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Public Health and Aquatic Life Concerns



Large kill of Gulf Menhaden in the Old Colorado River Channel

Public Health and Aquatic Life Concerns

Water pollution threatens public health by contaminating seafood, drinking water supplies, and recreational waters with toxic substances, as well as viruses and bacteria which cause disease. Aquatic organisms tend to tolerate most bacteria and viruses that are harmful to humans. Many aquatic organisms, however, are more sensitive to toxic substances than humans are.

Public Health Concerns

Some toxic pollutants in water, such as mercury, PCBs, and some pesticides have been linked to human birth defects, cancer, neurological disorders, and kidney ailments. Once discharged to surface waters, some toxic pollutants are persistent and accumulate in sediments or in organisms throughout the aquatic food chain. Humans can be exposed to toxic substances in water by ingestion of contaminated drinking water supplies, fish, or shellfish. Swimmers in contaminated recreational waters may also ingest toxic substances or absorb toxic pollutants through skin exposure. Edible fish and shellfish contaminated with toxic substances pose a greater threat to human health than contaminated drinking water. Fish and shellfish may bioconcentrate toxic substances in their tissues up to one million times the concentration of toxicants in the surrounding water.

The TNRCC and CRP monitor a large number of toxic substances in water, sediment, and fish tissue in streams and rivers, reservoirs and lakes, estuaries, and ocean waters suspected of potential contamination. Parametric coverage includes toxic substances with numeric criteria in the TSWQS (Table 72). For the 2000 report, water bodies with impaired aquatic life uses (due to acute or chronic exposure to metals and organic substances in water, ambient water and sediment toxicity tests), fish consumption uses (issuance of advisories and closures and exceedance of human health criteria for metals and organic substances in water) or concerns due to elevated toxic substances in fish tissue are identified and discussed separately in the streams and rivers, reservoirs and lakes, estuary, and ocean waters sections of this report. Public drinking water supplies that are threatened or impaired due organic substances in finished drinking water are also identified in each of the water body sections of the report. Impairments are also highlighted on the water body fact sheets in Volumes 2 and 3.

Table 72. Toxic Substances with Numerical Criteria in the Texas Surface Water Quality Standards

Toxicants with Criteria to Protect Aquatic Life:	
Aldrin	Guthion
Aluminum	Heptachlor
Arsenic	<i>gamma</i> -Hexachlorocyclohexane (lindane)
Cadmium	Lead
Carbaryl	Malathion
Chlordane	Mercury
Chlorpyrifos	Methoxychlor
Chromium (trivalent)	Mirex
Chromium (hexavalent)	Nickel
Copper	Total PCBs
Cyanide	Parathion
DDT	Phenanthrene
Demeton	Pentachlorophenol
Dicofol	Selenium
Dieldrin	Silver
Diuron	Toxaphene
Endosulfan I & II	Tributyltin
Endosulfan sulfate	2,4,5-Trichlorophenol
Endrin	Zinc
Toxicants with Human Health Criteria to Protect Human Consumption of Surface Water and Fish:	
Aldrin	N-Nitrosodi-n-butylamine
<i>alpha</i> -Hexachlorocyclohexane	PCBs
Arsenic	Pentachlorobenzene
Barium	2,4-D
Benzene	Danitol
Benzidine	Dibromochloromethane
Benzo(a)anthracene	1,2-Dibromoethane
Benzo(a)pyrene	Dieldrin
<i>beta</i> -Hexachlorocyclohexane	p-Dichlorobenzene (1,4-dichlorobenzene)
Bis(chloromethyl) ether	1,2-Dichloroethane
Cadmium	1,1-Dichloroethylene
Carbon tetrachloride	Dicofol
Chlordane	Dioxins/furans (TCDD equivalents)
Chlorobenzene	Endrin
Chloroform	Flouride
Chromium	<i>gamma</i> -Hexachlorocyclohexane (lindane)
Cresols	Heptachlor
Crysene	Heptachlor epoxide
Cyanide	Hexachlorobenzene
DDD	Hexachlorobutadiene
DDE	Pentachlorophenol
DDT	Pyridine
Hexachloroethane	Selenium
Hexachlorophene	1,2,4,5-Tetrachlorobenzene
Lead	Tetrachloroethylene
Mercury	Toxaphene
Methoxychlor	2,4,5-TP (silvex)
Methyl ethyl ketone	2,4,5-Trichlorophenol
Mirex	Trichloroethylene
Nitrate nitrogen	1,1,1-Trichloroethane
Nitrobenzene	TTHM (total trihalomethanes)
N-Nitrosodiethylamine	Vinyl chloride

Viral and bacterial pollutants in water may also cause serious human illness and death. Waters that receive inadequately treated sewage may contain organisms that cause dysentery, gastroenteritis, cholera, and infectious hepatitis. Bacteria and viruses may be ingested by humans that swim or have contact with contaminated water or through ingestion of contaminated drinking water or improperly cooked shellfish. Water bodies with impaired contact recreation use (elevated fecal coliform densities) are identified in each of the water body sections of the report. Coastal waters with impaired oyster waters (elevated fecal coliform densities) are identified in the estuary section of the report. The bacterial impairments are also highlighted and discussed on the water body fact sheets in Volumes 2 and 3.

There have been no closures of drinking water systems due to contamination of the raw water supply by toxic substances in the last five years. The state drinking water program that protects the health of citizens is discussed in its own section of this document.

Aquatic Life Concerns

Many aquatic organisms are sensitive to toxic pollutants. In severe cases of contamination, toxic pollutants kill aquatic life; in less severe cases, toxic pollutants may eliminate some species from the aquatic community. Toxic pollutants directly affect aquatic biota by increasing their susceptibility to disease, interfering with their reproduction, or reducing viability of their young. In some cases, toxic pollutants may cause physical abnormalities (tumors, skin lesions, fin damage, skeletal anomalies) in fish.

The number of fish kills provides a limited indication of pollutant impacts on aquatic life because fish kills do not always result from pollution. Natural conditions (drought, low flow, hot and cold water temperatures), bacteria and disease, and toxic algal blooms often cause fish kills. Discharge of organic pollutants which deplete dissolved oxygen is a leading cause of fish kills. Low dissolved oxygen concentrations may also result from natural conditions related to low stream flow in streams and rivers, sluggish tidal activity in estuaries, and poorly mixed headwater regions of reservoirs. The construction of dams and dead-end canals, which reduce circulation, also cause depression in dissolved oxygen that may lead to fish kills.

In many cases investigators cannot determine if pollution, natural causes, or both contributed to the fish kill. In many cases there is little evidence at the site or it may have been swept away by the currents before the investigation began. The exact location of the fish kill may also be difficult to determine, because currents in streams and rivers carry dead fish downstream from the source.

An estimated 137,414,484 fish were killed in Texas water bodies in 420 separate events over the five-year period considered in this report (June 1994 to May 1999) (TPWD, 2000). Most of the fish kills were small, involving less than 500 fish for each event. However, 27 massive kills, involving 1,000,000 or more fish, occurred during this time period. All but one of these large fish kills occurred bays or in the tidal portions of inflowing rivers. The only very large freshwater kill (9,000,000 fish) occurred on Lake Fork Reservoir (Segment 0512) in October 1994. The majority of the statewide fish kills were reported from coastal bays (90 kills; 21.4%), and Brazos River (55 kills; 13.1%), San Jacinto River (30 kills; 7.1%), and Colorado River (30 kills; 7.1%) basins. Approximately 70 percent of the 420 fish kills reported have been attributed to one of three causes: depressed dissolved oxygen concentrations, toxic substances, and extremes in water temperature (Figure 25). The depletion of dissolved oxygen by various sources accounted for 167 (39.8%) of the fish kills. Bacterial decay of organic materials, sewage bypasses, decreased stream flow, dead-end canals, and excessive aquatic plant growth that leads to nighttime anoxia are some examples of sources which contributed to the depressed dissolved concentrations.

Toxic substances caused the second largest number of kills (81; 19.3%) statewide, resulting in an estimated 284,645 dead fish (Figure 26). Spills of crude oil, gasoline, kerosene and other petroleum products accounted for the largest number (24 kills; 29.6 %) of toxic related fish kills. Substantial numbers of toxic-substances-related kills also resulted from chlorine discharges at domestic wastewater treatment plants (16 kills; 19.8%), pesticide applications (13 kills; 16.1%), and produced oil field brine water discharges (9 kills; 11.1%).

Most of the fish kills (68%) resulting from toxic substances were small, resulting in 500 or fewer dead fish for each event. Only six toxic substance related kills (7.4%) involved more than 10,000 fish. The majority of the statewide toxic substances related fish kills occurred the Trinity River (18 kills; 22.2%), San Jacinto River (12 kills; 14.8%), Brazos River (10 kills; 12.4%), and Sabine River (8 kills; 9.9%) basins and coastal bays (11 kills; 13.6%). Table 73 shows 81 fish kills that are suspected or known to have been caused by toxic substances.

Of the remaining statewide fish kills, some were the result of bacterial and viral diseases (39 kills; 9.3%) (Figure 25). Other kills were caused by physical damage (31 kills; 7.4%) due to entrapment, culling by-catch from shrimp nets, impingement on industrial intake screens, by organic substances in sewage spills (21 kills; 5.0%), and unknown causes (9.1%).

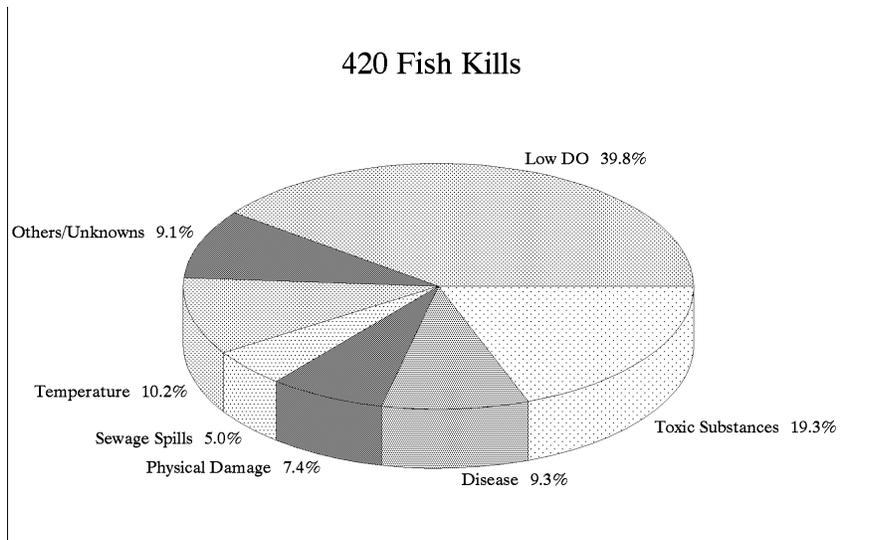


Figure 25. Major Causes of Statewide Fish Kills, 1994-1999.

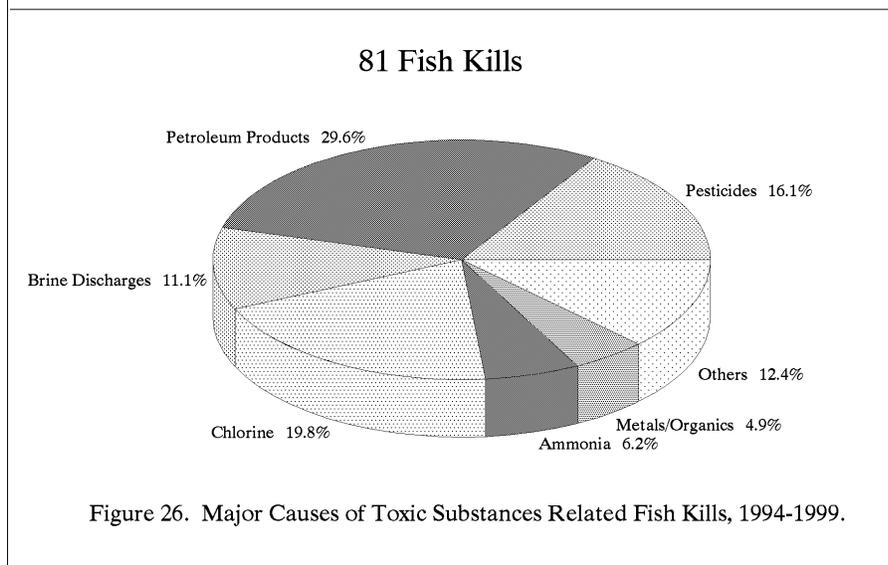


Figure 26. Major Causes of Toxic Substances Related Fish Kills, 1994-1999.

Fish Abnormalities

Significant reports of fish abnormalities have focused the efforts of TNRCC on the Rio Grande downstream of Laredo/Nuevo Laredo. The observations of unusually high numbers of fish abnormalities is often an indicator of toxic substances in the aquatic environment that effect normal growth or cause disease. Testing of water, sediment, tissue, and waste-water effluent has been undertaken to discover the potential sources of toxic substances for this water body. These concerns are outlined in Table 74.

Table 73. Toxic Substances Related Fish Kills, 1994-1999

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
0101	06/24/1998	19982A1629	Dixon Creek - downstream of Phillips 66 Refinery near Borger- Texas	3392	Inorganic compound	Hydrogen sulfide	See Specific Cause
0202	09/23/1994	19942M393	Choctaw Creek - at discharge from Oscar Meyer plant	50	Inorganic compound	Ammonia	See Specific Cause
0202	02/22/1996	19962M471	Waterloo Lake in Denison on north shoreline	20	Inorganic compound	Other	latex paint
0224	11/25/1995	19952M450	Private lake - Harold Taylor lease near Lefors-TX on Danny Lewis ranch.	100	Organic compound	Crude oil	See Specific Cause
0409	01/02/1997	19973A330	Gray's Creek -	21	Organic compound	Other	kerosene
0504	10/04/1996	19963A308	Mill Creek and Socagee Creek	12897	Inorganic compound	Brine	See Specific Cause
0505	08/02/94	19943M168	East Potter Creek-at Norit Americas plant or 5 mi up-stream from I-20 at Dale Creek	1000	Inorganic compound	Other	hydrochloric acid
0505	11/02/1995	19953M291	Hawkins Creek between Harrison Rd. and White Oak's water treatment plant.	1782	Inorganic compound	Brine	see Specific Cause
0505	07/07/1996	19963A315	Turkey Creek at Woodlawn Dr. in Kilgore	4	Inorganic compound	Brine	See Specific Cause
0505	07/11/1996	19963A294	Hawkins Cr at Bacle Rd	6474	Inorganic compound	Brine	See Specific Cause
0505	01/29/1997	19973A338	Hawkins Creek	917	Organic compound	Crude oil	See Specific Cause
0505	03/24/1997	19973A646	Prairie Creek - HWY 135 No of Kilgore to rt on 2207 to lft on Cole Bottom Rd	1	Organic compound	Crude oil	See Specific Cause
0506	06/23/1996	19963A311	Grand Saline Creek at HWY 80	62	Inorganic compound	Brine	See Specific Cause

Table 73. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
0601	04/22/1995	1995M457	Gulf States Utilities outfall canal	1388	Inorganic compound	Chlorine	See Specific Cause
0606	07/17/1995	19953M247	Trib of Black Fork Creek-1 mi NW of intersection of Hwy 31 and Loop 323; Tx Eastman.	100	Organic compound	Crude oil	see Specific Cause
0606	10/25/1995	19953M290	Black Fork Creek on La Gloria Oil and Gas refinery.	250	Organic compound	Gasoline	See Specific Cause
0804	05/24/1996	19963A301	Carrol Slough - on Richland WMA- North Unit	652	Inorganic compound	Brine	See Specific Cause
0806	03/24/1995	19952M353	Sycamore Creek - @ Vander Vorts Dairy Food Co. at 900 S. Main- Ft. Worth- TX.	15	Inorganic compound	Ammonia	See Specific Cause
0806	06/09/1995	19952M400	Sycamore Creek - in Sycamore Park on Vickery Blvd. in Ft.Worth- Tx.	100	Organic compound	Pesticide	organophosphate
0806	09/15/1997	19972A1386	Rush Creek - tributary at 4608 S. Cooper Street in Arlington-Texas	196	Inorganic compound	Chlorine	See Specific Cause
0806	07/11/1998	19982A1631	Little Fossil Creek - At intersection of Long and Broadway in Fort Worth-Texas	7047	Inorganic compound	Other	Lime
0810	04/11/1996	19962M492	Turkey Creek - near Bridgport-TX at Intersection of FM380 & 101	50	Organic compound	Diesel fuel	See Specific Cause
0820	03/30/1998	19982A1620	Kings Creek - City of Allen-Texas	95	Inorganic compound	Ammonia	See Specific Cause
0822	04/06/1995	19952M363	Beaver Creek leaving Las Calinas Golf Course in Dallas-Texas	100	Organic compound	Pesticide	Not Recorded In Original
0822	09/23/1995	19952M432	Quail Lake at Las Callinas Country Club	500	Organic compound	Pesticide	Not Applicable

Table 73. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
0822	12/08/1996	19972A721	Trinity River- at Indian Creek Golf Course between IH-35 and Hwy 121	5	Organic compound	Pesticide	Not Applicable
0827	06/16/1995	19952M388	White Rock Lake - Intersection of Floyd Road and Loop 635 in Dallas- Texas	300	Organic compound	Pesticide	diazanon
0827	08/14/1995	19952M420	White Rock creek - Coyt Road and L.B.J. in Dallas- Tx	20	Organic compound	Gasoline	See Specific Cause
0829	06/12/1995	19952M401	Unnammed waterbody - on Richland Country Club in Ft. Worth- Tx.	200	Organic compound	Pesticide	dursban
0829	01/19/1997	19972A738	Kings Creek-at Kings Creek Golf Course in Southwest Fort Worth	72	Organic compound	Other refined petroleum product	Jet A
0830	03/29/1996	19962M494	Benbrook Lake - at the drinking water plant	300	Inorganic compound	Other	Alum
0839	11/18/1995	19952M448	Pecan Creek - at IH-35- five miles north of the city of Denton- Tx.	150	Organic compound	Other refined petroleum product	waste motor oil
0841	03/08/1995	19952M351	Interturbine in Grand Prairie- Tx and Johnson Creek directly behind plant.	80	Inorganic compound	Metals	nickel chrome mix
0841	05/19/1995	19952M379	City View Lake #1 off Overton Park Blvd. in Ft. Worth- TX	300	Organic compound	Pesticide	Not Recorded In Original
1001	11/22/1996	19964A597	San Jacinto River- north of HWY 90 on San Jacinto River near Sheldon- Texas	10	Inorganic compound	Chlorine	See Specific Cause
1002	02/01/1995	1995M454	Ben's Branch Cr downstream of Woodland Hills Dr- Kingwood	2251	Inorganic compound	Chlorine	See Specific Cause
1004	06/02/1994	1994M444	Crystal Creek near Exxon plant--Conroe Field	30	Organic compound	Crude oil	see Specific Cause

Table 73. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
1004	01/23/1996	19964A573	IH 45 North Bound- North Conroe at the Shepherd Hill Exit	50	Organic compound	Other	antifreeze
1006	12/26/1994	1995M483	Greens Bayou and I-10	20	Organic compound	Other refined petroleum product	See Specific Cause
1007	10/25/1995	19964A590	Brays Bayou at Old Spanish Trail	1500	Pollutant	Chlorine	Not Applicable
1007	09/30/1996	19974A614	Little Vince Bayou at 1319 Red Bluff (Crown Petroleum)	40005	Organic compound	Crude oil	See Specific Cause
1014	09/07/1994	1995M464	Buffalo Bayou at Eldridge downstream two miles to below Wilcrest.	125	Inorganic compound	Chlorine	Undetermined
1014	10/05/1995	19964A586	Brays Bayou between Scott St. and O.S.T.	1000	Inorganic compound	Chlorine	See Specific Cause
1016	11/06/1997	19974B1043	Greens Bayou at Ella Blvd.	1000	Inorganic compound	Brine	See Specific Cause
1017	02/09/1995	1995M491	White Oak Bayou at HL&P @ Hwy 249 & Loop 610	200	Inorganic compound	Other	sulfuric acid
1017	11/06/1995	19964A581	White Oak Bayou	9569	Inorganic compound	Chlorine	Not Applicable
1101	07/06/1997	19974A1003	Unnamed tributary to Turkey Creek	5	Inorganic compound	Brine	See Specific Cause
1113	12/12/1997	19984B1047	Spencer Highway and Big Island Slough	19568	Organic compound	Gasoline	See Specific Cause
1208	04/13/1995	19952M365	Benjamin City lake - in Benjamin- TX	220	Organic compound	Rotenone	See Specific Cause
1217	06/19/1994	19942M311	Lampasas River - near Highway 190 at Kempner in East part of county	100	Organic compound	Pesticide	Rotenone

Table 73. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
1218	09/12/1997	19972A1385	South Nolan Creek - both Backstrom Crossing Bridges	1991	Inorganic compound	Chlorine	See Specific Cause
1219	12/15/1994	19952M330	31st Street and Golf Driving Range at Wincliff Addition south of Temple.	15	Organic compound	Other refined petroleum product	See Specific Cause
1223	09/18/1997	19972A1388	Leon River at Gustine- Texas	174	Organic compound	Pesticide	Undetermined
1224	06/11/1994	19942M306	North fork of Leon River at Missouri Pacific Railroad E. of Eastland	200	Inorganic compound	Other	hydrochloric acid
1227	09/28/1997	19972A1390	South Nolan Creek - from just above Levy Crossing to below Highway 190	2194	Inorganic compound	Chlorine	See Specific Cause
1231	12/16/1995	19962M457	Graham T.U. Electric Power Plant waste pond	300	Inorganic compound	Metals	See Specific Cause
1232	07/06/1997	19972A1348	Duck Creek - on old Caddo Rd. from Breckenridge to Melrose	300	Organic compound	Crude oil	See Specific Cause
1248	10/12/1998	20001A2891	Mankins Branch Creek at CR 102- E of Georgetown	37	Pollutant	Chlorine	Not Applicable
1401	04/10/95	1195M458	Town of Wadsworth, Big Boggy Creek-downstream of Gilmore Rd	6442	Inorganic compound	Other	Ammonim Nitrate Solution
1402	10/30/1994	1995M475	Linnville Creek	2	Inorganic compound	Fertilizer	Undetermined
1404	04/04/1998	19981A918	Hurst Creek at Lakeway Blvd. in Lakeway (Next to ""The Oaks"" golf course)	1317	Organic compound	Herbicide/defoli ant	daconil (chlorothalonil)
1427	07/09/1997	19971A889	Water main break at Stassney Ln 0.2 mi E of IH 35- Austin	6598	Inorganic compound	Chlorine	Not Applicable

Table 73. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
1428	03/29/1995	19951M750	Walnut Creek tributary in Austin	49	Organic compound	Gasoline	See Specific Cause
1429	07/27/1998	19981A929	Waller Cr next to MLK and Red River St in Austin.	1598	Pollutant	Chlorine	See Specific Cause
1429	08/17/1998	19981A930	Waller Cr at 2-000 blk of San Jacinto St.	4054	Inorganic compound	Chlorine	See Specific Cause
1604	04/25/1997	19975A423	North side of Hwy 59- approx 1 mile west of Ganado on Cherry rd	50	Inorganic compound	Brine	brine water
1804	10/28/1997	19971A883	Nash Creek - 0.5 mi downstream of CR 1150 (Darst Oil Field)	309	Organic compound	Crude oil	See Specific Cause
2002	04/30/1997	19975A415	3 miles N of Blackburn Ranch into Indian Creek- leading to Blanco Creek.	12	Organic compound	Crude oil	crude oil and brine
2302	06/09/1994	19975A864	Canal 4 miles S of Hwy 77 on FM 2520	100470	Inorganic compound	Pesticide	See Specific Cause
2424	07/06/1995	1995M504	Offats Bayou- area immediately behind Galveston Municipal Airport	100	Inorganic compound	Chlorine	See Specific Cause
2424	09/22/1995	19964A593	Highland Bayou diversionary canal (Hitchcock & Santa Fe area)	300	Inorganic compound	Chlorine	See Specific Cause
2425	07/25/1995	1995M505	Baytank docks- in the Clear Lake area	20	Organic compound	Other	Phenol
2425	10/16/1997	19974B1029	Kemah Channel and SH 146	100	Organic compound	Diesel fuel	See Specific Cause
2426	08/07/1994	1994M448	Goose Creek at Baker Street in Baytown	26529	Inorganic compound	Ammonia	Undetermined
2437	01/18/1996	19964A575	Sterling dock in the Texas City Ship Channel	125	Pollutant	Fuel oil	See Specific Cause

Table 73. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
2453	06/15/1994	19955M255	Lavaca Bay- bulk loading area in Calhoun Co. Nav. Channel	3	Inorganic compound	Other	Sodium Hydroxide
2453	12/04/1998	19995A2913	Cox Creek at Formosa Plastics Pt. Comfort	21	Pollutant	Other	AFPP (fire fighting foam)
2481	10/08/1994	19945M225	Gum Hollow Creek-Nueces and Corpus Christi Bays	14630	Organic compound	Crude oil	See Specific Cause
2481	03/30/1995	19955M286	Corpus Christi Bay- Ingleside by the Bay	2223	Organic compound	Pesticide	unknown
2481	05/13/1997	19975A889	Van Glidden Ditch- Bear Lane - Corpus Christi	39	Organic compound	Gasoline	super unleaded gasoline
2501	03/18/1996	19964A568	From Bolivar Roads to Gulf of Mexico	150	Pollutant	Fuel oil	See Specific Cause

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Table 74. Water Bodies Affected by Fish Abnormalities

Segment Name	Name of Water Body	Cause(s) Pollutant(s) of Concern	Source(s) of Pollutant(s)	Quantity of Fish with Abnormalities	Species Affected
Rio Grande Segment 2304	Rio Grande below Laredo	Municipal/ industrial dischargers	Nuevo Laredo, Tam., Mexico	10% or more	Carp, buffalo, catfish