping turtle (*Chelydra serpentina*)
Eastern american toad (*Bufo americanus*)
Eastern box turtle (*Terrapene carolina carolina*)
Eastern hog-nosed snake (*Heterodon platirhinos*)
Eastern milk snake (*Lampropeltis triangulum triangulum*)
Northern spring peeper (*Pseudacris crucifer*)
Painted turtle (*Chrysemys picta*)
Red-backed salamander (*Plethodon cinereus*)
Red-eared slider (*Trachemys scripta elegans*)
Spiny soft-shell turtle (*Apalone spinifera spinifera*)
Spotted turtle (*Clemmys guttata*)
Western chorus frog (*Pseudacris triseriata triseriata*)
Wood frog (*Rana sylvatica*)

Table A.3. Bird, reptile, amphibian, and mammal species common to the TRSAA^a (cont.)

Mammals

Beaver (*Castor canadensis*)

Ground hog (*Marmota monax*)

Meadow jumping mouse (*Zapus hudsonius*)

Mink (*Mustela vison*)

Muskrat (*Ondatra zibethica*)

Raccoon (*Procyon lotor*)

Short-tailed shrew (*Blarina brevicauda*)

White footed mouse (*Peromyscus leucopus*)

a. These species are in addition to those mentioned in the text.

B. Chemicals Produced by Dow

Table B.1. Dow products^a 1897-1917

Year	Product	Description	Reference
1897	Potassium bromide	Many industrial applications	Karpiuk, 1984; Dow Chemical, 2007c
1897	Bleaching powder (calcium hypochlorite)	Used primarily in the paper and linen industry	Stock and Orna, 1989; ATS, 2006b
1897	Zinc chloride (byproduct of bleach powder production)	Many industrial applications	Karpiuk, 1984; Stock and Orna, 1989
1903	Chloroform	Solvent, anesthetic	ATS, 2006b
1903	Carbon tetrachloride	Fire extinguisher, starting product, household cleaner	Karpiuk, 1984; ATS, 2006b
1904	Benzoic acid	Many industrial applications	ATS, 2006b
1905	Sodium benzoate	Preservative	Karpiuk, 1984
1905-1908	Calcium sulfide (lime sulfur)	Fungicide	Karpiuk, 1984
1910	Lead arsenate	Agriculture	Karpiuk, 1984; ATS, 2006b
1911	Magnesium chloride	Used to produce Milk of Magnesia, Epsom salts, and stucco building materials	Haynes, 1945; Karpiuk, 1984
1911	Calcium chloride	Dust control agent, refrigerant, road salt	Karpiuk, 1984
1913	Raw chlorine	Disinfectant, liquid bleach	Dow Chemical, 2007c
1913	Sodium hydroxide (caustic soda, co-product with chlorine extraction)	Replaced pot ash in industrial processes	ATS, 2006b

a. The products listed here are those identified as in-production from 1897 to 1910; additional products may have been produced during this period.

Table B.2. Dow products^a World War I (1914-1919)

Year	Product	Description	Reference
1914	Iron chloride	Engraving and rotogravure	Karpiuk, 1984
1914	Zinc chloride	Soldering flux and many industrial applications	Karpiuk, 1984
1914	Sodium hydroxide (caustic soda)	Replaced pot ash in industrial processes	Karpiuk, 1984; Brandt, 1997; ATS, 2006b
1914	Phenol (via sulfonation process)	Many industrial applications	Karpiuk, 1984
1914-1917	Indigo	Synthetic textile dye	Haynes, 1945; Karpiuk, 1984
1915	Salicylic acid	Chemical intermediate medicinal products	Karpiuk, 1984
1916	Calcium chloride	Dust control agent, refrigerant, road salt	Dow Chemical, 2007c
1916	Magnesium metal	Car engines, airplane parts, products made with metal (began marketing 1919)	Karpiuk, 1984; ATS, 2006b; Dow Chemical, 2007c
1916-1917	Acetylsalicylic acid (aspirin)	Pharmaceutical	Haynes, 1945; Dow Chemical, 2007c
1917	Benzyl chloride	Chemical intermediate	Haynes, 1945
1917	Sodium benzoate	Chemical intermediate	Haynes, 1945
^b	Dichlorodiethyl sulfide (mustard gas)	Poisonous gas	Karpiuk, 1984
^b	Ethylene glycol (from chlorohydrin)	Many industrial applications	Haynes, 1945; Karpiuk, 1984
^b	Chlorobromoethane	Smoke screens (ships and on the battle field)	Brandt, 1997
^b	Chlorine	Many industrial applications	Brandt, 1997; ATS, 2006b
^b	Bromine	Tear gas and other lachrymators	Brandt, 1997
^b	Carbon tetrachloride	War products	Brandt, 1997
^b	Trinitrophenol (picric acid)	Explosives	Brandt, 1997
^b	Acetic anhydride	Varnish for airplanes	Brandt, 1997
^b	Calcium sulfide and lead arsenate	Fruit insecticides	Brandt, 1997
^b	Chloroform	Solvent, anesthetic	Brandt, 1997
^b	Monochlorobenzene (chlorobenzene)	Explosives	Brandt, 1997
^b	Ethylene chlorohydrin (and acetate)	Many industrial applications	Haynes, 1945
^b	Dichloroacetic acid	Many industrial applications	Haynes, 1945

Table B.2. Dow products^a World War I (1914-1919) (cont.)

Year	Product	Description	Reference
^b	Sulfuric acid	Many industrial applications	Haynes, 1945
^b	Sodium acetate	Many industrial applications	Haynes, 1945
^b	2-phenylphenol (Dowicide)	Biocide, chemical intermediate	ATS, 2006b
^b	p-dichlorobenzene (1,4-dichlorobenzene or Paradow)	Moth repellent, deodorizer, chemical intermediate	ATS, 2006b

a. The products listed here are those identified as in-production during WWI; additional products may have been produced during this period.

b. Exact dates of production not known, but identified as produced during WWI.

Table B.3. Dow products^a Intra-War (1920-1938)

Product	Description	Reference
1,1,1-trichloroethane	Solvent	ATS, 2006b
2 ciba blues	Synthetic textile dye	Author unknown, 1926
2 vat blues	Synthetic textile dye	Author unknown, 1926
Acetic acid	Chemical intermediate	ATS, 2006b
Acetic anhydride	Chemical intermediate	Author unknown, 1926; Haynes, 1945
Acetyl salicylic acid (aspirin)	Pharmaceutical	Author unknown, 1926
Acetyl tetrabromide	Used in automotive gauges	Author unknown, 1926
Acetylene tetrabromide	Solvent	ATS, 2006b
Ammonium bromide	Pharmaceutical	Author unknown, 1926
Aniline	Used to produce dyes, plastics, and medicines	ATS, 2006b
Aniline hydrochloride	Used in dyeing and printing	ATS, 2006b
Anthralic acid	Chemical intermediate	ATS, 2006b
Anthranilic acid	Intermediate for production of dyes, pigments, and artificial flavors	Author unknown, 1926
Barium bromate	Chemical intermediate	ATS, 2006b
Bromine (purified)	Many industrial applications	ATS, 2006b
Bromoform	Solvent, sedative, and flame retardant	ATS, 2006b
Cadmium bromate	Chemical intermediate	ATS, 2006b
Calcium arsenate	Cotton insecticide	Author unknown, 1926
Calcium bromide	Pharmaceutical	Author unknown, 1926
Calcium chloride	Dust control agent, refrigerant, road salt	Author unknown, 1926
Camphor monobromated	Pharmaceutical	Author unknown, 1926
Carbon bisulfide	Chemical intermediate	ATS, 2006b
Carbon tetrachloride	Fire extinguisher, starting product, household cleaner	ATS, 2006b
Chloracetyl chloride	Chemical intermediate	ATS, 2006b

Table B.3. Dow products^a Intra-War (1920-1938) (cont.)

Product	Description	Reference
Chloroethylacetate	Solvent	Author unknown, 1926
Chlorinated phenols	Chemical intermediates, fungicides, bactericides, herbicides, polystyrene	ATS, 2006b
Chlorine	Many industrial applications	ATS, 2006b
Chlorobenzene	Intermediate for many phenolic chemicals	Author unknown, 1926; ATS, 2006b
Chloroform	Solvent, anesthetic	Author unknown, 1926
Cinchophen	Analgesic drug	ATS, 2006b
Coumarin	Chemical intermediate	ATS, 2006b
Dichloroacetic acid	Chemical intermediate	Author unknown, 1926
Dichloromethane	Solvent	Author unknown, 1926; ATS, 2006b
Diethylaniline	Chemical intermediate	ATS, 2006b
Dimethylaniline	Chemical intermediate	ATS, 2006b
Diphenyl oxide	Phenol side-product, Dowtherm, thermal fluid	Whitehead, 1968
Ethyl bromide	Chemical intermediate	Author unknown, 1926
Ethyl cellulose	Dow's first plastic: telephone headsets, dust goggles, airplane parts	ATS, 2006b
Ethyl monochloroacetate	Chemical intermediate	ATS, 2006b
Ethylene chlorhydrin	Intermediate for phenyl ethyl alcohol, procaine, synthetic indigo	Author unknown, 1926
Ethylene chloride	Solvent	Author unknown, 1926
Ethylene chlorobromide	Fruit fumigant	ATS, 2006b
Ethylene dibromide	Many industrial applications, prevent engine knocking	Brandt, 1997
Ferric chloride	Many industrial applications	ATS, 2006b
Ferrous chloride	Intermediate for production of dyes	Author unknown, 1926
Hexachloroethane	Smoke screens	Author unknown, 1926

Table B.3. Dow products^a Intra-War (1920-1938) (cont.)

Product	Description	Reference
Hydrobromic acid	Extracting radium from ore	Author unknown, 1926
Hydrochloric acid (Dowell)	Many industrial applications	ATS, 2006b
Indigo	Synthetic textile dye	Author unknown, 1926
Iron chloride	Engraving and rotogravure	Author unknown, 1926
Lead arsenate	Contact insecticide	Author unknown, 1926
Lime sulfur	Contact solution, fungicide	Author unknown, 1926
Lithium bromide	Pharmaceutical	Author unknown, 1926
Lithium salicylate	Chemical intermediate	ATS, 2006b
Magnesium	Commonly used metal	Whitehead, 1968
Magnesium alloy (Dowmetal)	Car engines, airplane parts, metal accessories	Author unknown, 1926
Magnesium arsenate	Insecticide	ATS, 2006b
Magnesium bromate	Chemical intermediate	ATS, 2006b
Magnesium bromide	Sedative	ATS, 2006b
Magnesium chloride	Used to produce Milk of Magnesia, Epsom salts, and stucco building materials	Author unknown, 1926
Magnesium oxychloride	Used to produce stucco building materials	ATS, 2006b
Magnesium salicylate	Pharmaceutical	ATS, 2006b
Magnesium sulfate	Epsom salt, medicine	Author unknown, 1926
Methyl anthranilate	Pharmaceutical	ATS, 2006b
Methyl bromide (bromomethane)	Fumigant	ATS, 2006b
Methyl salicylate (oil of wintergreen)	Flavoring agent, pharmaceutical, furniture polish	Author unknown, 1926; ATS, 2006b
Monobromobenzene	Intermediate for many phenolic chemicals	ATS, 2006b
Monochloroacetic acid	Chemical intermediate	Author unknown, 1926; ATS, 2006b
Nicotine sulfate	Contact insecticide	Author unknown, 1926
Orthocresotinic acid	Chemical intermediate	ATS, 2006b

Table B.3. Dow products^a Intra-War (1920-1938) (cont.)

Product	Description	Reference
Orthodichlorobenzene	Solvent	ATS, 2006b
Orthophenylphenol (phenol byproduct)	Insecticide	Whitehead, 1968; ATS, 2006b
Para dibromobenzene	Disinfectant	Author unknown, 1926
Paradichlorobenzene (1,4-dichlorobenzene)	Moth repellent, deodorizer, chemical intermediate	ATS, 2006b
Paraphenetidin	Pharmaceutical intermediate	ATS, 2006b
Paraphenylphenol (phenol byproduct)	Insecticide, boat hull varnish	Whitehead, 1968
Pentachloroethane	Solvent	Author unknown, 1926
Phenol	Many industrial applications	Whitehead, 1968; ATS, 2006b
Phenol salicylate	Chemical intermediate	ATS, 2006b
Phenyl acetate	Solvent	Author unknown, 1926
Phenyl salicylate (Salol)	Intestinal antiseptic	Author unknown, 1926
Phenylethyl alcohol	Pharmaceutical intermediate, biocide, synthetic rose perfumes	Haynes, 1945
Polystyrene	Plastic	ATS, 2006b
Potassium bromate	Used in baked preparing goods	ATS, 2006b
Potassium bromide	Pharmaceuticals, photograph production	Author unknown, 1926
Propylene chloride	Plastic resin	ATS, 2006b
Salicylaldehyde	Chemical intermediate	ATS, 2006b
Salicylic acid	Pharmaceutical intermediate, preservative, dye	Author unknown, 1926
Sodium bromate	Intermediate for production of dyes	ATS, 2006b
Sodium bromide	Pharmaceutical	Author unknown, 1926
Sodium chloride	Common salt	Whitehead, 1968; ATS, 2006b
Sodium hydroxide (caustic soda)	Many industrial applications	ATS, 2006b
Sodium salicylate	Rheumatism	Author unknown, 1926; ATS, 2006b
Sodium sulfide	Many industrial applications	ATS, 2006b

Table B.3. Dow products^a Intra-War (1920-1938) (cont.)

Product	Description	Reference
Strontium bromide	Pharmaceutical	Author unknown, 1926
Strontium salicylate	Pharmaceutical intermediate	ATS, 2006b
Styrene	Synthetic rubber intermediate	Brandt, 1997
Sulfur chloride	Chemical intermediate	ATS, 2006b
Sulfur monochloride	Chemical intermediate	ATS, 2006b
Tetrachloroethane	Chemical intermediate	ATS, 2006b
Tetrachloroethylene	Solvent	ATS, 2006b
Tribromophenol	Pesticide	ATS, 2006b
Trichloroacetic acid	Corn and wart remover	Author unknown, 1926
Trichloroacetic acid	Pharmaceutical intermediate	Author unknown, 1926; ATS, 2006b
Trichloroethylene	Solvent	Author unknown, 1926
Vinylidene chloride	Plastic intermediate	ATS, 2006b

a. The products listed here are those identified as in-production between WWI and WWII; additional products may have been produced during this period.

Table B.4. Dow products^a World War II (1939-1945)

Product	Description	Reference
Synthetic rubber	Airplane parts, tires	Brandt, 1997
Magnesium metal	Airplane parts	Brandt, 1997
Thiokol rubber	Retreading tires	Brandt, 1997; ATS, 2006b
Saran TM	Insect screens, military gear wrap, boot liner	Brandt, 1997
Hexachloroethane	Smoke screens	Brandt, 1997
Butadiene	Used in synthetic rubber production	Brandt, 1997
Styrene	Synthetic rubber intermediate	Brandt, 1997
Phenol	Many industrial applications	Brandt, 1997
CC2 (Impregnate)	Impregnate clothing, make resistant to gas warfare agents	Brandt, 1997
Polyfiber	Polystyrene fibers used to cover radar dishes	Brandt, 1997
Styraloy	Thermal-tolerant rubbery plastic	Brandt, 1997
Silicone	Chemically resistant greases, insulating resins, and lubricants	Brandt, 1997
2,4-dichlorophenoxyacetic acid (2,4-D; Dowspary 66; Esteron 44; Esteron 99; Brush killer)	Herbicide, ingredient in agent orange	ATS, 2006b
Polystyrene foam (Styrofoam)	Building and packaging material	ATS, 2006b
Diisopropanolamine	Many industrial applications	ATS, 2006b
1,1-dichloroethane	Many industrial applications	ATS, 2006b
1,2,4,5-tetrachlorobenzene	Pesticide intermediate	ATS, 2006b

a. Dow products confirmed to have been manufactured during WWII.

Table B.5. Dow products at Midland^a 1946 to present

Year	Product	Description	Reference
Post-WWII, exact dates not known	Chlorine	Organic chemicals, paper, water purification	Whitehead, 1968; Stock and Orna, 1989
Post-WWII, exact dates not known	Ammonia	General industrial uses	Whitehead, 1968
Post-WWII, exact dates not known	Aniline	Used to produce dyes, plastics, and medicines	Whitehead, 1968
Post-WWII, exact dates not known	Butadiene	Used in synthetic rubber production	Whitehead, 1968
Post-WWII, exact dates not known	Styrene	Used in synthetic rubber production	Whitehead, 1968
Post-WWII, exact dates not known	Bromides	Medical and photographic uses	Whitehead, 1968
Post-WWII, exact dates not known	Iodides	Medical and photographic uses	Whitehead, 1968
Post-WWII, exact dates not known	Calcium chloride	Dust control agent, refrigerant, road salt	Whitehead, 1968
Post-WWII, exact dates not known	Carbon tetrachloride	Dry cleaners, fire extinguishers, solvent extraction	Whitehead, 1968
Post-WWII, exact dates not known	Sodium hydroxide (caustic soda)	Many industrial applications	Whitehead, 1968
Post-WWII, exact dates not known	Dowicides	Treat lumber, fabrics, glue, paint, germicides	Whitehead, 1968
Post-WWII, exact dates not known	Epsom salts	Medical purposes, leather and rayon manufacturing	Whitehead, 1968
Post-WWII, exact dates not known	Ethylene dibromide	Many industrial applications, prevent engine knocking	Whitehead, 1968

Table B.5. Dow products at Midland^a 1946 to present (cont.)

Year	Product	Description	Reference
Post-WWII, exact dates not known	Ethylene and propylene glycols	Antifreeze, explosives, dyes, plasticizers, solvents	Whitehead, 1968; ATS, 2006b
Post-WWII, exact dates not known	Ethylene oxide	Manufacture of organic chemicals, detergents, plasticizers, insecticides	Whitehead, 1968
Post-WWII, exact dates not known	Ferric chloride	Many industrial applications, photoengraving, sewage	Whitehead, 1968
Post-WWII, exact dates not known	Hydrochloric acid	Many industrial uses	Whitehead, 1968
Post-WWII, exact dates not known	Magnesium chloride	Manufacture of stucco, cements, Mg ⁺ metal	Whitehead, 1968
Post-WWII, exact dates not known	Organic chlorides	Industrial solvent for waxes, tars, greases, fat extraction	Whitehead, 1968
Post-WWII, exact dates not known	Phenols	Manufacture of plastics, resins, pharmaceuticals, oil refining	Whitehead, 1968
Post-WWII, exact dates not known	Sodium sulphide	Manufacture of rubber, paper, leather	Whitehead, 1968
Post-WWII, exact dates not known	Vinyl	Plastic intermediate	Whitehead, 1968
Post-WWII, exact dates not known	Vinylidene chloride	Plastic intermediate	Whitehead, 1968
1940s ^b	Acrylonitrile	Plastic intermediate	ATS, 2006b
1940s ^b	Alpha-methylstyrene	Plastic intermediate	ATS, 2006b
1940s ^b	Antipyrone	Many industrial uses	ATS, 2006b
1940s ^b	Dimethylaminobenzene	Chemical intermediate	ATS, 2006b
1940s ^b	Dicyclopentadiene	Used in resins, inks, adhesives, and paints	ATS, 2006b
1940s ^b	Dinitro-o-sec-butylphenol (Dinoseb)	Herbicide	ATS, 2006b
1940s ^b	Toluene	Solvent, many industrial uses	ATS, 2006b

Table B.5. Dow products at Midland^a 1946 to present (cont.)

Year	Product	Description	Reference
1940s ^b	Xylidene	Used to produce dyes, drugs, and organic chemicals	ATS, 2006b
1946-1983	Bromoform	Solvent, sedative, and flame retardant	ATS, 2006b
1946-?	Diethylbenzene	Chemical intermediate	ATS, 2006b
1947-1980	Pentachlorophenol	Herbicide, insecticide, fungicide, algaecide, disinfectant, and as an ingredient in antifouling paint	ATS, 2006b
1947-2000	Methylchloroacetate	Chemical intermediate	ATS, 2006b
1948-1972	4-chloro-2-phenylphenol (Dowicide 32)	Pesticide	ATS, 2006b
1948-1977	Sodium trichloroacetate	Used in herbicides and pesticides	ATS, 2006b
1949-1984	2-chloropropionic acid	Intermediate in agricultural, chemical, and pharmaceutical production	ATS, 2006b
1950-?	2,4,5-trichlorophenoxyacetic acid (2,4,5-T)	Herbicide, ingredient in agent orange	ATS, 2006b
1950-?	2-chloro-1-morpholin-4-yl-ethanone (Morpholine)	Corrosion protectant, chemical emulsifier	ATS, 2006b
1950-1965	O-chlorophenol	Intermediate for the synthesis of pesticides, medicines, phenolic resins, dyes, aroma compounds, and other organic chemicals	ATS, 2006b
1950-1968	P-dibromobenzene	Chemical intermediate	ATS, 2006b
1950-1970	Bromobenzene	Pharmaceutical intermediate	ATS, 2006b
1950s ^b	Acrylic acid	Used to make plastics, coatings, adhesives, elastomers, as well as floor polishes and paints	ATS, 2006b
1950s ^b	Parachlorophenol	Antibacterial agent	ATS, 2006b
1950s ^b	Polystyrene foam (Styrofoam)	Building and packaging material	ATS, 2006b
1950s ^b	Tetrachlorobenzene	Pesticide intermediate	ATS, 2006b

Table B.5. Dow products at Midland^a 1946 to present (cont.)

Year	Product	Description	Reference
1950s ^b	Trichlorophenol	Pesticide	ATS, 2006b
1950s-?	Polyacrylamide (Separan)	Water-absorbent acrylate polymer	ATS, 2006b
1950s-?	Styrene/butadiene latex	Water-based polymer used for carpet backing and paper coating	ATS, 2006b
1951-?	O,o-dimethyl-o-(2,4,5-trichlorophenol) phosphorothioate (Dowpon, Ronnel Ruelene)	Pesticide	ATS, 2006b
1951-1966	Tetraethylene pentamine	Textile dye	ATS, 2006b
1951-pilot plant	Tetrasodium ethylenediaminetetraacetate (Versene)	Chelating agent	ATS, 2006b
1952-1976	Bromomethylbenzene (benzyl bromide)	Lachrymator, used in organic synthesis	ATS, 2006b
1954-?	2,2-Dichloropropionic acid (Dalapon)	Herbicide and plant growth regulator	ATS, 2006b
1954-1971	Acrylamide	Many industrial uses	ATS, 2006b
1954-1979	2-(2,4,5-trinitrophenoxy) ethyl 2,2-dichloropropanoate (Erbon)	Herbicide	ATS, 2006b
1957-1975	1,2-dibromo-3-chloropropane (Dowanol PM)	Solvent	ATS, 2006b
1957-1977	Dimethoxy-sulfanylidene-(2,4,5-trichlor-phenoxy-phosphrane) (Ronnel)	Organophosphorus pesticide	ATS, 2006b
1957-1988	2-ethoxyethanol (Dowanol EE)	Solvent	ATS, 2006b

Table B.5. Dow products at Midland^a 1946 to present (cont.)

Year	Product	Description	Reference
1957-1988	2-methoxyethanol (Dowanol EM)	Solvent	ATS, 2006b
1958-1990	1-methoxy-2-propanol (Dowanol PM)	Solvent	ATS, 2006b
1959-1983	Dichloroprpenes and dichloropropanes (Vidden)	Soil fumigant	ATS, 2006b
1960-?	O-2,4-dichlorophenyl-o-methyl	Herbicide	ATS, 2006b
1960-1967	2-phenoxyethanol (Dowanol EP and Dowanol EPH)	Solvent	ATS, 2006b
1960-1978	Methylene bromide	Many industrial uses	ATS, 2006b
1960-1988	2-butoxyethanol (Dowanol EB)	Solvent	ATS, 2006b
1960s ^b	Isopropylphosphoramidothioate (Zytron)	Herbicide	ATS, 2006b
1961-1965, pilot scale	4-dimethylamino-3,5-dimethyl-phenyl	Pesticide	ATS, 2006b
1961-1975	Methylaminoformate (Zectran)	Pesticide	ATS, 2006b
1962-1979	(17-acetyl-6-chloro-3-hydroxy-10,10-dimethyl-1,2,3,8,9,11,14,15,16-decahydrocyclopenta[a]phenanthren-17-yl) acetate (Verton)	Nylon composite	ATS, 2006b
1962-1981	1-isobutyxy-2-propanol (Dowanol PIB)	Liquid surfactant	ATS, 2006b

Table B.5. Dow products at Midland^a 1946 to present (cont.)

Year	Product	Description	Reference
1963-1965	Tert-butyl-salol (Tausol)	Unknown	ATS, 2006b
1963-1975	Dimethylamine salt of 2-methyl-chlorophenoxyacetic acid (Dowicil TBS)	Textile preservative	ATS, 2006b
1964-1979	O-sec-butylphenol	Many industrial uses	ATS, 2006b
1965, pilot scale	Chlorpyrifos o,o-diethyl o-(2,4,6-trichloro-2-pyridyl) (Dursban TM)	Pesticide	ATS, 2006b
1965-?	Zetabon	Coils of metal coated with ethylene copolymer plastic	ATS, 2006b
1965-1968	2,3,5-trichloro-1H-pyridin-4-one (Daxtron)	Herbicide	ATS, 2006b
1965-1982	4-Chloro-2-cyclopentylphenol (Dowicide 9)	Germicidal agent	ATS, 2006b
1966-?	Pentachloropyridine	Unknown	ATS, 2006b
1966-1970	T-butylsalol	Unknown	ATS, 2006b
1966-2000	Triisopropanolamine	Raw material for cement grinding aids	ATS, 2006b
1967-1979	Tricyclohexylstannane hydrate	Unknown	ATS, 2006b
1969-1986	Decabromodiphenyl oxide	Re retardant additive to thermoplastic resins, polyethylene, polystyrene, adhesives, polyester fibers and coatings for textiles, paints, and for high-impact polystyrene	ATS, 2006b
1970s	Chlopyrifos insecticides (Dursban TM and Lorsban TM)	Insecticides (domestic and industrial)	ATS, 2006b
1970s	2-chloro-N-isopropylacetanilide	Herbicide	ATS, 2006b
1980s	Saran/Handi-Wrap TM	Domestic products	ATS, 2006b
1980s	Scrubbing Bubbles [®]	Household cleaner	ATS, 2006b
1980s	Seldane TM	Non-sedating antihistamine	ATS, 2006b

Table B.5. Dow products at Midland^a 1946 to present (cont.)

Year	Product	Description	Reference
1980s	Drytech TM	Absorbent (especially used in diapers)	ATS, 2006b
2000	Silk	Semiconductor dielectric resin for IBM	Dow Chemical, 2007c
2003	Penoxsulam	Rice herbicide	Dow Chemical, 2007c

a. This is not a comprehensive list of chemical produced by Dow. This is partly due to Dow's expansion into other regions in the U.S. and world after WWI which made identifying products solely made in Midland difficult. Chemicals associated with research and development may not be reflected in this list.

b. Compound listed as produced in the decade indicated but no specific dates were reported.

C. Hazardous Substances Associated with Past and Present Dow Plant Processes

Table C.1. Hazardous substances associated with past and present Dow Plant processes.
Hazardous substances are identified by Chemical Abstracts Service (CAS) registry numbers.

Hazardous substance	CAS #
Formaldehyde	50-00-0
1,1'-(2,2,2-Trichloroethylidene)bis[4-chlorobenzene] (4,4' DDT)	50-29-3
Benzo[a]pyrene	50-32-8
2,4-Dinitrophenol	51-28-5
o-[4-[(Dimethylamino)sulfonyl]phenyl] o,o-dimethyl ester phosphorothioic acid (Famphur)	52-85-7
1,2-Dihydro-3-methylbenz[j]aceanthrylene (3-Methylcholanthrene)	56-49-5
Benz[a]anthracene	56-55-3
1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1H-indene (Chlordane)	57-74-9
1,2,3,4,5,6-Hexachloro-, (1.alpha.,2.alpha.,3.beta.,4.alpha.,5.alpha.,6.beta)-cyclohexane (Lindane)	58-89-9
4-Chloro-3-methyl-phenol (4-Chloro-m-cresol)	59-50-7
Acetamide	60-35-5
3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-(1aR,2R,2aS,3S,6R,6aR,7S,7aS)-rel-2,7:3,6-Dimethanonaphth[2,3-b]oxirene (Dieldrin)	60-57-1
Acetic acid	64-19-7
Acetone	67-64-1
Chloroform	67-66-3
2,2'-Methylenebis[3,4,6-trichloro]phenol (Hexachlorophene)	70-30-4
Benzene	71-43-2
1,1,1-Trichloroethane	71-55-6
3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-(1aR,2R,2aR,3R,6S,6aS,7S,7aS)-rel-2,7:3,6-dimethanonaphth[2,3-b]oxirene (Endrin)	72-20-8
1,1'-(2,2,2-Trichloroethylidene)bis[4-methoxy-benzene] (Methoxychlor)	72-43-5
1,1'-(2,2-Dichloroethylidene)bis[4-chlorobenzene] (4,4' DDD)	72-54-8
Bromomethane	74-83-9
Chloromethane	74-87-3
Chloroethane	75-00-3
Chloroethene (Vinyl chloride)	75-01-4
Acetonitrile	75-05-8
Acetaldehyde	75-07-0
Dichloromethane (Methylene chloride)	75-09-2
Carbon disulfide	75-15-0
Ethylene oxide	75-21-8

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
Bromodichloromethane	75-27-4
1,1-Dichloroethane	75-34-3
1,1-Dichloroethene (Vinylidene chloride)	75-35-4
propylene oxide	75-56-9
Dichlorodifluoromethane	75-71-8
2,2-Dichloropropanoic acid	75-99-0
Pentachloroethane	76-01-7
1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-Methano-1H-indene (Heptachlor)	76-44-8
1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene (Hexachlorocyclopentadiene)	77-47-4
Tetraethyl lead	78-00-2
1,2-Dichloropropane	78-87-5
1,1,2-Trichloroethane	79-00-5
Trichloroethene	79-01-6
Acrylamide	79-06-1
Propionic acid	79-09-4
Chloroacetic acid	79-11-8
1,1,2,2-Tetrachloroethane	79-34-5
1,2-Dihydroacenaphthylene (Acenaphthene)	83-32-9
Phenanthrene	85-01-8
Fluorene	86-73-7
1,1,2,3,4,4-Hexachloro-1,3-butadiene (Hexachlorobutadiene)	87-68-3
2,4,6-Trichlorophenol	88-06-2
2-(1-Methylpropyl)-4,6-dinitrophenol (Dinoseb)	88-85-7
2-Naphthalenamine	91-59-8
Biphenyl	92-52-4
[1,1'-Biphenyl]-4-amine (4-Aminobiphenyl)	92-67-1
2-(2,4,5-Trichlorophenoxy)propionic acid (Silvex 2,4,5-TP)	93-72-1
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T acid)	93-76-5
1,2-Dichlorobenzene	95-50-1
1,2,4,5-Tetrachlorobenzene	95-94-3
1,2-Dibromo-3-chloropropane	96-12-8

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
1,2,3-Trichloropropane	96-18-4
Acetophenone	98-86-2
4-Nitrobenzenamine (p-Nitroaniline)	100-01-6
4-Nitrophenol (p-Nitrophenol)	100-02-7
Styrene	100-42-5
1-Bromo-4-phenoxybenzene (4-Bromophenyl phenyl ether)	101-55-3
2,4-Dimethylphenol	105-67-9
4-Methylphenol (p-Cresol)	106-44-5
1,4-Dichlorobenzene	106-46-7
4-Chloro-benzenamine (p-Chloroaniline)	106-47-8
1,4-Benzenediamine (para-Phenylenediamine)	106-50-3
Chloromethyloxirane (1-Chloro-2,3-epoxypropane)	106-89-8
1,2-Dibromoethane (Dibromoethane)	106-93-4
1,3-Butadiene	106-99-0
Butadiene (1,3-Butadiene)	106-99-0
Acrolein	107-02-8
3-Chloro-1-propene (Allyl chloride)	107-05-1
1,2-Dichloroethane (ethylene dichloride)	107-06-2
1,2-Ethanediamine (Ethylenediamine)	107-15-3
Ethylene glycol	107-21-1
4-Methyl-2-pentanone	108-10-1
Acetic Anhydride	108-24-7
3-Methylphenol (m-Cresol)	108-39-4
Bis(2-chloro-1-methylethyl)ether (Dichloroisopropyl ether)	108-60-1
Chlorobenzene	108-90-7
2-Methylpyridine (2-Picoline)	109-06-8
Cyclohexane	110-82-7
2,2'-Iminobisethanol (Diethanolamine)	111-42-2
Bis(2-chloroethyl) ether	111-44-4
Bis(2-chloroethoxy) methane	111-91-1
3,3'-Dimethylbenzidine (o,o'-Toidine)	119-93-7

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
Anthracene	120-12-7
1,2-Benzenediol (Catechol)	120-80-9
1,2,4-Trichlorobenzene	120-82-1
1,4-Dioxane	123-91-1
2-Chlorobuta-1,3-diene (Chloroprene)	126-99-8
Pyrene	129-00-0
1,4-Naphthalenedione	130-15-4
Dibenzofuran	132-64-9
1-Naphthalenamine	134-32-7
1,1a,3,3a,4,5,5a,5b,6-Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta[cd]pentalen-2-one (Kepone)	143-50-0
Benzo[ghi]perylene	191-24-2
Benz[e]acephenanthrylene (Benzo[b]fluoranthene)	205-99-2
Benzo[k]fluoranthene	207-08-9
Acenaphthylene	208-96-8
Chrysene	218-01-9
o,o-Dimethyl o-(4-nitrophenyl) ester phosphorothioic acid (Methyl parathion)	298-00-0
o,o-Diethyl s-[(ethylthio)methyl] ester phosphorodithioic acid (Phorate)	298-02-2
o,o-Diethyl s-[2-(ethylthio)ethyl]ester phosphorodithioic acid (Disulfoton)	298-04-4
1,2,3,4,10,10-Xexachloro-1,4,4a,5,8,8a-hexahydro-(1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-1,4:5,8-dimethanonaphthalene (Aldrin)	309-00-2
4-(Dimethylamino)-3,5-dimethyl-, methylcarbamate phenol (Mexacarbate)	315-18-4
1,2,3,4,5,6-hexachloro-, (1.alpha.,2.alpha.,3.beta.,4.alpha.,5.beta.,6.beta.)-cyclohexane (alpha-BHC)	319-84-6
1,2,3,4,5,6-Hexachloro-, (1.alpha.,2.alpha.,3.beta.,4.alpha.,5.beta.,6.beta.)-cyclohexane (beta-BHC)	319-85-7
1,2,3,4,5,6-Hexachlorocyclohexane (delta-BHC)	319-86-8
1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-(1R,4S,4aS,5R,8S,8aR)-rel-1,4:5,8-dimethanonaphthalene (Isodrin)	465-73-6
1,3-Dichlorobenzene	541-73-1
Bromoethene (Vinyl bromide)	593-60-2
Pentachlorobenzene	608-93-5

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
1,1,1,2-Tetrachloroethane	630-20-6
6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide, (3.alpha.,5a.beta.,6.alpha.,9.alpha.,9a.beta.)-6,9-methano-2,4,3-benzodioxathiepin (alpha-Endosulfan)	959-98-8
6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3,3-dioxide-6,9-methano-2,4,3-benzodioxathiepin (Endosulfan sulfate)	1031-07-8
(2,4-Dichlorophenoxy)-2-butoxymethylethyl ester acetic acid (2,4-D Ester)	1320-18-9
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6
1,1,2,3,3,3-Hexachloro-1-propene (Hexachloropropene)	1888-71-7
(2,4-Dichlorophenoxy)-2-butoxyethyl ester acetic acid (2,4-D Ester)	1929-73-3
Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester (Diallate)	2303-16-4
2,2a,3,3,4,7-Hexachlorodecahydro-(1.alpha.,2.beta.,2a.beta.,4.beta.,4a.beta.,5.beta.,6a.beta.,6b.beta.,7R*)-1,2,4-methenocyclopenta[cd]pentalene-5-carboxaldehyde (Endrin aldehyde)	7421-93-4
Nickel	7440-02-0
Antimony	7440-36-0
Arsenic	7440-38-2
Barium	7440-39-3
Beryllium (powder)	7440-41-7
Cadmium	7440-43-9
Chromium	7440-47-3
Copper	7440-50-8
Hydrochloric acid	7647-01-0
Ammonia	7664-41-7
Sulphuric acid (Sulfuric acid)	7764-93-9
Bleach, Bleaching Powder (Chlorine)	7782-50-5
Aroclor 1260	11096-82-5
Aroclor 1254	11097-69-1
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1248	12672-29-6
Sulfur chloride (Sulfur monochloride)	12771-08-3

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
Sodium dodecylbenzene sulfonate	25155-30-0
Chlorophenols (generic)	25167-80-0
Dinitrophenol	25550-58-7
6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide, (3.alpha.,5a.alpha.,6.beta.,9.beta.,9a.alpha.)-6,9-methano-2,4,3-benzodioxathiepin (beta-Endosulfan)	33213-65-9
Aroclor 1242	53469-21-9
Phosphoric trichloride (Phosphrous oxychloride)	10025-87-3
Ethylbenzene	100-41-4
Styrene	100-42-5
N-Nitrosopiperidine	100-75-4
2,3,4,5,6,7,7-Heptachloro-1a,1b,5,5a,6,6a-hexahydro-, (1aR,1bS,2R,5S,5aR,6S,6aR)-rel-2,5-Methano-2H-indeno[1,2-b]oxirene (Heptachlor epoxide)	1024-57-3
Ethylene bromide (Ethylene dibromide)	106-93-4
2-Propen-1-ol	107-18-6
Chloromethyl methyl ether	107-30-2
Toluene	108-88-3
Phenol	108-95-2
N-Hexane (Hexane)	110-54-3
2-Ethoxyethanol (Ethylene glycol monoethyl ether)	110-80-5
Pyridine	110-86-1
Triethylene glycol	112-27-6
Di-n-octyl phthalate	117-84-0
Hexachlorobenzene	118-74-1
Isosafrole	120-58-1
2,4-Dinitrotoluene	121-14-2
N-Phenylbenzenamine (Diphenylamine)	122-39-4
Hydroquinone	123-31-9
Dibromochloromethane (Chlorodibromomethane)	124-48-1
Methacrylonitrile	126-98-7
Tetrachloroethene	127-18-4
Dimethyl phthalate	131-11-3

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
Vanadium oxide	1314-62-1
m and p-Xylene (Xylene)	1330-20-7
Radium-226 (Thorium X)	13982-63-3
Ethyl acrylate	140-88-5
Radium-228	15262-20-1
Indeno[1,2,3-cd]pyrene	193-39-5
Fluoranthene	206-44-0
Hexachlorocyclohexane (generic)	27154-44-5
o,o-Diethyl o-(3,5,6-trichloro-2-pyridinyl) ester phosphorothioic acid (Chlorpyrifos)	2921-88-2
o,o-Diethyl o-pyrazinyl ester phosphorothioic acid	297-97-2
Tetraethyl dithiopyrophosphate (Tetraethyldithiopyrophosphate)	3689-24-5
Ethyl 2,2-bis(4-chlorophenyl)-2-hydroxy-acetate (Chlorobenzilate)	510-15-6
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-o-cresol, and salts)	534-52-1
Dibenz[a,h]anthracene	53-70-3
N-9H-Fluoren-2-yl-acetamide (2-Acetylaminofluorene)	53-96-3
N-Ethyl-N-nitrosoethanamine (N-Nitrosodiethylamine)	55-18-5
Tetrachloromethane (Carbon tetrachloride)	56-23-5
o,o-Diethyl o-(4-nitrophenyl) ester phosphorothioic acid (Parathion)	56-38-2
Cyanide	57-12-5
7,12-Dimethylbenz[a]anthracene	57-97-6
2,3,4,6-Tetrachlorophenol	58-90-2
N-Nitrosomorpholine	59-89-2
N,N-Dimethyl-4-(phenylazo)- benzenamine (p-Dimethylaminoazobenzene)	60-11-7
o,o-Dimethyl S-[2-(methylamino)-2-oxoethyl] ester phosphorodithioic acid	60-51-5
2,6-Dinitrotoluene	606-20-2
N-Nitroso-N-propyl-1-propanamine (Di-n-propylnitrosamine)	621-64-7
N-(4-ethoxyphenyl)ethanamide (Phenacetin)	62-44-2
Ethyl methanesulfonate	62-50-0
N-Methyl-N-nitrosomethanamine (N-Nitrosodimethylamine)	62-75-9
Benzoic acid	65-85-0
Methanol	67-56-1

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
Hexachloroethane	67-72-1
N,N-Dimethylformamide (Dimethylformamide)	68-12-2
4-Chlorophenyl phenyl ether	7005-72-3
N-butyl alcohol	71-36-3
1,1'-(Dichloroethenylidene)bis[4-chlorobenzene] (4,4'-DDE)	72-55-9
Lead	7439-92-1
Mercury	7439-97-6
Silver	7440-22-4
Sodium	7440-23-5
Thallium	7440-28-0
Zinc	7440-66-6
Methyl bromide	74-83-9
Iodomethane	74-88-4
Dibromomethane	74-95-3
Ethylene oxide	75-21-8
Tribromomethane (Bromoform)	75-25-2
Carbonic dichloride	75-44-5
Propylene oxide	75-56-9
Nitric acid	7697-37-2
Selenium	7782-49-2
Isophorone	78-59-1
Isobutyl alcohol	78-83-1
2,3-Dichloropropene	78-88-6
Methyl ethyl ketone	78-93-3
2-Propenoic acid	79-10-7
Toxaphene	8001-35-2
1,3-dichloropropene	542-75-6
Methyl methacrylate	80-62-6
Pentachloronitrobenzene	82-68-8
Diethyl phthalate	84-66-2
Di-n-butyl phthalate	84-74-2

Table C.1. Hazardous substances associated with past and present Dow Plant processes (cont.)

Hazardous substance	CAS #
Butyl benzyl phthalate	85-68-7
N-Nitroso-N-phenybenzenamine (N-Nitrosodiphenylamine)	86-30-6
2,6-Dichlorophenol	87-65-0
Pentachlorophenol	87-86-5
2-Nitrophenol	88-75-5
Naphthalene	91-20-3
2-Chloronaphthalene	91-58-7
Diethylaniline (N,N-Diethylaniline)	91-66-7
N,N-Dimethyl-N'-2-pyridinyl-N'-(2-ethienylmethyl)-1,2-ethanediamine (Methapyrilene)	91-80-5
3,3'-Dichlorobenzidine	91-94-1
N-Butyl-N-nitroso-1-butanamine (N-Nitrosodi-n-butylamine)	924-16-3
N-Nitrosopyrrolidine	930-55-2
Safrole	94-59-7
2-(2,4-Dichlorophenoxy) acetic acid (2,4-D Acid)	94-75-7
2-Methylphenol (o-Cresol)	95-48-7
2-Methylbenzenamine (o-Toluidine)	95-53-4
2-Chlorophenol	95-57-8
2,4,5-Trichlorophenol	95-95-4
Ethyl methacrylate	97-63-2
Isopropylbenzene (Cumene)	98-82-8
Nitrobenzene	98-95-3
Sym-trinitrobenzene (1,3,5-Trinitrobenzene)	99-35-4
2-Methyl-5-nitroaniline (5-Nitro-o-toluidine)	99-55-8
m-Dinitrobenzene	99-65-0

D. Consumption and Contact Advisories Issued in the TRSAA

Table D.1. Summary table of fish consumption advisories (Michigan, 1977-1983)

Fish species	Length	1977		1978		1979		1980		1981		1982		1983	
Tittabawassee River															
All fish	Unspecified									1, 2 ⊗	PBB, TCDD	1, 2 ⊗	∅	1, 2 ⊗	∅
Saginaw River															
All fish	Unspecified					1, 2 ⊗	PBB, TCDD	1, 2 ⊗	PBB, TCDD	1, 2 ⊗	PBB, TCDD	1, 2 ⊗	∅	1, 2 ⊗	∅
Saginaw Bay^a															
Carp	> 17"	2, 3	PCB	2, 3	PCB										
	Unspecified					2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	∅	2, 3	∅
Catfish	> 17"	2, 3	PCB	2, 3	PCB										
	Unspecified					2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	∅	2, 3	∅
Salmon	Unspecified	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	∅	2, 3	∅
Trout	Unspecified											2, 3	∅	2, 3	∅
Muskellunge	Unspecified											2, 3	∅	2, 3	∅
Pine River															
Downstream from St. Louis															
All fish	Unspecified					1, 2 ⊗	PBB	1, 2 ⊗	PBB	1, 2 ⊗	PBB	1, 2 ⊗	∅	1, 2 ⊗	∅

Table D.1. Summary table of fish consumption advisories (Michigan, 1977-1983) (cont.)

a. Some of the advisories below were issued specifically for Saginaw Bay. Other advisories were issued for Lake Huron, in whole or in part, which includes Saginaw Bay. See Table D.5 for more information.

Advisory codes:

1 = No consumption for general population.

2 = No consumption for subpopulations (subpopulation = those at higher risk, e.g., pregnant or nursing women, women who plan on having kids, and small children).

3 = Restricted consumption for general population, no more than 1 meal/week.

4 = Restricted consumption for general population, no more than 1 meal/month.

5 = Restricted consumption for general population, no amount specified.

6 = Restricted consumption for subpopulations, no more than 1 meal/week.

7 = Restricted consumption for subpopulations, no more than 1 meal/month.

8 = Restricted consumption for subpopulations, no more than 6 meals/year.

9 = Restricted consumption for subpopulations, no amount specified.

Symbol key:

⊕ For this species, location, and year, an advisory was issued naming a list of pollutants that may have caused the advisory: mercury, PCB, PBB, DDT, dieldrin, chlordane, toxaphene, and dioxin.

⊗ Advisory was issued for all populations, which includes general and subpopulations.

∅ For this species, location, and year, an advisory was issued; however, the advisory did not identify a pollutant.

Table D.2. Summary table of fish consumption advisories (Michigan, 1984-1990)

Fish species	Length	1984		1985		1986		1987		1988		1989		1990	
Tittabawassee River															
Carp	Unspecified					1, 2 ⊗	⊕	1, 2 ⊗	⊕	1, 2 ⊗	∅	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin
Catfish	Unspecified					1, 2 ⊗	⊕	1, 2 ⊗	⊕	1, 2 ⊗	∅	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin
All other fish	Unspecified											7, 5	PCB, dioxin	7, 5	PCB, dioxin
All fish	Unspecified	1, 2 ⊗	⊕	1, 2 ⊗	⊕										
Saginaw River															
Carp	Unspecified					2, 3	⊕	1, 2 ⊗	⊕	1, 2 ⊗	∅	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin
Catfish	Unspecified							1, 2 ⊗	⊕	1, 2 ⊗	∅	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin
All other fish	Unspecified											7, 5	PCB, dioxin	7, 5	PCB, dioxin
All fish	Unspecified	1, 2 ⊗	⊕	1, 2 ⊗	⊕										
Saginaw Bay^a															
Carp	Unspecified	2, 3	⊕	2, 3	⊕	2, 3	⊕	1, 2 ⊗	⊕	1, 2 ⊗	∅	1, 2 ⊗	PCB	1, 2 ⊗	PCB
Catfish	Unspecified	2, 3	⊕	2, 3	⊕	2, 3	⊕	1, 2 ⊗	⊕	1, 2 ⊗	∅	1, 2 ⊗	PCB	1, 2 ⊗	PCB
Salmon	Unspecified	2, 3	⊕	2, 3	⊕	2, 3	⊕								
Trout	Unspecified	2, 3	⊕	2, 3	⊕	2, 3	⊕								
Muskellunge	Unspecified	2, 3	⊕	2, 3	⊕	2, 3	⊕								
Brown trout	Unspecified							2, 3	⊕	2, 3	∅	2, 3	PCB	2, 3	PCB
Lake trout	Unspecified			2, 3	⊕	2, 3	⊕	2, 3	⊕	2, 3	∅	2, 3	PCB	2, 3	PCB
Rainbow trout	Unspecified							2, 3	⊕	2, 3	∅	2, 3	PCB	2, 3	PCB

Table D.2. Summary table of fish consumption advisories (Michigan, 1984-1990) (cont.)

Fish species	Length	1984	1985	1986	1987	1988	1989	1990
Pine River								
Downstream from St. Louis, Gratiot and Midland counties								
All fish	Unspecified				1, 2 ⊗ ⊕	∅	1, 2 ⊗	PBB
Downstream from St. Louis								
All fish	Unspecified		1, 2 ⊗ ⊕	1, 2 ⊗ ⊕				
St. Louis								
All fish	Unspecified	1, 2 ⊗ ⊕						

a. Some of the advisories below were issued specifically for Saginaw Bay. Other advisories were issued for Lake Huron, in whole or in part, which includes Saginaw Bay. See Table D.5 for more information.

Advisory codes:

1 = No consumption for general population.

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5 = Restricted consumption for general population, no amount specified.

6 = Restricted consumption for subpopulations, no more than 1 meal/week.

7 = Restricted consumption for subpopulations, no more than 1 meal/month.

8 = Restricted consumption for subpopulations, no more than 6 meals/year.

9 = Restricted consumption for subpopulations, no amount specified.

Symbol key:

⊕ For this species, location, and year, an advisory was issued naming a list of pollutants that may have caused the advisory: mercury, PCB, PBB, DDT, dieldrin, chlordane, toxaphene, and dioxin.

⊗ Advisory was issued for all populations, which includes general and subpopulations.

∅ For this species, location, and year, an advisory was issued; however, the advisory did not identify a pollutant.

Table D.3. Summary table of fish consumption advisories (Michigan, 1991-1997)

Fish species	Length	1991	1992	1993	1994	1995	1996	1997	
Tittabawassee River									
White bass	6-14"							3	PCB
	6-22"							2	PCB
	14-22"							1	PCB
Carp	> 6"							1, 2	PCB, dioxin
	Unspecified	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin
Catfish	> 6"							1, 2	PCB, dioxin
	Unspecified	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin
Channel catfish	Unspecified						1, 2 ⊗	PCB, dioxin	
All other fish	Unspecified	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin
Saginaw River									
White bass	6-22"							2, 3	PCB
Carp	> 6"							1, 2	PCB, dioxin
	Unspecified	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin
Catfish	> 6"							1, 2	PCB, dioxin
	Unspecified	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗			

Table D.3. Summary table of fish consumption advisories (Michigan, 1991-1997) (cont.)

Fish species	Length	1991		1992		1993		1994		1995		1996		1997	
Channel catfish	Unspecified							1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB, dioxin		
All other fish	Unspecified	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin		
Saginaw Bay^a															
Carp	> 6"													1, 2	PCB
	Unspecified	1, 2 ⊗	PCB	1, 2 ⊗	PCB	1, 2 ⊗	PCB	1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB	1, 2 ⊗	PCB		
Catfish	> 6"													1, 2	PCB
	Unspecified	1, 2 ⊗	PCB	1, 2 ⊗	PCB	1, 2 ⊗	PCB								
Channel catfish	Unspecified							1, 2 ⊗	PCB, dioxin	1, 2 ⊗	PCB	1, 2 ⊗	PCB		
White bass	6-22"													2, 3	PCB
	Unspecified									2, 3	PCB	2, 3	PCB		
Brown trout	> 18"													2, 3	PCB
	> 21"									2, 3	PCB	2, 3	PCB		
	Unspecified	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB						

Table D.3. Summary table of fish consumption advisories (Michigan, 1991-1997) (cont.)

Fish species	Length	1991		1992		1993		1994		1995		1996		1997	
Lake trout	> 10"													2	PCB, chlordan, dioxin
	10-22"													3	PCB, chlordan, dioxin
	< 22"											2, 3	PCB, chlordan, dioxin		
	> 22"											1, 2 ⊗	Chlordane, dioxin	1	PCB, chlordan, dioxin
	< 26"							2, 3	PCB, dioxin	2, 3	PCB, dioxin				
	> 26"							1, 2 ⊗	PCB, chlordan, dioxin	1, 2 ⊗	PCB, chlordan, dioxin				
	Unspecified	2, 3	PCB	2, 3	PCB	2, 3	PCB, chlordan								
Rainbow trout	Unspecified	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB						

Table D.3. Summary table of fish consumption advisories (Michigan, 1991-1997) (cont.)

Fish species	Length	1991	1992	1993	1994	1995	1996	1997
Pine River								
St. Louis Impoundment and downstream								
All fish	> 6"							1, 2 PBB, DDT
Downstream from St. Louis, Gratiot and Midland counties								
All fish	Unspecified	1, 2 ⊗ PBB	1, 2 ⊗ PBB	1, 2 ⊗ PBB, DDT	1, 2 ⊗ PBB, DDT	1, 2 ⊗ PBB, DDT	1, 2 ⊗ PBB, DDT	

a. Some of the advisories below were issued specifically for Saginaw Bay. Other advisories were issued for Lake Huron, in whole or in part, which includes Saginaw Bay. See Table D.5 for more information.

Advisory codes:

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5 = Restricted consumption for general population, no amount specified.

6 = Restricted consumption for subpopulations, no more than 1 meal/week.

7 = Restricted consumption for subpopulations, no more than 1 meal/month.

8 = Restricted consumption for subpopulations, no more than 6 meals/year.

9 = Restricted consumption for subpopulations, no amount specified.

Symbol key:

⊕ For this species, location, and year, an advisory was issued naming a list of pollutants that may have caused the advisory: mercury, PCB, PBB, DDT, dieldrin, chlordane, toxaphene, and dioxin.

⊗ Advisory was issued for all populations, which includes general and subpopulations.

∅ For this species, location, and year, an advisory was issued; however, the advisory did not identify a pollutant.

Table D.4. Summary table of fish consumption advisories (Michigan, 1998-2007)

Fish species	Length	1998	1999	2000	2001	2002	2003	2004-2006	2007		
Tittabawassee River											
White bass	6-10"	7	PCB								
	6-14"	3	PCB								
	6-22"			1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin
	10-14"	8	PCB								
	14-22"	1, 2	PCB								
Carp	> 6"	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin
Catfish	> 6"	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin
White sucker	> 6"	7	PCB	7	PCB	7	PCB				
Walleye	6-22"								7	PCB	
	> 14"	7	PCB	7	PCB	7	PCB				
	> 22"								3, 8	PCB	
Smallmouth bass	14-30"					2, 3	PCB, dioxin	2, 3	PCB, dioxin	2, 3	PCB, dioxin
All other fish	> 6"					3, 7	PCB, dioxin	3, 7	PCB, dioxin	3, 7	PCB, dioxin
	Unspecified	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin				

Table D.4. Summary table of fish consumption advisories (Michigan, 1998-2007) (cont.)

Fish species	Length	1998	1999	2000	2001	2002	2003	2004-2006	2007
Saginaw River									
White bass	6-22"	3, 8	PCB	3, 8	PCB	3, 8	PCB	3, 8	PCB
Carp	> 6"	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin
Catfish	> 6"	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin
All other fish	> 6"					3, 7	PCB, dioxin	3, 7	PCB, dioxin
	Unspecified	7, 5	PCB, dioxin	7, 5	PCB, dioxin	7, 5	PCB, dioxin		
Saginaw Bay									
Carp	> 6"	1, 2	PCB	1, 2	PCB, dioxin	1, 2	PCB, dioxin	1, 2	PCB, dioxin
Catfish	> 6"	1, 2	PCB	1, 2	PCB				
	6-14"				7	PCB			
	14-22"				8	PCB			
	18-22"				3	PCB			
	> 22"				1, 2	PCB			
Channel catfish	> 12"					2	PCB, dioxin	2	PCB, dioxin
	12-18"					3	PCB, dioxin	3	PCB, dioxin
	> 18"					1	PCB, dioxin	1	PCB, dioxin

Table D.4. Summary table of fish consumption advisories (Michigan, 1998-2007) (cont.)

Fish species	Length	1998		1999		2000		2001		2002		2003		2004-2006		2007	
White bass	6-22"	3, 8	PCB	3, 8	PCB	3, 8	PCB	3, 8	PCB	3, 8	PCB	3, 8	PCB	3, 8	PCB	3, 8	PCB
	6-12"															7	PCB, dioxin
	12-22"															2, 3	PCB, dioxin
White perch	6-14"	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB
Yellow perch	6-22"	6	PCB	6	PCB	6	PCB										
	6-18"							6	PCB	6	PCB	6	PCB	6	PCB	6	PCB
Northern pike	22-26"	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB
	> 26"	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB
White sucker	6-14"	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB		
	> 14"	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB		
Suckers	6-14"															6	PCB
	> 14"															7	PCB
Brown trout	10-18"	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB
	> 18"	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB	2, 3	PCB
Lake trout	> 10"	2	PCB, chlordan, dioxin	2	PCB, chlordan, dioxin	2	PCB, chlordan, dioxin	2	PCB, chlordan, dioxin	2	PCB, chlordan, dioxin	2	PCB, chlordan, dioxin	2	PCB, chlordan, dioxin	2	PCB, dioxin
	10-22"	3	PCB, chlordan, dioxin	3	PCB, chlordan, dioxin	3	PCB, chlordan, dioxin	3	PCB, chlordan, dioxin	3	PCB, chlordan, dioxin	3	PCB, chlordan, dioxin	3	PCB, chlordan, dioxin		

Table D.4. Summary table of fish consumption advisories (Michigan, 1998-2007) (cont.)

Fish species	Length	1998		1999		2000		2001		2002		2003		2004-2006		2007	
Lake trout (cont.)	10-26"															3	PCB, dioxin
	> 22"	1	PCB, chlordanes, dioxin	1	PCB, chlordanes, dioxin	1	PCB, chlordanes, dioxin	1	PCB, chlordanes, dioxin	1	PCB, chlordanes, dioxin	1	PCB, chlordanes, dioxin	1	PCB, chlordanes, dioxin		
	> 26"															1	PCB, dioxin
Rainbow trout	> 10"	7	PCB	7	PCB	7	PCB	7	PCB, dioxin	7	PCB, dioxin	7	PCB, dioxin	7	PCB	7	PCB
Walleye	14-18"	6	PCB	6	PCB	6	PCB	6	PCB, mercury	6	PCB, mercury	6	PCB, mercury	6	PCB, mercury	6	PCB, mercury
	> 18"	7	PCB	7	PCB			7	PCB, mercury	7	PCB, mercury	7	PCB, mercury	7	PCB, mercury	7	PCB, mercury
	18-22"					7	PCB										
	> 22"					1, 2	PCB	3	PCB, mercury	3	PCB, mercury	3	PCB, mercury	3	PCB, mercury	3	PCB, mercury
Whitefish	6-18"			6	PCB, dioxin	6	PCB, dioxin	6	PCB, dioxin	6	PCB, dioxin	6	PCB, dioxin	6	PCB, dioxin	6	PCB, dioxin
	> 18"							2	PCB, dioxin	2	PCB, dioxin	2	PCB, dioxin	2	PCB, dioxin	2	PCB, dioxin
	18-22"			7	PCB, dioxin	7	PCB, dioxin	3	PCB, dioxin	3	PCB, dioxin	3	PCB, dioxin	3	PCB, dioxin	3	PCB, dioxin
	> 22"			1, 2	PCB, dioxin	1, 2	PCB, dioxin	1	PCB, dioxin	1	PCB, dioxin	1	PCB, dioxin	1	PCB, dioxin	1	PCB, dioxin
Lake whitefish	6-22"	6	PCB														
	> 22"	7	PCB														

Table D.4. Summary table of fish consumption advisories (Michigan, 1998-2007) (cont.)

Fish species	Length	1998		1999		2000		2001		2002		2003		2004-2006		2007	
Chinook salmon	10-30"	7	PCB														
	> 10"			7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB
	> 30"	8	PCB														
Coho salmon	> 10"	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB
Burbot	> 6"	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB
Pine River																	
Alma Impoundment																	
Carp	6-26"	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB	6	PCB
	> 26"	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB	7	PCB
Largemouth bass	14-30"	3, 7	Mercury														
Downstream of Alma dam																	
All fish	> 6"							1, 2	PBB, DDT	1, 2	PBB, DDT	1, 2	PBB, DDT	1, 2	PBB, DDT	1, 2	PBB, DDT
St. Louis Impoundment and downstream																	
All fish	> 6"	1, 2	PBB, DDT	1, 2	PBB, DDT	1, 2	PBB, DDT										
Sanford Lake																	
Channel catfish	12-26"							6	Mercury, PCB	6	Mercury, PCB	6	Mercury, PCB	6	Mercury, PCB	6	Mercury, PCB
	> 26"							3, 7	Mercury, PCB	3, 7	Mercury, PCB	3, 7	Mercury, PCB	3, 7	Mercury, PCB	3, 7	Mercury, PCB

Table D.4. Summary table of fish consumption advisories (Michigan, 1998-2007) (cont.)

a. Some of the advisories below were issued specifically for Saginaw Bay. Other advisories were issued for Lake Huron, in whole or in part, which includes Saginaw Bay. See Table D.5 for more information.

Advisory codes:

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3 = Restricted consumption for general population, no more than 1 meal/week.

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5 = Restricted consumption for general population, no amount specified.

6 = Restricted consumption for subpopulations, no more than 1 meal/week.

7 = Restricted consumption for subpopulations, no more than 1 meal/month.

8 = Restricted consumption for subpopulations, no more than 6 meals/year.

9 = Restricted consumption for subpopulations, no amount specified.

Symbol key:

⊕ For this species, location, and year, an advisory was issued naming a list of pollutants that may have caused the advisory: mercury, PCB, PBB, DDT, dieldrin, chlordane, toxaphene, and dioxin.

⊗ Advisory was issued for all populations, which includes general and subpopulations.

∅ For this species, location, and year, an advisory was issued; however, the advisory did not identify a pollutant.

Table D.5. Saginaw Bay fish advisory information, including which species were listed for the bay specifically, and which were listed for broader areas of Lake Huron**Saginaw Bay geography notes**

1977-1981		1982-1983		1984		1985-1986		
Lake Huron	Saginaw Bay	Lake Huron (southern half of lake only) ^a	Saginaw Bay	Lake Huron (southern half of lake only) ^a	Saginaw Bay	Lake Huron (southern half of lake only) ^a	Lake Huron, all areas ^a	Saginaw Bay ^a
Salmon	Carp, catfish	Salmon, trout, muskellunge	Carp, catfish	Salmon, trout, muskellunge	Carp, catfish	Muskellunge	Salmon, trout, lake trout	Carp, catfish, salmon, trout
1987		1988		1989-1993		1994		
Lake Huron ^a	Saginaw Bay ^a	Lake Huron ^a	Saginaw Bay	Lake Huron ^a	Saginaw Bay	Lake Huron ^a	Lake Huron, south of Tawas Point ^a	Saginaw Bay
Brown trout, lake trout, rainbow trout	Brown trout, lake trout, rainbow trout, carp and catfish	Brown trout, lake trout, rainbow trout	Brown trout, lake trout, rainbow trout, carp, catfish	Brown trout, rainbow trout, lake trout	Brown trout, rainbow trout, carp, catfish	Brown trout, rainbow trout	Lake trout	Brown trout, rainbow trout, lake trout, carp, channel catfish
1995			1996		1997		1998	
Lake Huron ^a	Lake Huron south of Tawas Point ^a	Saginaw Bay	Lake Huron ^a	Saginaw Bay ^b	Lake Huron ^a	Saginaw Bay ^a	Lake Huron ^a	Saginaw Bay ^a
Brown trout	Lake trout	White bass, carp, channel catfish	Brown trout, lake trout	White bass, carp, channel catfish	Brown trout, lake trout	White bass, carp, catfish	Brown trout, lake trout, rainbow trout, lake whitefish, chinook salmon, coho salmon, burbot	White bass, white perch, yellow perch, northern pike, walleye, white sucker, carp, catfish

Table D.5. Saginaw Bay fish advisory information, including which species were listed for the bay specifically, and which were listed for broader areas of Lake Huron (cont.)

Saginaw Bay geography notes

1999-2000		2001-2006		2007	
Lake Huron ^a	Saginaw Bay ^{a, b}	Lake Huron ^a	Saginaw Bay ^{a, b}	Lake Huron ^a	Saginaw Bay ^{a, b}
Brown trout, lake trout, rainbow trout, whitefish, chinook salmon, coho salmon, burbot	White bass, white perch, yellow perch, northern pike, walleye, white sucker, carp, catfish	Brown trout, lake trout, rainbow trout, whitefish, chinook salmon, coho salmon, burbot	White bass, white perch, yellow perch, northern pike, walleye, white sucker, carp, channel catfish	Brown trout, lake trout, rainbow trout, whitefish, chinook salmon, coho salmon, burbot	White bass, white perch, yellow perch, northern pike, walleye, suckers, carp, channel catfish

a. The advisories also apply to tributaries into which certain species (salmon, trout) may migrate.

b. These advisories were issued with a note specifically informing readers to also follow Lake Huron advisories.

Table D.6. Summary of wild game consumption advisory

Animal/animal part	Type of advisory	General advice
Deer liver	No consumption	
Deer muscle meat	Women of childbearing age and children under the age of 15 should eat only one meal of deer muscle meat per week	Trimming any visible fat will lower the level of dioxins in the cooked meat
Turkey	No consumption	At a minimum, remove skin, liver, and gizzard
Squirrel	Women of childbearing age and children under the age of 15 should eat only one meal of squirrel meat per week	

Table D.7. Summary of the 2003 soil movement advisory for private, public, and commercial projects related to the Tittabawassee River furan and dioxin floodplain soil and sediment contamination, as it pertains to human health exposure risk and personal precautions to take

Actions	Types of activities	Increases to human health exposure risk (workers and residential)	Personal precautions to take
Minor household soil movement	Flower gardening, crop gardening, tree planting, lawn work, post hole digging, mowing, electrical and plumbing conduit trenching, etc.	Yes (residential only). Soil dermal contact, soil inhalation, soil ingestion.	Minimize soil exposure. Avoid allowing children to play in soils. Wash hands and any other exposed body surfaces after any soil contact. Do not eat unwashed foods from your garden. Do not engage in other activities that may introduce soil into the mouth. Keep soil moist to control dust. Remove footwear before entering the house. Store all used gardening clothing outdoors.
Major household soil movement activities	Construction of ponds or berms, construction of footings for homes or outbuildings, installation of septic tanks or tile fields.	Yes (residential only). Dermal contact, inhalation, and ingestion of soil during construction/soil movement activities.	Avoid contact with soil during construction activity, insist that piles of disturbed/excavated soil be fully covered with plastic sheeting until they are properly disposed of, insist that only clean fill from outside of the floodplain area be used to bring any areas back up to grade.

Table D.7. Summary of the 2003 soil movement advisory for private, public, and commercial projects related to the Tittabawassee River furan and dioxin floodplain soil and sediment contamination, as it pertains to human health exposure risk and personal precautions to take (cont.)

Actions	Types of activities	Increases to human health exposure risk (workers and residential)	Personal precautions to take
Commercial soil movement activities	Sand mining, road construction/repair, bridge construction/repair, sewer/water line construction/repair, utility (electric, hard line phone) construction/repair, and underground storage tank repair/removal.	<p>Yes. Worker safety issues related to dermal contact, soil inhalation, and soil ingestion during construction and soil movement activities.</p> <p>Yes. Residential exposures related to dermal contact, soil inhalation, and soil ingestion due to fugitive dust created during construction and soil movement activities.</p>	Provide appropriate safety equipment and clothing to workers that are in contact with disturbed soil areas as guided and prescribed by the Michigan Occupational Safety and Health Act. Depending on the activity, safety equipment could include dust masks or other appropriate inhalation protection devices, gloves and/or appropriate clothing to avoid dermal contact. Analytical testing may be needed to evaluate the soils at depth. Proper soil erosion techniques must be implemented including covering of disturbed soil piles with plastic sheeting until they are properly disposed. Wash vehicles before transport and cover soils in the truck to prevent blowing.

Table D.7. Summary of the 2003 soil movement advisory for private, public, and commercial projects related to the Tittabawassee River furan and dioxin floodplain soil and sediment contamination, as it pertains to human health exposure risk and personal precautions to take (cont.)

Actions	Types of activities	Increases to human health exposure risk (workers and residential)	Personal precautions to take
Sediment dredging activities	Boat launch maintenance, marina maintenance, bridge construction and repair. Installation or removal of pilings.	<p>Yes. Worker safety issues related to dermal contact, soil inhalation, and soil ingestion during dredging, sediment handling, and sediment movement activities.</p> <p>Yes. Residential exposures related to dermal contact, soil inhalation, and soil ingestion due to fugitive dust created during construction and soil movement activities.</p>	Provide appropriate safety equipment and clothing to workers in contact with disturbed soil or sediment areas as guided and prescribed by the Michigan Occupational Safety and Health Act. Depending on the activity and the dredge equipment used, this safety equipment could include masks or other appropriate inhalation protection devices, gloves, and/or other appropriate clothing to avoid dermal contact. Proper soil erosion techniques must be implemented including the covering of disturbed soil piles with plastic sheeting until they are properly disposed.
Commercial or large scale farming	Commercial or large scale farming, soil drainage and tile system construction activities.	<p>Yes. Worker safety issues related to dermal contact, soil inhalation, and soil ingestion during routine plowing, planting, and harvesting activities.</p> <p>Yes. Residential exposures related to dermal contact, soil inhalation, and soil ingestion due to fugitive dust created during the plowing, planting, and harvesting process as well as from windblown erosion.</p>	Refer to the MDA "Food, Farming, and Gardening Guidelines for Minimizing Dioxin Exposure," on the MDEQ web site. The MDA recommends utilization of minimum tillage and dust reduction practices in any production cycle, and following the personal risk reduction strategies recommended for gardening. Anyone raising livestock should contact MDA.

Table D.8. Summary of the 2003 soil movement advisory for private, public, and commercial projects related to the Tittabawassee River furan and dioxin floodplain soil and sediment contamination, as it pertains permits and potential environmental liability

Actions	Permits required	Potential environmental liability	Actions to avoid potential liability
Minor household soil movement	Generally no.	Part 115 (Waste Management), Part 31 (Water Resources), Part 201 (Environmental Remediation) of the NREPA, as amended.	Minimize or eliminate soil displacement and movement activities on property located within the floodplain. Dispose of any removed soil at the licensed landfill serving your area and only use clean fill or topsoil to regrade area. Do not move soil from low lying, more potentially contaminated areas to higher, potentially uncontaminated or less contaminated areas. Immediately put in place measures sufficient to prevent soil erosion from wind and rain.
Major household soil movement activities	Yes. Part 31 (Water Resources) of the NREPA for all major household soil movement activities occurring within the floodplain/flood way. Part 91 (Soil and Erosion Control) of the NREPA.	Part 115 (Waste Management), Part 31 (Water Resources), Part 201 (Environmental Remediation) of the NREPA. Note: A contractor hired by the home owner, or the owner of a disposal location, could also acquire liability for mishandling contaminated soil.	Minimize or eliminate soil displacement and movement activities on property located within the floodplain. Avoid placement of outbuildings, or the expansion of the home, to areas within the floodplain. Dispose of any removed soil at the licensed landfill serving your area and only use clean fill or topsoil to regrade area. Do not move soil from low lying, more potentially contaminated areas to higher, potentially uncontaminated or less contaminated areas. Immediately put in place measures to prevent soil erosion from wind and rain.

Table D.8. Summary of the 2003 soil movement advisory for private, public, and commercial projects related to the Tittabawassee River furan and dioxin floodplain soil and sediment contamination, as it pertains permits and potential environmental liability (cont.)

Actions	Permits required	Potential environmental liability	Actions to avoid potential liability
Commercial soil movement activities	Yes, Part 31 (Water Resources), Part 31 (Stormwater), Part 301 (Inland Lakes & Streams), Part 91 (Soil Erosion & Control), Part 41 (Sewer and Wastewater Systems), Part 399 (Water Mains) of the NREPA, depending on the activity.	Part 115 (Waste Management), Part 31 (Water Resources), Part 301 (Inland Lakes & Streams), Part 201 (Environmental Remediation) of the NREPA.	Dispose of all disturbed floodplain soil or river sediment at a licensed landfill, or in accordance with permit conditions. In situ testing of soil can be considered in lieu of disposal. Do not move soil from low lying, more contaminated areas to higher elevation, potentially uncontaminated or less contaminated areas. Do not move soil from the floodplain for use as fill at properties located outside of the floodplain. Immediately put in place soil erosion control measures to prevent soil movement from wind and rain.
Sediment dredging activities	Yes. Part 31 (Water Resources), Part 301 (Inland Lakes & Stream), Part 91 (Local Agency) of the NREPA, depending on the activity.	Part 115 (Waste Management), Part 31 (Water Resources), Part 301 (Inland Lakes & Streams), Part 201 (Environmental Remediation) of the NREPA.	Dispose of all disturbed floodplain soil or river sediment at a licensed landfill, upland disposal area, or in accordance with permit conditions. Do not use floodplain soil or sediment as fill at properties located outside of the floodplain. Immediately conduct measures sufficient to prevent soil erosion from wind and rain.
Commercial or large scale farming	No. Anyone raising livestock for commercial or personal use should contact MDA.	Part 201 (Environmental Remediation) of the NREPA.	Follow MDA guidance on the utilization of minimum tillage and dust reduction in any production cycle.

E. Environmental Media Chemical Concentration Data

Table E.1. Tittabawassee River

	Citations			
	Pre-1980	1980-1989	1990-1999	2000-present
Soil quality		Dow Chemical, 1984 Clark, 1985 U.S. EPA, 1985b, 1988c		ATS, 2007 MDEQ, 2003b, 2003c SETAC, 2006
Sediment quality	Sylvester, 1974 Dow Chemical, 1978a, 1978b Zillich et al., 1973	Amendola and Barna, 1986 Rossmann et al., 1983	MDNR, 1994b Jude et al., 1993	ATS, 2007, 2008 CH2M Hill, 2005b Hilscherova et al., 2003 MDEQ, 2003b Taylor and McCabe, 2002 SETAC, 2006
Surface water quality	Dow Chemical, 1978a, 1978b Johnson and Creal, 1960 Lawler Matusky & Skelly Engineers, 1983a Lenon et al., 1979b Michigan Water Resources Commission, 1975 Rossmann et al., 1983	Lawler Matusky & Skelly Engineers, 1983a, 1983b Murphy and Richardson, 1987 Rossmann et al., 1983 U.S. EPA, 1985a	Jude et al., 1993 MDNR, 1990c, 1994b, 1994d, 1994e	
Groundwater quality		Dow Chemical, 1984 U.S. EPA, 1985a, 1988b		
Dow air emissions		Dow Chemical, 1984 Clark, 1985 U.S. EPA, 1988a		

Table E.1. Tittabawassee River (cont.)

	Citations			
	Pre-1980	1980-1989	1990-1999	2000-present
Dow effluent	Dow Chemical, 1978a, 1978b Lawler Matusky & Skelly Engineers, 1983a MDNR, 1978b	Amendola and Barna, 1986 Lawler Matusky & Skelly Engineers, 1983a Murphy and Richardson, 1987		
Fish survey	Lawler Matusky & Skelly Engineers, 1983a Lenon et al., 1979b Mrozinski, 1979 Zillich, 1972	Davis, 1989 Lawler Matusky & Skelly Engineers, 1983a, 1983b Amendola, 1987 FCMP, 2007	MDNR, 1994b Dow Chemical, 1993	SETAC, 2006
Fish and wildlife tissue	Batchelder and Alexander, 1974 Dow Chemical, 1978a, 1978b, 1978c Hesse and Lauer, 1972 Rossmann et al., 1983 Sylvester, 1974 U.S. EPA, 1978 Willson, 1972 Wuerthele, 1971	Amendola and Barna, 1986 MDNR, 1991b, 1991c Clark, 1985 Masterson, 1989 MDPH, 1985 Murphy and Richardson, 1987 Rohrer, 1982 Schneider, 1985 U.S. EPA, 1986, 1988c	MDNR, 1991b FCMP, 2007	Zwiernik et al., In press (c) FCMP, 2007

Table E.1. Tittabawassee River (cont.)

	Citations			
	Pre-1980	1980-1989	1990-1999	2000-present
Benthic macroinvertebrate survey/tissue residuals	Lawler Matusky & Skelly Engineers, 1983a Lenon et al., 1979a, 1979b Sylvester, 1974 Zillich, 1972 Zillich et al., 1973	Gersich et al., 1985 Lawler Matusky & Skelly Engineers, 1983a, 1983b	MDNR, 1994b	SETAC, 2006 Matthew Zwiernik, personal communication, 2008
Birds wholebody/egg tissue residual		Clark, 1985		MDEQ, 2003b
Aquatic/terrestrial plant, small mammal, and terrestrial invertebrate tissue residuals				SETAC, 2006
Periphyton/phytoplankton survey	Lenon et al., 1979a Lawler Matusky & Skelly Engineers, 1983a Zillich, 1972	Lawler Matusky & Skelly Engineers, 1983a, 1983b		
Bioassay (toxicity testing, bioaccumulation, caged fish studies)	MDNR, 1971, 1973	Amendola and Barna, 1986 MDNR, 1981b Murphy and Richardson, 1987	MDNR, 1990c	

Table E.2. Saginaw River

	Citations			
	Pre-1980	1980-1989	1990-1999	2000-present
Sediment quality	MDNR, 1988b Evans, 1976	MDNR, 1988c Goudy, 1989 USACE, 1984, 1988 USFWS, 1993	Gossiaux et al., 1993 Thermo Analytical and ERG, 1993 USFWS, 1993	MDEQ, 2003b, 2006a Taft-William, 2004 Taylor and McCabe, 2002
Surface water quality	Wuerthele, 1968 Robinson, 1965 Zillich et al., 1973	U.S. EPA, 1990	Suppnick, 1996 U.S. EPA, 1990	
Fish and invertebrate survey/tissue residuals	MDNR, 1983b Hesse and Lauer, 1972 Zillich et al., 1973 Powers, 1974 U.S. EPA, 1978	Brandon et al., 1991 MDNR, 1983b, 1988c, 1991b, 1993b Peterson and Rossio, 1986 U.S. EPA, 1994	Gale et al., 1997 MDEQ, 1995 Morse, 1996 U.S. EPA, 1994 PSC, 2002	Bohr and Day, 2004 FCMP, 2007

Table E.3. Saginaw Bay

	Citations			
	Pre-1980	1980-1989	1990-1999	2000-present
Soil quality				MDEQ, 2003c
Sediment quality		Gossiaux et al., 1993 Meyers and Tkeuchi, 1981 USACE, 1984	Gossiaux et al., 1993	MDEQ, 2003b Shen et al., 2006
Surface water quality	Beeton et al., 1967 Fetterolf, 1961 Robinson, 1972 Wuerthele, 1968		MDEQ and GLEC, 2001 U.S. DOI, 1995b Walterhouse and Gerard, 1999	MDEQ and GLEC, 2005 Taylor and McCabe, 2002
Fish survey/tissue residuals	Batchelder, 1973 Carr, 1962 DeVault, 1984 Fetterolf, 1963a, 1963b, 1965 Hendrix and Yocum, 1984 MDNR, 1983b, 1988c Mills and Newton, 1963, 1968 Newton, 1968 Willson, 1972	Brandon et al., 1991 DeVault, 1984 Fehringer et al., 1985 Hendrix and Yocum, 1984 MDNR, 1983b, 1988c, 1990c, 1991b, 1993b O'Keefe et al., 1983 Peterson and Rossio, 1986 FCMP, 2007	Giesy et al., 1997 FCMP, 2007 MDEQ, 1995 PSC, 2002 U.S. DOI, 1995a	
Bird survey/tissue residuals		Ellenton and McPherson, 1983 Fox et al., 1988 Hebert et al., 1994 Jones et al., 1994 Ludwig et al., 1993 Yamashita et al., 1993	Ewins et al., 1994 Hebert et al., 1994	
Benthic invertebrate survey	Shannon et al., 1965 Surber, 1953, 1954, 1955a, 1955b			