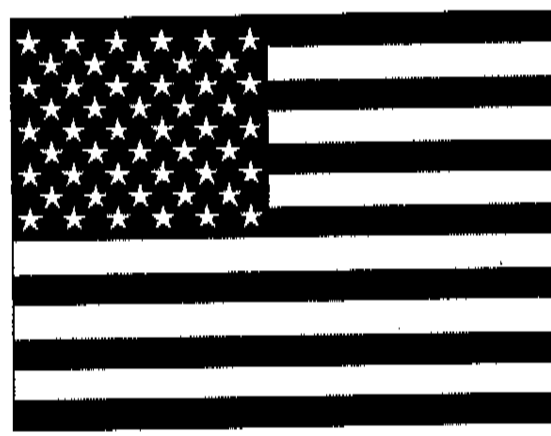
Binational Study Regarding the Presence of Toxic Substances in the Rio Grande / Rio Bravo and its Tributaries Along the Boundary Portion Between the United States and Mexico

Estudio Binacional sobre la Presencia de Sustancias Toxicas en el Rio Bravo/Rio Grande y sus Afluentes, en su Porcion Fronteriza Entre Mexico y Estados Unidos



Final Report, September 1994

Informe Final, Septiembre de 1994

AUTHORITY

This study and report were undertaken by the United States and México pursuant to the International Boundary and Water Commission Minute 289 entitled, "Observation of the Quality of the Waters Along the United States and México Border", dated November 13, 1992.

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Texas Natural Resources Conservation Commission
Texas Parks & Wildlife Department
Texas Department of Health

México

National Water Commission
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Forward

This report is issued by the Governments of México and the United States through their sections of the International Boundary and Water Commission, the National Water Commission of México and the U.S. Environmental Protection Agency. The governments of both countries thank the State of Texas, specifically the Texas Natural Resource Conservation Commission, the Texas Parks and Wildlife Department and the Texas Department of Health, for their participation in the study.

Copies of this report in English may be obtained from the Environmental Protection Agency Region 6 Office, 1445 Ross Avenue, Suite 1200, Dallas, Texas 75202-2733 or the International Boundary and Water Commission, 4171 North Mesa Street, Suite 310, El Paso, Texas 79902-1422.

Copies of this report in Spanish may be obtained from the Comisión Internacional de Límites y Aguas, Ave. Universidad No. 2180, Zona Chamizal, C.P. 32310 Cd. Juárez, Chih. or the following agencies of the Comisión Nacional del Agua: Gerencia Regional Norte, Sub Gerencia de Administracion del Agua, Comisión Nacional del Agua, Boulevard Revolucion No. 2343 Ote., C. P. 27000 Torreon, Coah., Tel. 18-9939, 18-9945; Gerencia de Calidad, Reuso del Agua e Impacto Ambiental, Ave. San Bernabe #549, Col. San Jeronimo Licice, México, D.F., C.P. 10200, tel. 595-2344, 683-1740.

EXECUTIVE SUMMARY

Over the last 15 years development has flourished along the México/U.S. border. Immigration to the area has led to substantial population growth in the cities, and given rise to many small, unincorporated communities. During this period, the population of the border region, a 200 km (124 mile) wide strip centered on the international boundary, has doubled to more than six million people (Emerson and Bourbon, 1991).

Economic growth, partially fueled by over 1,400 maquiladora (product assembly) plants that now exist along the border, has been accompanied by an increased potential for water quality degradation. Sewage treatment is inadequate in many communities on both sides of the border. In addition to potential impacts from oxygen-demanding substances, pathogenic microorganisms, and toxicants associated with sewage, other water quality concerns exist. One relates to the potential for pesticide contamination in farming regions around El Paso/Ciudad Juárez, Presidio/Ojinaga, Eagle Pass/Piedras Negras, and the lower Rio Grande/Río Bravo valley. Another is the threat of toxic chemical contamination posed by operation of the maquiladoras (Lewis et al., 1991) and other industries located on both sides of the border.

In the past few years, much local, state, and national media attention from both countries has focused on purported water quality problems in the Rio Grande/Río Bravo, particularly the potential for toxic chemical contamination associated with the proliferation of maquiladoras. At a 1991 public hearing on the proposed Integrated Border Environmental Plan, much public concern was voiced regarding environmental conditions along the river, and especially over the limited amount of toxic substances data available for the Rio Grande/Río Bravo.

In February 1992 the United States and México issued the Integrated Environmental Plan for the Mexican-U.S. Border Area (First Stage, 1992-1994). The plan calls for the two countries to work together to solve environmental problems in the border area. Specifically, the plan calls for the two countries to identify areas where any transboundary water source or potential transboundary water source is contaminated or where there is an identifiable threat of contamination.

In response to the need for comprehensive information, the two countries agreed to an intensive water quality investigation of the Rio Grande/Río Bravo from El Paso/Ciudad Juárez to Brownsville/Matamoros. Coordination between the two countries was conducted by the Mexican and U.S. sections of the International Boundary and Water Commission (IBWC). The IBWC developed IBWC Minute number 289, dated November 13, 1992, which approved the study design and addressed binational cooperation for the water quality investigation. Study participants included the Texas Natural Resource Conservation Commission, Texas Parks and Wildlife Department, Texas Department of Health, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. National Park Service, International Boundary and Water Commission - U.S. & México Sections, Comisión Nacional del Agua, and Secretaría de Desarrollo Social.

The main objective of the study was to screen the system for the occurrence and impact of toxic chemicals. The goals were to clarify concerns about present conditions in the river, and to determine if existing water quality controls are adequate. The study was conducted during 1992-93 and involved sampling at 19 mainstem sites and 26 tributaries along the reach of the river which forms the international boundary between the U.S. and México (see attached map and station descriptions). This study did not include sample collection from International Amistad and Falcon International Reservoirs.

Sampling and analysis were conducted by each country according to their respective analytical capabilities. Thus, the U.S. evaluation included determinations of toxic chemical concentrations in water (45 sites), sediment (45 sites), and fish tissue (18 mainstem sites, 6 tributaries); toxicity testing of water and sediment (45 sites); and bioassessments of fish communities (18 mainstem sites, 7 tributaries) and benthic macroinvertebrate communities (18 mainstem sites). México concurrently collected samples of water and sediment and conducted analyses for conventional parameters and heavy metals (45 sites).

Valid analytical results were obtained by the U.S. for 153 toxic chemicals in water, 145 in sediment, and 140 in tissue. A total of 48 toxic chemicals were detected, 30 of which exceeded the screening levels established by U.S. investigators. Valid results were obtained by México for 9 conventional parameters in water and 12 heavy metals in both water and sediment. A total of nine toxicants were identified, all of which exceeded Mexican standards.

Few potential toxic chemical-related problems were observed in the mainstem. Only 5 toxic chemicals exceeded U.S. screening levels in water, 8 in sediment, and 12 in tissue. A total of six toxic chemicals were identified by México in the mainstem, exceeding Mexican standards for aquatic life. In the toxicity tests, significant adverse effects occurred in just 2 of 114 determinations, from samples collected upstream from El Paso/Ciudad Juárez and downstream from Laredo/Nuevo Laredo. Fish and macrobenthic communities generally were healthy; however, in 5 of 36 instances, at the stations listed below, aquatic community characteristics reflected a moderate or high probability of toxic chemical impact (numbers in parentheses are station identifiers).

Downstream from El Paso/Ciudad Juárez (2)
Downstream from Eagle Pass/Piedras Negras (10)
Downstream from Laredo/Nuevo Laredo (12)
Downstream from Anhelo Drain South of Las Milpas (16)

Biotic integrity at the main stem sites indicated that if toxic impacts were occurring, the effects were relatively slight. No instances of severe aquatic life use impairment were observed.

Potential problems were more prevalent in tributaries, which was not surprising since some of them transport wastewater in relatively undiluted form. According to U.S. results, 17 toxic chemicals exceeded screening levels in water, 15 in sediment, and 8 in tissue. In addition, samples from 14 of the 26 tributaries produced significant adverse effects in at least one phase of the toxicity tests. Results from México's analyses indicated eight potentially toxic chemicals that exceeded their water quality standards.

Regarding human health issues, no short-term risks were indicated for the 24 sites that were subjected to edible fish tissue analysis, in that there were no exceedances of U.S. Food & Drug Administration action levels. However, low-level human health criteria were exceeded in water and/or edible fish tissue at 22 of the 45 sites. For 17 of these sites, slight human health risks could result from regular, long-term consumption of untreated water and/or fish. Significant risks were observed for the other five sites. However, because all five are sewage effluent-dominated tributaries, these waters are nonpotable and conventional water quality is not conducive for support of viable fish populations.

All available information was used to identify sites and chemicals of potential concern, to facilitate water quality management decisions and future monitoring efforts. The 30 chemicals identified by the U.S. that exceeded screening levels were considered to be of potential concern, and were assigned an approximate level of importance based on occurrence. A high priority group included residual chlorine, methylene chloride, toluene, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, chlordane, p,p' DDE, dieldrin, gamma-bhc (lindane), total PCB's, and cyanide. A medium priority group consisted of non-ionized ammonia, parachlorometa cresol, phenol, and diazinon. A low priority group was comprised of phenolics recoverable, chloroform, antimony, thallium, bis(2-ethylhexyl) phthalate, diethyl phthalate, and di-n-butyl phthalate. Results obtained by México were in agreement with the aforementioned priorities.

Regarding sites of potential concern, mainstem stations and tributary stations were addressed separately. The following stations include those that exhibited either high potential or slight to moderate potential for toxic chemical impacts. Unlisted sites exhibited negligible evidence of toxic chemical impacts.

Mainstem Sites

High Potential for Toxic Chemical Impacts

Downstream from El Paso/Ciudad Juárez (2)
Downstream from Laredo/Nuevo Laredo (12)

Slight to Moderate Potential for Toxic Chemical Impacts

Upstream from Río Conchos confluence near Presidio/Ojinaga (3)
Downstream from Eagle Pass/Piedras Negras (10)
Downstream from Anzalduas Dam (14)
Below Anhelo Drain South of Las Milpas (16)

Tributaries

High Potential for Toxic Chemical Impacts

El Paso Public Service Board Haskell R. Street Wastewater Treatment Plant (1a)
Ciudad Juárez Discharge Canal (2a)

Manadas Creek (10a)
Zacate Creek (11a)
Arroyo El Coyote (11c)
Anhelo Drain (15a)

Slight to Moderate Potential for Toxic Chemical Impacts

Río Conchos (3a)
San Felipe Creek (7b)
Unnamed Tributary South of Eagle Pass/Piedras Negras (9a)
Arroyo Los Olmos (12d)

Based on the degree of toxic chemical contamination and volume of inflow, the Haskell R. Street Wastewater Treatment Plant (1a) and Ciudad Juárez sewage discharge canal (2a) appeared to have a high potential for adversely affecting the Rio Grande/Río Bravo. The Río Conchos (3a), San Felipe Creek (7b), Zacate Creek (11a), and Anhelo Drain (15a) have a slight to moderate potential for adversely affecting the river. Remaining tributaries present little or no potential for significant impacts to the Rio Grande/Río Bravo based on data collected during the study.

Also, a binational study is proposed during 1994 and 1995 that will examine the prevalence and magnitude of toxic chemicals in fish tissue collected from International Falcon and Amistad Reservoirs.

Follow-up binational studies were recommended for the purposes of better defining the degree of impact, assessing temporal variation, and further identifying sources of toxic chemicals. The studies, listed below, would be conducted during 1994 and 1995, pending international agreement through the U.S. and México sections of IBWC.

Additional surveillance would be conducted at the six mainstem and ten tributary sites where a slight-to-moderate or high potential for toxic chemical impact was indicated, including expanded monitoring in the vicinities of El Paso/Ciudad Juárez (2) and Laredo/Nuevo Laredo (12)

Intensive surveys would be performed on tributaries of potential concern that support significant aquatic life habitat, i.e., Río Conchos (3a) and San Felipe Creek (7b)

Toxic chemical concentrations in fish tissue would be reassessed in the Rio Grande/Río Bravo stations at Foster Ranch (6), upstream from Del Rio/Ciudad Acuña (7), upstream from Eagle Pass/Piedras Negras (9), and upstream from the old Laredo/Nuevo Laredo International Bridge (11), and

Toxic chemical concentrations in fish tissue would be assessed in the headwaters of International Amistad and Falcon Reservoirs.

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INTRODUCTION

Over the last 15 years development has flourished along the México/U.S. border. Immigration to the area has led to substantial population growth in the cities, and given rise to many small, unincorporated communities, or colonias. During this period, the population of the border region, a 200 km (124 mile) wide strip centered on the international boundary extending from the Pacific Ocean to the Gulf of Mexico, has doubled to more than six million people (Emerson and Bourbon, 1991).

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Historical Information

Water quality and biological data for the U.S. portion of the Rio Grande/Río Bravo basin were summarized by TNRCC (1992a). The Comisión Nacional del Agua (CNA) also has conducted water quality analyses based on physical, chemical, and bacteriological parameters from 1976 to 1993. An evaluation of this data is found in Appendix D. Conclusions regarding conventional water quality are addressed elsewhere in the present report (see "Conventional Water Quality" under "RESULTS AND DISCUSSION").

Literature relative to biotic integrity in the Rio Grande/Río Bravo, some of which addressed influential environmental factors, also was reviewed in the 1992 report. Possible toxic chemical impacts were mentioned for several locations, but little supporting evidence was provided. Regarding toxic chemicals, the 1992 evaluation included all available information generated by U.S. agencies. For the international portion of the river, the data base was described, data were evaluated, toxic chemicals of potential concern were identified, potential sources of toxic chemicals were addressed, possible impacts were considered, and conclusions were drawn. Potential concerns were revealed for four locations.

The first was the segment of the Rio Grande/Río Bravo in El Paso/Ciudad Juárez (represented by station 2 in the present study), where flow is dominated by municipal wastewater effluent during low flow periods. Local macrobenthic community integrity was very low during a 1976-77 study, with toxic pollutants thought to be partially responsible. In addition, periodic toxicity testing by USEPA/TNRCC since 1992 has shown significant adverse effects in water on two occasions, and in sediment eluate on one occasion (Table 18). Whereas there have been indications of impacts by toxicants, the toxic chemical data base is limited, so concrete conclusions were not possible at the time of the 1992 evaluation.

The second was the segment of the Rio Grande/Río Bravo downstream from the Río Conchos confluence to a point 16 km (10 miles) downstream (represented by station 4 in the present study), where elevated concentrations of DDE, DDD, DDT, endrin, dieldrin, and PCB's were observed in sediment and/or fish tissue during special studies in the late 1970's. Upstream/downstream sampling identified inflow from the Río Conchos as the primary contributor, most clearly with respect to DDE and DDT. Data from the late 1980's indicated that contaminant levels, particularly for DDE and DDT, had diminished substantially. Periodic toxicity testing since 1992 has revealed only one instance of significant adverse effects (Table 18). The 1992 report concluded that existing pesticide concentrations probably are not significantly impairing biotic integrity in the reach, and more than likely do not pose an appreciable human health hazard, but that a possibility remains that predatory fish, birds, and wildlife may be moderately affected through accumulation and biomagnification of pesticide residues.

The third was the segment of the Rio Grande/Río Bravo from Laredo/Nuevo Laredo to the headwaters of International Falcon Reservoir (represented by station 12 in the present study). The basis was chemical data and field observations from a monitoring station 14 km (9 miles) downstream from Laredo, where copper, selenium, and chlordane in fish tissue had exceeded screening criteria. Also, on several occasions fish collected at the site had exhibited an elevated incidence of physical abnormalities. Whether toxic chemicals were responsible was unknown. A potential for slight toxic impact has been shown in periodic toxicity testing since 1991, as significant adverse effects have occurred on two occasions (Table 18). Nonetheless, recent studies have shown that the local species assemblage is fairly diverse, indicating that environmental conditions are reasonably healthy and that fish community integrity is not being appreciably impaired by toxic chemicals or other ecological factors.

The fourth was the segment of the Rio Grande/Río Bravo immediately upstream from International Anzalduas Dam near Mission/Reynosa (represented by station 14 in the present study), where elevated levels of DDT, DDE, and toxaphene in fish tissue were documented by the U.S. Fish and Wildlife Service (USFWS) during 1967-79. In a 1988 USFWS report, an evaluation of temporal trends for tissue data from the site (1970-86) showed that DDT and DDE steadily declined, while toxaphene exhibited a slight increase. Data for the site in a 1988 U.S. Geological Survey report included several instances where DDE and toxaphene exceeded screening criteria in fish tissue. TNRCC fish tissue monitoring for DDT, DDD, DDE, and toxaphene in this segment has shown only one exceedance, by DDD. Although no specific impacts by pesticide residues have been documented in the International Anzalduas Dam area, a potential appears to exist for adverse effects on piscivorous fish, birds, and wildlife.

To summarize the 1992 evaluation, the overall conclusion for the basin was that toxic chemical contamination and associated impacts were relatively insignificant at that point in time. However, it was emphasized that the toxic chemical data base was rather limited for some segments, mainly with regard to parametric and/or matrix coverage. Recommendations for filling data gaps were offered, and were taken into account in the design of the present study.

Study Area

The Rio Grande/Río Bravo originates in the San Juan Mountains of southern Colorado, flows southward through New Mexico, and enters Texas about 32 km (20 miles) northwest of El Paso/Ciudad Juárez. From there to the Gulf of Mexico, the river forms the international boundary between the United States and México. The river extends for about 3,059 km (1901 miles), with the U.S./México reach being about 2,053 km (1276 miles) in length. The watershed encompasses about 924,300 square kilometers (335,500 square miles). Of that total, about 231,317 square kilometers (88,968 square miles) in the United States and 227,149 square kilometers (87,365 square miles) in México contribute streamflow to the Rio Grande/Río Bravo; the remaining area drains internal (endorheic) basins. The U.S. portion of the basin below El

Paso/Ciudad Juárez contains 125,580 square kilometers (48,300 square miles), of which 100,880 square kilometers (38,800 square miles) contribute streamflow to the river.

The study was conducted on the U.S./México reach of the river, that portion extending from the New Mexico/Texas/Chihuahua border to the Gulf of Mexico (Figure 1). Population along the reach is centered in five transborder metropolitan areas: El Paso/Ciudad Juárez (1,303,130); Eagle Pass/Piedras Negras (116,829); Laredo/Nuevo Laredo (341,312); McAllen, Edinburg, Mission/Reynosa (416,776); and Brownsville/Matamoros (365,017). The economy of the area is based on wholesale and retail trade, oil and gas production, agriculture, manufacturing, tourism, and international trade.

The river is an important natural resource for industry, agriculture, domestic water supply, recreation and aesthetic enjoyment, and wildlife and aquatic life habitat. Most of the major tributaries, and some of the lesser ones, are also of significance in these respects. Substantial agricultural areas where river water is diverted for irrigation include the El Paso/Ciudad Juárez area, Eagle Pass/Piedras Negras area, and Rio Grande/Río Bravo valley downstream from International Falcon Dam. Through the reach from Laredo/Nuevo Laredo to the mouth, the river constitutes the primary drinking water source for up to 98% of the population in both countries.

In western Texas, a substantial reach extending from near Redford/El Mulato to near Terlingua/Nuevo Lajitas forms the southern boundary of the Big Bend Ranch State Natural Area. Immediately downstream, another long reach lies within the U.S. Big Bend National Park, and constitutes a major feature of that facility. The U.S. portion of the reach from the eastern boundary of the park to International Amistad Reservoir is a designated National Wild and Scenic River segment. International Amistad Reservoir and International Falcon Reservoir, two large mainstem impoundments constructed primarily for water conservation management and floodwater control, are major tourist attractions. Amistad is a designated National Recreational Area, and Falcon is the site of Falcon State Park, Texas. In the lower Rio Grande/Río Bravo valley, the river and its riparian environment are prominent features within a number of parks and refuges. In Texas these include Bentsen State Park, Anzalduas Park, Santa Ana National Wildlife Refuge, Anacua State Wildlife Management Area, Sabal Palm Sanctuary, and the Lower Rio Grande/Río Bravo Valley National Wildlife Refuge, the latter comprised of 30 small, separate tracts. Cumulatively, these parks and refuges are heavily utilized for recreation, and are inhabited by significant assemblages of plants, birds, wildlife, and aquatic life, including various rare and endangered species, and species that occur only peripherally in the United States. The States of México that border the river are Chihuahua, Coahuila, Nuevo Leon and Tamaulipas.

Various characteristics of the study area are important to an understanding of the river's ecology. These include climatic, hydrologic, geologic, physiographic, and biotic features.

Climate in the northern portion of the basin generally is hot and arid, but becomes increasingly tropical in a southward direction. Annual rainfall averages about 20 cm (8 inches) at El Paso/Ciudad Juárez, 46 cm (18 inches) at Del Rio/Ciudad Acuña, 51 cm (20 inches) at Laredo/Nuevo Laredo, and 65 cm (26 inches) at Brownsville/Matamoros.

The system is complex hydrologically. At the New Mexico/Texas/Chihuahua border, low flow in fall and winter is derived from alluvial seepage and delayed irrigation return flows. Higher flow during the spring/summer irrigation season originates from reservoir releases in New Mexico. Most of the flow reaching El Paso/Ciudad Juárez is diverted for irrigation at the American Dam (U.S.) and International Dam (México). Perennial flow reappears through the lower portion of El Paso, sustained by a large municipal wastewater discharge from the El Paso Public Service Board Haskell R. Street wastewater treatment plant. A short distance downstream, most of the flow is diverted for irrigation at the Riverside Diversion Dam (U.S.). The long reach from there to the Río Conchos confluence is seasonally intermittent. Base flows are derived mainly from irrigation returns, with small contributions from alluvial seepage and springflow from mountain creeks and arroyos.

Inflow from the Río Conchos (México), the largest tributary in the U.S./México reach, typically dominates flow through the next stretch, which assumes the Río Conchos' water quality and biological characteristics (Davis, 1980). The volume of flow contributed by the Río Conchos is dependent upon releases from Chihuahua reservoirs. Flow in the Rio Grande/Río Bravo is perennial from the mouth of the Río Conchos to the Gulf of Mexico. No overly significant inflows or diversions exist between the Conchos and International Amistad Reservoir near Del Rio/Ciudad Acuña. Two major U.S. tributaries, the Pecos and Devils rivers, contribute inflow to International Amistad Reservoir. Downstream from Amistad, instream flow volume is dependent on releases from the reservoir, and to a lesser extent on the amount of inflow contributed by tributaries, primarily San Felipe Creek, Sycamore Creek, Pinto Creek, and Las Moras Creek (U.S.), and the Río San Diego, Río San Rodrigo, and Río Escondido (México).

Major diversions for irrigation and electric power generation, and return flows, result in increasingly variable instream flow conditions downstream from Eagle Pass/Piedras Negras. In the Laredo/Nuevo Laredo area, instream flow is augmented by substantial volumes of domestic wastewater entering from both sides of the river. Downstream, the river is impounded by International Falcon Dam, and below there instream flows are governed by releases from the reservoir and by the volume of inflow from three Mexican tributaries, the Río Salado, Río Alamo, and Río San Juan. At International Anzalduas Dam near Mission/Reynosa, large volumes of water typically are diverted for domestic and agricultural usage in México. From there to the Gulf of Mexico, instream flow generally progressively decreases due to multiple small withdrawals, but is highly variable depending on releases from International Anzalduas Dam, operations of wastewater dischargers and municipal water supply systems, and irrigation return flows.

Based on geologic, physiographic, climatic, and biotic characteristics, the river is divisible into three distinctive reaches. The upper reach extends from El Paso/Ciudad Juárez to Big Bend Village/La Linda, and lies within the Chihuahuan biotic province (analogous to the Southern Deserts ecoregion). This reach is physiographically complex, and has three natural geological sections.

The Bolson Section from El Paso/Ciudad Juárez to Ft. Quitman/Banderas lies in a large bolson of Quaternary alluvial deposits, in terrain marked by arroyos, bad-land topography, dunes, and blow sand, with thin scrub brush and grass cover. Tertiary mountainous outcrops border the river valley on the Mexican side. The river through this section is principally a sand-bed stream. Channel width averages about 40 m (131 feet), and the mean gradient is 0.6 m/km (0.1 feet/mile). The river is channelized/leveed through much of the section, and there are no major tributaries.

The Presidio/Ojinaga section, from Ft. Quitman/Banderas to 16 km (10 miles) southeast of Redford/El Mulato, is topographically rugged, with mountains and basalt-capped mesas exhibiting precipitous fronts along the river valley except in a bolson at the Rio Grande/Río Bravo-Río Conchos confluence. Vegetation is sparse except in the river bottom where salt cedar and mesquite thrive. The bed load is principally coarse gravel to small boulder, although sand and fine gravel predominate in localized areas. Riverbed width is about 40 m (131 feet) and the mean gradient is 0.8 m/km (0.2 feet/mile). The Río Conchos is the only major tributary.

The complex terrain of the upper Canyon Section, from 16 km (10 miles) southeast of Redford/El Mulato to Big Bend Village/La Linda, alternates between level bolsons and elevated horst blocks, intrusive uplifts, and anticlinal mountains, through which the river has cut deep canyons. Vegetation is scant, except for dense salt cedar and mesquite along the river. Bed load material is mainly sand and gravel, ranging from fine sand to large cobbles. Stream width varies from 15 m (49 feet) in constrictive canyons to 40 m (131 feet) in bolsons, and the mean gradient is 0.9 m/km (0.2 feet/mile). Although no major tributaries exist, discharge increases through the section due to springflow.

The lower Canyon Section extends from Big Bend Village/La Linda to just south of Del Rio/Ciudad Acuña, and lies in a transitional zone between three biotic provinces: the Chihuahuan to the west, Balconian to the east, and Tamaulipan to the south (analogous to the Southern Deserts, Central Texas Plateau, and Southern Texas Plains ecoregions, respectively). The river throughout is incised in hilly Cretaceous limestones of the Stockton and Edwards plateaus. Desert shrub, mesquite, oak, and juniper cover thickens downstream with increasing rainfall, and extensive stands of cane grass and Bermuda grass grow along the stream margins. Streambed composition is similar to that in the upper Canyon Section. Stream width is variable, with a maximum of 100 m (328 feet) at Del Rio/Ciudad Acuña, and the mean gradient is 0.7 m/km (0.1 feet/mile). Principal tributaries are the Pecos and Devils rivers, which converge with the Rio Grande/Río Bravo below Langtry/San Ignacio to form International Amistad Reservoir.

Downstream of Del Rio/Ciudad Acuña, the river emerges from the Edwards Plateau and enters the Rio Grande/Río Bravo embayment, a broad, mesquite-chaparral syncline plunging gently to the south. This constitutes the lower reach, or Coastal Plains Section, which extends to the Gulf of Mexico. The area is encompassed by the Tamaulipan biotic province (analogous to the Southern Texas Plains ecoregion). Strong neotropical biotic influences are exerted, in contrast to the Chihuahuan and Balconian provinces where nearctic influences predominate. The topography is flat to gently rolling, with local relief rarely exceeding 90 m (295 feet). Vegetative cover, predominated by thorny brush species, increases to the south as the climate changes from semiarid near Del Rio/Ciudad Acuña to subtropical near Brownsville/Matamoros. The river is entrenched as much as 15 m (49 feet) into Tertiary formations. Bed load material between Del Rio/Ciudad Acuña and International Falcon Reservoir is principally small gravel and sand. Downstream from International Falcon Dam, it grades to fine sand and then to sandy silt as the Gulf of Mexico is approached. The channel generally is wide, in the range of 100-150 m (328-492 feet). The mean gradient decreases from 0.7 m/km (0.1 feet/mile) near Del Rio/Ciudad Acuña to 0.2 m/km (0.04 feet/mile) near Laredo/Nuevo Laredo, and approaches sea level near Brownsville/Matamoros. Significant tributaries include Sycamore Creek, Pinto Creek, and Las Moras Creek (U.S.), and the Río San Diego, Río San Rodrigo, Río Escondido, Rio Salado, Río Alamo, and Río San Juan (México).

STUDY DESCRIPTION

The study was designed on the basis of several interagency planning meetings, and comments from numerous internal and external reviews of early drafts of the work plan. Agencies with principal involvement in project planning included: UNITED STATES - Texas Natural Resource Conservation Commission (TNRCC), Texas Parks and Wildlife Department (TPWD), Texas Department of Health (TDH), U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), U.S. National Park Service (USNPS), U.S. Section, International Boundary and Water Commission (USIBWC); MÉXICO - Seccion Mexicana de La Comisión Internacional de Límites y Aguas (CILA), Comisión Nacional del Agua (CNA), Secretaria de Desarrollo Social (SEDESOL). The binational sampling team was comprised of representatives from TNRCC, TPWD, USEPA, USIBWC, CILA, and CNA.

Quality Assurance

The study was conducted in accordance with a USEPA-approved quality assurance project plan (TNRCC, 1992b). Specified data quality objectives were achieved. Results of data quality evaluations are presented in Appendix C.

Sampling Sites

A total of 45 sites were sampled (Table 1; Figure 1), 19 of which were on the mainstem. Sixteen mainstem sites were established to bracket areas where the greatest likelihood for toxic chemical contamination was thought to exist. These included sites upstream and downstream from El Paso/Ciudad Juárez, Presidio/Ojinaga, Del Rio/Ciudad Acuña, Eagle Pass/Piedras Negras, Laredo/Nuevo Laredo, International Anzalduas Dam, Hidalgo/Reynosa, and Brownsville/Matamoros. Single stations were established in the U.S. at Big Bend National Park and in the U.S. at Foster Ranch near Langtry/San Ignacio, to characterize conditions in remote, ecologically important reaches. A supplemental station was established at the mouth of Lozier Canyon to provide a baseline for future assessments of the effects of inflows from the canyon.

Twenty-six inflows to the river, collectively categorized as tributaries, were sampled (13 in the U.S.; 13 in México). These were selected based on size, geographical proximity to the mainstem areas of principal interest, and suspected potential for contributing toxicants to the mainstem. Each tributary was sampled in the lowermost reach, but far enough above the mouth to avoid mainstem backwaters.

Types of Analyses

The 18 major mainstem sites were subjected to measurements of selected conventional parameters in water; determinations of toxic chemical concentrations in water, sediment, and fish tissue; toxicity testing of water and sediment; and bioassessments of fish and benthic macroinvertebrate communities. Analyses performed at the supplemental mainstem site (5b) and all tributaries included measurements of selected conventional parameters in water; determinations of toxic chemical concentrations in water and sediment; and toxicity testing of water and sediment. Certain tributaries, mostly those that were large enough to permit boat electrofishing, were also subjected to determinations of toxic chemical concentrations in fish tissue, and/or bioassessments of fish communities (stations 3a, 6a, 6b, 7b, 8d, 9b, 12d).

México conducted analyses on conventional parameters and metals on the water and sediment samples.

Parametric Coverage

In addition to toxic chemical parameters, water samples were analyzed for ammonia, total organic carbon, total hardness, total suspended solids, total dissolved solids, chloride, sulfate, turbidity, pH, temperature, specific conductance, dissolved oxygen, and residual chlorine; sediment for particle size composition, total organic carbon, and acid volatile sulfide; and fish tissue for percent lipid content. A total of 161 toxicants were targeted for analysis in all sample matrices (Table 2). These included priority pollutants identified in the U.S. Code of Federal Regulations (CFR) Part 423 Appendix A, except for dioxin and asbestos, plus the following non-priority pollutants: 11 pesticides for which numerical criteria have been established by the State of Texas and approved by the U.S., 19 pesticides recommended for inclusion by USEPA Region 6, and three chemicals shown by Lewis et al. (1991) to have a potential for affecting the Rio Grande/Río Bravo. For water, the targeted list of toxicants totalled 163, due to inclusion of two potentially toxic conventional parameters, ammonia and residual chlorine. Numbers of parameters for which valid analytical data were obtained are summarized in the Data Completeness section of Appendix C.

METHODS

Physicochemical Techniques

Field Procedures

Standard TNRCC sampling protocols (Roques et al., 1991) were employed in the United States and México except where specific modifications were required. Dissolved oxygen, temperature, pH, and conductivity were measured in the field using a Hydrolab Surveyor II, and residual chlorine using the DPD ferrous titrimetric method (APHA, 1992). Instantaneous flow was obtained from U.S. Section IBWC flow gages where available; otherwise, measurements were made on-site by IBWC/CILA personnel.

Water Sampling

Water samples were collected in flowing water, generally at midstream, by boat or by wading. Aliquots for all but one parametric group were collected directly from the stream by submerging appropriate containers to a depth of one foot.

Aliquots for dissolved metals were obtained using ultra-clean procedures involving the use of disposable rubber gloves and a peristaltic pump. Water was pumped directly from the stream, through pretreated rubber tubing with a 0.45μ in-line filter in place. Metals-grade nitric acid and type 2 deionized water were used to pretreat tubing and containers and to preserve the samples. Volumes, specifications and pretreatment of containers, and preservation methods for the various types of water samples are presented in Table 3.

Field blanks and duplicates were employed at a frequency of about 10%. Quality assurance samples were collected, preserved, and handled in identical fashion to ambient water samples.

Sediment Sampling

Sediment sampling generally was performed in slack water areas near the stream banks, where deposition was adequate to allow collection of sufficient sample volume (> 9 liters). The entire column of fine-grained, surficial sediment was sampled, regardless of thickness. Thus, the depth to which subsamples were taken was variable among sites, ranging from about 0.5 cm (0.2 inches) to about 8 cm (3 inches).

Most samples were taken with a stainless steel Ekman dredge, which required the collection of 10-20 bites. During one survey, the dredge became inoperable, and sampling was conducted with a shovel, with 5-10 scoops comprising each sample. At a few tributary sites, surficial sediment layers were so thin that sampling had to be performed by scooping a large number of small subsamples with teflon lid liners.

At each site, subsamples were composited in a plastic bucket and thoroughly mixed with a large plastic spatula. The slurry was then poured into individual sample containers. Sediment sampling equipment was scrubbed with a brush in dilute Alconox solution and thoroughly rinsed with site water prior to collecting each sample. Types of sediment samples and descriptions of sample containers, container pretreatment, and sample preservation are presented in Table 3.

Tissue Sampling

Tissue sampling was conducted using the study protocol, which called for the collection and analysis of two whole body and two fillet (edible tissue) composite samples per selected site. Each composite sample was to be comprised of five fish of similar size, except where target species were scarce and a smaller number had to be utilized or where more individuals had to be composited to achieve the required amount of tissue. The actual number varied from two to 18, and occasionally an individual fish was analyzed. Efforts were made to include a predatory species and a bottom-feeding species at each site. Target species were largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), and common carp (*Cyprinus carpio*). Alternate species collected included white bass (*Morone chrysops*), smallmouth bass (*Micropterus dolomieu*) and blue catfish (*Ictalurus furcatus*).

Fishes were collected by boat electrofishing and were held in live wells until specimens were selected for analysis. The fish selected were held on ice in clean coolers pending field preparation of the samples. Total length and weight were recorded for each specimen and any unusual deformities, wounds, or infections were noted. The sex of each individual was also noted in the case of fillet samples. If fishes contacted debris during collection and handling, they were rinsed with distilled water before being processed.

The Texas Tissue Sampling Guidelines (Appendix 18 *in*: Roques et al., 1991), a consensus document prepared by Texas state and U.S. federal agencies, was followed with minor exceptions in preparation of edible fish tissue samples (fillets). Fishes were filleted on a polypropylene cutting board covered with aluminum foil. The dull side of the foil was placed toward the sample on the cutting board, and when specimens were wrapped. Skinless fillets were removed from both sides of each fish and individually double wrapped in aluminum foil. All coolers, stainless steel fillet knives, polypropylene cutting boards, weighing trays, and measuring boards were cleaned between stations, or between composite samples. The cleaning procedure was a detergent wash, followed by rinsing in ambient water and a final rinse in distilled water. All instruments were allowed to air dry. Cutting boards were covered with fresh foil between samples.

In processing whole fish samples, dorsal and pectoral spines, if present, were clipped (and included in the sample) to avoid puncturing the foil wrapping. Each fish was double wrapped in aluminum foil.

Foil packages were labeled and placed in a plastic bag with other individuals for that composite sample. Fillet samples were split for dual analysis by the U.S. and México.

Sample Handling

Recommended storage, preservation, and holding time requirements were observed during transport and analysis of water, sediment, and tissue samples (see Table 3). All samples were stored and shipped on ice. Ice chests containing the samples and appropriate chain-of-custody forms were sealed with tape, and shipped to the laboratories via overnight freight.

Laboratory Analyses

Split samples of water, sediment, and tissue were collected for analyses by labs in the U.S. and México. All U.S. analyses of water, sediment, and fish tissue were performed by the Texas Department of Health (TDH) Environmental Chemistry Laboratory, Austin, Texas. TDH performed analyses of environmental samples according to a USEPA-approved quality assurance/quality control plan (Twidwell et al., 1991).

México conducted lab analyses on its samples in the CNA Laboratories in Chihuahua, Chih., Torreon, Coah., Tampico, Tamps., Monterrey, N.L., and México, D.F., as well as in the laboratories of ATLATEC, S.A., in Monterrey, N.L. With regard to the evaluation of the results, México used Mexican standards for water quality.

Methods employed by both labs are presented in Table 4.

Data Evaluation

U.S. toxic chemical data were evaluated using screening level concentrations listed in Tables 7, 8, and 9. For water, screening values were derived from the following sources, in order of priority: (1) State of Texas criteria for protection of aquatic life and human health (TNRCC, 1991); (2) U.S. federal water quality criteria (USEPA, 1986, and subsequent updates thereto); (3) chemical concentrations that have been considered for U.S. federal criteria (USEPA, 1980a-1980n); (4) national 85th percentile values (Greenspun and Taylor, 1979); and (5) chemical concentrations from supplemental sources. All sources from which screening levels were adopted are documented in footnotes to Tables 7 and 8. This array of information allowed incorporation of at least one screening value for every toxic chemical detected in water (Table 13).

México evaluated data using Mexican water quality standards. The Mexican water quality standards are listed in Table 7.

For U.S. sediment data, preferential screening values involved national interim or draft sediment quality criteria (USEPA, 1989, 1991). However, as these are available for only a few chemicals, sediment data were primarily screened using contaminant threshold concentrations for protection of aquatic biota (USEPA, 1985a). These were derived by USEPA in a manner similar to the equilibrium partitioning approach (USEPA, 1989), employing an equilibrium partitioning assumption and USEPA aquatic life water quality criteria. The original values are based on an assumption that sediment contains four percent organic carbon. For the present study, threshold values presented by USEPA (1985) were modified using total organic carbon data from Table 11:

$$\text{site-specific screening level concentration} = \frac{\text{mg/kg TOC in sample}}{\text{40,000 mg/kg TOC}} \times \text{USEPA threshold concentration}$$

For sediment contaminants for which threshold values were not developed in the 1985 USEPA study, screening level concentrations were obtained from additional sources, as identified in footnotes to Tables 7 and 9. National 85th percentile values (Greenspun and Taylor, 1979) were also utilized if available.

U.S. edible fish tissue data were screened for human health risks using USFDA (1993) action or tolerance limits, USEPA (1993) values for establishment of fish advisories, and TDH (1992) risk assessment levels. Whole fish tissue data were primarily evaluated using national 85th percentiles (Schmitt and Brumbaugh, 1990), state 85th percentiles (TNRCC, 1994), national mean concentrations (Schmitt *et al.*, 1990; USEPA, 1992), and predator protection limits developed by various agencies. All sources from which screening levels were derived are identified in footnotes to Table 7.

Biological Techniques

Toxicity Testing

U.S. toxicity testing was performed by the USEPA Region 6 Laboratory in Houston, Texas, according to procedures described by Weber *et al.* (1989). Accuracy and precision were ensured through conformance with standard USEPA quality assurance/quality control procedures.

U.S. sediment eluates were prepared by combining a subsample from the homogenized sediment sample with appropriate culture water. The sediment and water were combined in a sediment-to-water ratio of 1:4 on a volume basis by volumetric displacement. After combining, the mixture was tumbled end-over-end for approximately 24 hours, after which the mixture was allowed to settle for an additional 24 hours at 3-4 °C. After settling, the eluate was siphoned off and filtered through a 1.5 μ glass fiber filter before testing was initiated.

U.S. water and sediment eluate samples were evaluated using two different toxicity tests. The first was the *Ceriodaphnia dubia* Seven-Day Survival and Reproduction Test (USEPA Method 1002.0). Neonates less than 24 hours old were utilized for testing. One neonate was added to each of ten replicates for the control (culture water) and the 100% test water or sediment eluate sample. Test chambers were 30 mL beakers containing 15 mL of test or control water. The organisms were fed once daily. Test solutions were renewed on days two, four, and six. Mortality, number of young produced, dissolved oxygen, and temperature were monitored and recorded daily. At the termination of the tests, mortality and reproduction data were analyzed statistically ($p = 0.05$) using Fisher's Exact Test and the t test, respectively, to determine differences between control organisms and those exposed to the test solutions.

The second was the Fathead Minnow, *Pimephales promelas*, Seven-Day Embryo/Larval Survival and Teratogenicity Test (USEPA Method 1001.0). Embryos less than 36 hours old were utilized for testing. Ten embryos were added to each of three replicates for the control (culture water) and the 100% test water or sediment eluate sample. Test chambers were 400 mL Nalgene culture dishes containing 250 mL of test or control water. Feeding was not required during the exposure period. Test solutions were renewed on days two, four, and six. Mortality (deformed larvae were counted as dead), dissolved oxygen, and temperature were monitored and recorded daily. At the termination of the tests, mortality data were analyzed statistically ($p = 0.05$) using the *t* test, to determine differences between control organisms and those exposed to the test solutions.

Macrobenthic Community Assessment

Macrobenthic organisms were collected using two techniques. At sites where rocky-bottomed riffles were present, a composite of three to five subsamples were taken with a Surber square foot sampler. Where riffles were lacking, snag (submerged woody debris) sampling was employed. Snags of 2.54 cm (1 inch) diameter or less were cut into pieces using lopping shears, with enough material collected to fill two 1-qt. Mason jars. At two sites, both types of samples were collected for purposes of comparison.

Benthic samples were preserved in 5% formalin, returned to the lab, and washed in a U.S. Standard No. 30 soil seive. Snags were scrubbed with a soft-bristle brush, and after all organisms were removed, the surface area of each snag was determined. Organisms were picked from debris at 12X magnification using a dissecting microscope, enumerated, and identified to the lowest possible taxonomic level.

Macrobenthic data were evaluated using two techniques, to provide a crosscheck. The first was the Mean Point Score (MPS), the method routinely used by TNRCC for assessing macrobenthic community integrity. The MPS involves six metrics, five of which relate to community structure (species richness, standing crop, Ephemeroptera-Plecoptera-Tricoptera or EPT index, diversity, and equitability). The sixth relates to community function, and is comprised of three submetrics (number of functional feeding groups, prevalence of the most abundant functional feeding group, and cumulative prevalence of organisms that feed on fine particulate organic matter). Each metric value is assigned from 1 to 4 points using criteria developed by TNRCC (Twidwell and Davis, 1989). Point scores correspond to aquatic life use subcategories (4 = exceptional; 3 = high; 2 = intermediate; 1 = limited). The point score assigned the community function metric represents the lowest indicated by any of the three submetrics. The MPS is calculated by dividing the sum of the individual point scores by six. An aquatic life use subcategory rating is derived from the following MPS criteria ranges: >3.50 = exceptional; 2.50-3.50 = high; 1.50-2.49 = intermediate; <1.50 = limited.

The second technique was the Invertebrate Community Index (ICI) developed by Ohio EPA (1987), which utilizes ten community structure metrics (taxa richness, mayfly taxa richness, caddisfly taxa richness, dipteran taxa richness, percent mayfly composition, percent caddisfly composition, percent tribe Tanytarsini midge composition, percent other dipteran and non-insect composition, percent tolerant organisms, and EPT index). Each metric value is assigned a point score (0, 2, 4, or 6), and the scores are summed to arrive at the ICI value. An aquatic life use subcategory rating is derived from the following ICI criteria ranges: 45-60 = exceptional; 35-44 = high; 11-34 = intermediate; 0-10 = limited.

Fish Community Assessment

U.S. fish community evaluations were conducted by the TPWD Freshwater Studies Program. Boat electrofishing and seining were employed in tandem at all mainstem sites as well as at sites on selected tributaries (Figure 1). The goal was to collect a representative sample of the fish species present in proportion to their relative abundances. Attempts were made to sample all major habitat types in a study reach. Electrofishing was conducted with a boat-mounted, boom electrode powered by a 7.5 kV generator producing pulsed DC current. Duration was at least 15 minutes per site, with sampling occurring in a downstream direction. Attempts were made to net all observed fish. As a complementary technique, seining was typically used to sample habitats where boat electrofishing would not be as effective (*e.g.*, shallow riffles and bars). Two straight seines were used for most collecting: 30 feet by 6 feet by 1/4 inch delta weave mesh and 15 feet x 6 feet x 3/8 inch delta weave mesh. The number of seine hauls depended on available habitat and varied from four to 11. All fishes collected by both methods were examined for deformities, lesions, and tumors. Seine samples and voucher specimens of larger fishes were fixed in 10% formalin and later transferred to 75% ethanol. Fishes were identified or field identifications were verified in the laboratory employing a variety of references, including Hubbs *et al.* (1991). Common and scientific names follow Robins *et al.* (1991).

Several approaches were used to evaluate the fish community for potential anthropogenic influences, and reflect different levels of screening. An initial screen was provided by descriptively evaluating the occurrence of species in this study and determining whether patterns of presence or absence of fish species indicated any long-term trends. That evaluation was followed by comparisons to historic data. A second level screen involved evaluating species richness and composition and then employing a similarity index, a measure of the similarity of species composition between two sampling sites (Odum, 1971). This index varies from zero, with no species in common between sites, to 1.0, with all species in common. The equation employed was:

$$\mathbf{S} = 2\mathbf{C} / (\mathbf{A} + \mathbf{B}),$$

where **S** = index of similarity, **A** = number of species in sample A, **B** = number of species in sample B, and **C** = number of species common to both samples. Given the fact that the study design employed sites upstream and downstream from major sister cities, any substantial change in species composition between the samples could indicate impacts (in the absence of sampling bias or physical habitat related differences). A third level of screening involved calculating a community index derived from the Index of Biotic Integrity (IBI) presented by Karr *et al.* (1986), and evaluating individual metrics as well as observing the cumulative score.

Developing an IBI type index for the Rio Grande/Río Bravo and its tributaries was problematic given the wide range of habitats, faunal changes, and hydrologic modifications encountered over the more than 2,000 km (1,243 miles) of river covered by the study. Despite these problems, an attempt was made to present a preliminary IBI, though much more emphasis was placed on interpretation of individual metrics than the total score. These metrics should be considered provisional until they can be applied to additional data sets to determine if they respond in a predictable fashion to direct or indirect impacts to the fish community. Two different series of IBI metrics were calculated corresponding to communities identified through preliminary analysis of faunal patterns. These groupings encompassed the following areas: mainstem Rio Grande/Río Bravo upstream of International Falcon Reservoir and tributaries including the Río Conchos, Pecos River, Devils River, San Felipe Creek, Río San Rodrigo, and Río Escondido (stations 1-12, 3a, 6a, 6b, 7b, 8c, and 9b); and the mainstem Rio Grande/Río Bravo downstream of International Falcon Reservoir and including Arroyo Los Olmos (12-18, 12d). More indices could have been derived given the differences noted by Hubbs *et al.* (1977) upstream and downstream of the Río Conchos and the distinct fauna found in the tributaries. However, since the goal of this effort was to evaluate communities relative to the potential presence of toxic chemicals, it was appropriate to simplify the criteria and employ only one set of metrics for the entire area above International Falcon Reservoir. This approach was reinforced by the overall study design, which emphasized differences between sites upstream and downstream of major sister cities rather than a longitudinal comparison of all sites. Furthermore, the middle river tributaries (3a, 6a, 6b, 7b, 8c, and 9b) comprise distinct habitats and were analyzed separately from the mainstem sites. In summary, IBI scores were not and should not be compared among these groups since the composition and rationale of the metrics as well as the habitats varied widely.

This IBI was substantially modified from Karr *et al.* (1986) given the variation of Rio Grande/Río Bravo fish communities from those in the midwestern United States from which the index was originally developed. Modifications were based upon examination of this data set, suggestions by Karr *et al.* (1986) and Miller *et al.* (1988), and previous experience in applying IBI to Texas streams (Linam and Kleinsasser, 1987; Kleinsasser and Linam, 1989; Hornig *et al.*, in press). Criteria were developed using historical data (Trevino-Robinson, 1959; Hubbs *et al.*, 1977; Edwards and Contreras-Balderas, 1991), a summary of fauna in the Rio Grande/Río Bravo basin (Smith and Miller, 1986), and data from a project designed to develop biological criteria for stream communities within the state's ecoregions (Bayer *et al.*, 1992).

The metrics employed for the mainstem upstream of International Falcon Reservoir and the Río Conchos are summarized in Table 5 along with the rating criteria. The number of metrics was much reduced from that proposed by Karr *et al.* (1986), with only three of the original ones being employed in this study. The original metrics were the total number of species, total number of individuals, and percentage of diseased individuals. Though Miller *et al.* (1988) caution against reducing the number of metrics, the Rio Grande/Río Bravo fauna is somewhat depauperate and cannot be appropriately evaluated using simple modifications. Consequently, we followed the approach of Moyle *et al.* (1986), who used a reduced series of metrics to evaluate the depauperate fauna of the Sacramento-San Joaquin drainage in California.

Metrics evaluating the contribution of percids, centrarchids, and catostomids were eliminated in favor of a single metric representing the number of minnow species other than the introduced common carp. Centrarchids and percids were eliminated because native species from those groups are fewer in the Rio Grande/Río Bravo when compared to the fauna of more eastern drainages (Smith and Miller, 1986). Suckers are also somewhat depauperate in the mainstem of the Rio Grande/Río Bravo, with only four species being commonly collected and those species having differing responses to man-induced environmental stress. Cyprinid species have historically been species rich throughout the Rio Grande/Río Bravo basin and dominated the diversity of the Rio Grande/Río Bravo ichthyofauna (Smith and Miller, 1986). We have observed them to be reliable indicators of environmental change in our other studies of Texas streams and rivers (Linam and Kleinsasser, 1987; Kleinsasser and Linam, 1989). Hughes and Gammon (1987) used cyprinids as a target group in an IBI study of the Willamette River in Oregon, citing the responsiveness of that family to deterioration of habitat structure (see also Minckley, 1973; Moyle, 1976). Ramsey (1968) proposed that many species in the minnow family could be good indicators of water quality, though he cautioned that specific habitat requirements for many species are unknown.

Metrics relating to tolerance were eliminated given the naturally harsh environmental conditions in the Rio Grande/Río Bravo basin. The number of intolerant species and proportion of green sunfish [=tolerant species (Karr *et al.*, 1986)] were replaced with a single metric, the percentage of individuals in the most abundant species, as an indication of whether a single species was dominating the fish community at a site.

The hybrid metric (Karr *et al.*, 1986) has rarely provided much information about degradation in previous studies employing IBI in Texas and was replaced in this study with the percentage of individuals as introduced species. Miller *et al.* (1988) indicated that the hybrid metric has been difficult to apply in most regions and reviewed the problems associated with it. Use of a metric dealing with introduced species provides another means of evaluating perturbations, since these species may become populous in altered habitats. This metric has previously been used by Crumby *et al.* (1990), and, as cited by Miller *et al.* (1988), the proportion of introduced individuals often increases with increasing habitat degradation (see Moyle and Nichols, 1973; Courtenay and Hensley, 1980; Leidy and Fielder, 1985). Hubbs (1982) indicates that the survival of exotics can be enhanced by other perturbations and used impoundments as an example. The term "introduced species" as employed here, refers to species not native to the Rio Grande/Río Bravo basin, recognizing, however, that certain species native to the basin such as inland silverside (*Menidia beryllina*) have increased their ranges through introductions. The status (introduced or not) of the species we collected are listed in Table 6 and result from consulting Hubbs (1982), Smith and Miller (1986), and Hubbs *et al.* (1991).

Trophic metrics--proportion of insectivorous cyprinids, proportion of top carnivores, and proportion of omnivores--were not employed because of concerns about collecting fishes in their relative abundances in a large, turbid river system.

Metrics and criteria used to evaluate the mainstem Rio Grande/Río Bravo downstream of International Falcon Reservoir, and Arroyo Los Olmos, are listed in Table 5. They are similar to those used on the upstream reach of the river, but were modified to take into account the proportionate numbers of euryhaline species that have become common downstream. Consequently, a metric was added to account for the percentage of the sample as estuarine/marine species. Designation of these species is listed in Table 6 and follows Edwards and Contreras-Balderas (1991), though estuarine and marine species were combined into one group. Criteria were adapted from historical information in Trevino (1955) and summarized in Edwards and Contreras-Balderas (1991). This metric measures the species shift from the native, riverine community to one increasingly represented by euryhaline species. The number of minnow species was eliminated, recognizing that they were historically an important group in the lowermost reach. However, all sites downstream of International Falcon Reservoir would have scored poorly using that metric, making it insensitive in differentiating between sites. In addition, it was beneficial to keep the number of metrics the same in upstream and downstream reaches. However, if the primary intent of the study had been to consider historical changes in the fauna, it would have been included.

Though it departs from the conventions of others (Trevino-Robinson, 1959; Hubbs *et al.*, 1977; Smith and Miller, 1986; and the description of the Study Area in the present report), in discussing fish communities the upper reach is defined as the area upstream of International Amistad Reservoir; the middle reach, the area from International Amistad Dam to International Falcon Reservoir; and the lower reach, the area from International Falcon Dam to the mouth.

Finally, it should be noted that a single sample evaluation of the fish community can provide an indication of potential problems, but only at a screening level. In short, further sampling and evaluation would be needed to validate and define the extent of potential problem sites noted in this study.

RESULTS AND DISCUSSION

Sampling was accomplished through four field surveys: El Paso/Ciudad Juárez to Big Bend National Park/San Vicente, November 11-15, 1992; Rio Grande City/Camargo to Brownsville/Matamoros, January 11-14, 1993; Langtry/San Ignacio to Eagle Pass/Piedras Negras, February 8-12, 1993; and Eagle Pass/Piedras Negras to Rio Grande City/Camargo, March 22-26, 1993. Sampling dates for individual sites are presented in Table 10. Survey sequence was based on prevalence of favorable weather and hydrological conditions.

The study focused on instream conditions associated with low flow. As such, demonstrable instream effects primarily reflected influences by point source discharges. Instream flows (Table 10) were within targeted ranges at 18 of the 19 Rio Grande/Río Bravo sampling sites. Flow at station 13, (Rio Grande/Río Bravo at Los Ebanos/Valadeces), was about four times the preferred level, due to releases from International Falcon Reservoir. Despite a request, the release could not be shut down because of irrigation needs in México. The existence of high flow downstream from International Falcon Reservoir was not considered a major detriment. Station 13, the only sampling site in the affected reach, was an upstream control site where no appreciable toxic chemical-related problems were anticipated. Most of the flow there would have consisted of water released from International Falcon Reservoir, whether the discharge had been 28 or 113 cms (1,000 or 4,000 cfs). In addition, most of the water released from the reservoir was being diverted at International Anzalduas Dam, and desired low flow conditions were prevalent at the remaining survey sites.

There were slight differences in the analytical results between the two countries, possibly as a result of the differences in methodology and instrumentation.

Conventional Water Quality

Previous information (TNRCC, 1992a) and data from the present study (Table 10) were reviewed to provide an indication of conventional water quality. CNA also has conducted water quality analyses based on physical, chemical, and bacteriological parameters from 1976 to 1993. An evaluation of this data is found in Appendix D.

Mainstem

TNRCC (1992a) summarized ten years of U.S. water quality data (1982-1991) for 12 Rio Grande/Río Bravo monitoring sites that bracket six major U.S./México sister cities. Potential human health risks due to bacteriological contamination were evident for five of the six downstream sites. Nutrient concentrations were somewhat elevated in these same areas. Inflows of treated and untreated sewage and nonpoint source runoff from the sister cities were considered responsible. Average dissolved oxygen concentrations, however, exceeded 5 mg/L throughout the longitudinal gradient, with no major depressions at sites downstream from the sister cities. Only 16 of 1,257 instantaneous dissolved oxygen measurements, or about 1%, were less than 5 mg/L. Most of the depressed values occurred at the site upstream from Presidio/Ojinaga, and in the reach downstream from International Falcon Reservoir, and were attributed mainly to sluggish current velocity/low atmospheric reaeration rates associated with extreme low flows. One other item of potential concern involved periodic exceedances of total dissolved solids criteria upstream from Presidio/Ojinaga and downstream from Brownsville/Matamoros.

Data from the present study for chloride, sulfate, total dissolved solids, pH, temperature, and dissolved oxygen were evaluated using Texas Surface Water Quality Standards (TNRCC, 1991). Criteria were not achieved in only two instances, as chloride and total dissolved solids were elevated at station 3, and sulfate and total dissolved solids at station 18, the same sites where occurrences of this type have previously been documented by TNRCC (1992a). Dissolved oxygen concentrations were greater than 5 mg/L at all sites. Total organic carbon data were reviewed as an indicator of organic enrichment. Levels were relatively low at all sites, ranging from 3-11 mg/L. Concentrations at ten of the 19 sites were 5 mg/L or less.

Thus, indications are that conventional water quality in the Rio Grande/Río Bravo is reasonably good, except for locally elevated levels of fecal coliform bacteria, nutrients, and total dissolved solids. The river evidently is able to assimilate the oxygen-demanding load it receives without the development of substantial dissolved oxygen depression.

CNA evaluated water quality in the Rio Grande/Río Bravo from 1976 to 1993, (Appendix D). CNA obtained results similar to TNRCC's relative to the quality of the waters of the Rio Grande/Río Bravo during this period.

Tributaries

Data for the same parameters mentioned above were evaluated to provide an indication of conventional water quality in the tributaries that were sampled (Table 10). The lower Pecos River (6a), Devils River (6b), and San Felipe Creek (7b) are designated segments, and are governed by specific water quality criteria (TNRCC, 1991). All conventional parameter criteria were achieved at these sites, except in the Pecos River where chloride and sulfate levels were slightly elevated.

Nondesignated segments are presumed to support a high aquatic life use and are expected to meet a 5 mg/L minimum dissolved oxygen concentration (TNRCC, 1991). Of the 23 tributaries in this category, four exhibited dissolved oxygen concentrations less than 5 mg/L (2a, Ciudad Juárez sewage discharge canal; 9a, unnamed tributary 3.6 km (2.2 miles) downstream from Piedras Negras; 11c, Arroyo el Coyote; 15a, Anhelo Drain). The observed concentrations were noteworthy in light of the season of occurrence and prevalence of low water temperatures, and reflected a potential for anoxic conditions during summertime. These four tributaries transport domestic effluent from Ciudad Juárez, Piedras Negras, Nuevo Laredo, and Reynosa, respectively.

Five of the 23 sites exhibited total organic carbon concentrations greater than 20 mg/L, including the four just mentioned, plus station 11a (Zacate Creek). The concentrations ranged from 22-49 mg/L, reflecting a degree of organic enrichment. Organic loading to the mainstem appears minimal for 9a and 11c, which had inflow volumes less than 0.06 cms (2 cfs), slight for 15a

(0.45 cms or 16 cfs), and substantial for 2a (1.7 cms or 61 cfs). At the first mainstem sites downstream from these tributaries, only the one below 2a (station 3) exhibited a total organic carbon concentration perceptibly above baseline levels.

Four of the 23 sites exhibited total dissolved solids concentrations that were elevated compared to the maximal level observed in the mainstem (1,820 mg/L at station 3) (10a, Manadas Creek; 11b, Chacon Creek; 12a, Río Salado; 12d, Arroyo Los Olmos). The Pecos River (station 6a) also was in this category, although the criterion for that segment was not exceeded. The recorded levels (2,920-7,480 mg/L) would be expected to have deleterious effects on freshwater aquatic life. Three of these tributaries (10a, 11b, 12d) appeared to contribute little total dissolved solids to the mainstem, as corresponding flows were less than 0.06 cms (2 cfs). The opposite appeared true for the other two (6a, 12a), as their flows were substantial (6.2 and 1.0 cms, or 218 and 37 cfs, respectively).

In conclusion, conventional water quality in tributaries generally was good, with several exceptions.

Toxic Chemicals in Water

U.S. water samples from all 45 stations were analyzed for toxic chemicals. Thirty-five of the 153 toxic chemicals for which valid analytical results were generated occurred at detectable levels (Tables 10 and 13). Seventeen of the 35 exhibited possible screening level exceedances (Table 14). These, together with the number of sites involved, were: un-ionized ammonia (4); residual chlorine (2); parachlorometa cresol (1); phenol (1); phenolics recoverable (1); chloroform (1); antimony (1); arsenic (9); chromium (1); mercury (2); selenium (8); silver (5); thallium (1); diazinon (2); bis(2-ethylhexyl) phthalate (1); diethyl phthalate (1); and cyanide (2).

Mainstem

The number of toxic chemicals detected by U.S. data ranged from two at stations 9, 10, and 15 to eight at station 2. At 16 of the 19 sites, five or fewer toxic chemicals were detected (Table 13).

U.S. data indicated elevated toxic chemical concentrations were uncommon in the mainstem (Table 15). There were only six instances where possible screening level exceedances occurred, involving five toxic chemicals (Table 14): residual chlorine, acute and chronic, station 2; arsenic, national 85th percentile, stations 4 and 5; selenium, chronic, station 11; silver, acute and chronic, station 12; and cyanide, chronic, station 14. No station exhibited elevated concentrations for more than one chemical.

The presence of residual chlorine at station 2 (downstream from El Paso/Ciudad Juárez) probably contributed to the impoverished condition of the macrobenthic community at the site. Although the concentration was too low to quantify, it probably was greater than the acute aquatic life criterion, in light of chlorine's extreme toxicity. The primary source was the El Paso Public Service Board Haskell R. Street wastewater treatment plant discharge (station 1a), which enters 13.8 km (8.6 miles) upstream. The effluent, which is chlorinated for disinfection purposes, contained a residual chlorine concentration of 1.2 mg/L, and the discharge volume was substantial (1.3 or 45 cfs, equivalent to 24% of the flow at station 2).

Arsenic levels at stations 4 (downstream from Presidio/Ojinaga) and 5 (mouth of Santa Elena Canyon), 14.4 and 15.8 $\mu g/L$, respectively, did not appear to be impacting the river. There were no significant effects in the toxicity tests, and resident fish and macrobenthic communities were healthy. This is not surprising, since the screening level that was exceeded, the national 85th percentile, is not based on biological effects. Both concentrations were far less than the chronic aquatic life criterion of 190 $\mu g/L$. The principal source of arsenic evidently was the Río Conchos (station 3a), which enters 18.7 km (11.6 miles) upstream from station 4. That tributary exhibited the highest arsenic level in the study (20.6 $\mu g/L$), and contributed a large volume of inflow (15 cms or 530 cfs, equivalent to 66% of the flow at station 4). Alamito Creek (station 3b), entering 0.6 km (0.4 miles) upstream from station 4, contained 10.6 $\mu g/L$ of arsenic. However, its contribution was negligible, in light of the low inflow volume (0.03 cms or 1.1 cfs, equivalent to 0.1% of the flow at station 4).

Arsenic in surface waters is primarily derived from natural processes (dissolution of arsenates from metallic ore-bearing rocks; soil erosion), air pollution (fossil fuel combustion), industrial wastewaters, and arsenical pesticides (Irwin, 1989; McKee and Wolf, 1963). Arsenic levels at stations 4 and 5 appear to be naturally-derived to an extent, judging from the somewhat elevated level in Alamito Creek, a minimally-impacted stream, plus the fact that the concentration at station 5 was slightly higher than at station 4, despite an absence of likely anthropogenic inputs through the intervening reach. Baseline concentrations in the Río Conchos may be similarly derived; however, the presence of arsenical pesticides entering in agricultural runoff may be responsible for the magnitude of the concentration that was observed there. The Río Conchos in the past has been shown to contribute other agriculturally-derived pesticides to the Rio Grande/Río Bravo (TNRCC, 1992a).

The slight exceedance of the chronic aquatic life criterion by selenium at station 11 (above Laredo/Nuevo Laredo) did not appear ecologically important, as no adverse impacts were indicated by toxicity testing or bioassessment results. There were no obvious sources of selenium that would have affected the site. Although this was the only mainstem station where selenium was elevated, seven tributaries had concencentrations that exceeded screening levels. Interestingly, six of these eight sites, including station 11, were geographically clustered from just upstream of Laredo/Nuevo Laredo to Rio Grande City/Camargo.

Selenium occurs at naturally high levels in soils in other parts of the United States. It has numerous industrial applications, and may be present in industrial wastewaters. Other potential sources include atmospheric fallout from coal-fired power plant emissions (including washoff from land surfaces where fallout is deposited), municipal sewage from industrial communities, and insecticide sprays (Irwin, 1989; McKee and Wolf, 1963).

The concentration of silver at station 12 (downstream from Laredo/Nuevo Laredo) was greater than acute and chronic aquatic life criteria; whether this was an actual exceedance is uncertain, because the criteria are based on the free ion form while the measured concentration represented total dissolved silver. Nevertheless, a possibility exists that the observed silver concentration may have been partially responsible for depressed fish and macrobenthic community integrity at the site. There were no conspicuous sources, as levels in the three proximal, upstream tributaries that were sampled (stations 11a, 11b, 11c) were below detection. However, there are a number of other inflows between stations 11 and 12 (Buzan, 1990) that could have been involved.

Silver generally does not occur in significant concentrations in natural waters. Various forms of silver have industrial applications, including the production of jewelry, silverware, metallic alloys, and ink; for electroplating; in the processing of food and beverages; and in photography. Silver in surface waters typically is derived from wastes generated by these processes (McKee and Wolf, 1963).

Although the cyanide concentration at station 14 (downstream from International Anzalduas Dam) was greater than the chronic aquatic life criterion, no appreciable impacts were evident. There were no significant effects in the toxicity tests, and resident macrobenthic and fish community integrity was relatively high (although fish exhibited a slightly elevated incidence of physical abnormalities). Regarding sources, there were no obvious inputs that would have contributed cyanide to the site. Cyanide enters surface waters in effluents from gas works, coke ovens, gas-scrubber processes of steel mills, metal cleaning/electroplating operations, and chemical industries (McKee and Wolf, 1963).

Tributaries

U.S. data indicates toxic chemicals were more prevalent in tributaries than in the mainstem. This is not surprising since some of the tributaries transport wastewater in relatively undiluted form. The number of toxic chemicals detected ranged from one at station 8d to 17 at station 1a. More than five toxic chemicals were detected at eight of the 26 sites (Table 13).

There were 37 instances where screening levels possibly were exceeded, involving 17 toxic chemicals (Table 14): un-ionized ammonia, acute and chronic, station 2a; chronic, stations 7a, 9a, and 11c; residual chlorine, acute and chronic, station 1a; parachlorometa cresol, national 85th percentile, station 2a; phenol, national 85th percentile, station 2a; phenolics recoverable, national 85th percentile, station 2a; chloroform, national 85th percentile, station 1a; antimony, human health and national 85th percentile, station 10a; arsenic, human health, stations 1a, 2a, 9a, 11c, and 15a; national 85th percentile, stations 3a and 3b; chromium, chronic, station 12a; mercury, human health, stations 2a and 15a; selenium, chronic, stations 5a and 11a; chronic and national 85th percentile, station 11c; human health, chronic, and national 85th percentile, stations 9b, 12a, 12b, and 12c; silver, acute and chronic, stations 7b, 8a, 8b, and 8e; thallium, human health, station 10a; diazinon, acute and chronic, stations 11a and 12d; bis(2-ethylhexyl) phthalate, chronic and national 85th percentile, station 11c; diethyl phthalate, chronic, station 15a; and cyanide, chronic, station 12d. The number of chemicals that occurred at elevated levels, by station, were: six, station 2a; four, station 11c; three, stations 1a and 15a; two, stations 9a, 10a, 11a, 12a, and 12d; one, stations 3a, 3b, 5a, 7a, 7b, 8a, 8b, 8e, 9b, 12b, and 12c; zero, stations 6a, 6b, 8c, 8d, 11b, and 12e.

U.S. data shows the four tributaries that had elevated un-ionized ammonia concentrations, represented by stations 2a, 7a, 9a, and 11c, transport effluent from Ciudad Juárez, Ciudad Acuña, Piedras Negras, and Nuevo Laredo, respectively. These elevated levels result from decomposition of nitrogenous organic matter introduced in domestic effluent from each of the cities. Significant effects occurred in toxicity testing of water from all four sites, and in each case un-ionized ammonia was considered the primary causative agent. Un-ionized ammonia inputs associated with stations 7a, 9a, and 11c probably had little or no effect on the Rio Grande/Río Bravo, in light of low inflow volume (Table 10). Contributions from 2a, however, may have exerted substantial effects for some distance downstream, as the associated inflow volume was considerable (1.7 cms or 61 cfs).

Residual chlorine at station 1a (El Paso Public Service Board Haskell R. Street wastewater treatment plant outfall) was judged to be the primary cause of toxicity in water from that site. The input adversely affected the mainstem for at least 13.8 km (8.6 miles) downstream (discussed in more detail under "Mainstem" above).

Elevated levels of three related chemicals (parachlorometa cresol, phenol, phenolics recoverable) at station 2a reflected an origin in Ciudad Juárez. These contaminants may emanate from the distillation and chemical treatment of coal tar or wood tar, or from gas works, coke ovens, oil refineries, chemical plants, livestock dips, or human and animal refuse (McKee and Wolf, 1963). Although these chemicals may have had minor involvement in toxic effects of water from the site, the Rio Grande/Río Bravo appeared unaffected, as none exceeded screening levels anywhere in the mainstem.

Exceedance of the national 85th percentile by chloroform at station 1a probably was of no ecological consequence, as the concentration was well below human health and chronic aquatic life criteria. No elevated chloroform concentrations were observed anywhere in the mainstem. Chloroform is used as an anesthetic, counterirritant, solvent, cleansing agent, and antiseptic (McKee and Wolf, 1963).

Elevated levels of antimony and thallium at station 10a, (Manadas Creek), did not appear ecologically detrimental. Significant adverse effects occurred in toxicity testing of water from the site, but were attributed to total dissolved solids, as antimony and thallium levels were well below aquatic life criteria. Both metals exceeded human health criteria, indicating a potential human health hazard if untreated water and/or fish from the creek were consumed on a regular, long-term basis. Contributions by Manadas Creek inflow did not noticeably affect the Rio Grande/Río Bravo, as neither metal exceeded screening levels anywhere in the mainstem. The probable source was a nonferrous metals smelter/refinery owned by Anzon, Inc., located in the upper portion of the Manadas Creek watershed. The operation was under enforcement action in 1991 for an unauthorized stormwater discharge of antimony to Manadas Creek (TNRCC, 1992a).

Arsenic levels at stations 3a (Río Conchos) and 3b (Alamito Creek), discussed in part under "Mainstem" above, exceeded the national 85th percentile but were well below aquatic life criteria. No adverse effects were observed in associated water toxicity tests, and the fishery evaluation at 3a reflected relatively high community integrity.

Arsenic concentrations at stations 1a, 2a, 9a, 11c, and 15a were not elevated compared to levels observed elsewhere. There probably were no effects on aquatic life, and the amount of arsenic contributed to the mainstem would have been negligible. However, because flow in these tributaries is dominated by domestic effluent, their waters are considered nonpotable. Therefore, the stringent national human health criterion based on consumption of fish, which takes into account the carcinogenicity of arsenic, was applicable. The arsenic level at each of these five sites exceeded the criterion, indicating a possible human health hazard if fish from these systems were regularly consumed on a long-term basis. However, potential risks appear minimal, because conventional water quality is not conducive for support of viable fish populations.

The chromium concentration at station 12a, (Río Salado), was greater than the chronic aquatic life criterion. Whether or not an actual exceedance occurred is unknown, because the amount of chromium present in the hexavalent state was not determined. There were no significant effects in toxicity testing of water from the site. Chromium in surface waters generally is derived from industrial effluent or cooling system discharges (McKee and Wolf, 1963).

Mercury levels at stations 2a (Ciudad Juárez sewage discharge canal) and 15a (Anhelo Drain) exceeded the applicable human health criterion. Flows in these tributaries were dominated by domestic effluent from Ciudad Juárez and Reynosa, respectively. Elemental mercury is used in scientific and electrical instruments, dentistry, power generation, solders, and the manufacture of lamps. Mercuric salts are used commercially and industrially as medicinal products, disinfectants, detonators, pigments, and in photoengraving. Mercury contamination of surface waters usually results from the disposal of wastes from these types of operations (McKee and Wolf, 1963).

Whereas the observed mercury concentrations would not be expected to adversely affect aquatic life, a human health hazard could exist if fish from these systems were consumed on a regular, long-term basis. However, degraded conventional water quality probably precludes the existence of viable fish populations in these tributaries (verified for Anhelo Drain through collecting efforts). Mercury contributions from Anhelo Drain probably have little effect on the mainstem, due to the small inflow volume (0.45 cms or 16 cfs). Inflow from the Ciudad Juárez sewage discharge canal, on the other hand, was substantial (1.7 cms or 61 cfs), and human health hazards resulting from associated mercury inputs could extend for some distance downstream in the Rio Grande/Río Bravo.

Selenium exceeded various screening levels at stations 5a, 9b, 11a, 11c, 12a, 12b, and 12c. A degree of geographical clustering was apparent, as was discussed under "Mainstem" above. Levels at all of these sites were greater than the chronic aquatic life criterion, reflecting a potential for minor deleterious effects on resident aquatic life. However, only stations 11a and 11c exhibited significant adverse effects in toxicity testing of water, and the role of selenium appeared to be slight or negligible in those two instances. Based on exceedances of the human health criterion, a potential human health hazard was indicated for the Río Escondido, Río Salado, Río Alamo, and Río San Juan, if untreated water and/or fish from those streams were consumed on a regular, long-term basis. Selenium inputs from the seven tributaries did not appear to appreciably affect the Rio Grande/Río Bravo, as only one mainstem station (11) exhibited a screening level exceedance.

Silver concentrations at stations 7b, 8a, 8b, and 8e were greater than acute and chronic aquatic life criteria. It is not certain that these were actual exceedances, because the criteria are based on the free ion form, while the data represent total dissolved silver. As for selenium, the sites were clustered, as all four tributaries enter between Del Rio/Ciudad Acuña and Eagle Pass/Piedras Negras. However, a factor other than geography may have been responsible in this case, as the silver concentrations that were observed may have resulted from procedural contamination. The four sites were sampled during the third field survey, during which silver was detected in the field blank (see Appendix C).

In the water toxicity tests, station 7b (San Felipe Creek) was the only one of the four sites for which significant effects were observed. The associated silver concentration was considerably higher than anywhere else in the study, and evidently was the primary causative factor. Effects of silver inputs from these tributaries on the Rio Grande/Río Bravo appeared negligible, as an excessive concentration was observed at only one geographically removed mainstem site (station 12).

Elevated diazinon levels at stations 11a (Zacate Creek) and 12d (Arroyo Los Olmos) were considered primarily responsible for adverse effects in toxicity testing of water from those sites, and probably were involved in depressed fish community integrity observed at the latter site. Resident aquatic communities in Zacate Creek probably were also adversely affected. Flow in both tributaries was minimal (Table 10), and effects of inputs on the Rio Grande/Río Bravo probably were negligible, as diazinon was not detected anywhere in the mainstem. Probable sources were urban runoff from Laredo and Rio Grande City, respectively.

Phthalate esters occurred at excessive levels in two effluent-dominated tributaries. The bis(2-ethylhexyl) phthalate concentration at station 11c (Arroyo el Coyote), which exceeded the chronic aquatic life criterion, was considered partially responsible for adverse effects in toxicity testing of water from the site. Diethyl phthalate exceeded the chronic aquatic life criterion at station 15a (Anhelo Drain). It may have been the main cause of toxicity in the water sample, and could have been partially responsible for the apparent absence of fish from the drain. Flow in both tributaries was minimal (Table 10), and effects of inputs of these phthalate esters on the Rio Grande/Río Bravo appeared negligible, as neither was detected in water at any mainstem site.

The elevated cyanide concentration at station 12d (Arroyo Los Olmos) may have been marginally involved in toxic effects of water from the site, and in reduced integrity of the local fish community. The flow volume was extremely small (0.02 cms or 0.8 cfs), and effects on the mainstem appeared negligible, as cyanide was not detected in water at the first Rio Grande/Río Bravo site downstream (station 13).

Toxic Chemicals in Sediment

Sediment samples from all 45 stations were analyzed for toxic chemicals. Valid analytical results were obtained for 145 toxic chemicals, thirty of which occurred at detectable levels (Tables 11 and 13), and 16 of which exceeded screening levels (Table 14). These, together with the number of sites involved, were: methylene chloride (6); toluene (3); arsenic (8); chromium (27); copper (2); lead (1); mercury (2); nickel (29); selenium (1); silver (1); zinc (2); chlordane (4); DDE (3); dieldrin (1); bis(2-ethylhexyl) phthalate (1); and di-n-butyl phthalate (1). Two additional chemicals for which no screening levels exist occurred at anomalously high concentrations: parachlorometa cresol (2); and phenol (1).

Mainstem

U.S. data indicates that the number of toxic chemicals detected was relatively uniform, ranging from 11 at stations 4, 5, 14, 15, and 18, to 17 at station 12 (Table 13). There were 48 instances where screening levels were exceeded, involving eight toxic chemicals (Table 14): methylene chloride, threshold value, stations 1, 2, 3, and 12; toluene, threshold value, stations 2 and 12; arsenic, threshold value, stations 2, 3, 4, 5, 5b, and 14; chromium, threshold value, stations 1, 2, 3, 4, 5, 5b, 6, 7, 8, 11, 13, 14, 15, 16, 17, and 18; copper, threshold value, station 2; lead, threshold value, station 2; mercury, threshold value, station 2; and nickel, threshold value, stations 1, 2, 3, 4, 5, 5b, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17, and 18. The number of toxic chemicals that exceeded screening levels, by station, were: eight, station 2; four, station 3; three, stations 1, 3, 5, 5b, 12, and 14; two, stations 6, 7, 8, 11, 13, 15, 16, 17, and 18; zero, stations 9 and 10.

Methylene chloride, an organic solvent, exceeded aquatic life threshold values at four sites. There was no discernible impact at stations 1 and 3. No significant effects occurred in sediment eluate toxicity tests, and local fish and macrobenthic communities did not reflect appreciable impacts by toxic chemicals. A possibility of slight impact was evident for station 2. Although there were no effects in the sediment eluate toxicity test, the concentration was the highest observed in the mainstem, and macrobenthic community integrity was relatively low. The concentration at station 12 was regarded as a possible contributing factor to sediment eluate toxicity and the impaired condition of local fish and macrobenthic communities. There were no obvious sources of methylene chloride in the vicinity.

Toluene was elevated at stations 2 and 12. In both cases, implications for impact were the same as for methylene chloride. Toluene is a constituent of coal tar, and is used in the manufacture of organic materials and as a solvent in the extraction of various substances from plants (McKee and Wolf, 1963). There was no obvious source of toluene upstream from station 2. For station 12, inflows from Chacon Creek (station 11b) and Arroyo el Coyote (station 11c) were probable contributors. Chacon Creek had the highest toluene concentration in water in the study (9.0 μg/L), probably derived from urban runoff from Laredo. Arroyo el Coyote, which transports domestic effluent from Nuevo Laredo, had the third highest toluene concentration in water in the study (6.0 μg/L), and the highest concentration in sediment (33,000 μg/kg).

Arsenic levels exceeded threshold values at five successive sites from downstream of El Paso/Ciudad Juárez to the mouth of Lozier Canyon (stations 2, 3, 4, 5, and 5b), then disjunctly at station 14 (downstream from International Anzalduas Dam). However, associated ecological effects were minimal. There were no significant effects in corresponding sediment eluate toxicity tests, and fish and macrobenthic community characteristics reflected little or no potential that toxic impacts were being exerted at stations 4, 5, and 14. A moderate potential for toxic impact was indicated by the macrobenthic community at station 2, but arsenic did not appear to be involved, as the amount by which the threshold value was exceeded was no greater than for several unimpacted sites. The arsenic concentration at station 3, which exceeded the threshold value by the greatest relative amount in the study, may have contributed to less-than-optimal macrobenthic integrity at that site.

Arsenic concentrations from station 2 to station 5b appear to be naturally derived to some extent. However, several inputs to the reach were evident. Arsenic concentrations were elevated in water in inflows from the El Paso Public Service Board Haskell R. Street wastewater treatment plant (1a), the Ciudad Juárez sewage discharge canal (2a), the Río Conchos (3a), and Alamito Creek (3b), while high levels in sediment were documented for the Río Conchos (3a) and Terlingua Creek (5a). For further information on arsenic inputs to the reach, see previous discussions for water.

Regarding station 14, Los Olmos Creek (12d) was shown to be a contributor to that reach, as it exhibited the highest arsenic concentration in sediment in the study. However, in light of the small volume of inflow, its role may not be significant.

Chromium exceeded threshold values at all mainstem stations except 9, 10, and 12. No substantial impacts were apparent, as none of the 16 sites exhibited significant effects in sediment eluate toxicity tests.

The prevalence of elevated concentrations was in sharp contrast to results for water, in which there were no screening level exceedances in the mainstem. This, together with the lack of appreciable impact by chromium in sediment, suggests that most of the chromium present in the Rio Grande/Río Bravo is in highly insoluble form, such as hydroxide or carbonate salts, and therefore is biologically unavailable. In effect, then, the USEPA threshold value may be overly stringent for this system.

Regarding inputs, 14 of the 26 tributaries had comparatively high chromium concentrations in sediment. The most noteworthy were those recorded for stations 1a, 7a, 11c, 12a, 12b, and 12d, where associated concentrations ranged from 12.9 to 45.1 mg/kg. Station 12a also exhibited an anomalously high chromium concentration in water (15 μg/L).

Potential industrial sources of chromium were addressed in the preceding discussion for water. For the Rio Grande/Río Bravo system, there is evidence that chromium levels in sediment may be naturally elevated due to geological characteristics of the watershed, with chromium entering the river via weathering of volcanic rock, soil erosion, and runoff from tailings from past mining activities (Irwin, 1989).

The elevated copper concentration at station 2 did not appear to be causing substantial impact, as there were no significant effects in the sediment eluate toxicity tests. It is possible, though, that it may have been partially responsible for the somewhat degraded condition of the macrobenthic community.

Copper is one of the most common contaminants in urban runoff. Other sources include soil erosion, corrosion of pipes and tubes, and industrial and sewage treatment plant discharges (Irwin, 1989). Urban runoff from El Paso/Ciudad Juárez may have been involved, but the principal source of copper at station 2 appeared to be the El Paso Public Service Board Haskell R. Street wastewater treatment plant effluent (station 1a), which exhibited the highest copper concentrations in the study. The level in water (8.8 μg/L) was more than twice the next-to-highest value recorded, while the concentration in sludge (292 mg/kg) exceeded the second highest concentration observed by an order of magnitude.

Lead exceeded the aquatic life threshold value at station 2; the implications for impact were the same as for copper. Lead is introduced to surface waters in effluents from various types of industries, sewage treatment plants, and mining operations, from dissolution of lead pipe, and in urban runoff (McKee and Wolf, 1963). Effluent from the El Paso Public Service Board Haskell R. Street wastewater treatment plant (station 1a) evidently was a primary contributor of lead to station 2, as associated levels in water (2.8 μg/L) and sludge (80.6 mg/kg) were the highest in the study. Urban runoff from El Paso/Ciudad Juárez may also have been involved.

Mercury was another metal that was elevated at station 2. Potential effects were similar to those for copper. As for the previous two metals, effluent from the El Paso Public Service Board Haskell R. Street wastewater treatment plant appeared to be the major contributor. The concentration in water was below detection, but the concentration in sludge (1.51 mg/kg) was by far the highest in the study.

With regard to implications of copper, lead, and mercury concentrations in the El Paso Public Service Board Haskell R. Street wastewater treatment plant "sediment" sample, it is important to note that those results were based on a sample of sludge which had been removed from the system. Whereas the observed characteristics are not directly relatable to conditions in the river, they do reflect contaminant concentrations associated with the suspended solids fraction of the effluent, which do have a potential for exerting instream impact.

Nickel exceeded aquatic life threshold values at all mainstem stations except 9 and 10. The greatest margins of exceedance occurred in the reach from station 1 to station 5. Impacts appeared relatively minor, as no significant effects were observed in sediment eluate toxicity tests for 16 of the 17 affected sites. At the only site where toxic effects were seen, station 12, nickel did not appear to be a contributing factor, as the margin by which the threshold value was exceeded was much less than at many sites where no toxicity occurred.

The lack of substantial toxic effects, together with the fact that screening levels were not exceeded in water, suggests that nickel is tightly bound in the sediments and biologically unavailable. As for chromium, then, the USEPA threshold value may be overly stringent for the Rio Grande/Río Bravo system.

Regarding inputs, nickel concentrations in sediment either exceeded threshold values or were over 10 mg/kg at 16 of the 26 tributary sites. The most noteworthy, eight tributaries which exhibited concentrations from 10.6 to 18.9 mg/kg, were distributed throughout the longitudinal gradient. As in the mainstem, nickel concentrations in water did not exceed screening levels at any tributary site.

Nickel has a variety of industrial applications, metal-plating processes being one of the more prominent, and may enter surface waters in industrial or municipal wastewater effluents (McKee and Wolf, 1963). Indications are, however, that much of the nickel in the Rio Grande/Río Bravo system may be naturally derived. Igneous rock and associated ores and minerals typically contain an abundance of nickel (Hem, 1970), and igneous outcrops are common in the watershed. Dissolution of these formations, erosion of associated soils, and runoff from tailings from past mining activities may be the principal contributor of nickel to the Rio Grande/Río Bravo. That the source may be largely natural is supported by the fact that the highest concentration in the study occurred in a remote, relatively unimpacted tributary, Terlingua Creek (station 5a).

Tributaries

Based based on U.S. data the number of toxic chemicals detected ranged from nine at stations 6a and 8a to 19 at station 1a. More than 12 toxic chemicals were detected at 11 of the 26 sites (Table 13).

There were 44 instances where screening levels were exceeded, involving 15 toxic chemicals (Table 14): methylene chloride, threshold value, stations 2a and 3b; toluene, threshold value, station 2a; arsenic, threshold value, stations 3a and 5a; chromium, threshold value, stations 2a, 3a, 3b, 5a, 7a, 8c, 8e, 10a, 11b, 12a, and 12b; copper, national 85th percentile, station 1a; mercury, national 85th percentile, station 1a; nickel, threshold value, stations 2a, 3a, 5a, 8c, 8e, 10a, 11a, 11b, 12a, 12b, 12c, and 12e; selenium, national 85th percentile, station 1a; silver, national 85th percentile, station 1a; zinc, national 85th percentile, stations 1a and 11c; chlordane, threshold value, stations 11a and 15a; threshold value and national 85th percentile, stations 11b and 11c; DDE, national 85th percentile, stations 10a, 11a, and 12d; dieldrin, national 85th percentile, station 11a; bis(2-ethylhexyl) phthalate, national 85th percentile, station 11c; and di-n-butyl phthalate, national 85th percentile, station 12d. The number of toxic chemicals that exceeded screening levels, by station, were: five, station 1a; four, stations 2a and 11a; three, stations 3a, 5a, 10a, 11b, and 11c; two, stations 3b, 8c, 8e, 12a, 12b, and 12d; one, stations 7a, 12c, 12e, and 15a; zero, stations 6a, 6b, 7b, 8a, 8b, 8d, 9a, and 9b. Two other chemicals for which screening levels do not exist occurred at comparatively high concentrations: parachlorometa cresol, stations 1a and 11c; and phenol, station 1a.

The methylene chloride concentration at station 2a (Ciudad Juárez sewage discharge canal) was the highest in the study, while that at station 3b (Alamito Creek) was comparatively low (Table 10). Impacts were imperceptible in both cases, as no significant effects occurred in the sediment eluate toxicity tests (Tables 16 and 17). Regarding effects on the Rio Grande/Río Bravo, inputs associated with 2a may have been partially responsible for the elevated concentration at mainstem station 3. Although the intervening distance is considerable (385 km), the substantial volume of inflow (1.7 cms or 61 cfs) makes this a possibility. Inputs associated with 3b appeared negligible. The inflow volume was small (0.03 cms or 1.1 cfs), and the concentration at mainstem station 4, located 0.6 km (0.4 miles) downstream, was below detection. Sewage wastes emanating from Ciudad Juárez were the probable source of methylene chloride at station 2a. No potential sources are known for Alamito Creek, a remote, minimally-impacted stream.

The potential for impact and probable origin of toluene at station 2a were the same as for methylene chloride. Resultant inputs again appeared to affect the Rio Grande/Río Bravo. Although the concentration at the first downstream site, station 3, was below the screening level, it represented one of only three instances where toluene was detected in the mainstem.

Regarding elevated arsenic levels at stations 3a (Río Conchos) and 5a (Terlingua Creek), potential effects on the mainstem and possible origins were addressed in previous discussions. The observed concentrations did not appear to be impacting the tributaries themselves, as no significant effects occurred in the sediment eluate toxicity tests. In addition, fish community integrity at station 3a was relatively high (fish from the site did, however, exhibit a slightly elevated incidence of physical abnormalities).

Elevated levels of copper, mercury, selenium, silver, and phenol occurred at a single tributary site, station 1a (El Paso Public Service Board Haskell R. Street wastewater treatment plant effluent). Selenium, silver, and phenol were regarded as potential cofactors in the manifestation of sediment eluate toxicity (along with parachlorometa cresol, discussed below). The discharge was at least partially responsible for elevated levels of copper and mercury at station 2, the only mainstem site where these two metals exceeded screening levels. Selenium, silver, and phenol were not excessive at station 2. Additional information for these five chemicals is presented in previous discussions. High levels of a variety of toxic chemicals in the El Paso Public Service Board Haskell R. Street wastewater treatment plant sludge sample probably result from industrial discharges to the collection system.

Zinc and parachlorometa cresol were the two other chemicals that were elevated at station 1a, and the preceding discussion also applies here. Inputs to the mainstem were not apparent in data from station 2. The factor that distinguished them from the previous five chemicals was that they were also excessive at an additional station, 11c (Arroyo el Coyote). At that site, the zinc concentration was the second highest, and the parachlorometa cresol concentration the highest, in the study. Impact by zinc appeared negligible, but parachlorometa cresol was considered a possible cofactor in the manifestation of sediment eluate toxicity. Although the inflow volume was small (0.05 cms or 1.8 cfs), contributions to the Rio Grande/Río Bravo were discernible, as station 12 exhibited the highest zinc concentration of any mainstem site, and was one of only two mainstem stations where parachlorometa cresol was detected.

Chromium exceeded aquatic life threshold values at 11 sites, and nickel at 12 sites, but no impacts were evident. Sediment eluate toxicity was observed for one of these stations, 3a (Río Conchos), but neither metal appeared to be a major factor. Effects of tributary inputs on the Rio Grande/Río Bravo, potential sources, and other relevant information, were discussed under "Mainstem".

Chlordane was detected at five sites. A substantial concentration occurred at station 1a (El Paso Public Service Board Haskell R. Street wastewater treatment plant effluent), although it did not exceed the aquatic life threshold value. Threshold values were exceeded at the other four sites (11a - Zacate Creek; 11b - Chacon Creek; 11c - Arroyo el Coyote; 15a - Anhelo Drain). Stations 11a and 11b evidently were not adversely affected, as no significant effects occurred in sediment eluate toxicity tests. The opposite was true for stations 11c and 15a, and chlordane appeared to be a primary factor. It may also have been partially responsible for the apparent absence of fish from Anhelo Drain. Likely sources of chlordane were urban runoff from Laredo (11a, 11b), and a combination of urban runoff and domestic effluent from Nuevo Laredo (11c) and Reynosa (15a). None of the tributaries appeared to affect the Rio Grande/Río Bravo, as chlordane was below detection at all mainstem sites.

DDE levels in excess of the national 85th percentile at stations 10a (Manadas Creek), 11a (Zacate Creek), and 12d (Arroyo Los Olmos) did not appear to have adverse impacts, as no significant effects were observed in the sediment eluate toxicity tests. Contributions to the Rio Grande/Río Bravo were imperceptible, as no elevated DDE concentrations occurred anywhere in the mainstem.

Dieldrin exceeded the national 85th percentile by a slight margin at station 11a (Zacate Creek). Implications for local impact and effects on the mainstem were the same as for DDE.

Two phthalate esters occurred at elevated concentrations: bis(2-ethylhexyl) phthalate at station 11c (Arroyo el Coyote), and di-n-butyl phthalate at station 12d (Arroyo Los Olmos). National 85th percentiles were exceeded by factors of 7.3X and 6.9X, respectively. Bis(2-ethylhexyl) phthalate was considered a potential cofactor in the manifestation of sediment eluate toxicity at station 11c. No such effects were evident for di-n-butyl phthalate at station 12d. Inputs to the Rio Grande/Río Bravo appeared negligible, as neither chemical exceeded screening levels in the mainstem.

Toxic Chemicals in Fish Tissue

Fish tissue samples from the 18 major mainstem sites and six tributaries were analyzed for toxic chemicals (Table 12). In all, 94 tissue samples were collected, including 45 fillet samples and 49 whole fish samples. Of the 140 toxic chemicals for which valid analytical results were obtained, 29 occurred above detection limits, including 16 organic chemicals and 13 inorganic chemicals (Table 13). Twelve toxic chemicals exceeded screening levels (Table 14). These, together with the number of sites involved, were: cadmium (1); chromium (6); copper (20); lead (2); mercury (17); selenium (23); zinc (14); chlordane (1); total DDT (5); dieldrin (2); gamma-bhc (lindane) (1); and total PCB's (6).

Copper, selenium, and zinc were above detection limits in all U.S. samples, and p,p' DDE was detected in most samples (Table 13). Aluminum, arsenic, cadmium, chromium, mercury, and nickel were detected in more than half of the samples. Methylene chloride, lead, and thallium were occasionally detected. Chlordane, p,p' DDD, arochlor 1248, arochlor 1254, cyanide, and silver were infrequently detected. The remaining chemicals rarely occurred at detectable levels.

Several organic chemicals for which no screening criteria are available were detected (Table 13). Possible sources include field or laboratory contamination of samples, chlorinated municipal effluent, and industrial effluent.

Methylene chloride was detected in 27 samples. It has been documented as a field contaminant of water and sediment samples (USEPA, 1982), and has been identified as a possible laboratory contaminant by TDH staff. It is commonly used as an organic solvent, and is a constituent of chemical paint strippers. Methylene chloride was detected in samples from stations 6, 6a, 6b, 7, 8, 8d, 9, 9b, 10, 11, 13, 14, 15, 17, and 18. It was not detected in water or sediment at any of these sites. No municipal or industrial effluent influences are present at a number of these sites, and it is likely that most of the methylene chloride detected in tissue was an artifact of laboratory contamination.

Toluene was detected in three samples collected downstream from Laredo/Nuevo Laredo (station 12) and downstream from Hidalgo/Reynosa (station 16). At station 12, the concentration in sediment exceeded the aquatic life threshold value. However, toluene was not detected in water or sediment at station 16. Toluene is a solvent associated with industrial effluent, is a component of petroleum products, and can be a field or laboratory contaminant (USDOE, 1993).

1,2-dichlorobenzene was detected in four samples. It can occur as a result of mixing of chlorinated effluent and organic compounds, such as benzene, in the water column (USEPA, 1982; Joel Lusk, U.S. Fish and Wildlife Service, personal communication). This contaminant was detected only at station 2 (downstream from El Paso/Ciudad Juárez), in whole body and fillet samples of carp and channel catfish. Although 1,2-dichlorobenzene was not detected in water or sediment from that site, it was present in water and sludge from station 1a, the El Paso Public Service Board Haskell R. Street wastewater treatment plant outfall, located 13.8 km (8.6 miles) upstream. Thus, the discharge from that facility may contribute to body burdens at station 2.

The remaining parameters were detected in only one or two samples, including chloroform downstream from Hidalgo/Reynosa (station 16); trichlorofluoromethane downstream from International Anzalduas Dam (station 14) and downstream from Brownsville/Matamoros (station 18); and 1,1,1-trichloroethane at the mouth of Santa Elena Canyon (station 5). These chemicals are potentially associated with the combination of chlorinated municipal effluent and organic compounds in water, and stations 16 and 18 are downstream of cities. None of them were detected in water or sediment from the sites listed. Also, they are possible field or laboratory contaminants, so their presence may not reflect actual concentrations in fish tissues (USEPA, 1982; USDOE, 1993).

Hexachlorobenzene was detected in one sample collected downstream from Laredo/Nuevo Laredo (station 12). It is used as a pesticide, and also occurs as a breakdown product of and impurity in other pesticides. Additionally, it may be generated as a byproduct during the chlorination of wastewater (USEPA, 1992; Cain, 1993). It was not detected in water or sediment at station 12.

The last of the organic chemicals for which no screening levels exist, bis(2-ethylhexyl) phthalate, was measured at 99 mg/kg (99 times the detection limit) in a sample from station 4 (downstream from Presidio/Ojinaga). It generally is derived from industrial effluent, but may also be a field or laboratory contaminant associated with plastic (USDOE, 1993; Verschueren, 1983). The fact that it was not detected in water or sediment from station 4 suggests that sample contamination may have been responsible for the occurrence.

Edible Fish Tissue

Data from fillet samples were evaluated for potential human health risks using USFDA action or tolerance levels, USEPA screening levels, and TDH risk assessment values (Table 7). No USFDA action or tolerance levels were exceeded. However, there were a number of instances where USEPA fish tissue values were exceeded, and one instance where the TDH risk assessment value for selenium was exceeded (Table 14).

Total DDT and total PCB concentrations exceeded USEPA fish tissue values in 11.1% and 13.3% of the fillet samples, respectively. Because the detection limit for PCB's (0.04 mg/kg) is greater than the USEPA value (0.01 mg/kg), the number of samples shown to exceed the screening level may be conservative. Mercury and dieldrin screening values were exceeded twice, and chlordane and selenium screening levels once. Possible sources of these contaminants include irrigation return flows/agricultural runoff (DDT, dieldrin, selenium), nonpoint sources in urban areas (chlordane, PCB's), and nonpoint sources related to previous land use, including mining, coal-fired power plants, and waste disposal sites (mercury, selenium, PCB's).

Elevated pesticide and PCB concentrations were noted only in blue catfish, channel catfish, and carp. As these chemicals are lipophilic, they are more likely to bioaccumulate in fish with higher lipid content, such as carp and catfish (Kanazawa, 1981; Irwin, 1988; Inmon *et al.*, 1993). Metals, however, were elevated in largemouth bass and white bass at a limited number of sites.

Dieldrin exceeded the USEPA fish tissue value upstream from Del Rio/Ciudad Acuña (station 7) and in San Felipe Creek (station 7b). Although not produced in or imported to the U.S. since 1985, dieldrin continues to enter aquatic systems in agricultural runoff (USEPA, 1992). Total PCB's also exceeded the USEPA value at these two sites, as well as further downstream, below Del Rio/Ciudad Acuña (station 8), and upstream and downstream from Eagle Pass/Piedras Negras (stations 9 and 10). PCB's have been used extensively as lubricants, insulators, and coolants, and occur in the environment throughout the U.S. (Eisler, 1986a; USEPA, 1992). Neither chemical was detected in water or sediment from these sites.

Total DDT exceeded the USEPA fish tissue value upstream from the Río Conchos confluence (station 3), in the Río Conchos (station 3a), upstream from Del Rio/Ciudad Acuña (station 7), and in San Felipe Creek (station 7b), then in the lower reaches of the mainstem, downstream from International Anzalduas Dam (station 14), downstream from Hidalgo/Reynosa (station 16), and upstream from Brownsville/Matamoros (station 17). DDT or its metabolites, DDE and DDD, were detected in sediment samples from stations 2a and 3a. Large volumes of irrigation return flow which enter the river via the Río Conchos and downstream from International

Anzalduas Dam are the probable source of pesticide residues in fish tissue (Gamble *et al.*, 1988; Irwin, 1989; TNRCC, 1992a; USEPA, 1992).

Mercury exceeded the USEPA fish tissue value in the Rio Grande/Río Bravo upstream and downstream from Hildago/Reynosa (stations 15 and 16). It was detected in water and sediment from Anhelo Drain (station 15a), with the concentration in water exceeding human health criteria. Mercury input from that tributary may contribute to tissue residues at stations 15 and 16.

Selenium exceeded the TDH risk assessment value only at station 6, near Langtry/San Ignacio. The concentration in sediment also was substantial (2.23 mg/kg); although screening levels were not exceeded, the value was greater than 1-2 mg/kg, the background level for aquatic sediments identified by Eisler (1985) and Lemly (1985). Chlordane also exceeded the screening level (USEPA fish tissue value) at one site, downstream from Laredo/Nuevo Laredo (station 12). Chlordane was detected in sediment from several proximal tributaries (stations 11a, 11b, and 11c), and associated inputs probably are at least partially responsible for elevated chlordane levels in fish tissue at station 12.

San Felipe Creek (station 7b) and the Río Conchos (station 3a) were the only tributaries where contaminant concentrations in fish tissue exceeded human health screening levels. Contaminant levels in fish from the El Paso/Ciudad Juárez and Big Bend areas did not exceed human health criteria, nor did residues in fish collected upstream from Laredo/Nuevo Laredo, upstream from International Anzalduas Dam, and in the Brownsville/Matamoros area.

The mainstem upstream from Del Rio/Ciudad Acuña (station 7) had three contaminants in edible fish tissue that exceeded human health screening levels (total DDT, total PCB's, dieldrin) (Figure 2). Fish from stations 3, 3a, 6, 7b, 8, 9, 10, 12, 14, 15, and 16 contained one or two contaminants that exceeded human health screening values. No exceedances occurred at the remaining sites.

Whole Fish Tissue

Two types of screening were used to evaluate data from whole fish tissue samples.

Body Burdens.—This evaluation phase utilized screening levels derived by USFWS (national 85th percentiles and national geometric means), USEPA (national means), and TNRCC (state 85th percentiles). Information from supplemental sources also was used. All screening values employed, and the sources from which they were adopted, are presented in Table 7. Appropriate screening values were not available for aluminum, nickel, silver, thallium, or cyanide.

Zinc exceeded the USFWS national 85th percentile in 14 instances (Table 14). Only whole carp samples were involved. Zinc is a component of fish scales, and fish with large scales typically contain substantial concentrations (Joel Lusk, USFWS, personal communication). Since zinc was elevated only in samples where large scales were analyzed, the observed concentrations probably do not represent abnormally high levels.

Copper exceeded the USFWS national 85th percentile at most mainstem sites, and in all tributaries except the Río Conchos (Table 14). Copper generally was above detection limits in sediment, and in water was detected at nine mainstem sites and 11 tributaries. Copper is associated with mining, plumbing, and electrical industries (Phillips and Russo, 1978; Moore and Ramamoorthy, 1984; USEPA, 1985b). As many of the tributaries are dominated by springflow, the copper levels in fish tissue may be a result of naturally elevated concentrations in water and soil.

Selenium exceeded the USFWS national 85th percentile in two reaches of the river. The first was from upstream of the Río Conchos confluence (station 3) to upstream of Del Rio/Ciudad Acuña (station 7), including three tributaries, the Río Conchos, Pecos, and Devils rivers (stations 3a, 6a, 6b). Concentrations again were high at sites upstream from Laredo/Nuevo Laredo, upstream from International Anzalduas Dam, and upstream from Hidalgo/Reynosa (stations 11, 13, 15). Levels were highest in the mainstem from station 3 to station 7, and in the Río Conchos.

Selenium concentrations in sediment exceeded 2 mg/kg at stations 1a, 5, 6, 10, 11c, 12, and 12d. Selenium was detected at lower concentrations at stations 1a, 5, 5a, 5b, 6a, 11, 12a, 12b, and 12c. In addition, concentrations in water exceeded the aquatic life chronic criterion at stations 5a and 11. These occurrences generally coincided with areas where selenium was elevated in fish tissue.

In rural areas, especially in the arid western U.S., the most likely source of selenium is irrigation return flows or runoff from agricultural land (Phillips and Russo, 1978; Presser and Barnes, 1985; CWRCB, 1988; TNRCC, 1992a). In urban areas, coal-fired power plants may contribute selenium, via air deposition of fly ash, or return of cooling waters associated with fly or bottom ash (Phillips and Russo, 1978; EPRI, 1986; Maier *et al.*, 1988).

Mercury concentrations occasionally exceeded the USFWS national 85th percentile, primarily in the lower half of the study area. Affected sites were upstream from Eagle Pass/Piedras Negras, the Río Escondido, upstream from Laredo/Nuevo Laredo, upstream from International Anzalduas Dam, and downstream from Hidalgo/Reynosa (stations 9, 9b, 11, 13, 16). The mercury concentration in water exceeded screening levels at station 15a, and concentrations in sediment were greater than 0.1 mg/kg at stations 9a, 10a, and 15a.

Mining for metals (including mercury) and coal historically has occurred through much of the Rio Grande/Río Bravo watershed (TNRCC, 1992a). The Mexican city of Piedras Negras ("black rock") is named for the abundant coal deposits in the area. Mercury is a trace contaminant associated with mining, and runoff from active or abandoned mining sites is a probable contributor of trace metals. Additionally, mercury may be associated with coal-fired power plants, discarded batteries, and discharges from older sewage treatment plants (Phillips and Russo, 1978; Eisler, 1987; TNRCC, 1992a; USEPA, 1992).

Lead exceeded the USFWS national 85th percentile upstream from Eagle Pass/Piedras Negras (station 9). Lead is a cumulative toxin, affecting growth, reproduction, development, metabolism, and behavior in multiple species. It is associated with atmospheric deposition from automobile exhausts and smelter stacks, discarded batteries and paints, and metal alloys (Phillips and Russo, 1978; Moore and Ramamoorthy, 1984; Irwin, 1988). It was not detected in water at the site, and was not elevated in sediment. Potential sources in the vicinity were not apparent.

Cadmium exceeded the USFWS national 85th percentile upstream from El Paso/Ciudad Juárez (station 1). Cadmium is associated with lead and zinc deposits, smelters, fossil fuels, and industrial wastes (Eaton, 1974; Brown and Lemay, 1977). It was not detected in water and was not elevated in sediment from the site. No potential sources were evident.

Aluminum concentrations generally were above detection limits (Table 13), and ranged from 1.9 to 797 mg/kg. Aluminum levels in fish are strongly influenced by the consumption of soil by bottom feeders, such as carp and catfish (Brumbaugh and Kane, 1985; Joel Lusk, USFWS, personal communication). Predatory species, such as largemouth bass, smallmouth bass, and white bass, never contained more than 3.2 mg/kg in this study. There was no apparent relationship between aluminum concentrations in sediment and whole fish. The concentrations that were observed in tissue did not appear to indicate environmental contamination.

Nickel concentrations ranged from 0.079 to 6.93 mg/kg, and were maximal (0.38 to 6.93 mg/kg) at stations 1, 2, 13, and 16. However, levels in other fish samples from the same sites were substantially lower. Intermediate concentrations (0.142 to 0.249 mg/kg) occurred in fish from stations 2, 3, 5, 6a, 6b, 7, 8, 8d, 9b, 11, 13, 14, and 15. Low concentrations (0.079 to 0.126 mg/kg) were found in fish from stations 1, 4, 6, 6a, 7, 7b, 8, 8d, 13, 14, 15, 16, and 18. Although nickel concentrations in sediment exceeded aquatic life threshold values at most sites (Table 14), there was no apparent correlation with levels observed in fish tissue. Potential sources of nickel include metal plating, alloys, and coal combustion (Phillips and Russo, 1978).

Silver was infrequently detected in whole fish (Table 13), with concentrations ranging from 0.035 to 0.088 mg/kg. A degree of clustering was evident, with detectable levels occurring upstream and downstream from Eagle Pass/Piedras Negras, in the Río Escondido, and upstream and downstream from Laredo/Nuevo Laredo (stations 9, 9b, 10, 11, 12). Additionally, both samples collected downstream from Hidalgo/Reynosa (station 16) contained detectable silver concentrations.

Although silver concentrations in water and sediment did not exceed screening levels at stations 9, 9b, 10, 11, or 16, the concentration in water at station 12 was high enough to potentially exceed acute and chronic aquatic life criteria (Table 14). Industrial effluents associated with metals, metal alloys, and electroplating are a potential source of silver (Phillips and Russo, 1978).

Thallium also was infrequently detected, with concentrations ranging from 0.038 to 0.053 mg/kg. It was found in fish from stations 7b, 8, 13, 15, and 16. Thallium is a byproduct of iron, cadmium, and zinc processing, is associated with alloys, and has been used as a rodenticide and insecticide (Doull *et al.*, 1980). No water or sediment screening values for thallium were exceeded at these sites.

Cyanide was detected in two samples, from stations 7b and 14. The measured concentrations were 2.0 mg/kg, which is only slightly greater than the detection limit (1.0 mg/kg). Cyanide in water exceeded the acute aquatic life criterion downstream from International Anzalduas Dam (station 14), but elevated levels were not noted in water or sediment from station 7b.

Several organic chemicals exceeded screening criteria. Arochlor 1248 concentrations were greater than the USFWS national geometric mean upstream from Eagle Pass/Piedras Negras (station 9), and upstream from Laredo/Nuevo Laredo (station 11). PCB's were not detected in water or sediment from these sites. The sources of PCB's in tissue were not apparent.

Chlordane exceeded the TNRCC state 85th percentile in one sample collected downstream from Laredo/Nuevo Laredo (station 12). It was widely used in urban areas as a pesticide until sales were banned in the United States in 1988. However, it is highly persistent in the environment, and still sometimes occurs in reaches of rivers downstream from cities (USEPA, 1992). The probable source of chlordane at station 12 is urban/industrial runoff from Laredo/Nuevo Laredo.

Gamma-bhc (lindane) exceeded the USEPA national mean upstream from the Río Conchos confluence (station 3). It was not detected in water or sediment from that site. Although usage of this pesticide has been restricted in the U.S. since 1985, substantial agricultural activity in the area is the probable source (Irwin, 1989; TNRCC, 1992a; USEPA, 1992).

To summarize the occurrence of toxic chemicals based on body burden screening, five contaminants in fish tissue exceeded screening levels at station 9, four at station 11, and three at station 13 (Figure 3). Eleven sites exhibited screening level exceedances for two contaminants (1, 3, 4, 5, 6a, 6b, 7, 9b, 10, 12, 16), and ten sites for one contaminant (2, 3a, 6, 7b, 8, 8d, 14, 15, 17, 18).

Predator Protection Limits.—Whole fish tissue data were subjected to a second type of screening using predator protection limits (PPL's) (Table 7). These limits are maximum concentrations recommended by USFWS, USEPA, and others for protection of predatory fish and wildlife from the effects of ingesting contaminants in prey organisms.

For chromium, mercury, and selenium, PPL's are lower than 85th percentile values used in body burden screening. Thus, some values for these contaminants which did not exceed 85th percentiles did exceed PPL's. Also, the PPL for total PCB's is < 0.1 mg/kg; to be able to estimate exceedances, a value of 0.1 mg/kg was employed. Therefore, the potential for effects by PCB's on predatory species may be underestimated.

Selenium concentrations exceeded the PPL at every site except downstream from Brownsville/Matamoros (station 18). Selenium can affect reproduction in fish and predatory birds (Eisler, 1985; Lemly, 1985; Gillespie and Baumann, 1986; Ohlendorf *et al.*, 1986; Hoffman and Heinz, 1988; Ohlendorf, 1989). Although whole body concentrations of selenium were greater than the PPL throughout the system, highest concentrations were from upstream of the Río Conchos confluence to Del Rio/Ciudad Acuña, and fish in that area may constitute a more serious threat to predators. See previous discussions regarding potential sources of selenium.

Similarly, mercury often exceeded the PPL. The only areas where concentrations were less than the PPL included sites upstream from the Río Conchos confluence (stations 1-3), on the Pecos and Devils rivers (stations 6a and 6b), downstream from Del Rio/Ciudad Acuña (station 8), and downstream from Brownsville/Matamoros (station 18). See previous discussions regarding potential sources, and occurrences in water and sediment at these sites.

Chromium occasionally exceeded the PPL. Concentrations in fish from the Pecos River, the Río Escondido, upstream and downstream from Laredo/Nuevo Laredo, downstream from International Anzalduas Dam, and downstream from Hidalgo/Reynosa were high enough to be a potential risk to fish-eating predators. Chromium was detected in water from several tributaries in these areas, including 6a, 9a, 12a, and 15a. Chromium levels in sediment from stations 11, 14, and 16 exceeded aquatic life threshold values. General sources of chromium include wastewater discharges from metal plating, chemical, power plant, and industrial facilities (Eisler, 1986b).

Total PCB's exceeded the PPL upstream from Eagle Pass/Piedras Negras and upstream from Laredo/Nuevo Laredo (stations 9 and 11). PCB's were not detected in water or sediment at these sites. There is extensive documentation regarding bioaccumulation of PCB's and subsequent effects on organisms. PCB's are persistent, bioaccumulative, and carcinogenic, and are known to cause reproductive failure in mammals (Parslow and Jefferies, 1973; Neidermyer and Hicky, 1976; Addison and Brodie, 1977; Eisler, 1986a; USEPA, 1992).

The PPL for lead was exceeded only downstream from El Paso/Ciudad Juárez (station 2). Lead was also elevated in sediment at that site, exceeding the aquatic life threshold value (Table 14). It also occurred at a high concentration in sludge from station 1a, the El Paso Public Service Board Haskell R. Street wastewater treatment plant outfall, located 13.8 km (8.6 miles) upstream, implicating that facility as a probable contributor of lead to station 2. See previous discussions regarding biological effects and potential sources.

To summarize indications of toxic chemical contamination from predator protection limit screening, the following sites had three or four contaminants that exceeded PPL's in whole fish tissue: upstream from Eagle Pass/Piedras Negras, the Río Escondido, upstream and downstream from Laredo/Nuevo Laredo, downstream from International Anzalduas Dam, and downstream from Hidalgo/Reynosa (stations 9, 9b, 11, 12, 14, 16) (Figure 4). Stations 2, 3a, 4, 5, 6, 6a, 7, 7b, 8d, 10, 13, and 15 had two contaminants that exceeded PPL's, while the remaining sites had zero or one (1, 3, 6b, 8, 17, 18).

Toxicity Testing

Toxicity testing was performed on water and sediment eluate samples from all 45 sites. The results are presented in Tables 14 and 15. Reference toxicant tests were conducted throughout the study, the results of which were within established acceptable limits based on previous tests with the subject organisms (Terry Hollister, USEPA Laboratory-Houston, personal communication).

Mainstem

In toxicity testing of water, significant adverse effects were seen in only one instance. This involved the sample from station 1, where 100% mortality occurred in *Ceriodaphnia dubia*. As that site was the upstream control station for the El Paso/Ciudad Juárez reach, this occurrence was surprising. Five toxic chemicals were present at quantifiable levels, but none exceeded screening levels. Thus, no causative agent was identified. Local fish and macrobenthic communities were healthy, indicating that toxic impacts are not persistent. Supplemental data for the site suggest that the occurrence may have been an aberration, as no significant effects have been observed in periodic toxicity testing conducted since 1993 (Table 18).

Toxicity testing of sediment eluates also revealed only one instance of significant adverse effects. This was in the sample from station 12, downstream from Laredo/Nuevo Laredo, where 100% mortality occurred in fathead minnow embryo/larvae. Seventeen toxic chemicals were detected in sediment, the highest number for any mainstem station. Concentrations of methylene chloride, toluene, and nickel were in excess of aquatic life threshold values, and probably were at least partially responsible for the observed effects. However, other chemicals, acting synergistically or additively, may also have been involved. Fish and macrobenthic communities at the site were moderately impaired; the observance of sediment eluate toxicity indicates that toxic properties of local sediments were among the causative factors. Periodic toxicity testing since 1991 has documented two other instances of significant adverse effects, involving one water sample and one sediment eluate sample (Table 18).

A total of 114 toxicity determinations were made on mainstem samples (*Ceriodaphnia dubia* survival in water and sediment, *C. dubia* reproduction in water and sediment, and fathead minnow embryo/larval survival in water and sediment, at each of 19 sites). That significant effects occurred in only two of 114 possible instances was an important finding regarding toxic chemical impacts in the Rio Grande/Río Bravo, indicating that such effects are rare during low flow conditions.

Supplemental toxicity testing data, referenced for stations 1 and 12 above, exist for seven other mainstem locations (Table 18). Most of the sites are located below major sister cities, to monitor impacts in areas susceptible to toxic chemical contamination. In addition to occurrences mentioned for station 12, significant adverse effects have been seen in water and/or sediment eluate samples from stations 2, 4, and 10. Thus, a potential for toxic effects exists at those three sites, despite the fact that toxicity was not seen there during the present study.

Tributaries

Toxicity was much more prevalent than for the mainstem, as samples from 14 of the 26 stations produced significant adverse effects in at least one phase of the toxicity tests. The 14 affected sites are discussed individually below.

Station 1a, the El Paso Public Service Board Haskell R. Street wastewater treatment plant outfall, exhibited the most severe degree of toxicity in the study. One hundred percent mortality occurred in *Ceriodaphnia dubia* and fathead minnow embryo/larvae in both the water and sludge sample. Chemistry data for the water sample reflected the presence of 17 toxic chemicals, the highest number in the study. Residual chlorine, chloroform, and arsenic were elevated, but only the former exceeded an aquatic life screening level. The residual chlorine concentration was 63 times greater than the acute criterion, and undoubtedly was the main cause of water toxicity. In sludge, copper, mercury, selenium, silver, and zinc concentrations exceeded national 85th percentiles, and two other chemicals for which no screening levels exist occurred at comparatively high concentrations (parachlorometa cresol, phenol). Effects by copper, mercury, and zinc probably were negligible, as the observed concentrations were considerably less than aquatic life threshold values. Selenium and silver do not have threshold values; however, the margin by which they exceeded national 85th percentiles was slight for selenium (1.3X), but extreme for silver (11.8X). The parachlorometa cresol concentration was the second highest observed, while the detection of phenol was the only such occurrence in the study. Thus, among potential causes of toxicity in the sludge sample, selenium may have played a minor role, while silver, parachlorometa cresol, and phenol possibly had major involvement.

The water sample from station 2a, the Ciudad Juárez sewage discharge canal, induced 100% mortality in *C. dubia* and fathead minnow embryo/larvae. Twelve toxicants were detected, six of which exceeded screening levels (un-ionized ammonia, parachlorometa cresol, phenol, phenolics recoverable, arsenic, mercury). Un-ionized ammonia, the only one that exceeded an aquatic life screening level (at a concentration 2.6 times greater than the acute criterion), evidently was the primary causative agent.

One hundred percent mortality occurred in *C. dubia* in sediment eluate from station 3a, the Río Conchos. Twelve toxicants were detected in sediment. Arsenic, chromium, and nickel exceeded aquatic life threshold values and were potential causative agents. However, the arsenic concentration stood out, as the amount by which it exceeded the threshold value was the greatest in the study. The amounts by which chromium and nickel exceeded threshold values, on the other hand, were comparable to amounts for sites where sediment toxicity was not observed. Fish community integrity was relatively high at the site (although specimens exhibited a slightly elevated incidence of physical abnormalities), indicating that any instream toxic stresses that were being exerted were not appreciably affecting resident aquatic life.

In the water sample from station 6a, the Pecos River, *C. dubia* reproduction was significantly reduced. Five toxicants were detected, but none exceeded screening levels. The causative agent evidently was total dissolved solids, as the observed concentration approximated the range known to induce stress in *C. dubia* (Terry Hollister, USEPA Region 6 Laboratory-Houston, personal communication). The local fish community was healthy, indicating that no appreciable instream impacts were occurring.

Ceriodaphnia dubia reproduction was also significantly reduced in samples from the next three sites. However, the effects probably were not ecologically important. The effect occurred in water and sediment eluate from station 6b, Devils River. Three toxicants were detected in water and 11 in sediment, but none exceeded screening levels. Fish community integrity was high at the site, providing evidence that no toxic impacts were occurring in the river.

For station 7a, Arroyo de las Vacas, only the water sample was involved. Of four toxicants that were detected, only un-ionized ammonia appeared important. The measured concentration was equivalent to the chronic aquatic life criterion, and probably was responsible for the observed effect.

For station 7b, San Felipe Creek, the effect occurred only in the water sample. Two toxic chemicals were detected; one of these, silver, exceeded aquatic life screening levels and was the probable causative agent. The observed concentration was considerably greater than at any other site. The local fish community was relatively healthy, indicating that any toxic effects that may have been occurring in the creek were not severe.

In the water sample from station 9a, an unnamed tributary 3.6 km (2.2 miles) south of Eagle Pass/Piedras Negras, *C. dubia* reproduction was significantly reduced, and 100% mortality occurred in fathead minnow embryo/larvae. Seven toxic chemicals were detected, two of which occurred at elevated levels. The arsenic concentration exceeded the human health criterion, but was much lower than applicable aquatic life criteria. Un-ionized ammonia, on the other hand, was over four times greater than the chronic aquatic life criterion, and most likely was responsible for the observed effects.

In the water sample from station 10a, Manadas Creek, *C. dubia* survival and reproduction were significantly reduced. Four toxic chemicals were detected, two of which occurred at concentrations above screening levels. Antimony and thallium exceeded human health criteria, with antimony also exceeding the national 85th percentile. However, concentrations of both were well below aquatic life criteria. The probable causative agent was total dissolved solids, as the observed concentration was within the range known to adversely affect *C. dubia* (Terry Hollister, USEPA Laboratory-Houston, personal communication).

The water sample from station 11a, Zacate Creek, produced 100% mortality in *C. dubia*. Eight toxicants were present at detectable concentrations, two of which exceeded screening levels. The selenium concentration exceeded the chronic aquatic life criterion, but only by a very slight amount, and its impact probably was minimal. The diazinon concentration, however, was two times greater than the acute screening value, and evidently was the main causative factor.

One hundred percent mortality occurred in *C. dubia* exposed to water from station 11b, Chacon Creek. Five toxic chemicals were detected, but none exceeded screening levels. Adverse effects were attributable to total dissolved solids, which were at a level known to be highly stressful to *C. dubia* (Terry Hollister, USEPA Laboratory-Houston, personal communication).

For station 11c, Arroyo el Coyote, *C. dubia* survival and reproduction were negatively affected in the water sample. Ten toxic chemicals were detected, four of which exceeded screening levels. Arsenic exceeded the human health criterion, but not the aquatic life criteria. Un-ionized ammonia, selenium, and bis(2-ethylhexyl) phthalate exceeded chronic aquatic life criteria by factors of 6.2X, 2.1X, and 3.3X, respectively. Thus, un-ionized ammonia appears to have been the main cause of water toxicity, with selenium and bis(2-ethylhexyl) phthalate involved in lesser roles. In the sediment eluate, 100% mortality occurred in both *C. dubia* and fathead minnow embryo/larvae. Seventeen toxic chemicals were detected in sediment, with zinc, chlordane, and bis(2-ethylhexyl) phthalate exceeding screening levels. Zinc exceeded the national 85th percentile, but was far less than the aquatic life threshold value. Chlordane exceeded the aquatic life threshold value by a factor of 1.9X. No aquatic life threshold value exists for bis(2-ethylhexyl) phthalate, but the concentration was very high, exceeding the national 85th percentile by 7.3X and the next highest level in the study by 8X. One other chemical for which no screening level exists, parachlorometa cresol, also was conspicuously elevated, exceeding the next highest level in the study by 2.3X. Thus, indications are that chlordane, bis(2-ethylhexyl) phthalate, and parachlorometa cresol were potentially important in the manifestation of sediment eluate toxicity.

Significant adverse effects were recorded for the water sample from station 12d, Arroyo Los Olmos, as 100% mortality occurred in both *C. dubia* and fathead minnow embryo/larvae. Seven toxic chemicals were detected, with two exceeding screening levels. Cyanide exceeded the chronic aquatic life criterion by a factor of 1.8X, and may have been marginally involved in the observed effects. Diazinon exceeded the acute aquatic life criterion by 26.3X, and evidently had a major causative role. Total dissolved solids probably contributed to the impact on *C. dubia*, as the concentration was in the range known to adversely affect that organism (but below the level known to stress fathead minnow embryo/larvae) (Terry Hollister, USEPA Laboratory-Houston, personal communication). Local fish community structure reflected a moderate probability that some form of instream impact was occurring.

In the water sample from station 15a, Anhelo Drain, *C. dubia* reproduction was significantly reduced. Sixteen toxic chemicals were detected, with arsenic, mercury, and diethyl phthalate exceeding screening levels. Of the three, only diethyl phthalate exceeded an aquatic life screening level, with a concentration 2.7 times greater than the chronic criterion. In the sediment eluate, fathead minnow embryo/larval survival was significantly reduced. Fourteen toxic chemicals were detected in sediment, but only chlordane exceeded screening levels, with a concentration 3.7 times greater than the aquatic life threshold value. Fish apparently were absent from the drain, as an attempt to collect samples for tissue analysis produced no specimens. This was reflective of severe instream stress, but whether toxic or conventional pollutants were primarily responsible was not clear.

Macrobenthic Community Assessment

Macrobenthic bioassessments were performed at the 18 major mainstem stations (Table 19). One hundred and ninety-nine taxa were collected, a high total that reflected physiographic complexity and varying zoogeographical influences along the longitudinal gradient.

Prior to interpreting the data, sample collecting techniques and data evaluation methods (described in the "Biological Techniques" section) were reviewed to evaluate their relative abilities to characterize macrobenthic integrity.

Evaluation of Collecting Techniques

Because snag sampling had not previously been used in TNRCC studies, a comparison to Surber sampling was performed. This involved the employment of both collecting techniques at two stations. At station 8, macrobenthic integrity was higher in the Surber sample, as indicated by greater species richness, diversity, equitability, and EPT index, plus a more optimally-sized standing crop. This was not reflected by TNRCC Mean Point Scores (MPS's), which were identical. It was, however, by the Ohio Invertebrate Community Index (ICI); although both ICI values were within the range associated with an intermediate aquatic life use rating, that for the Surber sample was 36% greater than that for the snag sample.

At station 12, a similar relationship was evident, for the same reasons. However, in this case both rating techniques clearly indicated better integrity in the Surber sample. The MPS for the Surber sample was 23% greater than that for the snag sample, the latter being reduced by one subcategory (from high to intermediate). The ICI reflected an intermediate use rating for both samples; however, the value for the Surber sample was 57% greater than that for the snag sample.

Thus, the two sampling methods resulted in slightly different indications of macrobenthic integrity. Surber sampling produced 0-23% greater MPS's, and 36-57% greater ICI's, than did snag sampling. Two natural factors relating to physical habitat probably are instrumental in this relationship. First, rocky-bottomed substrates from which Surbers were taken were more physically complex than snags, which had relatively smooth surfaces. This afforded a greater variety of microhabitats, which would be expected to support a more diverse macrobenthic assemblage. Second, current velocity associated with Surber sample habitats typically was considerably greater, as snags generally occurred in slackwaters along the shorelines. Maximal macrobenthic diversity in streams typically is associated with relatively swift current velocity (Hynes, 1970).

However, a possibility also exists that snag communities were more affected by certain environmental stresses, such as toxicants, than were riffle communities, in relation to aforementioned hydrological variability. Kerans *et al.* (1992) showed that effects of environmental stresses on certain invertebrate metrics are manifested to a greater degree in slackwater habitats than in riffles. Potential stresses may be ameliorated in riffles by the effects of high reaeration, continuous flushing, and low degree of accumulation of (potentially contaminated) fine particulates on the substrate, whereas the reverse appears true for slackwaters.

The evaluation revealed an inherent tendency for Surber sampling to sometimes produce more favorable indications of macrobenthic integrity than snag sampling. However, supplemental information suggests that environmental stresses may compound innate differences. Therefore, in interpreting the data, indications of reduced macrobenthic integrity from snag sampling were not automatically discounted. Rather, the possibility that environmental stresses might be involved was closely scrutinized.

Comparison of Data Evaluation Methods

In a TNRCC study of 81 minimally-impacted ecoregion stream sites, the MPS indicated exceptional or high ratings at a 15% greater frequency than did the ICI (Bayer *et al.*, 1992). Thus, intrinsic differences in the way the techniques function appear to account for this amount of divergence.

In the present study, the MPS produced an aquatic life use rating one subcategory higher than did the ICI in nine instances. Ratings were consistent in the other 11 cases. Therefore, the MPS resulted in a higher aquatic life use rating 45% of the time.

Thus, the frequency of divergence for the Rio Grande/Río Bravo exceeded what would be expected in minimally-impacted streams by 30%. This may reflect differing sensitivities of the two techniques in situations where toxicants or certain other types of environmental stresses occur, with the ICI producing harsher indications. There is evidence from other TNRCC studies that the MPS is very sensitive to the effects of organic enrichment, but less so to toxic stresses (Davis, 1991), which precipitated employment of both techniques in the present study.

Comparison of the two rating methods showed that the MPS can be expected to sometimes give a more favorable impression of macrobenthic integrity than the ICI, with the gap widening where certain types of environmental impact occur. Accordingly, in cases where the ICI was reduced relative to the MPS, the potential for inherent variation, and the possibility of stress-induced divergence, were given equal consideration in interpreting the data.

Macrobenthic Integrity

A high aquatic life use is in effect for 17 of the 18 macrobenthic stations. The only deviation is for station 2, where a limited aquatic life use is applicable (TNRCC, 1991).

An important finding was that no limited aquatic life use ratings were indicated by either rating method. Such a rating usually reflects severe instream impact.

The 18 sampling stations were placed into four categories based on indications of macrobenthic integrity. Category 1 included seven sites, for which both rating methods indicated attainment of a high or exceptional aquatic life use (stations 4, 6, 7, 9, 10, 11, 14). Determinations for all seven were based on Surber samples. Ranges and means for rating method values and principal metrics included: MPS, 3.17-3.67, 3.45; ICI, 36-46, 40.3; species richness, 33-65, 49.6; standing crop, 443-22,637, 5,794 individuals/m^2; diversity, 3.88-4.51, 4.16; equitability, 0.71-0.80, 0.74; EPT index, 10-20, 15; prevalence of dominant functional feeding group, 23.31-42.97, 31.60%.

All but the lowermost of these seven sites were between the Río Conchos confluence and International Falcon Reservoir, and five were clustered in the reach between Langtry/San Ignacio and Laredo/Nuevo Laredo. Thus, zoogeographical factors appeared to be partially responsible for superior macrobenthic integrity, *i.e.*, overlap of influences within a transitional zone between three biotic provinces (see "Study Area" section, and discussion by Davis, 1980).

Macrobenthic integrity at station 6 stood out from all other sites. It was the only site categorized as exceptional by both rating methods, and the MPS and ICI values were the highest in the study. This was fostered by the remoteness of the area, together with general environmental and zoogeographical considerations discussed for category 1 sites.

Levels of integrity at category 1 sites reflected optimal environmental conditions, lack of effects by toxic chemicals or other detrimental factors, and full attainment of the designated high aquatic life use. Supplemental information supported this assessment, as no significant effects occurred in water or sediment eluate toxicity tests (Tables 16 and 17), and few toxic chemicals exceeded screening levels (Table 13). Such conditions were not surprising for the three sites that were upstream control stations (station 7, Del Rio/Ciudad Acuña reach; station 9, Eagle Pass/Piedras Negras reach; station 11, Laredo/Nuevo Laredo reach), or for station 6 which was in a remote reach. For the other three, however, which were downstream sites in reaches where potential contaminant sources exist (station 4, Presidio/Ojinaga; station 10, Eagle Pass/Piedras Negras; station 14, International Anzalduas Dam), the findings were particularly noteworthy in indicating that effects of pollutants introduced from those areas were negligible.

Category 2 consisted of six sites which partially attained a high aquatic life use (stations 1, 2, 5, 8, 13, 16). These were rated high by the MPS but intermediate by the ICI. Ranges and means for rating method values and principal metrics included: MPS, 2.50-3.17, 2.76; ICI, 22-30, 26.6; species richness, 15-51, 36.3; standing crop, 495-35,642, 10,687 individuals/m^2; diversity, 2.78-3.79, 3.37; equitability, 0.58-0.71, 0.66; EPT index, 5-10, 6.9; prevalence of dominant functional feeding group, 29.62-77.15, 48.00%.

Stations 1 and 13 were upstream control sites for the El Paso/Ciudad Juárez reach and the International Anzalduas Dam reach, respectively. As such, no appreciable instream impacts were anticipated. Respective MPS values of 3.00 and 3.17 were in the mid- to upper portion of the range associated with a high aquatic life use, while ICI values of 30 were only slightly below the minimum associated with a high use. These were the highest values observed in the study for snag samples.

The inherent tendency for snag samples to slightly underrate macrobenthic integrity could account for the amount by which ICI values fell short of the high range at these two sites. In addition, physical macrohabitat characteristics were not particularly suitable for macrobenthos at either site, and indications of slightly depressed macrobenthic integrity could have been a product of physical habitat limitations. Station 1 had a monotonous, sandy substrate, and was located in a channelized reach subject to episodic scour and refill. The harsh nature of the aquatic environment at this site has been described by Davis (1980). Station 13 also had a homogenous, predominantly sand substrate, plus various other limitations as discussed for stations 15, 17, and 18 below. In addition, instream flow at both sites, which is dependent on upstream reservoir releases, is highly variable and sometimes changes abruptly, resulting in wide physicochemical fluctuations.

The indicated level of macrobenthic integrity at station 5 was slightly lower than at stations 1 and 13, even though Surber sampling was employed. The MPS was in the lower portion of the high use subcategtory range, and the ICI was in the middle of the intermediate use subcategory range. In those respects, it resembled characteristics for stations 2, 8, and 16. However, it was lumped with stations 1 and 13 for the following reasons. It was located in a remote reach far removed from any wastewater discharges or other likely sources of contamination. Physical habitat characteristics in the immediate vicinity were very poor, as has been described by Davis (1980), primarily with respect to extreme substrate embeddedness and lack of microhabitat diversity. This condition evidently is induced by inflow from Terlingua Creek, which enters immediately upstream from the collecting area, during spates. That the physical nature of the substrate was the primary factor limiting macrobenthic integrity was substantiated by additional field observations. Subsequent to sampling activities in the area, communication with the fisheries team revealed that conditions were substantially different a kilometer or so downstream, where fish collecting was performed. No embeddedness was evident, and large invertebrates such as Megaloptera, which were absent from the macrobenthic sample, were collected in abundance during seining.

Based on physical habitat, sampling technique, macrobenthic integrity, and geographical considerations, it was concluded that the potential that toxic chemical-induced environmental stress was occurring at stations 1, 5, and 13 was very slight. Associated data substantiated this conclusion, as few toxic chemicals exceeded screening levels (Table 15) and no adverse effects were seen in sediment eluate toxicity tests. In addition, no significant effects occurred in toxicity testing of water from stations 5 and 13 (Tables 16 and 17). Although *Ceriodaphnia dubia* survival was significantly reduced in water from station 1, no potential causative agents were identified, and the healthy condition of local fish and macrobenthic communities indicated that instream toxicity is not persistent.

Indications of macrobenthic integrity at the remaining sites in category 2 were summarized in the second paragraph preceding. All three were downstream sites in reaches where potential contaminant sources exist (station 2, El Paso/Ciudad Juárez; station 8, Del Rio/Ciudad Acuña; station 16, Hidalgo/Reynosa).

At station 2, low flow is dominated by the El Paso Public Service Board Haskell R. Street wastewater treatment plant effluent. In addition, physical habitat is poor, due to the effects of stream channelization, lack of substrate complexity, and other factors (as described by Davis, 1980). Based on these considerations, a limited aquatic life use has been designated for the segment (TNRCC, 1991). In an effort to eliminate physical habitat effects, Surber samples were collected from localized, gravel-bottomed riffles about 2 km (1.2 miles) downstream, immediately below Riverside Diversion Dam. The results showed that although the designated limited aquatic life use was attained, macrobenthic integrity was considerably reduced compared to levels that would be expected in unimpacted situations. Furthermore, absolute MPS and ICI values were somewhat lower than at the upstream control site, despite the fact that station 1 data was based on snag sampling. A degree of organic enrichment was indicated by the prevalence of miners (organisms that feed on deposited fine particulate organic matter), primarily oligochaetes which are highly tolerant of such conditions. Whereas organic enrichment may have contributed to depressed macrobenthic integrity, a possiblity that effects by toxic chemicals may also have been involved was not ruled out.

Station 8 was subjected to Surber and snag sampling. Regarding the Surber sample, the physical habitat was not ideal, but consisted of runs about 0.3 m (1 foot) deep over coarse gravel partially embedded in sand and silt. Also, a degree of organic enrichment was indicated by the prevalence of miners, mostly tolerant species of oligochaetes. Comparison to data from the control site (station 7) reflected a moderate reduction in macrobenthic integrity, which was partially attributable to less-suitable physical habitat. For the snag sample, the ICI value was the second lowest observed in the study, and was appreciably less than that for the Surber, as was reflected by reductions in individual metrics such as species richness and EPT index. Whereas physical habitat limitations, organic enrichment, and inherent variability among sampling techniques and rating methods may have contributed to indications of reduced macrobenthic integrity, a possibility also existed that slight effects by toxic chemicals may have been occurring.

Indications of macrobenthic integrity at station 16 were influenced by the same limiting factors discussed for station 13, as physical habitat characteristics and the employment of snag sampling were common to both sites. Other limitations are addressed in the discussion for stations 15, 17, and 18 below. Another possible detriment was slight organic enrichment, which was reflected by the large standing crop and predominance by miners. Cumulatively, these factors undoubtedly contributed to indications of reduced macrobenthic integrity. In fact, there were strong indications that unsuitable physical habitat conditions were the primary determinant, as macrobenthic integrity actually was better than at the upstream control site (station 15). However, in light of the fact that this was the downstream station for the Hidalgo/Reynosa reach, where potential contaminant sources exist, together with the level of macrobenthic integrity that was observed, a possibility also existed that slight effects by toxic chemicals may have been occurring.

With ample consideration ascribed to physical habitat characteristics, sampling techniques, macrobenthic integrity, geographical location, chemical data, and toxicity testing results, it was concluded that the potential that toxic chemical-induced environmental stress was occurring was slight for stations 8 and 16, but moderate for station 2. At stations 8 and 16, few toxic chemicals exceeded screening levels, and no significant effects occurred in water or sediment eluate toxicity tests. At station 2, no significant effects were seen in the toxicity tests, but a number of toxic chemicals occurred at elevated concentrations, most notably in sediment (Table 15). For all three sites, however, observed levels of macrobenthic integrity indicated that if toxic stresses were being manifested, the effects were relatively minor.

Category 3 consisted of four sites where an intermediate use was indicated by both rating methods (stations 3, 15, 17, 18). Thus, the designated high aquatic life use level was not attained. However, the degree by which they failed to do so was relatively slight (with the exception of the MPS value for station 3). The main difference between these sites and those in category 2 was that MPS values were slightly lower and fell into the upper end of the intermediate use range (while ICI values were comparable, in most cases actually being slightly higher). Ranges and means for rating method values and principal metrics included: MPS, 1.50-2.33, 2.12; ICI, 27-30, 28.3; species richness, 19-34, 28.3; standing crop, 4,869-42,517, 16,078 individuals/m^2; diversity, 1.50-3.43, 2.78; equitability, 0.11-0.69, 0.51; EPT index, 5-8, 6.5; prevalence of dominant functional feeding group, 54.36-95.73, 69.10%.

Station 3 was in a remote area far removed from any obvious contaminant sources, and for that reason was established as the upstream control site for the Presidio/Ojinaga reach. The Surber sample from the site exhibited anomalously low diversity, equitability, and MPS, as well as next-to-lowest species richness in the study. In addition, functional feeding group composition was more imbalanced than at any other site. The main contributing factor was the presence of dominant numbers of filter-feeding, facultative blackfly larvae (*Simulium* nr *bivittatum*). Although values for certain metrics resulted in a depressed MPS, the ICI was more normal, in the upper half of the range associated with an intermediate aquatic life use. Also, sensitive species were fairly well represented, as reflected by the EPT index value. Thus, the degree by which macrobenthic integrity was suppressed was not as severe as was implied by the MPS.

Numerous elements contribute to poor macrobenthic habitat in the station 3 area, as discussed by Davis (1980). Among these are: elevated dissolved solids resulting from evapotranspiration and irrigation return flows in the reach from El Paso/Ciudad Juárez to Presidio/Ojinaga; excessive turbidity and sedimentation; predominance of fine sediment and high degree of embeddedness of stones on the substrate; wide physicochemical fluctuations promoted by highly variable flow; and seasonal intermittency of flow. Collectively, these factors result in reduced physical habitat complexity/suitability, and generally stressful environmental conditions. Optimal macrobenthic integrity would not be expected under such conditions.

Of the other sites in category 3, two were upstream control sites (station 15, Hidalgo/Reynosa reach; station 17, Brownsville/Matamoros reach), and the other was a downstream site (station 18, Brownsville/Matamoros reach). All three were subjected to snag sampling, and resultant indications of macrobenthic integrity were very consistent. Habitat characteristics also were relatively similar. Low gradient and stream channel morphometry result in physical homogeneity, *i.e.*, the river typically is wide and deep, and lacks riffles and runs. The substrate is monotonous, comprised mainly of sand and silt. Instream flow is highly variable (see Study Area description), resulting in wide physicochemical fluctuations. Cumulatively, these factors act to create relatively poor macrobenthic habitat.

Based on physical habitat, sampling technique, macrobenthic integrity, and geographical considerations, it was concluded that the potential that toxic chemicals were exerting instream stress at stations 3, 15, 17, and 18 was slight. Further evidence supporting this conclusion included the relative insignificance of toxic chemical concentrations (Table 15), and the lack of significant effects in water and sediment eluate toxicity tests (Tables 16 and 17).

Category 4 contained a single site, station 12, which did not fit previous patterns. Both sampling techniques were employed, and respective indications of macrobenthic integrity were considerably different. For the Surber sample, the MPS indicated a high use, but the ICI, the lowest observed for Surber samples, was in the lower half of the intermediate use range. For the snag sample, both rating methods reflected an intermediate use; however, the MPS was the lowest observed for snag samples, and the ICI was the lowest recorded for any sample by a substantial margin. As three of the four ratings were in the intermediate range, it was concluded that the designated high aquatic life use was not attained. Ranges and means for rating method values and principal metrics included: MPS, 2.17-2.67, 2.42; ICI, 14-22, 18; species richness, 27-41, 34; standing crop, 14,801-18,300, 16,551 individuals/m^2; diversity, 3.28-3.89, 3.59; equitability, 0.69-0.73, 0.71; EPT index, 2-5, 3.5; prevalence of dominant functional feeding group, 63.15-70.99, 67.07%.

Rocky-bottomed riffles were common in the area, and overall physical habitat characteristics were favorable. Nevertheless, sensitive species were poorly represented, as was reflected by low EPT index values (that from the Surber being the lowest observed for Surber samples, while that from snags was the lowest seen for any sample). The scope of reduction was broad, as the Surber EPT index value represented a 71% decrease from that at the control site (station 11).

A degree of organic enrichment was indicated by the predominance of miners, mainly tolerant species of oligochaetes and chironomids, and by the relatively large standing crops. This probably was partially responsible for reduced macrobenthic integrity.

The site was the downstream station for the Laredo/Nuevo Laredo reach, where the potential for contaminant introduction is high. Based on this consideration, together with the prevalence of favorable physical habitat, the observed level of macrobenthic integrity, and the paucity of sensitive species, it was concluded that the potential that toxic chemical-induced environmental stress was occurring at the site was high. This presumption is supported by the fact that significant effects occurred in the sediment eluate toxicity test (Table 17). Nonetheless, the level of macrobenthic integrity observed indicated that if toxic stresses were being manifested, the effects were not severe.

In conclusion, the 18 major mainstem stations were grouped according to the potential that macrobenthic communities were being affected by toxic chemicals, as follows.

indicated potential	station(s)
none	4, 6, 7, 9, 10, 11, 14
very slight	1, 5, 13
slight	3, 8, 15, 16, 17, 18
moderate	2
high	12

Fish Community Assessment

A total of 53 species of fish were collected from 18 sites on the mainstem Rio Grande/Río Bravo and seven tributaries sampled during this study. The initial inspection of the fish community data revealed several major faunal breaks that could be defined by differences in fish species occurrence. One division occurred surrounding the Río Conchos, with another at International Amistad Reservoir. The final one was observed surrounding International Falcon Reservoir. These trends appear more related to changes in stream hydrology than other factors.

Collections from stations 1 and 2, upstream and downstream of El Paso/Ciudad Juárez, contained similar species to those found in the Texas portion of the upper Rio Grande/Río Bravo by previous researchers (Hubbs *et al.*, 1977; Bestgen and Platania, 1988). Species considered common in the upper river by Hubbs *et al.* (1977) were gizzard shad (*Dorosoma cepedianum*), red shiner (*Cyprinella lutrensis*), common carp, river carpsucker (*Carpiodes carpio*), channel catfish, western mosquitofish (*Gambusia affinis*), and green sunfish (*Lepomis cyanellus*). Subsequently, Bestgen and Platania (1988) indicated that those species were still common and added bullhead minnow (*Pimephales vigilax*) and longear sunfish (*Lepomis megalotis*). Collected during the study, but not reported by Hubbs *et al.* (1977) or Bestgen and Platania (1988), was an introduced species, walleye (*Stizostedion vitreum*), from station 1. Hubbs *et al.* (1977) characterized Rio Grande/Río Bravo fauna upstream of the Río Conchos as widely distributed and salt tolerant.

The influence of the Río Conchos (3a) on species assemblages in the Rio Grande/Río Bravo became apparent at station 3, upstream of the confluence, and continued downstream to International Amistad Reservoir. Hubbs *et al.* (1977) discussed the Río Conchos influence and the influx of species that occur in the Rio Grande/Río Bravo beginning in the reach that contains the confluence of the two rivers. The faunal differences upstream and downstream of the Río Conchos also appear to be longstanding (Hubbs *et al.*, 1977).

In this study, International Amistad Reservoir presented a distinct boundary between a slightly turbid upstream reach influenced by stream modifications, irrigation return flows, runoff, and the Río Conchos (stations 3, 3a, 4, 5, and 6) and a downstream reach influenced by clear inflows of water from the reservoir and to a lesser degree, by springflow emanating from tributaries on both sides of the border. Modification of this downstream habitat through changes in flow patterns and reduced turbidity (Table 10) has apparently created a longitudinal gap in the occurrence of some fish species. Several members of the fish community were observed upstream of the reservoir and further downriver, around Eagle Pass/Piedras Negras and Laredo/Nuevo Laredo (stations 9, 10, 11, and 12), but were absent immediately downstream of International Amistad Reservoir at stations 7 and 8. Tamaulipas shiner (*Notropis braytoni*) was collected at stations 3, 3a, 4, 5, and 6 upstream of the reservoir and station 11 downstream, being absent from intervening sites. Other species demonstrating a similar pattern were Rio Grande shiner (*Notropis jemezanus*), collected at stations 5, 6, 9, 9b, and 11; speckled chub (*Macrhybopsis aestivalis*), collected at stations 3, 3a, 4, 5, 6, 6a, 11, and 12; and blue sucker (*Cycleptus elongatus*), collected at stations 3a, 4, 5, and 12. Longnose dace (*Rhinichthys cataractae*) was observed at stations 3a, 4, 5, and 6, but not downstream. River carpsucker and blue catfish were present upstream of International Amistad and downstream of International

Falcon Reservoirs, but were absent from the entire middle reach. Platania (1991) observed similar patterns of occurrence for Tamaulipas shiner, Rio Grande shiner, speckled chub, and longnose dace. Those four species, plus river carpsucker and blue catfish were all collected in the vicinity of stations 7 and 8 prior to the impoundment of International Amistad Reservoir (Trevino-Robinson, 1959). Coupled with the absence of certain species downstream of Amistad, was the presence of "stream" or "creek" oriented fishes (Smith and Miller, 1986) in the mainstem at stations 7, 8 and 9. The occurrence of roundnose minnow (*Dionda episcopa*) and Rio Grande darter (*Etheostoma grahami*) in a big river habitat illustrates the influence of Amistad and associated spring-fed tributaries on the Rio Grande/Río Bravo in that reach. Other species largely unique to the middle reach and tributaries were Texas shiner (*Notropis amabilis*), gray redhorse (*Moxostoma congestum*), and smallmouth bass (*Micropterus dolomieui*).

International Falcon Reservoir provides a break between the river's freshwater middle reach and a lowermost reach that becomes increasingly brackish toward the river's mouth. Estuarine and marine species were present at all sites downstream of the reservoir, but assumed the greatest proportions of the fish community at the two lowermost stations, 17 and 18, which are at river kilometer 155.8 and 78.3, respectively. Species representing this estuarine and marine fauna were American eel (*Anguilla rostrata*), Atlantic needlefish (*Strongylura marina*), gulf killifish (*Fundulus grandis*), sheepshead minnow (*Cyprinodon variegatus*), Amazon molly (*Poecilia formosa*), sailfin molly (*Poecilia latipinna*), mountain mullet (*Agonostomus monticola*), striped mullet (*Mugil cephalus*), and bigmouth sleeper (*Gobiomorus dormitor*). Based upon the collection from Arroyo Los Olmos (12d), whose confluence is more than 330 km (205 miles) upstream from the Rio Grande/Río Bravo mouth, brackish water species move far upriver during periods of reduced flow probably following changing salinity gradients. Estuarine or marine species accounted for approximately 96 percent of the total collection for Arroyo Los Olmos. That site had very high conductivities. A collection from the next downstream station on the mainstem was not dominated by brackish water species, possibly because flows were elevated at the time of sampling. Absent from our collections throughout the reach downstream of International Falcon Reservoir were several minnow species—Tamaulipas shiner, Rio Grande shiner, and speckled chub—which were historically observed in this area (Trevino-Robinson, 1959), suggesting a shift in the fish community. Edwards and Contreras-Balderas (1991) observed the elimination of freshwater restricted species downstream of Brownsville/Matamoros and replacement by estuarine and marine forms. They also noted an increase in the proportion of estuarine species between International Anzalduas Dam and Brownsville/Matamoros. Changes in both segments were attributed primarily to decreasing stream flows and concurrent increases in salinity. They also speculated that increases in chemical pollution were affecting indigenous species in concert with changes in stream flow. Species such as largemouth bass and white bass also become common downstream of International Falcon Reservoir, undoubtedly because of the influence of the reservoir fisheries.

In summary, hydrologic modifications have largely shaped the present Rio Grande/Río Bravo fish community. Upstream of the Río Conchos, where flow is undependable, species assemblages are small and adapted to highly variable conditions. The Río Conchos provides a reliable supply of water and habitat for species that characterize the river downstream to International Amistad Reservoir. The reservoir reduces turbidity and alters water quality and along with spring system influences, causes a shift in the fish community towards a clear water, small stream assemblage. Further downstream around Eagle Pass/Piedras Negras and Laredo, some characteristic community members observed upstream of Amistad are again present. International Falcon Reservoir and subsequent diversions serve to reduce flows downstream, with estuarine and marine species invading further upstream. Any evaluation of fish communities for the purposes of ascertaining pollutant impacts must be conducted within the context of these altered faunal patterns.

Fish Community Measures - El Paso/Ciudad Juárez to International Falcon Reservoir (Stations 1-12, 3a)

Species Richness, Composition, and Similarity.—Species number (Figure 5) ranged from nine to 19 species at Rio Grande/Río Bravo sites upstream of International Falcon Reservoir and on the Río Conchos. The median value was 12. The Río Conchos (3a) sample contained noticeably more species (18) than surrounding sites. Hubbs *et al.* (1977) noted this same trend. Sites with fewer species than the median (stations 1-3) were all upstream of the Río Conchos with one exception, station 7, downstream of International Amistad Reservoir, which had the lowest number of species. The collection from station 9, upstream of Eagle Pass/Piedras Negras, had the most species of any site between El Paso/Ciudad Juárez and International Falcon Reservoir. The most notable variation in species richness between sites bracketing the major sister cities came at stations 9 and 10, with a difference of seven species. Species present upstream but not downstream were roundnose minnow, Rio Grande shiner, Mexican tetra (*Astyanax mexicanus*), flathead catfish (*Pylodictis olivaris*), smallmouth bass, largemouth bass, and Rio Grande darter. Several of those species--the two minnows and darter--are among the more habitat sensitive species in the mainstem, suggesting the potential for impacts based upon community composition. Texas shiner was collected at station 10, but not station 9. These changes were not well reflected in the similarity index (Table 21) given the fact that the two sites also had many species in common. It should be noted, however, that station 9 shared higher similarity to an intervening tributary, the Río Escondido (9b), than to station 10.

The only other drop in species number between upstream and downstream sites came at station 2 relative to station 1 and amounted to a decrease of one, although the community composition was slightly different. Flathead catfish, walleye, and bluegill (*Lepomis macrochirus*) were collected at station 1, but not station 2, whereas white bass and largemouth bass were taken downstream but not upstream. From an impact analysis standpoint, little can be ascribed to the community differences between those sites, and the index of similarity value for those collections was the highest in the study when comparing upstream-downstream sites in the mainstem (Table 21).

Increases in species richness were observed at downstream stations relative to upstream when comparing stations 7 and 8, four species; 11 and 12, three species; and 3 and 4, two species. Collected at station 7 but not 8 were Texas shiner, smallmouth bass, and Rio Grande cichlid (*Cichlasoma cyanoguttatum*), whereas spotted gar (*Lepisosteus oculatus*), blacktail shiner (*Cyprinella venusta*), roundnose minnow, gray redhorse, channel catfish, green sunfish, and largemouth bass were taken downstream but were absent upstream. Similarity between the sites was relatively low (Table 21). These community changes probably reflect the fish community's state of flux given the aforementioned influence of International Amistad Reservoir.

Though the increase in species richness was not large at station 12 relative to 11, the similarity between the two stations was low (Table 21). Western mosquitofish, Tamaulipas shiner, Rio Grande shiner, and flathead catfish were all collected upstream, but were absent downstream, whereas the reverse was true for blue sucker, gray redhorse, Mexican tetra, white bass, warmouth (*Lepomis gulosus*), longear sunfish, and largemouth bass. Physical habitat was substantially more diverse at station 12 and consisted of more backwaters, snags, and instream vegetation, which would tend to favor additional centrarchid species. A specific habitat favoring blue sucker, boulder fields with swift velocities, was also observed downstream. The low similarity and elimination of the two shiner species, however, suggest potential impacts from intervening inputs of wastewater from Laredo/Nuevo Laredo.

The difference in species richness at stations 3 and 4 was minor and index of similarity between the two sites was high (Table 21). Present upstream but not downstream were fathead minnow (*Pimephales promelas*) and Mexican tetra, whereas gizzard shad, blue sucker, longnose dace, and longear sunfish were collected downstream but were absent upstream. Two of these species, longnose dace and blue sucker, were not observed upstream of the Río Conchos and their absence from station 3 may reflect the lack of reliable flows upstream of the confluence and the influence of irrigation return flows. The river was turbid (110 jtu) at station 3 and was of high conductivity (2,640 μmhos/cm). That situation also precluded effective electrofishing and may have biased the sample slightly, providing a somewhat tenuous comparison between upstream and downstream sites. However, species richness and composition comparisons for stations 3 and 4 do not suggest substantial impact from intervening pollutant inputs.

Species richness was the same at stations 5 and 6 with community similarity being moderate. Present at station 5 but not 6 were blue sucker, blue catfish, flathead catfish, and blue tilapia (*Tilapia aurea*). Those found downstream but absent upstream were smallmouth buffalo (*Ictiobus bubalus*), white bass, largemouth bass, and freshwater drum (*Aplodinotus grunniens*). Physical habitat, particularly substrate, at station 5 was different from that at station 6. Many cobble riffles were present, with some rubble and small boulders at station 5, whereas station 6 had smaller substrate particle sizes, mainly gravel and sand with some cobble. Those conditions may have favored blue sucker at station 5 over 6, whereas the proximity of International Amistad Reservoir downstream probably explains the presence of white bass and largemouth bass at station 6.

Index of Biotic Integrity.—Index of Biotic Integrity (IBI) scores for sites upstream of International Falcon Reservoir and in the Río Conchos ranged from 13 to 24 out of a possible 30 points (Table 22). The median value for those sites was 18. Stations with a score in the bottom two quartiles were 3a, 5, 6, 7, 8, 12. Station 12, downstream from Laredo/Nuevo Laredo, posted the lowest score in this reach (IBI=13). Species richness was rated high, though the site was downrated slightly for a reduced number of minnow species. Other areas in which it was downrated were for dominance by a single species, red shiner, which made up 60% of the sample; a relatively low catch rate; an elevated number of introduced individuals, primarily common carp; and the highest incidence of deformities, lesions, and tumors of any sample collected in the study. We noted deformities, lesions, and tumors in 10.9% of the electrofishing catch at this site and 2.75% of the total catch.

Stations 7 and 8 also had scores that were less than the median (14 and 17, respectively). As noted earlier, the collection from station 7 contained the fewest species in the study and only one minnow species, Texas shiner. The catch rate was the lowest in the river upstream of International Falcon Reservoir and the second lowest in the overall study. In addition, the number of introduced individuals-common carp and smallmouth bass-was elevated. Station 8 had moderate species richness and two minnow species, roundnose minnow and blacktail shiner, the latter being an introduction. Catch rate was again relatively low and the number of introduced individuals was elevated and consisted of common carp and blacktail shiner. As already noted, those sites, particularly station 7, demonstrated modified faunal patterns related to the presence of International Amistad Reservoir. Though a potential for contaminant impact is present at station 8 through point sources upstream, it is largely impossible to differentiate from the aforementioned influences.

Stations 5 and 6 were downrated for incidence of deformities, lesions, and tumors and relatively low catch rates. Station 5 was also downrated for a high incidence of introduced individuals, primarily common carp. The station 6 sample was dominated by more than 65% red shiner, which caused it to receive a less than optimal rating. Both of these sites contained many characteristic Rio Grande/Río Bravo species, however, including speckled chub, Tamaulipas shiner, Rio Grande shiner, and longnose dace. Given the presence of those species, the remoteness of the sites, and a low potential for pollutant inputs, the probability of contaminant impact appears very slight.

The final site with a score less than the median was the Río Conchos (3a). This site had high species richness relative to surrounding sites on the Rio Grande/Río Bravo, though the collection was downrated for the percentage of introduced fishes, primarily represented by common carp. Several sensitive minnow species were observed, including speckled chub, Tamaulipas shiner, and longnose dace. However, this site also had the third highest incidence of deformities, lesions, and tumors in the study. When only electrofishing samples were considered, 4.5 % of the catch had some physical anomaly.

In evaluating differences between paired samples bracketing the major sister cities, two (stations 3 and 4 and stations 7 and 8) had higher IBI scores downstream rather than upstream. Sampling difficulties noted earlier may have influenced the score at station 3 as well as return flow impacts on water quality. In addition, the influx of species from the Río Conchos (3a) may have reduced dominance by a single species at station 4, the sole metric that improved over station 3. The situation at stations 7 and 8 has already been discussed.

Three paired sites had lower downstream values. Station 12 was nine points lower than station 11, station 10 was four points lower than station 9, and station 6 was two points lower than station 5. No difference was noted between stations 1 and 2. Though station 12 had more species than 11, two characteristic minnow species-Rio Grande shiner and Tamaulipas shiner-were absent downstream. As noted earlier station 12 also had a greater dominance by one species, a lower catch rate, and a higher incidence of disease. The substantial decrease in IBI scores between stations 11 and 12, the low similarity index value, and the overall depressed score for station 12 indicates a high probability of pollutant impact. The drop in IBI scores between stations 9 and 10 is also supported by the aforementioned decrease in species richness, and suggests a moderate probability of pollutant impact. Given the small variation between the scores at stations 5 and 6 and the lack of pollutant inputs, the potential for impact is very slight.

In summary, based upon a variety of fish community measures station 12 has a high probability of pollutant impact; station 10, a moderate probability; and station 3a, a slight probability. In the latter case, the presence of fin deformities was the primary indicator, though Bestgen and Platania (1988) noted impacts in the Rio Grande/Río Bravo at their sites downstream of the Río Conchos. Downstream of the Río Conchos, they observed decreases in fish density and noted thick deposits of anoxic silt. Station 3 demonstrated very slight impacts that may relate to irrigation return flows. Stations 5 and 6 demonstrated some potential for contaminant impact, but as noted, that probability appears very slight. Finally, the situation at stations 7 and 8 preclude any definitive evaluation. Stations 1, 2, 4, 9 and 11 demonstrated no potential for contaminant impact based upon the fish community evaluation.

Fish Community Measures - International Falcon Reservoir to Brownsville/Matamoros (Stations 12d, 13-18)

Species Richness, Composition, and Similarity.---Downstream of International Falcon Reservoir, species richness ranged from 11 to 21, with the lowest numbers at stations 16 and 12d (11 species) and station 18 (12 species). Species richness was highest (21 species) at stations 13 and 14, the first stations downstream of International Falcon Reservoir, having been augmented by estuarine fishes, introduced species, and gamefish. Richness was noticeably lower at stations 12d, 16, and 18. Comparing sites bracketing the major sister cities, a difference of seven species was noted between stations 15 and 16 and six species between 17 and 18. In the former instance, none of the species present upstream and absent downstream are particularly sensitive to pollution impacts, though the magnitude of difference in species number suggests an effect. Species present at station 15 but not 16 were longnose gar (*Lepisosteus osseus*), gizzard shad, bullhead minnow, smallmouth buffalo, western mosquitofish, white bass, Rio Grande cichlid, blue tilapia, and striped mullet. Present downstream but not upstream were blue catfish and gulf killifish. Similarity (Table 21) was moderate.

The situation at stations 17 and 18 was somewhat similar, with a clear pattern not evident in considering species present at 17 but not 18. Those present at the upstream site but absent downstream were spotted gar, gizzard shad, threadfin shad (*Dorosoma petenense*), red shiner, Mexican tetra, blue catfish, western mosquitofish, white bass, redear sunfish (*Lepomis microlophus*), and mountain mullet. Those present at station 18 but absent at 17 were sheepshead minnow, Amazon and sailfin mollies, and Rio Grande cichlid. The downstream species are more estuarine in nature, suggesting a generally higher salinity in the reach. However, several of the species that dropped out between the two sites are tolerant of brackish conditions and the assemblage at station 18 contains freshwater elements, including longear sunfish and largemouth bass. Similarity was the lowest in the study (Table 21).

Though stations 13 and 14 had the same number of species, several differences were apparent. Upstream but not downstream were Atlantic needlefish, sailfin molly, redbreast sunfish (*Lepomis auritus*), green sunfish, freshwater drum, Rio Grande cichlid, and threadfin shad. Species observed at station 14 but not 13 were American eel, river carpsucker, blue catfish, western mosquitofish, mountain mullet, striped mullet, and bigmouth sleeper. No particular pattern in terms of species sensitivity is apparent from those differences. However, the number of estuarine/marine species appears slightly greater downstream of International Anzalduas Dam (station 14), which presents a migrational barrier at times. Similarity (Table 21) between the two sites was moderate.

Station 12d had what appeared to be a highly modified community given its location several hundred kilometers inland and the presence of 96% euryhaline species. Conductivity was elevated (Table 10) which undoubtedly accounts for the brackish nature of the community. The collection was dominated by Amazon molly.

Index of Biotic Integrity.---All of the upstream sites had higher IBI scores than their downstream counterparts (Table 23). The largest difference was at station 16, which had a six point lower IBI than station 15. Station 14 was four points lower than station 13, primarily because of the second highest incidence of deformities, lesions, and tumors in the study. Station 18's IBI score dropped three points from the score at 17. Station 12d's score was comparable to the downstream stations.

Station 16 posted a slightly depressed IBI from station 15, because of the already mentioned drop in species richness and a greater domination of the sample by a single species, Mexican tetra. As noted earlier, these sites had lower similarity. In fact, the fish community at station 15 was more similar to station 17 than to station 16. That factor, coupled with the lowered IBI score and the sharp drop in species richness compared to surrounding sites, suggests probable contaminant impact at station 16.

The lower IBI score at station 14 relative to 13 was the result of an increased number of individuals with deformities, lesions, and tumors. The percentage was the second highest in the study. Similarity was relatively high for the two sites and species richness at station 14 was the second highest in the study. Consequently, the only indicator pointing to potential impact is the percentage of diseased individuals. Based only upon that finding, the potential for pollutant impact appears slight.

The decrease in IBI score at station 18 relative to station 17 is difficult to evaluate in terms of probable pollution impacts. The site was downrated from station 17 for lower than optimal species richness and the elevated percentage of estuarine and marine species. The latter metric suggests that the community changes observed at station 18 are "real", but partitioning the influences of decreased flows from contaminant impacts would require additional study.

Station 12d was downrated because of the aforementioned dominance by euryhaline species, which exceeded even that of the lowermost site, station 18. The site was also downrated for dominance by a single species. Seine catch rates were high compared to mainstem sites, but that may relate more to the lack of flow and small size of the stream, a circumstance making collecting more efficient. Given the modified nature of the community, the potential for impact appears moderate.

In summary, of the sites downstream of International Falcon Reservoir, 12d and 16 appear to have a moderate potential for impact, with station 14 having a slight probability. The only indicator pointing to station 14, however, is the presence of fishes with deformities, lesions, or tumors. Station 18 is difficult to interpret given the aforementioned factors. Stations 13, 15, and 17 demonstrate no impact attributable to contaminants, based upon this evaluation.

<u>Fish Community Measures - Middle Reach Tributaries (Stations 6a, 6b, 7b, 8d, 9b)</u>

Species Richness, Composition, and Similarity.—Species richness in the middle reach tributaries ranged from 12 to 23 (Figure 5), with the fewest number in the Pecos River (6a) and San Felipe Creek (7b). In the latter case, seining sites were sparse in the reach sampled, which may have influenced the collection. The Río Escondido (9b) and Río San Rodrigo (8d) had the greatest number of species with 23 and 18, respectively. The Devils River (6b) collection contained 15 species. Similarity (Table 21) among the tributaries was generally low and in the range of 0.333 to 0.667, with the widely varying habitats probably responsible. A major exception was a value of 0.829 between the Río Escondido and San Rodrigo. The Pecos River was most dissimilar to the other tributaries with 75% of its fauna comprised of cyprinid species and no centrarchids being represented. Several native minnow species were observed, including proserpine shiner (*Cyprinella proserpina*), speckled chub, Texas shiner, and Tamaulipas shiner. Centrarchid species were numerous in the Río Escondido and Río San Rodrigo with six and seven species, respectively. The collections from those two streams included several characteristic minnow species such as roundnose minnow and Texas shiner in both streams and Rio Grande shiner in the Río Escondido. Four centrarchid species were in the Devils River collection along with several unique minnow species, including proserpine shiner and sand shiner (*Notropis stramineus*), the latter only being taken from this site. San Felipe Creek had only two minnow species--proserpine and blacktail shiner--and two centrarchid species. Blacktail shiner, an introduced species, was quite abundant throughout the middle reaches of the river. Gray redhorse, a catostomid, was also common at all of these tributary sites. Rio Grande darter was found in the Pecos River, Río Escondido, and Río San Rodrigo.

Index of Biotic Integrity.—IBI scores ranged from 18 to 23 (Table 24), with the lowest score at San Felipe Creek (7b). That site was downrated for lower than optimal species richness, few minnow species (one of which is introduced), lower than optimal catch rates, and a high percentage of introduced species, primarily carp and blue tilapia. All of the tributaries were downrated for a high percentage of introduced species. The IBI score for San Felipe Creek, together with low species richness and few numbers of minnow species, would appear to indicate a slight potential for impact. Also notable is the lack of Rio Grande darter, which Trevino-Robinson (1959) collected at several stations on San Felipe Creek. Platania (1991), however, collected additional minnow species and Rio Grande darter further upstream in Hinds Spring, a tributary to San Felipe Creek. He also observed roundnose minnow and Texas shiner immediately downstream of the spring pool in Del Rio. Consequently, any impacts would appear to be in the lowermost reach of the creek.

The Pecos River (6a) had the second lowest IBI based upon slightly depressed species richness, low catch rate, and high number of introduced species, primarily blacktail shiner. The Pecos did have the highest number of minnow species of all sites in the study, several of which are relatively sensitive to habitat degradation. The low catch rate may have in part related to elevated conductivity (4,330 μmhos) making electrofishing difficult. Elevated conductivity undoubtedly also selects against certain species that might otherwise populate the area. The source of conductivity is partially natural, from brine springs, and also partially attributable to man's activities. However, the potential for impact appears very slight.

Based upon this evaluation of the middle river tributaries, San Felipe Creek (7b) has slight potential for contaminant impact; the Pecos River (6a), very slight potential; and the remainder of the tributaries (6b, 8d, and 9b), no potential.

A summary of all of the fish community data yielded the following ratings for potential impacts:

indicated potential	station(s)
inconclusive	7, 8, 18
none	1, 2, 4, 6b, 8d, 9, 9b, 11, 13, 15, 17
very slight	3, 5, 6, 6a
slight	3a, 7b, 14
moderate	10, 12d, 16
high	12

Integration of Data

The final aspect of the evaluation was to integrate available information to identify sites and chemicals of potential concern. The objective was prioritization for purposes of water quality management and future monitoring.

Sites of Potential Concern

Sites were grouped according to potential for toxic chemical impact, based on cumulative information. Mainstem and tributary sites were treated separately, since the scope of evaluation was different for the two.

Mainstem.---Sites were ranked for 17 individual components belonging to seven categories, as described below.

Water chemistry: (1) number of toxic chemicals detected; (2) number of toxic chemicals that exceeded screening levels; (3) mean factor by which screening levels were exceeded.

Sediment chemistry: (4), (5), and (6), same as for water chemistry.

Tissue chemistry: (7), (8), and (9), same as for water chemistry.

Toxicity testing of water: (10) *Ceriodaphnia dubia* mortality, percent greater than in the control; (11) *Ceriodaphnia dubia* reproduction, percent less than in the control; (12) fathead minnow embryo/larval mortality, percent greater than in the control.

Toxicity testing of sediment eluates: (13), (14), and (15), same as for toxicity testing of water.

Macrobenthic community evaluation: (16) indicated potential for effects by toxic chemicals.

Fish community evaluation: (17) indicated potential for effects by toxic chemicals.

Station 5b, (Rio Grande/Río Bravo downstream from mouth of Lozier Canyon), was excluded because no tissue data, macrobenthic data, or fish community data were generated for that site. For a parameter that exceeded multiple screening levels, the exceedance factor utilized was that associated with the most stringent screening level. Ranks based on evaluations of macrobenthic communities and fish communities were multiplied by a factor of three to give all categories equal weight. Rankings for individual components were added for each site, and the rank sums were divided by the appropriate number of components. The latter step was necessary because fish community evaluations were inconclusive for stations 7, 8, and 18, and could not be used in the ranking. Thus, the divisor was 18 for stations 7, 8, and 18, and 21 for the other 15 stations. A final ranking was derived from the respective quotients (Table 25).

The ranking was used along with supplemental information to group the mainstem sites according to potential for toxic chemical impact. Accessory information included USEPA/TNRCC TOXNET data (Table 18), and other historical data relative to toxic chemicals (see "Historical Information" section). The term "impact" as applied here refers to adverse effects on aquatic life, or human health hazards associated with regular consumption of water and/or fish.

Groupings were based on eight characteristics. Sites for which at least six characteristics reflected a potential for toxic chemical impact were placed in the first group. The first group, for which a high potential for toxic chemical impact was indicated, included stations 2 and 12. Both were downstream from areas where appreciable amounts of wastewater enter the river (El

Paso/Ciudad Juárez, and Laredo/Nuevo Laredo, respectively). These sites were characterized by: significant effects in water and/or sediment eluate toxicity tests, and/or in multiple instances in the USEPA/TNRCC TOXNET program (Table 18); four or more toxic chemicals that exceeded screening levels in water and/or sediment; exceedance of human health criteria in water and/or tissue by one or more toxic chemicals; moderate to high potential for instream impact as indicated by macrobenthic and fish communities; a high ranking, from 1.0 to 3.0; and indications of toxic chemical effects from historical data sources. Station 12 exhibited all of these characteristics. Station 2 did not exhibit any human health criteria exceedances, nor did the local fish community reflect any impact. Indications are that toxic effects at that site may be selective for invertebrates, as suggested by macrobenthic community structure and the fact that TOXNET effects have involved *Ceriodaphnia dubia*, but not fathead minnow embryo/larvae (Table 18).

Characteristics of the remaining sites were too diverse for specific limits to be established; the following general characteristics were used for grouping purposes: significant effects in water and/or sediment eluate toxicity tests, in the present study or the TOXNET program; four toxic chemicals that exceeded screening levels in water and/or sediment; exceedance of human health criteria in water and/or tissue by one or more toxic chemicals; moderate potential for instream impact as indicated by macrobenthic or fish communities; a ranking from 2.0 to 9.0; and indications of toxic chemical effects from historical data sources. Sites exhibiting three or more of these characteristics were placed in the second group; those exhibiting two or less were placed in the third group.

The second group, for which a slight to moderate potential for toxic chemical impact was indicated, included stations 3, 10, 14, and 16. The latter three were downstream from areas where a substantial potential for toxic chemical input exists (Eagle Pass/Piedras Negras, International Anzalduas Dam, and Hidalgo/Reynosa, respectively), while station 3 was the upstream control site for the Presidio/Ojinaga reach. Characteristics placing these sites into the second group consisted of the following. Station 3 had four toxic chemicals that exceeded screening levels in water and/or sediment, one chemical that exceeded human health criteria in tissue, and a relatively high ranking (5.0). Station 10 had one toxic chemical that exceeded human health criteria in tissue, a moderate potential for toxic chemical impact as indicated by the fish community, and two instances of significant toxic effects from the TOXNET program. Station 14 had four toxic chemicals that exceeded screening levels in water and/or sediment, one toxic chemical that exceeded human health criteria in tissue, a relatively high ranking (6.5), and implications of toxic effects from historical information. Station 16 had two toxic chemicals that exceeded human health criteria in tissue, a moderate potential for toxic chemical impact as indicated by the fish community, and a relatively high ranking (4.0).

The third group, for which little or no potential for toxic chemical impact was indicated, included stations 1, 4, 5, 6, 7, 8, 9, 11, 13, 15, 17, and 18. Not surprisingly, the group was dominated by upstream control sites (1, 7, 9, 11, 13, 15, 17) and remote sites (5, 6). Three, however, were downstream sites (4, 8, 18), and associated characteristics indicate that effects of toxic chemical inputs from the Presidio/Ojinaga, Del Rio/Ciudad Acuña, and Brownsville/Matamoros areas are minimal.

Three of the sites in the third group (4, 7, 8) exhibited two of the aforementioned characteristics, five (1, 5, 6, 9, 15) exhibited one of the characteristics, and four (11, 13, 17, 18) exhibited none of the characteristics. Stations 7 and 8 displayed exceedances of human health criteria in tissue, 8 had a slightly elevated ranking (8.0), and 7 had a high ranking (2.0). The latter mainly resulted from elevated levels of a variety of toxic chemicals in fish tissue. This may be related to hypolimnetic releases from International Amistad Reservoir, as there are no known extrinsic inputs of contaminants between the dam and station 7. The only adverse indications for station 4 were from historical data, involving one instance of significant effects in the TOXNET program (Table 18), and documentation of elevated pesticide levels during the 1970's and early 1980's (TNRCC, 1992a). There were no indications of toxic chemical-related problems at station 4 during the present study.

Among sites having one negative characteristic, stations 6, 9, and 15 exhibited exceedances of human health criteria in fish tissue, station 5 ranked relatively high (6.5), due mainly to exceedances of screening levels by metals in fish tissue, and station 1 displayed significant effects in toxicity testing of water. The latter occurrence may have been an aberration. No causative agent was apparent in the accompanying chemical data, and no other finding gave any indication of toxic chemical impact. Furthermore, there have been no significant effects in five samples collected for the TOXNET program (Table 18).

Tributaries.---Sites were ranked for each of 12 components belonging to four categories (water chemistry, sediment chemistry, toxicity testing of water, and toxicity testing of sediment eluates, as described for mainstem sites). Toxic chemical data for fish tissue, and bioassessment data for macrobenthic and fish communities, were not employed in the ranking because they were not generated for all tributary sites. For a parameter that exceeded multiple screening levels, the exceedance factor utilized was that associated with the most stringent screening level. Rankings for the 12 components were added for each site, and a final ranking was derived from the rank sums (Table 26).

The ranking was used along with supplemental information to group the tributaries according to potential for toxic chemical impact. Accessory information included exceedances of human health criteria in tissue (available for six sites), and observations on the condition of fish communities (available for eight sites). The term "impact" as applied here refers to adverse effects on aquatic life within the tributaries themselves, or human health hazards associated with regular consumption of water and/or fish from these systems. Potential effects tributary inflows exert on the Rio Grande/Río Bravo are considered separately.

The first group, for which a high potential for toxic chemical impact was indicated, included stations 1a, 2a, 10a, 11a, 11c, and 15a. These were characterized by: significant effects in water and/or sediment eluate toxicity tests, for which probable toxic chemical causative agents were identified; four or more toxic chemicals that exceeded screening levels in water and/or sediment; exceedance of human health criteria in water and/or tissue by one or more toxic chemicals, by factors > 5X; high potential for instream impact as indicated by fish community attributes (if the fish community was assessed); and a high ranking, from 1.0 to 7.0. Stations 1a, 2a, and 15 a exhibited all of these characteristics, and stations 10a, 11a, and 11c, all but one. Divergences were: 10a, total dissolved solids as the probable cause of toxicity testing effects; 11a, no exceedance of human health criteria; and 11c, exceedance of human health criteria by a factor < 5X.

The second group, for which a slight to moderate potential for toxic chemical impact was implied, consisted of stations 3a, 7b, 9a, and 12d. Traits of this group were: significant effects in water and/or sediment eluate toxicity tests, for which probable toxic chemical causative agents were identified; two or three toxic chemicals that exceeded screening levels in water and/or sediment; exceedance of human health criteria in water and/or tissue by one or more toxic chemicals, by a factor of 2 to 3X; slight or moderate potential for instream impact as reflected by the condition of the fish community (if the fish community was assessed); and a moderate ranking, from 8.0 to 14.0. Stations 3a and 9a exhibited all of these traits, station 12d all but one, and station 7b all but two. Deviations were: 12d, a ranking higher than 8.0; and 7b, fewer than two toxic chemicals that exceeded screening levels in water and/or sediment, and exceedance of human health criteria by a factor > 3X.

The third group, for which little or no potential for toxic chemical impact was indicated, was comprised of stations 3b, 5a, 6a, 6b, 7a, 8a, 8b, 8c, 8d, 8e, 9b, 11b, 12a, 12b, 12c, and 12e. These displayed the following attributes: no significant effects in water or sediment eluate toxicity tests, significant effects attributable to total dissolved solids, or significant effects regarded as ecologically unimportant; two or fewer toxic chemicals that exceeded screening levels in water and/or sediment; no exceedance of human health criteria, or exceedance only by selenium in water by a factor ≤ 1.4X; very slight or no potential for instream impact as indicated by the fish community (if the fish community was assessed); and a low ranking, from 15.0 to 26.0. Stations 6a, 6b, 7a, 8a, 8b, 8c, 8d, 9b, and 12e exhibited all of these characteristics, stations 3b, 5a, 12b, and 12c all but one, and stations 8e, 11b, and 12a all but two. Divergences were: 3b, 5a, and 12b, more than two toxic chemicals that exceeded screening levels in water and/or sediment; 12c, a ranking higher than 15.0; and 8e, 11b, and 12a, more than two toxic chemicals that exceeded screening levels in water and/or sediment, and a ranking higher than 15.0.

During low-flow conditions such as were prevalent during the study, the potential for adverse effects on the Rio Grande/Río Bravo is related to the above grouping and the volume of inflow. Among tributaries in the first group, the potential appears to be high for 1a and 2a (1.3-1.7 cms or 45-61 cfs), moderate for 11a and 15a (0.17-0.45 cms or 5.9-16 cfs), and slight for 10a and 11c (< 0.06 cms or 2 cfs). The potential associated with tributaries in the second group is slight to moderate for 3a and 7b (4-15 cms or 141-530 cfs), and very slight for 9a and 12d (< 0.03 cms or 1 cfs). Tributaries in the third group would not be expected to affect the mainstem, regardless of inflow volume.

A possibility exists that tributaries in the first and second group may exert greater relative effects during high flow events, due to scouring of contaminated bottom sediments. However, this has not been documented.

Toxic Chemicals of Potential Concern

The 30 toxic chemicals that exceeded screening levels are considered to be of potential concern in the Rio Grande/Río Bravo system. These chemicals were assigned an approximate level of importance based on their occurrence.

A high priority group includes 19 chemicals that exceeded screening levels in the mainstem.

residual chlorine	lead	chlordane
methylene chloride	mercury	p,p' DDE
toluene	nickel	dieldrin
arsenic	selenium	gamma-bhc (lindane)
cadmium	silver	total PCB's
chromium	zinc	cyanide
copper		

A medium priority group includes four chemicals that exceeded screening levels at multiple tributary sites.

un-ionized ammonia	phenol	diazinon
parachlorometa cresol		

A low priority group includes seven chemicals that exceeded screening levels at only one tributary site.

phenolics recoverable	thallium	diethyl phthalate
chloroform	bis(2-ethylhexyl) phthalate	di-n-butyl phthalate
antimony		

Identification of these 30 chemicals is very consistent with earlier indications for the system. In its review of historical water quality data for the Rio Grande/Río Bravo basin, TNRCC (1992a) identified toxic chemicals of potential concern. All but five of those (endrin, hexachlorobenzene, toxaphene, 2,4,5-T, total PAH's) are included in the preceding list. 2,4,5-T, historically elevated in the lower Pecos River, was not analyzed in the present study, but the other four were. Neither endrin nor toxaphene was detected in any matrix. Hexachlorobenzene was detected in tissue at one site (station 12), but did not exceed screening levels. Of fifteen PAH's that were analyzed, naphthalene was the only one that occurred above detection limits, in water from stations 1a and 15a, but again, screening levels were not exceeded. Thus, the subject chemicals were not shown to be problemmatic during the present study, and for that reason were not included in the preceding list.

RECOMMENDATIONS

Follow-up monitoring should be conducted at sites of potential concern as identified in the present study. The objectives would be to reexamine or better define the degree of impact, to assess temporal variation, and, in some cases, to try to further identify sources of toxic chemicals. Surveillance should be conducted at sites where a slight-to-moderate or high potential for toxic chemical impact was shown to exist (mainstem stations 2, 3, 10, 12, 14, 16; tributary stations 1a, 2a, 3a, 7b, 9a, 10a, 11a, 11c, 12d, 15a). Except for cases addressed below, the scope of evaluation should be the same as that employed in the present study (see "Types of Analyses" under "STUDY DESCRIPTION").

Expanded monitoring is recommended for the two mainstem locations where a high potential for toxic chemical impact was indicated (station 2, downstream from El Paso/Ciudad Juárez; station 12, downstream from Laredo/Nuevo Laredo). In reevaluating the station 2 area, three stations should be sampled, including 1a, 2, and a new mainstem site located a short distance upstream from 1a. The purpose of sampling the new site would be to try to distinguish the effects of upstream urban influences from those of the El Paso Public Service Board Haskell R. Street wastewater treatment plant discharge. The scope of evaluation at the new site should include toxic chemical analyses and toxicity testing of water and sediment. Bioassessments and analysis of contaminants in fish tissue are not recommended for the new site because physical habitat in the vicinity is extremely poor (channelized, concrete-lined streambed). Addition of another mainstem site downstream from station 2 would serve no purpose, because all flow in the river typically is diverted a short distance downstream, at Riverside Diversion Dam.

In reevaluating the station 12 area, sampling should be performed at station 12, at a new site downstream from station 12, and in local tributaries sampled during the present study (10a, 11a, 11b, 11c). A number of additional inflows exist in the vicinity (Buzan, 1990), and as many of these as possible should also be sampled in an effort to identify toxic chemical inputs. The new mainstem site should be established 10-15 km (6.2-9.3 miles) downstream from station 12, to examine longitudinal variation and to further define the extent of impact of toxic chemicals emanating from Laredo/Nuevo Laredo.

Another recommendation is that the Río Conchos (3a) and San Felipe Creek (7b), the only tributaries of potential concern that support significant aquatic life habitat, should be subjected to intensive surveillance. Multiple sites along the gradient of each stream should be evaluated similarly to the way mainstem stations were evaluated in the present study. Point source discharges should also be sampled, and evaluated as were tributaries during the present study.

Finally, surveillance to specifically evaluate toxic chemical concentrations in fish tissue (whole body and edible portions) is recommended for six locations. Four are sites where the potential for overall toxic chemical impact was shown to be low in the present study, but which did exhibit elevated numbers of toxic chemicals that exceeded screening levels, or anomalously high concentrations of certain contaminants, in fish tissue (stations 6, 7, 9, 11). These should be reevaluated to further characterize possible risks to fish communities, predatory species that feed on fish, and human health. Additionally, contaminant levels in fish tissue should be evaluated at a minimum of one site in International Amistad Reservoir and one site in International Falcon Reservoir, neither of which was sampled during the present study. Both support significant sport fisheries, and baseline data is needed to characterize existing tissue contaminant levels. The most important locations, if single sites were utilized, would be in the extreme upper end of each reservoir, where the potential for contamination is greatest in association with riverine inflow.

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APPENDIX A

Tables

Table 1
List of Sampling Stations

Map Code	Station Description
	Mainstem Stations
1	Rio Grande at Courchesne Bridge (Hwy. 273) in El Paso, 2.7 km upstream from American Dam, at river km 2,020.8
2	Rio Grande at Zaragosa International Bridge in El Paso, at river km 1,992.8
3	Rio Grande 5.0 km upstream from Rio Conchos confluence near Presidio, at river km 1,552.2
4	Rio Grande below Rio Conchos confluence, 14.4 km downstream from Presidio/Ojinaga International Bridge, at river km 1,528.5
5	Rio Grande at mouth of Santa Elena Canyon in Big Bend National Park, at river km 1,424.7
5b*	Rio Grande immediately downstream from mouth of Lozier Canyon, 44 km southeast of Dryden, at river km 1,062.7
6	Rio Grande at Foster Ranch near Langtry, at river km 1,058.2
7	Rio Grande 0.4 km upstream from Del Rio/Ciudad Acuna International Bridge, at river km 903.2
8	Rio Grande 6.4 km downstream from Del Rio/Ciudad Acuna International Bridge, at river km 896.8
9	Rio Grande 1.0 km upstream from Eagle Pass/Piedras Negras International Bridge, at river km 799.8
10	Rio Grande 14 km downstream from Eagle Pass/Piedras Negras International Bridge, near irrigation canal lateral 50, at river km 785.8
11	Rio Grande at Laredo water treatment plant, 5.1 km upstream from old Laredo/Nuevo Laredo International Bridge (U.S. 81), at river km 585.9
12	Rio Grande at pipeline crossing, 13.2 km downstream from old Laredo/Nuevo Laredo International Bridge (U.S. 81), at river km 567.6
13	Rio Grande at Los Ebános, 54.7 km upstream from Anzalduas Dam, at river km 328.8
14	Rio Grande 0.8 km downstream from Anzalduas Dam, at river km 273.3
15	Rio Grande at Hidalgo/Reynosa International Bridge (U.S. 281), at river km 256.7
16	Rio Grande below Anhelo Drain south of Las Milpas, at river km 244.1
17	Rio Grande 6.3 km downstream from San Benito pumping plant and 15.3 km southwest of San Benito, at river km 155.8
18	Rio Grande 0.3 km downstream from El Jardin pumping plant and 11.2 km downstream from Brownsville/Matamoros International Bridge (U.S. 77), at river km 78.3

Table 1 (continued)
List of Sampling Stations

Map Code	Station Description
	Tributary Stations
1a	El Paso Public Service Board Haskell Street WWTP outfall, in El Paso County, Texas
2a	Ciudad Juarez sewage discharge canal (Dren de Interceptacion) immediately above Alamo grade control structure, 2.0 km northeast of Colonia Esperanza, in the Mexican state of Chihuahua
3a	Rio Conchos 0.2 km upstream from mouth and 4.8 km northwest of Ojinaga, in the Mexican state of Chihuahua
3b	Alamito Creek at FM 170, 0.5 km upstream from mouth, and 9.7 km southeast of Presidio, in Presidio County, Texas
5a	Terlingua Creek 0.2 km upstream from mouth and 13.7 km south of Terlingua, in Brewster County, Texas
6a	Pecos River at Shumla Bend, 12.1 km east of Langtry, in Val Verde County, Texas
6b	Devils River at Pafford Crossing, 18.5 km east of Comstock, in Val Verde County, Texas
7a	Arroyo de las Vacas 0.2 km upstream from mouth in Ciudad Acuna, in the Mexican state of Coahuila
7b	San Felipe Creek at Silos Farm road bridge, 1.8 km upstream from the mouth and 3.2 km south-southeast of Del Rio, in Val Verde County, Texas
8a	Pinto Creek at Moody Ranch, 2.6 km upstream from mouth, in Kinney County, Texas
8b	Rio San Diego at highway crossing, 2.4 km upstream from mouth and 6.0 km west of Jimenez, in the Mexican state of Coahuila
8c	Las Moras Creek at U.S. 277 north of Quemado, 1.8 km upstream from mouth, in Maverick County, Texas
8d	Rio San Rodrigo 1.6 km upstream from mouth at El Moral, in the Mexican state of Coahuila
8e	Maverick Canal return flow to Rio Grande, immediately downstream from Maverick Power Plant, 14.5 km north-northwest of Eagle Pass, in Maverick County, Texas
9a	Unnamed tributary 0.1 km upstream from mouth and 3.6 km south of Eagle Pass/Piedras Negras International Bridge, in the Mexican state of Coahuila
9b	Rio Escondido 0.1 km upstream from mouth and 5.9 km east of Villa de Fuente, in the Mexican state of Coahuila
10a	Manadas Creek 0.8 km upstream from mouth and 1.2 km downstream from FM 1472, near northern city limit of Laredo, in Webb County, Texas

Table 1 (continued)
List of Sampling Stations

Map Code	Station Description
11a	Zacate Creek 0.1 km upstream from mouth in Laredo, in Webb County, Texas
11b	Chacon Creek 0.1 km upstream from mouth in Laredo, in Webb County, Texas
11c	Arroyo el Coyote 0.1 km upstream from mouth and 7.2 km south-southeast of Nuevo Laredo, in the Mexican state of Tamaulipas
12a	Rio Salado at flow gage located 10 km southeast of Las Tortillas, in the Mexican state of Tamaulipas
12b	Rio Alamo at flow gage located 8 km upstream from mouth and 1 km north of Ciudad Mier, in the Mexican state of Tamaulipas
12c	Rio San Juan at flow gage located 5 km upstream from mouth in Camargo, in the Mexican state of Tamaulipas
12d	Arroyo Los Olmos 2.1 km upstream from mouth at U.S. 83 south of Rio Grande City, in Starr County, Texas
12e	Puertecitos Drain 3.8 km upstream from mouth and 12.3 km west-northwest of Ciudad Diaz Ordaz, in the Mexican state of Tamaulipas
15a	Anhelo Drain 0.1 km upstream from mouth and 3.2 km east of Reynosa, in the Mexican state of Tamaulipas

* - supplemental mainstem station established to provide a baseline for assessing future effects of Lozier Canyon inflow; parametric coverage similar to that for tributaries

Table 2
Toxic Chemicals Targeted for Analysis in Water, Sediment, and Fish Tissue[a]

Phenols and Cresols

parachlorometa cresol
pentachlorophenol
phenol (C_6H_5OH) single compound
phenolics recoverable
2-chlorophenol
2-nitrophenol
2,4-dichlorophenol
2,4-dimethylphenol
2,4-dinitrophenol
2,4,6-trichlorophenol
4-nitrophenol
4,6-dinitro-ortho-cresol

Ethers

bis(chloromethyl) ether*
bis(2-chloroethyoxy) methane
bis(2-chloroethyl) ether
bis(2-chloroisopropyl) ether
2-chloroethyl vinyl ether*
4-bromophenyl phenyl ether
4-chlorophenyl phenyl ether

Halogenated Aliphatics

bromodichloromethane
bromoform
carbon tetrachloride
chloroethane
chloroform
dibromochloromethane
dichlorodifluoromethane
hexachlorobutadiene
hexachlorocyclopentadiene
hexachloroethane
methyl bromide
methyl chloride
methylene chloride
tetrachloroethylene
trichloroethylene
trichlorofluoromethane
vinyl chloride
1,1-dichloroethane
1,1-dichloroethylene
1,1,1-trichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
1,2-dichloroethane
1,2-dichloropropane
1,2-trans-dichloroethylene
1,3-trans-dichloropropene
1,3-cis-dichloropropene

Polycyclic Aromatic Hydrocarbons

acenaphthene
acenaphthylene
anthracene/phenanthrene
benzo(A) anthracene 1,2-benzanthracene
benzo(B) fluoroanthene
benzo(GHI) perylene 1,12-benzoperylene
benzo(K) fluoranthene
benzo-A-pyrene
chrysene
fluoranthene
fluorene
indeno(1,2,3-CD) pyrene
naphthalene
pyrene
1,2,5,6-dibenzanthracene

Monocyclic Aromatics

benzene
chlorobenzene
ethylbenzene
hexachlorobenzene
nitrobenzene
styrene[d]
toluene
xylene[d]
1,2-dichlorobenzene
1,2,4-trichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
2,4-dinitrotoluene
2,6-dinitrotoluene

Nitrosamines and Other N Compounds

acrylonitrile
benzidine
n-nitrosodi-N-propylamine
n-nitrosodimethylamine
n-nitrosodiphenylamine
1,2-diphenylhydrazine
3,3-dichlorobenzidine

Metals

aluminum[d]
antimony
arsenic
beryllium
cadmium
chromium
copper

Table 2 (continued)
Toxic Chemicals Targeted for Analysis in Water, Sediment, and Fish Tissue[a]

Metals (continued)

- lead
- mercury
- nickel
- selenium
- silver
- thallium
- zinc

Pesticides

- acrolein*
- aldicarb[c]
- aldrin
- alpha benzene hexachloride
- atrazine[c]
- beta benzene hexachloride
- carbaryl[b]
- carbofuran[c]
- chlordane
- chlorfenvinphos[c]
- chlorothalonil[c]
- chlorpyrifos[b]
- chlorsulfuron[c]*
- p,p' DDD
- p,p' DDE
- p,p' DDT
- delta benzene hexachloride
- demeton[b]*
- diazinon[c]
- dibromochloropropane (dbcp)[c]
- dicamba[c]
- 2,4-dichlorophenoxyacetic acid (2,4-D)[b]
- dicofol (kelthane)[b]
- dicrotophos[c]*
- dieldrin
- dinoseb[c]
- endosulfan alpha
- endosulfan beta
- endosulfan sulfate
- endrin
- endrin aldehyde
- fenthion (baytex)[c]*
- gamma-bhc (lindane)
- guthion[b]
- heptachlor
- heptachlor epoxide
- isophorone
- malathion[b]
- metsulfuron[c]*
- methomyl[c]
- methoxychlor[b]
- metolachlor[c]
- mirex[b]
- parathion[b]
- picloram[c]
- prometon[c]*
- simazine[c]
- tetraethylpyrophosphate (tepp)[c]*
- toxaphene
- 2,4,5-TP (silvex)[b]

PCB's and Related Compounds

- arochlor 1016
- arochlor 1221
- arochlor 1232
- arochlor 1242
- arochlor 1248
- arochlor 1254
- arochlor 1260
- 2-chloronaphthalene

Phthalate Esters

- bis(2-ethylhexyl) phthalate
- di-n-butyl phthalate
- di-n-octyl phthalate
- diethyl phthalate
- dimethyl phthalate
- n-butyl benzyl phthalate

General Inorganics[d]

- cyanide

[a] - parameters without superscripts are designated as priority pollutants by the Code of Federal Regulations Part 423 Appendix A; parameters with superscripts are non-priority pollutants whose inclusion is accounted for in footnotes b, c, and d; two additional toxicants, ammonia and residual chlorine, also were analyzed in water, but are included in the conventional parameter category

Table 2 (continued)
Toxic Chemicals Targeted for Analysis[a]
in Water, Sediment, and Fish Tissue[a]

[b] - parameters for which numerical criteria have been established by the State of Texas
[c] - parameters which were recommended for inclusion by USEPA Region 6
[d] - parameters which Lewis et al. (1991) showed to have a potential for affecting the Rio Grande
* - parameters which the laboratory did not have the capability to analyze

Table 3
Sample Specifications

Parameters	Sample Volume/ Type of Container	Preservation	Holding Time
WATER			
•TSS, TDS, chloride, sulfate	one 1 qt. cubitainer[a]	ice	7 days
•total hardness, turbidity	one 1 qt. cubitainer[a]	ice	24 hrs.
•ammonia, TOC, phenol	one 1 qt. Mason jar w/ teflon lid liner[a]	conc. H_2SO_4 to pH <2; ice	28 days
•dissolved metals	one 1 qt. plastic bottle[b]	filter; HNO_3 to pH <2; ice	28 days
•volatile organics	two 40-mL glass screw top vials w/ teflon lid liners[c]	ice	7 days
•pesticides	two 1 qt. Mason jars w/ teflon lid liners[d]	[e]ice	7 days
•other organics	one 1 qt. Mason jar w/ teflon lid liner[d]	ice	7 days
•cyanide	one 1 qt. cubitainer[a]	[f]NaOH to pH <12; ice	14 days
•toxicity testing	two 1 gal. cubitainers[a]	ice	24 hrs.
SEDIMENT			
•organics	one 1 qt. Mason jar w/ teflon lid liner[d]	ice	7 days
•metals	one 1 qt. Mason jar w/ teflon lid liner[b]	ice	28 days
•TOC, acid volatile sulfide, particle size distribution	one 1 qt. Mason jar w/ teflon lid liner[a]	ice	7 days

Table 3 (continued)
Sample Specifications

Parameters	Sample Volume/ Type of Container	Preservation	Holding Time
•toxicity testing	one 1 gal. cubitainer[a]	ice	7 days

[a] - containers pretreated by rinsing with site water
[b] - containers pretreated by rinsing with 10% metals-grade HNO_3 followed by type 2 deionized water
[c] - containers pretreated by manufacturer
[d] - containers pretreated by rinsing with methylene chloride, then baked at 40 °C overnight to remove traces of solvent
[e] - initially, 100 mg sodium thiosulfate added if residual chlorine present
[f] - initially, 0.6 g ascorbic acid added if residual chlorine present

Table 4
Methods Utilized by Texas Department of Health Environmental Chemistry Laboratory

Analyte	Matrix	Preparation/Digestion/ Extraction Method	Analytical Method	Method Description
GRAIN SIZE ANALYSIS	sediment			fraction separation and gravimetric determination
INORGANICS				
acid volatile sulfide	sediment	sample screened	Method 9030A	distillation, titrimetric
ammonia	water	sample filtered	EPA 350.1	colorimetric, automated phenate
chloride	water	sample filtered	EPA 325.2	colorimetric, automated ferricyanide AAII
cyanide	water	distillation	EPA 335.2	total, spectrophotometric
	sediment	sample screened	EPA 335.2	total, spectrophotometric
	tissue		EPA 335.2	total, spectrophotometric
lipid content	tissue	sample ground	AOAC 15 ed. 964.12	digestion
phenolics recoverable	water	distillation/extraction with chloroform	EPA 420.1	spectrophotometric, manual 4-AAP with distillation
	sediment	sample screened	EPA 420.1	spectrophotometric, manual 4-AAP with distillation
	tissue		EPA 420.1	spectrophotometric, manual 4-AAP with distillation
sulfate	water	sample filtered	EPA 9036	automated methylthymol blue method
total dissolved solids	water	sample filtered	EPA 160.1	residue, filterable, gravimetric, dried @ 180 °C
total hardness	water	sample filtered	EPA 130.2	titrimetric, EDTA
total organic carbon	water		EPA 415.1	combustion or oxidation
	sediment	sample screened, dried	EPA 415.1	combustion or oxidation
total suspended solids	water		EPA 160.2	residue, non-filterable, gravimetric, dried @ 103-105 °C
turbidity	water		EPA 180.1	nephelometric
METALS				
aluminum	water		EPA 200.7	ICP
	sediment	EPA SW Method 3050	EPA 200.7	ICP
	tissue	modification of EPA SW Method 200.3	EPA 200.7	ICP
antimony	water	EPA 3005	EPA 204.2	GFAA

Table 4 (continued)
Methods Utilized by Texas Department of
Health Environmental Chemistry Laboratory

Analyte	Matrix	Preparation/Digestion/ Extraction Method	Analytical Method	Method Description
arsenic	water	SM 3113B	EPA 206.2	GFAA
	sediment	EPA SW Method 3050	EPA 206.2	GFAA
	tissue	modification of EPA SW Method 200.3	EPA 206.3	hydride
beryllium	water		EPA 200.7	ICP
	sediment	EPA SW Method 3050	EPA 200.7	ICP
	tissue	modification of EPA SW Method 200.3	EPA 200.7	ICP
cadmium	water		EPA 213.2	GFAA
	sediment	EPA SW Method 3050	EPA 213.2	GFAA
	tissue	modification of EPA SW Method 200.3	EPA 213.2	GFAA
chromium	water		EPA 200.7	ICP
	sediment	EPA SW Method 3050	EPA 200.7	ICP
	tissue	modification of EPA SW Method 200.3	EPA 218.2	GFAA
copper	water		EPA 200.7	ICP
	sediment	EPA SW Method 3050	EPA 200.7	ICP
	tissue	modification of EPA SW Method 200.3	EPA 220.2	GFAA
lead	water		EPA 239.2	GFAA
	sediment	EPA SW Method 3050	EPA 239.2	GFAA
	tissue	modification of EPA SW Method 200.3	EPA 239.2	GFAA
mercury	water	EPA 245.1	EPA 245.1	manual cold vapor
	sediment	EPA SW Method 3050	EPA 245.5	manual cold vapor
	tissue	modification of EPA SW Method 200.3	EPA 245.6	manual cold vapor
nickel	water		EPA 200.7	ICP
	sediment	EPA SW Method 3050	EPA 200.7	ICP
	tissue	modification of EPA SW Method 200.3	EPA 249.2	GFAA
selenium	water	SM 3113B	EPA 270.2	GFAA
	sediment	EPA SW Method 3050	2,3-diaminonaphthalene	fluorometric

Table 4 (continued)
Methods Utilized by Texas Department of Health Environmental Chemistry Laboratory

Analyte	Matrix	Preparation/Digestion/ Extraction Method	Analytical Method	Method Description
selenium	tissue	EPA SW Method 3050	2,3-diaminonaphthalene	fluorometric
silver	water		EPA 200.7	ICP
	sediment	EPA SW Method 3050	EPA 272.2	GFAA
	tissue	modification of EPA SW Method 200.3	EPA 272.2	GFAA
thallium	water		EPA 279.2	GFAA
	sediment	EPA SW Method 3050	EPA 279.2	GFAA
	tissue	modification of EPA SW Method 200.3	EPA 279.2	GFAA
zinc	water		EPA 200.7	ICP
	sediment	EPA SW Method 3050	EPA 200.7	ICP
	tissue	modification of EPA SW Method 200.3	EPA 200.7	ICP
VOLATILE ORGANICS	water	EPA 5030, purge & trap	EPA 8260	GC/MS
	sediment	EPA 5030, methanol extraction, purge & trap	EPA 8260	GC/MS
	tissue	EPA Region VII Lab sonication	EPA 8260	GC/MS
SEMIVOLATILE ORGANICS	water	EPA 3520, continuous liquid/liquid	EPA 8270	GC/MS
	sediment	EPA 3540, Soxhlet extraction	EPA 8270	GC/MS
	tissue	EPA 3540, Soxhlet extraction; EPA 3640, GPC cleanup	EPA 8270	GC/MS
INSECTICIDES	water	EPA 3510, separatory funnel	EPA 8080	GC-ECD
	sediment	EPA 3540, Soxhlet extraction; EPA 3620, cleanup florisil fractionation	EPA 8080	GC-ECD
	tissue	USFDA PAM Method 211, blender extraction; EPA 3640, GPC cleanup; EPA 3620, cleanup florisil fractionation	EPA 8080	GC-ECD
HERBICIDES	water	EPA 3510, separatory funnel, diazomethane esterification	EPA 8150	GC-ECD
	sediment	EPA 8150, shaker, separatory funnel, diazomethane esterification	EPA 8150	GC-ECD
CARBAMATES	water	dilution, direct injection	EPA 531	HPLC post column derivatization

Table 4 (continued)

Methods Utilized by Comisión Nacional del Agua

ANALYTICAL METHODOLOGIES, SAMPLE PREPARATION, DESCRIPTION OF EQUIPMENT, AND DETECTION LIMITS

ANALYTICAL METHODOLOGIES

PHYSICAL-CHEMICAL PARAMETERS IN WATER SAMPLES:

The samples were filtered in the field to 0.45 microns, except for those to be analyzed for Total Organic Carbon, Total Suspended Solids, and Turbidity.

The techniques employed are those recommended by Mexican Official Norms, listed in the National Water Commission's (CNA) Manual of Techniques. These procedures are similar to the analytical methods described in the APHA-AWWA-WEF's "Standard Methods for the Examination of Water and Wastewater" 18th edition (17th for Sulfates). Below are described the methods employed in this study, as well as the limits of detection.

HYDROGEN POTENTIAL (pH):

Field determination, electrometric method using a CheckMate 90 Analyzer, Corning. L.D.= 0.5.

ELECTRICAL CONDUCTIVITY:

In the first phase, the reported values were field determinations using the electrometric method. In the 2nd, 3rd and 4th phases, the CheckMate 90 Analyzer was used with method NOM-AA--93-1984 / Method 2510 B Standard Methods, L.D.= 1 micromhos/cm.

DISSOLVED OXYGEN:

Field determination, electrometric method using the CheckMate 90 Analyzer, Corning L.D. =0.3 mg/l.

CHLORIDES (Cl):

Method NOM-AA-73-1981 / Method 4500-Cl B Standard Methods by Argentometry, titration with $AgNO_3$ 0.0141 N, using Potassium Chromate as an indicator, L.D. =2 mg/l.

TOTAL DISSOLVED SOLIDS (TDS):

Method NOM-AA-20-1980 / Method 2540 C by gravimetry, drying at 178-182 degrees Centigrade. L.D.= 1 mg/l.

TOTAL SUSPENDED SOLIDS (TSS):

Method NOM-AA-34-1981/Method 2540 D Standard Methods by gravimetry, determining the amount of material retained by a 0.45 micron filter, and drying at 103-105 degrees Centrigrade, L.D.= 1 mg/l.

TOTAL HARDNESS:

In the 3rd phase, Method 2340 B Standard Methods was employed, calculated after the separate determinations for Calcium and Magnesium by atomic absorption expressed in mg/l of $CaCO_3$. L.D.=3 mg/l. In the first stage, there being no sample, a calculation was made using lineal regression analysis of electrical conductivity - hardness and total dissolved solids - hardness. In stages 2 and 4, method NOM-AA-72-1981 / Method 2340 C Standard Methods, titration with EDTA, L.D.=1 mg/l as $CaCO_3$.

SULFATES (SO_4):

Method NOM-AA-74-1981 / Method 4500-SO4 E, Standard Methods 17th edition, by turbidity, precipitation using Barium Chloride. In the first stage, an HF Instruments DRT 100 turbidity meter was used, L.D.= 5 mg/l. In stage 2, a Bausch and Lomb Spectronic 20 spectrophotometer was used, L.D. =1 mg/l. In stage 3, a Milton Roy Spectronic 21 D spectrophotometer was used, L.D.=1 mg/l. In stage 4, a Coleman Jr. II Perkin Elmer spectrophotometer was used, L.D. 1 mg/l.

TURBIDITY:

Nephelometric method, Method 2130 B Standard Methods. In stage 1, an HF Instruments DRT 100 turbidity meter was used. In stage 2, a Digital Monitec TA1 nephelometer was used. In stages 3 and 4, a Cole Parmer 8391-35 turbidity meter was used. L.D. = 0.05 UTN (?).

AMMONIACAL NITROGEN (N-NH_3):

In stages 1,3 and 4, the titrimetric method with prior distillation was used. Method 4500-NH3 E Standard Methods. A Macro Kjeldhal Lab Conco distiller was employed using a Boric acid solution as an indicator as an absorbent of the distillate and titrating with H_2SO_4 0.02N. L.D.=0.11 mg/l. In stage 2, Method 4500-NH3 Standard Methods colorimetric Nesslerization with distillation, using a Spectronic 20 spectrophotometer was used. L.D.= 0.02 mg/l.

TOTAL ALKALINITY:

Method NOM-AA-36_1980, titration with HCl 0.02 N using Orange Methyl as an indicator and expressing the results in mg/l of $CaCO_3$, L.D.= 3mg/l.

CYANIDES (CN):

For stage 2, Method 4500-CN E Standard Methods was used. Colorimetric with reaction to Barbituric-Pyridine acid. A B&L Spectronic 20 spectrophotometer was used. L.D.= 0.02 mg/l. For stage 4, Method 4500-CN F Standard Methods ion cyanide selective was used. A Corning 250 Analyzer was used. L.D.=0.001 mg/l.

PHENOLS:

Method 5530 C Standard Methods, extraction with chloroform with 4-Aminoantipyrine. For stage 2, a B&L Spectronic 20 spectrophotometer was used; for stage 4, a Coleman Jr. II Perkin Elmer spectrophotometer was used. L.D. =0.001 mg/l.

ANALYSIS FOR METALS IN WATER SAMPLES

The samples were filtered to 0.45 microns in the field, treated with ultrapure nitric acid to a pH of < 2, and refrigerated until the analysis was accomplished. The analyses were done using atomic absorption.

In stages 1 and 3, a Varian Spectra-20 spectrophotometer was used; in stages 2 and 4, a Perkin Elmer 5000 spectrophotometer was used. Both of these are double light source with background correction, using single element bulbs with hollow cathodes. The calibration curves and standards are prepared daily using 5 standards plus the blank, which are acid treated the same as the samples. For the parameters Cd, Cu, Fe (in stages 1 and 3), Ag, Ni, Pb, Zn, Al (in stages 2 and 4) and Cr, the flame-by-direct-aspiration of the sample system was used; and for the analysis of As, Se and Hg in stages 1 and 3, the hydrate generator system and cold vapor Varian VGA -76 was used; and, in stages 2 and 4, the hydrate generator system and cold vapor Perkin Elmer was used. As and Se were sequentially analyzed in the same manner following the hydrate generation system. The sample was prepared in HCl 6 M, placing in the recipient of the reducer: 0.6% $NaBH_4$; 0.5% NaOH: 10% KI, HCl 10 M was put into the acid canal. Mercury was analyzed in a separate sample using the cold vapor technique, adding nitric acid (5% v/v) and chlorhydric acid (5% v/v), placing in the recipient of the reducer 25% w/v $SnCl_2$ en 20% v/v HCl, and HCl 5 M was put into the acid canal.

ANALYSIS FOR METALS IN SEDIMENT SAMPLES

In stages 1 and 3, the sample preparation included drying and screening. An extraction with diluted HCl using 20g of sample and 125 ml of HCl 0.5 N, 16 hour reaction time in an Ederbach mechanical agitator, and later filtration to 0.45 microns was accomplished. The analyses were accomplished in a similar manner with the same equipment as the water samples reporting the results in mg/kg of dry material. This corresponds to the extractable or non-residual metals, in which are included the metallic particles that are deposited on the sediment particles, as well as metal-organic material compounds and metals found the form of insoluble salts.

For the analysis for metals in sediments for stages 2 and 4, 3 g of dry, screened material were treated with 5 ml of suprapure nitric acid, digested by microwave, and the extract was diluted with 50 ml of distilled water, and then quantification was accomplished by atomic absorption.

The limits of detection in micro-grams/l of solution in the metals' analysis by atomic absorption were as follows:

For Stages 1 and 3:

	Ag	As	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Se	Zn
L.D.	3	1	3	10	3	8	0.2	10	13	1	3
S.D	1	0.5	1	5	1	3	0.1	5	7	0.5	2

For Stages 2 and 4:

L.D.	30	1	2	40	40	10	0.5	50	80	0.5	10
S.D.	9	0.5	1	10	5	5	0.1	10	10	0.1	3

TABLE 5. Modified Index of Biotic Integrity rating criteria for sites on the Rio Grande and tributaries.

	Ratings		
Metric (Sites 1-12, 3A, 6A, 6B, 7B, 8D, 9b)	**5**	**3**	**1**
1. Total number of species	>14	8 - 14	<8
2. Number of minnow species	>5	3 - 5	<3
3. % of individuals in most abundant species	<40	40 - 55	>55
4. Total number of individuals*			
a. Individuals per hour electrofishing	>224	112-224	<112
b. Individuals per seine haul	>67	34 - 67	<34
5. % diseased individuals	<0.5	0.5 - 1	>1
6. % of individuals as introduced species	<6	6 - 12	>12

Metric (Sites 13-18, 12D)	**5**	**3**	**1**
1. Total number of species	>14	8 - 14	<8
2. % of individuals as estuarine/marine species	0-18	>18 - 49	>49
3. % of individuals in most abundant species	<40	40 - 55	>55
4. Total number of individuals*			
a. Individuals per hour electrofishing	>224	112-224	<112
b. Individuals per seine haul	>67	34 - 67	<34
5. % diseased individuals	<0.5	0.5 - 1	>1
6. % of individuals as introduced species	<6	6 - 12	>12

* Rating calculated as a mean of a and b

TABLE 6 - Status (N=native, I=introduced) and preferred habitat (F=freshwater, E=estuarine or marine) of fish species collected in the Rio Grande and tributaries.

Scientific name	Common name	Status	Preferred habitat
Lepisosteus oculatus	Spotted gar	N	F
Lepisosteus osseus	Longnose gar	N	F
Anguilla rostrata	American eel	N	E
Dorosoma cepedianum	Gizzard shad	N	F
Dorosoma petenense	Threadfin shad	N	F
Cyprinella lutrensis	Red shiner	N	F
Cyprinella proserpina	Proserpine shiner	N	F
Cyprinella venusta	Blacktail shiner	I	F
Cyprinus carpio	Common carp	I	F
Dionda episcopa	Roundnose minnow	N	F
Macrhybopsis aestivalis	Speckled chub	N	F
Notropis amabilis	Texas shiner	N	F
Notropis braytoni	Tamaulipas shiner	N	F
Notropis jemezanus	Rio Grande shiner	N	F
Notropis stramineus	Sand shiner	N	F
Pimephales promelas	Fathead minnow	N	F
Pimephales vigilax	Bullhead minnow	N	F
Rhinichthyes cataractae	Longnose dace	N	F
Carpiodes carpio	River carpsucker	N	F
Cycleptus elongatus	Blue sucker	N	F
Ictiobus bubalus	Smallmouth buffalo	N	F
Moxostoma austrinum	Mexican redhorse	N	F
Moxostoma congestum	Gray redhorse	N	F
Astyanax mexicanus	Mexican tetra	N	F
Ictalurus furcatus	Blue catfish	N	F
Ictalurus punctatus	Channel catfish	N	F
Ictalurus lupus	Headwater catfish	N	F
Pylodictis olivaris	Flathead catfish	N	F
Strongylura marina	Atlantic needlefish	N	E
Cyprinodon variegatus	Sheepshead minnow	N	E
Fundulus grandis	Gulf killifish	N	E
Fundulus zebrinus	Plains killifish	I	F
Gambusia affinis	Mosquitofish	N	F
Poecilia formosa	Amazon molly	N	E
Poecilia latipinna	Sailfin molly	N	E
Menidia beryllina	Inland silverside	N	E
Morone chrysops	White bass	I	F
Lepomis auritus	Redbreast sunfish	I	F
Lepomis cyanellus	Green sunfish	N	F
Lepomis gulosus	Warmouth	N	F
Lepomis macrochirus	Bluegill sunfish	N	F
Lepomis megalotis	Longear sunfish	N	F
Lepomis microlophus	Redear sunfish	I	F
Micropterus dolomieu	Smallmouth bass	I	F
Micropterus salmoides	Largemouth bass	N	F
Etheostoma grahami	Rio Grande darter	N	F
Stizostedion vitreum	Walleye	I	F
Aplodinotus grunniens	Freshwater drum	N	F
Cichlasoma cyanoguttatum	Rio Grande cichlid	N	F
Tilapia aurea	Blue tilapia	I	F
Agonostomus monticola	Mountain mullet	N	E
Mugil cephalus	Striped mullet	N	E
Gobiomorus dormitor	Bigmouth sleeper	N	E

Table 7
Screening Level Concentrations

Parameter	Water					Sediment		Tissue		
	National 85th Percentile [1] (µg/L)	Human Health		Aquatic Life		National 85th Percentile [1] (mg/kg)	Other (mg/kg)	Whole Body		Edible Tissue [21] (mg/kg)
		Consumption of Fish and Water [25] (µg/L)	Consumption of Fish Only [24] (µg/L)	Acute Value (µg/L)	Chronic Value (µg/L)			National 85th Percentile [1] (mg/kg)	Other (mg/kg)	
CONVENTIONALS										
ammonia (unionized)	NV	NV	NV	SS	SS	NM	NM	NM	NM	NM
residual chlorine	NV	NV	NV	19 [14]	11 [14]	NM	NM	NM	NM	NM
PHENOLS AND CRESOLS										
parachlorometa cresol	25	NV	NV	30 [20]	NV	NV	NV	NA	NA	NA
phenol (C_6H_5OH) single compound	13	21,000 [14]	4,600,000 [14]	10,200 [4]	2,560 [4]	NV	NV	NA	NA	NA
phenolics recoverable	24	NV	NV	NV	NV	NM	NM	NM	NM	NM
HALOGENATED ALIPHATICS										
bromodichloromethane*	10	2.7 [14]	220 [14]	11,000 [6]	NV	NA	NA	NA	NA	NA
chloroform*	27	100 [19]	12,130 [19]	28,900 [5]	1,240 [5]	NV	NV	NV	NV	NV
methylene chloride*	68	47 [14]	16,000 [14]	11,000 [6]	NV	NV	SS	NV	NV	NV
tetrachloroethylene*	4	597 [19]	1,832 [19]	5,280 [7]	840 [7]	NA	NA	NA	NA	NA
trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NV	NV	NV
1,1,1-trichloroethane	20	200 [19]	1,030,000 [8]	18,000 [8]	NV	NA	NA	NV	NV	NV
POLYCYCLIC AROMATIC HYDROCARBONS										
naphthalene	10	36 [14]	2,600 [14]	2,300 [9]	620 [9]	NA	NA	NA	NA	NA
MONOCYCLIC AROMATICS										
benzene*	100	5 [19]	312 [19]	5,300 [10]	NV	NA	NA	NA	NA	NA
chlorobenzene	NA	NA	NA	NA	NA	NV	NV	NA	NA	NA
ethylbenzene	10	3,100 [14]	29,000 [14]	32,000 [13]	NV	NA	NA	NA	NA	NA
hexachlorobenzene*	NA	NA	NA	NA	NA	NA	NA	NV	NV	0.07
toluene	31	6,800 [14]	200,000 [14]	17,500 [12]	NV	NV	SS	NV	NV	NV
xylene	NV	10,000 [18]	NV	10,000 [21]	5,000 [22]	NV	NV	NA	NA	NA
1,2 dichlorobenzene	10	2,700 [14]	17,000 [14]	250 [11]	50 [11]	NV	SS	NV	NV	NV
1,4-dichlorobenzene	10	400 [14]	2,600 [14]	250 [11]	50 [11]	NV	SS	NA	NA	NA
METALS										
aluminum	NV	NV	NV	991 [19]	87 [14]	NV	NV	NV	NV	NV
antimony	54	14 [14]	4,300 [14]	9,000 [15]	1,600 [15]	NM	NM	NM	NM	NM
arsenic*	10	50 [19]	1.4 [14]	360 [19]	190 [19]	14	SS	0.2	0.27 [33]; 0.5 [32]	NV

Table 7 (continued)
Screening Level Concentrations

Parameter	Water: Human Health: National 85th Percentile [1] (µg/L)	Water: Human Health: Consumption of Fish and Water [23] (µg/L)	Water: Human Health: Consumption of Fish Only [24] (µg/L)	Water: Aquatic Life: Acute Value (µg/L)	Water: Aquatic Life: Chronic Value (µg/L)	Sediment: National 85th Percentile [1] (mg/kg)	Sediment: Other (mg/kg)	Tissue: Whole Body: National 85th Percentile [1] (mg/kg)	Tissue: Whole Body: Other (mg/kg)	Tissue: Edible Tissue [28] (mg/kg)
beryllium	NA	NA	NA	NA	NA	3	NV	NA	NA	NA
cadmium	6	10 [19]	NV	SS	SS	6.6	SS	0.3	0.05 [33]; 0.5 [32]	10
chromium, total	20	50 [19]	NV	NV	NV	60	SS	0.39	0.2 [32]; 1.2 [34]	NV
trivalent	NV	33,300 [25]	673,000 [25]	SS	SS	NM	NM	NM	NM	NM
hexavalent	NV	50 [25]	NV	16 [19]	11 [19]	NM	NM	NM	NM	NM
copper	20	1,300 [14]	NV	SS	SS	52	SS	2.2	1.0 [33]	NV
lead	20	5 [19]	25 [19]	SS	SS	110	SS	0.8	0.22 [33]; 0.3 [32]	NV
mercury	1.3	0.0122 [19]	0.0122 [19]	2.4 [19]	1.3 [19]	0.77	SS	0.63	0.1 [32]; 0.17 [33]	0.6; 1.0 [29]
nickel	20	610 [14]	4,600 [14]	SS	SS	44	SS	0.6	NV	NV
selenium	10	10 [19]	NV	20 [19]	5 [19]	3.5	NV	0.83	0.5 [32]; 0.73 [35]	50; 2.0 [26]
silver	10	50 [19]	NV	0.92 [19]	0.49 [19]	3	NV	0.80	NV	NV
thallium	NV	1.7 [14]	6.3 [14]	NV	20 [16]	NV	NV	NV	NV	NV
zinc	80	5,000 [25]	NV	SS	SS	170	SS	28	34.2 [33]	NV
PESTICIDES										
chlordane*	NA	NA	NA	NA	NA	77 µg/kg	SS	0.47	0.04 [34, 36]	0.08 [36]; 0.3 [29, 36]
chlorpyrifos	NA	NA	NA	NA	NA	NV	SS	NA	NA	NA
p,p' DDD*	NA	NA	NA	NA	NA	22 µg/kg	SS	0.64	0.1 [34]; 1.0 [27, 32]	0.3 [27] 5.0 [27, 29]
p,p' DDE*	NA	NA	NA	NA	NA	18 µg/kg	SS	2.9	1.21 [34]; 1.0 [27, 32]	0.3 [27] 5.0 [27, 29]
p,p' DDT*	NA	NA	NA	NA	NA	NA	NA	2.0	0.11 [24]; 1.0 [27, 32]	0.3 [27] 5.0 [27, 29]
diazinon	NV	NV	NV	0.35 [3]	0.30 [3]	NA	NA	NA	NA	NA
dieldrin*	NA	NA	NA	NA	NA	5.5 µg/kg	SS	0.28	0.01 [34]; 0.1 [32]	0.007 0.3 [29]
gamma-bhc (lindane)*	0.1	4 [19]	16 [19]	2 [19]	0.08 [19]	NA	NA	NV	0.0027 [35]	0.08
PCB's AND RELATED COMPOUNDS										
arochlor 1248*	NA	NA	NA	NA	NA	NA	NA	NV	0.06 [31]; <0.1 [30, 32]	0.01 [30] 2.0 [29, 30]
arochlor 1254*	NA	NA	NA	NA	NA	NA	NA	9.6	0.21 [31]; <0.1 [30, 32]	0.01 [30] 2.0 [29, 30]

Table 7 (continued)
Screening Level Concentrations

Parameter	Water: Human Health: National 85th Percentile [1] (μg/L)	Water: Human Health: Consumption of Fish and Water [23] (μg/L)	Water: Human Health: Consumption of Fish Only [24] (μg/L)	Water: Aquatic Life: Acute Value (μg/L)	Water: Aquatic Life: Chronic Value (μg/L)	Sediment: National 85th Percentile [1] (mg/kg)	Sediment: Other (mg/kg)	Tissue: Whole Body: National 85th Percentile [1] (mg/kg)	Tissue: Whole Body: Other (mg/kg)	Tissue: Edible Tissue [21] (mg/kg)
PHTHALATE ESTERS										
bis(2-ethylhexyl) phthalate*	5	18 [14]	59 [14]	940 [17]	3 [17]	8,900 μg/kg	NV	NV	NV	NV
diethyl phthalate	20	23,000 [14]	120,000 [14]	940 [17]	3 [17]	NA	NA	NA	NA	NA
di-n-butyl phthalate	NA	NA	NA	NA	NA	350 μg/kg	85	NA	NA	NA
GENERAL INORGANICS										
cyanide	0.068 mg/L	0.7 mg/L [14]	220 mg/L [14]	0.046 mg/L [19]	0.011 mg/L [19]	18	NV	NV	NV	NV

1 - from Greenspun and Taylor, 1979
2 - from Norberg-King *et al.*, 1989 (represents 48 hr. LC50 value for *Ceriodaphnia dubia*)
3 - from Arthur *et al.*, 1983 (represents lowest recorded adverse effect level, which resulted in lowered emergence and elevated drift of stream insects)
4 - from USEPA, 1980 a
5 - from USEPA, 1980 b
6 - from USEPA, 1980 c
7 - from USEPA, 1980 d
8 - from USEPA, 1980 e
9 - from USEPA, 1980 f
10 - from USEPA, 1980 g
11 - from USEPA, 1980 h
12 - from USEPA, 1980 i
13 - from USEPA, 1980 j
14 - national criterion (USEPA, 1986)
15 - from USEPA, 1980 k
16 - from USEPA, 1980 l
17 - from USEPA, 1980 m
18 - drinking water maximum contaminant level (TNRCC, 1993)
19 - state criterion (TNRCC, 1991)
20 - from USEPA, 1980 n
21 - minimum concentration reported to kill fish (McKee and Wolf, 1963)
22 - concentration reported to adversely affect bluegill sunfish within a ten hour period (McKee and Wolf, 1963)
23 - applicable to all mainstem stations, and tributary stations 3a, 3b, 5a, 6a, 6b, 7b, 8a, 8b, 8c, 8d, 8e, 9b, 10a, 11a, 11b, 12a, 12b, 12c, 12d, 12e
24 - applicable to tributaries dominated by treated or untreated domestic sewage effluent, which are not regarded as potential drinking water supplies (1a, 2a, 7a, 9a, 11c, 15a)
25 - established as a national criterion, but later withdrawn in National Toxics Rule (USEPA, 1986)
26 - from a risk assessment by TDH (1992)
27 - value is for total DDT (sum of DDD + DDE + DDT)

Table 7 (continued)
Screening Level Concentrations

28 - from Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (USEPA, 1993)
29 - action or tolerance level (USFDA, 1993)
30 - value is for total PCBs (sum of all arochlors)
31 - geometric mean from the USFWS National Contaminant Biomonitoring Program (Schmitt *et al.*, 1990)
32 - U.S. Fish and Wildlife Service predator protection limit
33 - 85th percentile value from the USFWS National Contaminant Biomonitoring Program (Schmitt and Brumbaugh, 1990)
34 - 85th percentile value from the TNRCC Surface Water Quality Monitoring program (TNRCC, 1994)
35 - mean concentration from National Study of Chemical Residues in Fish (USEPA, 1992)
36 - value is for total chlordane (sum of trans + cis isomers)
NV - no value exists
NA - not applicable because parameter was not detected in this matrix
NM - parameter was not measured in this matrix
SS - criterion is site-specific; see Table 8 for water, Table 9 for sediment
* - parameter identified as a carcinogen; human health criteria based on risk factor of 10^{-5}

Table 7 (continued)
México Water Quality Standards
Criteria in Water for Specific Toxic Materials
Aquatic Life Protection

Parameter	México Fresh Water Aquatic Life Criteria*
Aldrin	3
Aluminum	50
Arsenic	200
Cadmium	@exp(0.785[ln(hardness)]-3.490)
Chlordane	2
Chromium (Hex)	10
Copper	@exp(0.8545[ln(hardness)]-1.465)
Cyanide**	5
DDT	1
Dieldrin	2
Endosulfan	0.2
Endrin	0.02
Heptachlor	0.5
Hexachlorocyclohexane (Lindane)	2.5
Lead	@exp(1.273[ln(hardness)]-4.105)
Mercury	0.01
Nickel	@exp(0.846[ln(hardness)]+1.1645)
Total PCB's	0.01
Parathion	0.04
Pentachlorophenol	0.5
Selenium	8
Silver, as free ion	@exp(1.72[ln(hardness)]-6.52)
Toxaphene	0.0002
2,4,5 Trichlorophenol	10
Zinc	@exp(0.8473[ln(hardness)]+10.36)

* All Values Listed or Calculated in Micrograms per Liter - Hardness Concentrations are Input as Milligrams per Liter

** Amenable to Chlorination

Table 8
Site-Specific Screening Level Concentrations for Water[a]

Parameter	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
CONVENTIONALS (mg/L)												
ammonia (unionized) [m,n]	0.096/0.018	0.302/0.041	NA	0.151/0.029	0.127/0.025	NA	NA	NA	NA	NA	0.123/0.024	0.146/0.028
METALS (µg/L) [b]												
cadmium [c,d,s]	NA	NA	146/3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
chromium, trivalent [e,f,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper [g,h,s]	NA	33.4/21.1	65.2/38.8	NA	NA	46.4/28.5	13.0/9.0	65.8/39.1	NA	NA	NA	62.2/37.1
lead [i,j,s]	477/18.6	173/6.7	NA	433/16.9	715/27.9	NA	NA	NA	475/18.5	NA	NA	NA
nickel [k,l,s]	NA	2,332/259	NA	4,300/478	5,999/667	3,131/348	NA	4,290/477	4,573/508	NA	NA	NA
zinc [o,p,s]	NA	193/174	351/318	355/322	496/449	NA	82.3/74.5	355/321	378/342	NA	NA	336/304

Table 8 (continued)
Site-Specific Screening Level Concentrations for Water[a]

Parameter	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
CONVENTIONALS (mg/L)												
ammonia (unionized) [m,n]	0.099/0.016	0.138/0.025	NA	0.092/0.010	NA	0.118/0.023	0.157/0.030	NA	NA	NA	NA	NA
METALS (μg/L) [b]												
cadmium [c,d,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chromium, trivalent [e,f,s]	10,404/1,240	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper [g,h,s]	NA	34.1/21.5	45.2/27.8	62.3/37.2	NA	NA	NA	NA	NA	NA	33.9/21.4	NA
lead [i,j,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
nickel [k,l,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
zinc [o,p,s]	NA	NA	253/229	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 8 (continued)
Site-Specific Screening Level Concentrations for Water[a]

Parameter	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
CONVENTIONALS (mg/L)												
ammonia (unionized) [m,n]	0.115/0.017	NA	NA	NA	NA	0.202/0.037	NA	0.148/0.014	0.224/0.041	NA	0.283/0.041	0.302/0.041
METALS (μg/L) [b]												
cadmium [c,d,s]	NA	137/3.0	NA	807/10.3	107/2.5	71.6/1.9	1,017/12.2	NA	NA	613/8.6	NA	155/3.3
chromium, trivalent [e,f,s]	6,816/812	NA	NA	NA	NA	NA	NA	NA	NA	14,280/1,702	NA	NA
copper [g,h,s]	NA	61.8/37.0	NA	272/142	50.5/30.7	36.0/22.6	330/169	NA	NA	NA	NA	68.9/40.8
lead [i,j,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
nickel [k,l,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,466/496
zinc [o,p,s]	NA	NA	NA	NA	NA	206/187	NA	NA	NA	NA	NA	NA

Table 8 (continued)
Site-Specific Screening Level Concentrations for Water[a]

Parameter	Station								
	12d	12e	13	14	15	15a	16	17	18
CONVENTIONALS (mg/L)									
ammonia (unionized) [m,n]	0.016/0.020	0.114/0.015	0.152/0.029	NA	NA	0.102/0.013	0.143/0.028	NA	NA
METALS (µg/L) [b]									
cadmium [c,d,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA
chromium, trivalent [e,f,s]	NA	NA	NA	NA	NA	7,533/898	NA	NA	NA
copper [g,h,s]	109/61.7	NA	47.1/28.9	46.5/28.6	NA	104/59.2	48.6/29.7	63.2/37.7	77.4/45.3
lead [i,j,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA
nickel [k,l,s]	NA	NA	NA	NA	NA	NA	NA	NA	NA
zinc [o,p,s]	557/504	534/484	NA	NA	NA	534/484	270/244	342/309	NA

NA - not applicable because parameter was below the detection limit at this site
a - values in table represent criteria for protection of freshwater aquatic life, presented as acute value/chronic value
m - calculated according to equations described by USEPA (1984)
n - values for this parameter represent national criteria (USEPA, 1986)
s - values for this parameter represent state criteria (TNRCC, 1991)
b - metals criteria calculated using hardness concentrations from Table 8, according to following equations:

c = $e^{(1.128[\ln(hardness)]-1.6774)}$ i = $e^{(1.273[\ln(hardness)]-1.460)}$

d = $e^{(0.7852[\ln(hardness)]-3.490)}$ j = $e^{(1.273[\ln(hardness)]-4.705)}$

e = $e^{(0.8190[\ln(hardness)]+3.688)}$ k = $e^{(0.8460[\ln(hardness)]+3.3612)}$

f = $e^{(0.8190[\ln(hardness)]+1.561)}$ l = $e^{(0.8460[\ln(hardness)]+1.1645)}$

g = $e^{(0.9422[\ln(hardness)]-1.3844)}$ o = $e^{(0.8473[\ln(hardness)]+0.8604)}$

h = $e^{(0.8545[\ln(hardness)]-1.386)}$ p = $e^{(0.8473[\ln(hardness)]+0.7614)}$

Table 9
Site-Specific Screening Level Concentrations for Sediment*

Parameter	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
HALOGENATED ALIPHATICS (μg/kg)												
methylene chloride [a]	110	NA	139	315	230	NA	550	NA	NA	NA	NA	NA
MONOCYCLIC AROMATICS (μg/kg)												
toluene [b]	550	39,350	695	1,575	1,150	NA	2,750	NA	NA	NA	NA	NA
1,2-dichlorobenzene [c]	NA	11,018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-dichlorobenzene [c]	NA	11,018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
METALS (mg/kg)												
arsenic [d]	1.82	130	2.29	5.20	3.60	2.39	9.00	4.46	5.36	4.54	3.96	13.6
cadmium [e]	1.71	122	2.15	4.88	3.57	2.25	8.53	4.19	5.04	4.26	3.72	12.8
chromium [f]	1.38	98.4	1.74	3.94	2.88	1.81	6.80	3.38	4.06	3.44	3.00	10.3
copper [g]	7.40	535	9.45	21.4	15.6	9.86	37.4	18.4	22.1	18.7	16.7	56.1
lead [h]	7.26	519	9.17	20.8	15.2	9.57	36.3	17.8	21.5	18.2	15.8	54.5
mercury [i]	0.04	3.15	0.06	0.13	0.09	0.06	0.22	0.11	0.13	0.11	0.10	0.33
nickel [j]	1.10	78.7	1.39	3.15	2.30	1.45	5.50	2.70	3.25	2.75	2.40	8.25
zinc [k]	41.8	2,991	52.8	120	87.4	55.1	209	103	124	105	91.2	314
PESTICIDES (μg/kg)												
chlordane [l]	NA	78.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chlorpyrifos **	NA	507	NA	20.3	NA	NA	NA	NA	NA	NA	NA	NA
p,p' DDD [m]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p,p' DDE [n]	NA	NA	NA	4,410	NA	2,030	NA	NA	NA	NA	NA	NA
dieldrin ***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PHTHALATE ESTERS (μg/kg)												
di-n-butyl phthalate [o]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 9 (continued)
Site-Specific Screening Level Concentrations for Sediment*

Parameter	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
HALOGENATED ALIPHATICS (μg/kg)												
methylene chloride [a]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MONOCYCLIC AROMATICS (μg/kg)												
toluene [b]	NA	15,750	1,435	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-dichlorobenzene [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-dichlorobenzene [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
METALS (mg/kg)												
arsenic [d]	32.9	52.0	4.74	52.1	31.7	12.1	80.4	43.6	5.78	22.1	5.42	11.4
cadmium [e]	30.9	48.8	4.45	48.9	29.8	11.4	75.6	40.9	5.43	20.8	5.09	10.7
chromium [f]	24.9	39.4	3.59	39.4	24.0	9.19	60.9	33.0	4.38	16.8	4.11	8.63
copper [g]	136	214	19.5	215	131	50.0	332	180	23.8	91.1	22.3	46.9
lead [h]	132	208	18.9	208	127	48.5	322	174	23.1	88.4	21.7	45.5
mercury [i]	NA	NA	0.11	1.26	NA	0.29	NA	1.06	0.14	NA	0.13	0.28
nickel [j]	20.0	31.5	2.87	31.6	19.2	7.35	48.6	26.4	3.50	13.4	3.29	6.90
zinc [k]	758	1,197	109	1,199	730	279	1,853	1,003	133	509	125	262
PESTICIDES (μg/kg)												
chlordane [l]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chlorpyrifos **	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p,p' DDD [m]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p,p' DDE [n]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9,660
dieldrin ***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PHTHALATE ESTERS (μg/kg)												
di-n-butyl phthalate [o]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 9 (continued)
Site-Specific Screening Level Concentrations for Sediment*

Parameter	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
HALOGENATED ALIPHATICS (µg/kg)												
methylene chloride [a]	NA	NA	NA	NA	NA	NA	NA	NA	530	NA	NA	NA
MONOCYCLIC AROMATICS (µg/kg)												
toluene [b]	6,025	NA	NA	NA	NA	NA	NA	47,750	2,650	NA	NA	NA
1,2-dichlorobenzene [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-dichlorobenzene [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
METALS (mg/kg)												
arsenic [d]	19.9	14.4	7.05	11.6	7.82	12.8	7.10	158	8.75	9.82	10.2	11.1
cadmium [e]	18.7	13.6	6.63	10.9	7.35	12.0	6.67	148	8.23	9.22	9.61	10.4
chromium [f]	15.1	10.9	5.34	8.81	5.93	9.69	5.38	119	6.63	7.44	7.75	8.38
copper [g]	81.9	59.5	29.1	47.9	32.2	52.7	29.2	649	36.0	40.5	42.2	45.6
lead [h]	79.5	57.8	28.2	46.5	31.1	51.2	28.4	630	35.0	39.3	40.9	44.2
mercury [i]	0.48	0.35	0.17	0.28	0.19	0.31	0.17	3.82	0.21	0.24	0.25	0.27
nickel [j]	12.6	8.75	4.28	7.05	4.74	7.75	4.30	95.5	5.30	5.95	6.20	6.70
zinc [k]	458	333	162	268	180	295	163	3,629	201	226	236	255
PESTICIDES (µg/kg)												
chlordane [l]	NA	NA	NA	NA	NA	7.8	4.3	95.5	NA	NA	NA	NA
chlorpyrifos **	NA	NA	NA	NA	NA	NA	NA	615	NA	NA	NA	NA
p,p' DDD [m]	NA	NA	NA	NA	NA	5,038	NA	NA	NA	NA	NA	NA
p,p' DDE [n]	16,870	12,250	NA	9,870	6,636	10,850	6,020	NA	7,420	NA	NA	NA
dieldrin ***	NA	NA	NA	NA	NA	140	NA	NA	NA	NA	NA	NA
PHTHALATE ESTERS (µg/kg)												
di-n-butyl phthalate [o]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 9 (continued)
Site-Specific Screening Level Concentrations for Sediment*

Parameter	Station 12d	12e	13	14	15	15a	16	17	18
HALOGENATED ALIPHATICS (µg/kg)									
methylene chloride [a]	NA	NA	NA	NA	NA	NA	NA	NA	NA
MONOCYCLIC AROMATICS (µg/kg)									
toluene [b]	NA	NA	NA	NA	NA	4,475	NA	NA	NA
1,2-dichlorobenzene [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-dichlorobenzene [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA
METALS (mg/kg)									
arsenic [d]	24.6	11.8	5.69	2.37	3.47	14.8	2.85	4.29	3.22
cadmium [e]	23.1	11.3	5.35	2.22	3.26	13.9	2.68	4.03	3.02
chromium [f]	18.6	8.94	4.31	1.79	2.63	11.2	2.16	3.25	2.44
copper [g]	101	48.6	23.5	9.76	14.3	60.9	11.8	17.7	13.3
lead [h]	98.3	47.2	22.8	9.47	13.9	59.1	11.4	17.2	12.9
mercury [i]	0.60	0.29	0.14	0.06	0.08	0.36	0.07	0.10	0.08
nickel [j]	14.9	7.15	3.45	1.44	2.11	8.95	1.73	2.60	1.95
zinc [k]	566	272	131	54.5	80.0	340	65.7	98.8	74.1
PESTICIDES (µg/kg)									
chlordane [l]	NA	NA	NA	NA	NA	9.0	NA	NA	NA
chlorpyrifos **	NA	NA	NA	NA	NA	NA	NA	NA	NA
p,p' DDD [m]	NA	NA	NA	NA	NA	NA	NA	NA	NA
p,p' DDE [n]	20,860	NA	NA	NA	NA	NA	NA	NA	NA
dieldrin ***	NA	NA	NA	NA	NA	NA	NA	NA	NA
PHTHALATE ESTERS (µg/kg)									
di-n-butyl phthalate [o]	$1.49x10^6$	NA	NA	NA	NA	NA	NA	NA	NA

NA - not applicable because parameter was below the detection limit at this site

* - values for all parameters except chlorpyrifos and dieldrin calculated as described in "Physicochemical Methods" section, using total organic carbon data from Table 9, and the following threshold concentrations (from USEPA, 1985a):

a - 2 mg/kg	f - 25 mg/kg	k - 760 mg/kg
b - 10 mg/kg	g - 136 mg/kg	l - 0.02 mg/kg
c - 2.8 mg/kg	h - 132 mg/kg	m - 13 mg/kg
d - 33 mg/kg	i - 0.8 mg/kg	n - 28 mg/kg
e - 31 mg/kg	j - 20 mg/kg	o - 2,000 mg/kg

** - values derived from interim sediment quality criterion of 3.22 µg/g organic carbon (USEPA, 1989), normalized using total organic carbon data from Table 9

*** - values derived from proposed national criterion of 9.0 µg/g organic carbon (USEPA, 1991), normalized using total organic carbon data from Table 9

Table 10
Analytical Data - Water

Parameter	Station 1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
DATE	111292	111192	111192	111292	111392	111392	111392	111492	111592**	111592	020893	020893
TIME	0900	1600	1000	1400	1000	1200	1600	0900	1200	1200	1040	1322
CONVENTIONALS												
ammonia (NH_3-N) (mg/L)	0.09	20.82	<0.02	17.67	0.19	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	0.09
ammonia (unionized) (mg/L)[f]	0.006	0.028	<0.001	0.395	0.010	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
chloride (mg/L)	202	378	238	293	500	65	21	227	237	9	223	213
dissolved oxygen (mg/L)	9.8	5.9	6.8	0.3	8.9	9.6	11.2	8.8	9.3	8.8	10.4	10.7
flow (cfs)	185	45	186	61	278	530	1.1	798	722	2.8	*	847
pH (std. units)	8.6	6.3	7.7	7.9	8.4	8.1	8.6	8.2	8.4	8.1	7.9	8.0
residual chlorine (mg/L)	0.0	1.2	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
specific conductance (μmhos/cm)	1,700	1,830	1,760	1,810	2,640	962	525	1,620	1,680	1,305	1,550	1,540
sulfate (mg/L)	445	175	406	206	510	262	49	368	386	560	347	369
temperature (°C)	8.4	27.4	15.1	15.7	12.5	15.7	23.4	13.9	14.5	17.5	12.8	14.5
total dissolved solids (mg/L)	1,200	1,100	1,240	1,180	1,820	680	318	1,120	1,190	1,030	1,060	1,030
total hardness (mg/L)	400	180	366	371	550	255	66	370	399	386	344	348
total organic carbon (mg/L)	5	15	6	49	11	4	1	7	8	1	8	9
total suspended solids (mg/L)	54	5	120	96	358	20	5	97	109	7	116	155
turbidity (jtu)	1.8	2.4	23	12	110	3.5	0.4	22	28	1.4	32	21
PHENOLS AND CRESOLS (μg/L)												
parachlorometa cresol	<5.5	<13	<5.8	27	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<6.9	<5.6
pentachlorophenol	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
phenol (C_6H_5OH) single compound	<11	<13	<12	15	<14	<12	<11	<11	<11	<11	<12	<12
phenolics recoverable	<2.0	10	<2.0	36.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	*	*
2-chlorophenol	<11	<13	<12	<12	<14	<12	<11	<11	<11	<11	<12	<12
2-nitrophenol	<11	<13	<12	<12	<14	<12	<11	<11	<11	<11	<12	<12
2,4-dichlorophenol	<11	<13	<12	<12	<14	<12	<11	<11	<11	<11	<12	<12
2,4-dimethylphenol	<11	<13	<12	<12	<14	<12	<11	<11	<11	<11	<12	<12
2,4-dinitrophenol	<22	<26	<23	<23	<28	<23	<22	<22	<22	<22	<23	<23
2,4,6-trichlorophenol	<11	<13	<12	<12	<14	<12	<11	<11	<11	<11	<12	<12
4-nitrophenol	<22	<26	<23	<23	<28	<23	<22	<22	<22	<22	<23	<23
4,6-dinitro-ortho-cresol	<22	<26	<23	<23	<28	<23	<22	<22	<22	<22	<23	<23
ETHERS (μg/L)												
bis(2-chloroethyoxy) methane	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
bis(2-chloroethyl) ether	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
bis(2-chloroisopropyl) ether	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
4-bromophenyl phenyl ether	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
4-chlorophenyl phenyl ether	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
HALOGENATED ALIPHATICS (μg/L)												
bromodichloromethane	<2.0	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
bromoform	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
carbon tetrachloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
chloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chloroform	<2.0	37.5	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dibromochloromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dichlorodifluoromethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachlorobutadiene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
hexachlorocyclopentadiene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
hexachloroethane	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
methyl bromide	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methylene chloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
tetrachloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
trichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
trichlorofluoromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
vinyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,1-trichloroethane	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2-trichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2,2-tetrachloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloropropane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-trans-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-trans-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-cis-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
POLYCYCLIC AROMATIC HYDROCARBONS (μg/L)												
acenaphthene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
acenaphthylene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
anthracene/phenanthrene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
benzo(A) anthracene 1,2-benzanthracene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
benzo(B) fluoranthene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
benzo(GHI) perylene 1,12-benzoperylene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
benzo(K) fluoranthene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
benzo-A-pyrene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
chrysene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
fluoranthene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
fluorene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
indeno(1,2,3-CD) pyrene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
naphthalene	<2.0	6.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
pyrene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
1,2,5,6-dibenzanthracene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
MONOCYCLIC AROMATICS (µg/L)												
benzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
chlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ethylbenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
hexachlorobenzene	<0.02	<0.02	<0.02	<0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
nitrobenzene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
styrene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
toluene	<2.0	<2.0	<2.0	7.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
xylene	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
1,2-dichlorobenzene	<2.0	5.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2,4-trichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,4-dichlorobenzene	<2.0	2.5	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2,4-dinitrotoluene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
2,6-dinitrotoluene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
NITROSAMINES AND OTHER N COMPOUNDS (µg/L)												
acrylonitrile	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
benzidine	<11	<13	<12	<12	<14	<12	<11	<11	<11	<11	<12	<12
n-nitrosodi-N-propylamine	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
n-nitrosodimethylamine	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
n-nitrosodiphenylamine	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
1,2-diphenylhydrazine	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
3,3-dichlorobenzidine	<11	<13	<12	<12	<14	<12	<11	<11	<11	<11	<12	<12
METALS (µg/L)												
aluminum	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
antimony	1.5	5.8	6.3	3.2	5.6	6.3	1.4	5.0	4.1	1.7	2.1	1.9
arsenic	2.6	7.1	4.4	4.6	8.1	20.6	10.6	14.4	15.8	<0.7	4.5	5.5
beryllium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.8	<0.8
cadmium	<0.10	<0.10	0.21	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.13	<0.10
chromium	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6

Table 10 (continued)
Analytical Data - Water

Parameter	Station 1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
copper	<1.6	8.8	4.2	<1.6	<1.6	2.1	2.1	2.4	<1.6	<1.6	<1.6	1.8
lead	1.1	2.8	<1.0	1.2	1.6	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0
mercury	<0.13	<0.13	<0.13	0.14	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
nickel	<4.7	5.9	<4.7	8.1	15.4	9.6	<4.7	19.6	10.6	<4.7	<4.7	<4.7
selenium	<2.4	3.7	<2.4	<2.4	<2.0	<2.0	<2.4	<2.4	3.0	5.5	4.9	<4.0
silver	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.7	<2.7
thallium	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
zinc	<5.0	20.7	9.7	6.4	5.2	<5.0	6.4	14.0	7.6	<5.0	<5.0	5.3
PESTICIDES (μg/L)												
aldicarb	<10	<10	<10	<10	<10	<10	<10	<5	<5	<5	<10	<10
aldrin	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
alpha benzene hexachloride	<0.03	<0.03	<0.03	<0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
atrazine	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
beta benzene hexachloride	<0.03	<0.03	<0.03	<0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
carbaryl	<10	<10	<10	<10	<10	<10	<10	<5	<5	<5	<10	<10
carbofuran	<10	<10	<10	<10	<10	<10	<10	<5	<5	<5	<10	<10
chlordane	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
chlorfenvinphos	<0.07	<0.07	<0.07	<0.14	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
chlorothalonil	<0.02	<0.02	<0.02	<0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorpyrifos	<0.6	<0.6	<0.6	<1.2	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
p,p' DDD	<0.15	<0.15	<0.15	<0.30	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
p,p' DDE	<0.10	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
p,p' DDT	<0.15	<0.15	<0.15	<0.30	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
delta benzene hexachloride	<0.03	<0.03	<0.03	<0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
diazinon	<0.3	<0.3	<0.3	<0.6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
dibromochloropropane (dbcp)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dicamba	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-dichlorophenoxyacetic acid (2,4-D)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
dicofol (kelthane)	<2.0	<2.0	<2.0	<4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dieldrin	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
dinoseb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
endosulfan alpha	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan beta	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan sulfate	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin aldehyde	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
gamma-bhc (lindane)	<0.03	<0.03	<0.03	<0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
guthion	<3.0	<3.0	<3.0	<6.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
heptachlor	<0.02	<0.02	<0.02	<0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
heptachlor epoxide	<0.06	<0.06	<0.06	<0.12	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
isophorone	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
malathion	<0.4	<0.4	<0.4	<0.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
methomyl	<10	<10	<10	<10	<10	<10	<10	<5	<5	<5	<10	<10
methoxychlor	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
metolachlor	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
mirex	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
parathion	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
picloram	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
simazine	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
toxaphene	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4,5-TP (silvex)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PCB's AND RELATED COMPOUNDS (µg/L)												
arochlor 1016	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1221	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1232	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1242	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1248	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1254	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1260	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloronaphthalene	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
PHTHALATE ESTERS (µg/L)												
bis(2-ethylhexyl) phthalate	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
di-n-butyl phthalate	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
di-n-octyl phthalate	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
diethyl phthalate	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
dimethyl phthalate	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
n-butyl benzyl phthalate	<5.5	<6.3	<5.8	<5.6	<6.9	<5.8	<5.3	<5.5	<5.4	<5.4	<5.7	<5.6
GENERAL INORGANICS (mg/L)												
cyanide	0.01	0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

a - not measured, but approximately equivalent to flow at station 6
f - calculated from total ammonia concentration according to equations described by USEPA (1984)
* - lab unable to produce satisfactory results
** - for semivolatile organics, no sample obtained on this date due to a field error; data for this chemical group based on resampling by U.S. National Park Service (012093; 1300 hrs.)

Table 10 (continued)
Analytical Data - Water

Parameter	Station 6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
DATE	020893	020993	021093	021093	020993	021093	021193	021193	021193	021293	021293	032293
TIME	1645	0920	1640	1505	1502	1000	1735	0930	1000	1125	1210	0752
CONVENTIONALS												
ammonia (NH_3-N) (mg/L)	0.02	0.02	<0.02	1.86	<0.02	0.06	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ammonia (unionized) (mg/L)[f]	<0.001	<0.001	<0.001	0.010	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chloride (mg/L)	1,120	15	118	75	17	108	52	24	106	20	17	122
dissolved oxygen (mg/L)	10.2	9.1	11.7	6.6	8.3	9.4	10.0	9.9	9.0	9.4	10.3	8.2
flow (cfs)	218	323	6	18	141	1,172	19	142	25	19	1,244	993
pH (std. units)	7.6	7.9	8.1	7.2	7.7	7.7	7.9	7.8	7.8	7.7	8.1	8.1
residual chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
specific conductance (µmhos/cm)	4,330	400	978	927	451	936	541	508	404	403	934	990
sulfate (mg/L)	650	10	210	182	20	191	51	71	205	33	16	204
temperature (°C)	12.7	13.7	15.2	18.3	21.6	14.0	16.3	14.0	12.4	16.5	14.8	18.0
total dissolved solids (mg/L)	2,920	208	630	636	202	606	298	296	622	215	214	678
total hardness (mg/L)	890	184	248	349	202	255	193	225	256	178	183	281
total organic carbon (mg/L)	1	5	4	8	2	4	3	2	5	2	3	3
total suspended solids (mg/L)	<5	6	<5	40	18	7	5	<5	21	<5	141	15
turbidity (jtu)	0.4	0.2	0.3	5.5	1.2	0.8	1.3	1.8	2.2	1.2	14	4.4
PHENOLS AND CRESOLS (µg/L)												
parachlorometa cresol	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
pentachlorophenol	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
phenol (C_6H_5OH) single compound	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
2-nitrophenol	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
2,4-dichlorophenol	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
2,4-dimethylphenol	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
2,4-dinitrophenol	<24	<23	<22	<23	<22	<22	<22	<23	<23	<22	<21	<23
2,4,6-trichlorophenol	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
4-nitrophenol	<24	<23	<22	<23	<22	<22	<22	<23	<23	<22	<21	<23
4,6-dinitro-ortho-cresol	<24	<23	<22	<23	<22	<22	<22	<23	<23	<22	<21	<23
ETHERS (µg/L)												
bis(2-chloroethyoxy) methane	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
bis(2-chloroethyl) ether	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
bis(2-chloroisopropyl) ether	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
4-bromophenyl phenyl ether	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
4-chlorophenyl phenyl ether	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
HALOGENATED ALIPHATICS (μg/L)												
bromodichloromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
bromoform	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
carbon tetrachloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
chloroethane	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chloroform	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dibromochloromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dichlorodifluoromethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachlorobutadiene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
hexachlorocyclopentadiene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
hexachloroethane	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
methyl bromide	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methylene chloride	<2.0	<2.0	<2.0	4.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
tetrachloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
trichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
trichlorofluoromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
vinyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,1-trichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2-trichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2,2-tetrachloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloropropane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-trans-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-trans-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-cis-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
POLYCYCLIC AROMATIC HYDROCARBONS (μg/L)												
acenaphthene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
acenaphthylene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
anthracene/phenanthrene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
benzo(A) anthracene 1,2-benzanthracene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
benzo(B) fluoroanthene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
benzo(GHI) perylene 1,12-benzoperylene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
benzo(K) fluoranthene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
benzo-A-pyrene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
chrysene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
fluoranthene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
fluorene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
indeno(1,2,3-CD) pyrene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
naphthalene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
pyrene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
1,2,5,6-dibenzanthracene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
MONOCYCLIC AROMATICS (μg/L)												
benzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
chlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ethylbenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
hexachlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
nitrobenzene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
styrene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
toluene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
xylene	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
1,2-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2,4-trichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,4-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2,4-dinitrotoluene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
2,6-dinitrotoluene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
NITROSAMINES AND OTHER N COMPOUNDS (μg/L)												
acrylonitrile	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
benzidine	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
n-nitrosodi-N-propylamine	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
n-nitrosodimethylamine	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
n-nitrosodiphenylamine	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
1,2-diphenylhydrazine	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
3,3-dichlorobenzidine	<12	<12	<11	<12	<11	<11	<11	<12	<12	<11	<11	<12
METALS (μg/L)												
aluminum	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
antimony	3.8	2.6	5.2	2.8	1.4	1.0	1.6	1.7	2.3	1.6	3.9	3.0
arsenic	<2.0	<2.0	4.8	<2.0	<2.0	4.8	<2.0	<2.0	5.3	<2.0	<2.0	5.3
beryllium	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
cadmium	<0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.13	<0.10	<0.10	<0.13
chromium	5.1	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
copper	<1.6	1.8	2.4	1.8	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	1.8	<1.6
lead	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
mercury	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
nickel	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7
selenium	4.0	<8.0	<8.0	<4.0	<8.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
silver	<2.7	<2.7	<2.7	<2.7	4.8	<2.7	2.9	2.9	<2.7	<2.7	3.4	<2.7
thallium	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
zinc	<5.0	<5.0	16.7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PESTICIDES (μg/L)												
aldicarb	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
aldrin	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
alpha benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
atrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
beta benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
carbaryl	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
carbofuran	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
chlordane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
chlorfenvinphos	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
chlorothalonil	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorpyrifos	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
p,p' DDD	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
p,p' DDE	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
p,p' DDT	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
delta benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
diazinon	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
dibromochloropropane (dbcp)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dicamba	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-dichlorophenoxyacetic acid (2,4-D)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
dicofol (kelthane)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dieldrin	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
dinoseb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
endosulfan alpha	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan beta	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan sulfate	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin aldehyde	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
gamma-bhc (lindane)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
guthion	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
heptachlor	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
heptachlor epoxide	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
isophorone	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
malathion	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
methomyl	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
methoxychlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
metolachlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
mirex	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
parathion	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
picloram	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
simazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
toxaphene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4,5-TP (silvex)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PCB's AND RELATED COMPOUNDS (µg/L)												
arochlor 1016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1221	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1232	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1242	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1248	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1254	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1260	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloronaphthalene	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
PHTHALATE ESTERS (µg/L)												
bis(2-ethylhexyl) phthalate	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
di-n-butyl phthalate	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
di-n-octyl phthalate	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
diethyl phthalate	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
dimethyl phthalate	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
n-butyl benzyl phthalate	<5.9	<5.6	<5.4	<5.6	<5.4	<5.5	<5.4	<5.7	<5.6	<5.5	<5.3	<5.8
GENERAL INORGANICS (mg/L)												
cyanide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

b - not measured, but approximately equivalent to flow at station 8
f - calculated from total ammonia concentration according to equations described by USEPA (1984)
* - lab unable to produce satisfactory results

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
DATE	032293	032293	032393	032393	032493	032393	032493	032593	032493	032693	032593	032693
TIME	1116	1330	0845	1614	0835	1753	1640	1000	1343	1200	1700	1805
CONVENTIONALS												
ammonia (NH_3-N) (mg/L)	7.07	<0.02	<0.02	<0.02	<0.02	0.13	<0.02	8.82	0.24	<0.02	0.02	0.02
ammonia (unionized) (mg/L)[f]	0.070	<0.001	<0.001	<0.001	<0.001	0.008	<0.001	0.087	0.010	<0.001	0.004	0.001
chloride (mg/L)	535	86	121	868	125	93	1,530	333	131	333	70	636
dissolved oxygen (mg/L)	3.7	8.7	7.7	9.1	8.3	8.3	11.4	0.4	7.9	9.3	6.4	15.5
flow (cfs)	0.7	74	1,172	1.3	c	5.9	0.7	1.8	1,384	37	4	1.0
pH (std. units)	7.4	7.8	7.9	8.0	8.0	7.8	7.9	7.3	8.0	8.0	8.0	8.0
residual chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
specific conductance (µmhos/cm)	2,610	893	989	6,000	1,013	796	8,760	2,130	1,054	3,460	587	2,800
sulfate (mg/L)	287	135	206	2,350	213	187	3,310	475	223	1,550	54	438
temperature (°C)	20.1	20.0	18.4	20.4	20.0	20.8	22.6	23.2	20.7	24.9	24.1	28.3
total dissolved solids (mg/L)	1,720	588	618	5,100	660	530	7,480	1,450	696	3,050	364	1,830
total hardness (mg/L)	531	346	285	1,670	279	195	2,050	484	291	1,310	166	388
total organic carbon (mg/L)	22	1	3	12	3	33	14	28	4	4	7	6
total suspended solids (mg/L)	28	14	15	19	19	111	36	79	22	33	88	41
turbidity (jtu)	3.0	5.0	3.6	7.3	6.4	58	14	35	5.8	18	51	5.2
PHENOLS AND CRESOLS (µg/L)												
parachlorometa cresol	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	13	<5.2	<5.5	<5.4	<5.4
pentachlorophenol	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
phenol (C_6H_5OH) single compound	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
2-nitrophenol	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
2,4-dichlorophenol	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
2,4-dimethylphenol	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
2,4-dinitrophenol	<23	<22	<22	<22	<22	<22	<21	<22	<21	<22	<22	<22
2,4,6-trichlorophenol	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
4-nitrophenol	<23	<22	<22	<22	<22	<22	<21	<22	<21	<22	<22	<22
4,6-dinitro-ortho-cresol	<23	<22	<22	<22	<22	<22	<21	<22	<21	<22	<22	<22
ETHERS (µg/L)												
bis(2-chloroethyoxy) methane	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
bis(2-chloroethyl) ether	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
bis(2-chloroisopropyl) ether	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
4-bromophenyl phenyl ether	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
4-chlorophenyl phenyl ether	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
HALOGENATED ALIPHATICS (µg/L)												
bromodichloromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
bromoform	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
carbon tetrachloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
chloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chloroform	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dibromochloromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dichlorodifluoromethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachlorobutadiene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
hexachlorocyclopentadiene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
hexachloroethane	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
methyl bromide	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methylene chloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
tetrachloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
trichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
trichlorofluoromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
vinyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,1-trichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2-trichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2,2-tetrachloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloropropane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-trans-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-trans-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-cis-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
POLYCYCLIC AROMATIC HYDROCARBONS (µg/L)												
acenaphthene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
acenaphthylene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
anthracene/phenanthrene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
benzo(A) anthracene 1,2-benzanthracene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
benzo(B) fluoroanthene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
benzo(GHI) perylene 1,12-benzoperylene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
benzo(K) fluoranthene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
benzo-A-pyrene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
chrysene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
fluoranthene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
fluorene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
indeno(1,2,3-CD) pyrene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
naphthalene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
pyrene	<5.6	<5.3	<5.4	<5.4	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
1,2,5,6-dibenzanthracene	<5.6	<5.3	<5.4	<5.4	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
MONOCYCLIC AROMATICS (µg/L)												
benzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
chlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ethylbenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
hexachlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
nitrobenzene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
styrene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
toluene	3.8	<2.0	<2.0	<2.0	<2.0	<2.0	9.0	6.0	<2.0	<2.0	<2.0	<2.0
xylene	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	6.8	<6.0	<6.0	<6.0	<6.0
1,2-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2,4-trichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,4-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.0	<2.0	<2.0	<2.0	<2.0
2,4-dinitrotoluene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
2,6-dinitrotoluene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
NITROSAMINES AND OTHER N COMPOUNDS (µg/L)												
acrylonitrile	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
benzidine	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
n-nitrosodi-N-propylamine	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
n-nitrosodimethylamine	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
n-nitrosodiphenylamine	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
1,2-diphenylhydrazine	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
3,3-dichlorobenzidine	<12	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11	<11
METALS (µg/L)												
aluminum	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	30
antimony	2.5	1.3	3.1	78.0	4.4	8.9	8.3	4.1	1.5	3.3	5.3	5.3
arsenic	3.9	<2.0	2.7	<10	3.6	2.2	<10.0	2.1	2.7	<10.0	<2.0	3.6
beryllium	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
cadmium	<0.10	0.40	<0.13	0.37	0.15	0.12	0.19	<0.10	<0.12	0.19	<0.10	0.19
chromium	3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	<3.6	15.0	<3.6	<3.6

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
copper	<1.6	2.7	<1.6	1.6	1.6	6.1	1.8	<1.6	<1.6	<1.6	<1.6	3.8
lead	<1.0	<1.0	<1.0	<4.0	<1.0	<1.0	<4.0	<1.0	<1.0	<4.0	<1.0	<1.0
mercury	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
nickel	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	7.9
selenium	4.6	14.4	<4.0	<8.0	5.4	5.1	1.4	10.7	<4.0	10.3	13.7	11.2
silver	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	2.9	<2.7	<2.7	<2.7
thallium	1.0	<0.8	<0.8	2.2	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	1.0
zinc	<5.0	<5.0	<5.0	<5.0	<5.0	5.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PESTICIDES (µg/L)												
aldicarb	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
aldrin	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
alpha benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
atrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
beta benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
carbaryl	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
carbofuran	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
chlordane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
chlorfenvinphos	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
chlorothalonil	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorpyrifos	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
p,p' DDD	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
p,p' DDE	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
p,p' DDT	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
delta benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
diazinon	<0.3	<0.3	<0.3	<0.3	<0.3	0.7	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
dibromochloropropane (dbcp)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dicamba	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-dichlorophenoxyacetic acid (2,4-D)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
dicofol (kelthane)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dieldrin	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
dinoseb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
endosulfan alpha	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan beta	<0.2	<0.2	<0.2	≤0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan sulfate	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin aldehyde	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
gamma-bhc (lindane)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.07	<0.03	<0.03	<0.03	<0.03
guthion	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
heptachlor	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
heptachlor epoxide	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06

Table 10 (continued)
Analytical Data - Water

Parameter	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
isophorone	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
malathion	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
methomyl	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
methoxychlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
metolachlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
mirex	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
parathion	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
picloram	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
simazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
toxaphene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4,5-TP (silvex)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PCB's AND RELATED COMPOUNDS (μg/L)												
arochlor 1016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1221	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1232	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1242	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1248	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1254	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1260	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloronaphthalene	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
PHTHALATE ESTERS (μg/L)												
bis(2-ethylhexyl) phthalate	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	10	<5.2	<5.5	<5.4	<5.4
di-n-butyl phthalate	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
di-n-octyl phthalate	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
diethyl phthalate	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
dimethyl phthalate	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
n-butyl benzyl phthalate	<5.6	<5.3	<5.4	<5.5	<5.4	<5.3	<5.3	<5.4	<5.2	<5.5	<5.4	<5.4
GENERAL INORGANICS (mg/L)												
cyanide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

c - not measured, but approximately equivalent to flow at station 12
d - no flow, but perennial pools present, from which samples were taken
f - calculated from total ammonia concentration according to equations described by USEPA (1984)
* - lab unable to produce satisfactory results

Table 10 (continued)
Analytical Data - Water

Parameter	Station								
	12d	12e	13	14	15	15a	16	17	18
DATE	011193	011293	011193	011293	011293	011393	011393	011493	011493
TIME	1045	1400	1400	1415	1700	1730	1000	1000	1500
CONVENTIONALS									
ammonia (NH_3-N) (mg/L)	0.02	0.09	0.02	<0.02	<0.02	0.03	0.02	<0.02	<0.02
ammonia (unionized) (mg/L)[f]	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chloride (mg/L)	1,370	381	127	123	128	530	125	171	234
dissolved oxygen (mg/L)	8.9	9.1	10.2	11.9	11.3	1.3	9.8	10.0	10.3
flow (cfs)	0.8	38	4,180	990	e	16	940	95	150
pH (std. units)	7.8	7.4	8.1	8.1	8.0	7.4	7.8	7.8	7.8
residual chlorine (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
specific conductance (μmhos/cm)	6,860	3,130	1,220	1,180	1,200	3,310	1,394	1,610	1,970
sulfate (mg/L)	1,050	710	218	235	236	430	249	266	350
temperature (°C)	11.5	17.7	15.1	15.9	15.9	16.1	15.8	15.9	16.7
total dissolved solids (mg/L)	4,100	1,970	690	680	690	1,810	740	850	1,070
total hardness (mg/L)	610	600	259	256	260	600	268	354	439
total organic carbon (mg/L)	7	3	5	4	4	39	6	7	7
total suspended solids (mg/L)	48	57	43	22	19	43	43	45	39
turbidity (jtu)	13	22	10	7.3	8.3	9.3	7.0	10	10
PHENOLS AND CRESOLS (μg/L)									
parachlorometa cresol	<6.0	<5.5	<5.6	<5.4	<5.3	8.5	<5.5	<5.6	<5.7
pentachlorophenol	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
phenol (C_6H_5OH) single compound	<12	<11	<12	<11	<11	<12	<11	<12	<12
phenolics recoverable	<2.0	<2.0	<2.0	<2.0	<2.0	16	5	*	*
2-chlorophenol	<12	<11	<12	<11	<11	<12	<11	<12	<12
2-nitrophenol	<12	<11	<12	<11	<11	<12	<11	<12	<12
2,4-dichlorophenol	<12	<11	<12	<11	<11	<12	<11	<12	<12
2,4-dimethylphenol	<12	<11	<12	<11	<11	<12	<11	<12	<12
2,4-dinitrophenol	<24	<22	<23	<22	<22	<23	<22	<23	<23
2,4,6-trichlorophenol	<12	<11	<12	<11	<11	<12	<11	<11	<12
4-nitrophenol	<24	<22	<23	<22	<22	<23	<22	<23	<23
4,6-dinitro-ortho-cresol	<24	<22	<23	<22	<22	<23	<22	<23	<23
ETHERS (μg/L)									
bis(2-chloroethyoxy) methane	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
bis(2-chloroethyl) ether	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
bis(2-chloroisopropyl) ether	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
4-bromophenyl phenyl ether	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7

Table 10 (continued)
Analytical Data - Water

Parameter	Station								
	12d	12e	13	14	15	15a	16	17	18
4-chlorophenyl phenyl ether	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
HALOGENATED ALIPHATICS (µg/L)									
bromodichloromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
bromoform	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
carbon tetrachloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
chloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chloroform	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dibromochloromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dichlorodifluoromethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachlorobutadiene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
hexachlorocyclopentadiene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
hexachloroethane	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
methyl bromide	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methylene chloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
tetrachloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
trichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	<2.0
trichlorofluoromethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
vinyl chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,1-trichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2-trichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,2,2-tetrachloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloroethane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-dichloropropane	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-trans-dichloroethylene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-trans-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-cis-dichloropropene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
POLYCYCLIC AROMATIC HYDROCARBONS (µg/L)									
acenaphthene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
acenaphthylene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
anthracene/phenanthrene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
benzo(A) anthracene 1,2-benzanthracene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
benzo(B) fluoranthene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
benzo(GHI) perylene 1,12-benzoperylene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
benzo(K) fluoranthene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
benzo-A-pyrene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7

Table 10 (continued)
Analytical Data - Water

Parameter	Station								
	12d	12e	13	14	15	15a	16	17	18
chrysene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
fluoranthene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
fluorene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
indeno(1,2,3-CD) pyrene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
naphthalene	<2.0	<2.0	<2.0	<2.0	<2.0	4.4	<2.0	<2.0	<2.0
pyrene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
1,2,5,6-dibenzanthracene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
MONOCYCLIC AROMATICS (µg/L)									
benzene	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0
chlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ethylbenzene	<2.0	<2.0	<2.0	<2.0	<2.0	2.9	<2.0	<2.0	<2.0
hexachlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
nitrobenzene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
styrene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
toluene	<2.0	<2.0	<2.0	<2.0	<2.0	5.0	<2.0	<2.0	<2.0
xylene	<6.0	<6.0	<6.0	<6.0	<6.0	18.1	<6.0	<6.0	<6.0
1,2-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2,4-trichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,4-dichlorobenzene	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0
2,4-dinitrotoluene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
2,6-dinitrotoluene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
NITROSAMINES AND OTHER N COMPOUNDS (µg/L)									
acrylonitrile	<10	<10	<10	<10	<10	<10	<10	<10	<10
benzidine	<12	<11	<12	<11	<11	<12	<11	<12	<12
n-nitrosodi-N-propylamine	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
n-nitrosodimethylamine	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
n-nitrosodiphenylamine	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
1,2-diphenylhydrazine	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
3,3-dichlorobenzidine	<12	<11	<12	<11	<11	<12	<11	<12	<12
METALS (µg/L)									
aluminum	<20	<20	<20	<20	<20	<20	<20	<20	<20
antimony	4.0	4.5	5.4	1.2	2.9	2.9	4.6	5.9	1.1
arsenic	3.4	<4.0	1.8	2.3	2.1	2.6	2.6	4.2	2.8
beryllium	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
cadmium	<0.12	<0.10	<0.12	<0.10	<0.10	<0.10	<0.12	<0.12	<0.10
chromium	<3.6	<3.6	<3.6	<3.6	<3.6	3.6	<3.6	<3.6	<3.6

Table 10 (continued)
Analytical Data - Water

Parameter	Station 12d	12e	13	14	15	15a	16	17	18
copper	1.8	<1.6	3.0	2.1	<1.6	2.1	1.8	2.8	2.1
lead	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
mercury	<0.25	<0.25	<0.25	<0.25	<0.25	0.29	<0.25	<0.25	<0.25
nickel	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7
selenium	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0
silver	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7	<2.7
thallium	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
zinc	5.1	5.1	<5.0	<5.0	<5.0	5.8	5.8	5.8	<5.0
PESTICIDES (µg/L)									
aldicarb	<15	<15	<15	<15	<15	<10	<10	<10	<10
aldrin	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
alpha benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
atrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
beta benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
carbaryl	<15	<15	<15	<15	<15	<10	<10	<10	<10
carbofuran	<15	<15	<15	<15	<15	<10	<10	<10	<10
chlordane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
chlorfenvinphos	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
chlorothalonil	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorpyrifos	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
p,p' DDD	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
p,p' DDE	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
p,p' DDT	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
delta benzene hexachloride	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
diazinon	9.2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
dibromochloropropane (dbcp)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dicamba	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-dichlorophenoxyacetic acid (2,4-D)	<20	<20	<20	<20	<20	<20	<20	<20	<20
dicofol (kelthane)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dieldrin	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
dinoseb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
endosulfan alpha	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan beta	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endosulfan sulfate	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
endrin aldehyde	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
gamma-bhc (lindane)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
guthion	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
heptachlor	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
heptachlor epoxide	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06

Table 10 (continued)
Analytical Data - Water

Parameter	Station								
	12d	12e	13	14	15	15a	16	17	18
isophorone	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
malathion	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
methomyl	<15	<15	<15	<15	<15	<10	<10	<10	<10
methoxychlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
metolachlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
mirex	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
parathion	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
picloram	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
simazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
toxaphene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4,5-TP (silvex)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PCB's AND RELATED COMPOUNDS (µg/L)									
arochlor 1016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1221	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1232	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1242	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1248	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1254	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
arochlor 1260	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloronaphthalene	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
PHTHALATE ESTERS (µg/L)									
bis(2-ethylhexyl) phthalate	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
di-n-butyl phthalate	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
di-n-octyl phthalate	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
diethyl phthalate	<6.0	<5.5	<5.6	<5.4	<5.3	8.0	<5.5	<5.6	<5.7
dimethyl phthalate	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
n-butyl benzyl phthalate	<6.0	<5.5	<5.6	<5.4	<5.3	<5.6	<5.5	<5.6	<5.7
GENERAL INORGANICS (mg/L)									
cyanide	0.02	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0.01	<0.01

e - not measured, but approximately equivalent to flow at station 16
f - calculated from total ammonia concentration according to equations described by USEPA (1984)
* - lab unable to produce satisfactory results

Table 10 (continued)

Analytical Data - Water
Comisión Nacional del Agua

CUADRO I.1 RESULTADOS DE FISICO-QUIMICOS ETAPA 1

ESTACION	pH	CONDUCTIVIDAD ELECTRICA µ mhos/cm	CLORUROS mg/L	SOLIDOS DISUELTOS mg/L	DUREZA mg/L	SULFATOS mg/L	NITROGENO AMONIACAL mg/L	OXIGENO DISUELTO mg/L
1	8.2	1700	202	1136	350	488	0	9.0
1a	6.4	1831	362	1240	358	182	19	5.9
2	7.6	1760	232	1100	357	484	1.6	6.4
2a	7.8	1810	290	1132	360	196	17.7	0.31
3	8.4	2610	456	1604	491	586	0	8.9
3a	8.2	962	64	596	281	250	0	9.6
3b	8.8	459	21	120	97	82	0	11.2
4	8.1	1620	212	1168	380	441	0	8.77
5	8.4	1680	333	882	329	511	0.0	9.3
5a	8.1	1305	8.4	968	388	655	0.0	8.8

MAXIMOS
PERMISIBLES
NORMAS
MEXICANAS:

VIDA ACUATICA	6-9						0.06	MIN 5.0
CONSUMO HUMANO	6-9	1000	250	500		500	1	MIN 4.0
RIEGO AGRICOLA	6-9	*1000	147.5	*500		130	5.0	MIN 3.2
USO PECUARIO	6-9	1000		1000		100	2.0	MIN 4.0

* NOTA: LOS VALORES DE CONDUCTIVIDAD ELECTRICA
\> 500 NO EFECTOS NOCIVOS EN NINGUN CULTIVO.
500-1000 NO EFECTOS EN CULTIVOS SENSIBLES.
1000-2000 PARA COSECHAS QUE REQUIEREN MANEJO ESPECIAL.
2000-5000 PARA PLANTAS TOLERANTES EN SUELOS PERMEABLES.

CUADRO 1.2 RESULTADOS DE ANALISIS DE METALES PESADOS EN AGUA ETAPA 1

ESTACION	PLATA µg/L	COBRE µg/L	NIQUEL µg/L	SELENIO µg/L	ZINC µg/L
1	147 ±35	44 ±34	53.5 ±455	0.3	21.1
1a	201 ±36	51 ±35	65 ±455	1.8	23.5
2	189 ±36	41 ±35	62.5 ±463	0.8	12.7
2a	275 ±38	31 ±36	79.5 ±475	0.1	9.3
3	196 ±63	47 ±46	57 ±606	0.1	16.7
3a	192 ±24	49 ±29	64 ±379	0.8	5.9
3b	198 ±4	116 ±11	95.5 ±154	0.2	6.5
4	189 ±4	48 ±37	93.5 ±488	0.4	7.1
5	171 ±31	50 ±33	74 ±432	2.2	3.8
5a	159 ±12	47 ±38	54.5 ±496	2.2	4.7

MAXIMOS
PERMISIBLES
NORMAS
MEXICANAS:

VIDA ACUATICA	*	*	*	8	
CONSUMO HUMANO	50	1000	10	10	5000
RIEGO AGRICOLA		200	200	20	2000
USO PECUARIO		500	1000	50	50000

NR = NO SE REPORTARON VALORES

CUADRO 2.1 RESULTADOS DE ANALISIS FISICO-QUIMICOS ETAPA 2

ESTACION	pH	CONDUCTIVIDAD ELECTRICA µ mhos/cm	CLORUROS mg/L	SOLIDOS DISUELTOS mg/L	SOLIDOS SUSPENDIDOS mg/L	DUREZA mg/L	SULFATOS mg/L	NITROGENO AMONIACAL mg/L	OXIGENO DISUELTO mg/L	TURBIEDAD NTU	FENOLES mg/L	CIANUROS mg/L
12d	7.82	6280	1445	4526	6	638	1070	0.08	9.1	37.1	0.003	<0.02
12e	7.4	3130	397	2108	65	543	698	0.08	9.1	28.4	<0.001	<0.02
13	8	1010	132	821	50	262	21.4	0.05	10	8.8	<0.001	<0.02
14	8.1	1086	130	712	27	251	192	0.03	11.85	11.8	0.002	<0.02
15	8	1072	135	962	35	261	224	0.03	11.3	11.3	<0.001	<0.02
15a	7.43	3310	542	2149	59	590	360	9.75	1.31	96.1	0.01	<0.02
16	7.8	1394	147	808	53	270	218	0.27	9.71	17.5	<0.001	<0.02
17	7.8	1610	175	850	35	343	298	0.17	10.02	17.3	0.036	<0.02
18	7.6	1970	237	946	39	411	339	0.09	10.27	13.4	0.012	<0.02

MAXIMOS PERMISIBLES NORMAS MEXICANAS:

VIDA ACUATICA	6-9							0.06	MIN 5.0		0.1	0.005
CONSUMO HUMANO	6-9	1000	250	500			500	1	MIN 4.0		0.3	0.02
RIEGO AGRICOLA	6-9	*1000	147.5	*500			130	5.0	MIN 3.2		-	-
USO PECUARIO	6-9	1000		1000			100	2.0	MIN 4.0		-	-

* NOTA: LOS VALORES DE CONDUCTIVIDAD ELECTRICA
> 500 NO EFECTOS NOCIVOS EN NINGUN CULTIVO.
500-1000 NO EFECTOS EN CULTIVOS SENSIBLES.
1000-2000 PARA COSECHAS QUE REQUIEREN MANEJO ESPECIAL.
2000-5000 PARA PLANTAS TOLERANTES EN SUELOS PERMEABLES.

CUADRO 2.2 RESULTADOS DE ANALISIS DE METALES PESADOS EN AGUA ETAPA 2

ESTACION	PLATA µg/L	ARSENICO µg/L	CADMIO µg/L	CROMO µg/L	COBRE µg/L	MERCURIO µg/L	NIQUEL µg/L	PLOMO µg/L	SELENIO µg/L	ZINC µg/L
12d	<30 *98	15.5	130.6 *4.9	<40 *58	<40 *58	10	<50 *756	<80 *34	<0.5	<10
12e	<30 *75	1.9	63.9 *4.3	<40	<40 *50	9	<50 *660	<80 *27	<0.5	<10
13	<30 *21	2.5	3.6 *2.4	<40	<40 *27	5	<50 *356	<80 *11	<0.5	<10
14	<30 *20	2.5	5.4 *2.3	<40	<40 *26	0.4	<50 *343	<80 *10	<0.5	<10
15	<30 *21	2.6	3.7 *2.4	<40	<40 *27	0.4	<50 *355	<80 *11	<0.5	<10
15a	<30 *86	2.4	3.9 *4.6	<40	<40 *54	8	<50 *708	<80 *30	<0.5	<10
16	<30 *22	2.6	1.7 *2.5	<40	<40 *28	7	<50 *365	<80 *11	<0.5	<10
17	<30 *34	3.2	2 *3.0	<40	<40 *31	7.8	<50 *447	<80 *15	<0.5	<10
18	<30 *16	2.9	4.4 *3.4	<40	<40 *40	7	<50 *521	<80 *19	<0.5	<10

MAXIMOS
PERMISIBLES
NORMAS
MEXICANAS:

VIDA ACUATICA	*	200	*	10	*	0.01	*	*	8	
CONSUMO HUMANO	50	50	10	50	1000	1	10	50	10	5000
RIEGO AGRICOLA		100	10	100	200		200	5000	20	2000
USO PECUARIO		200	20	100	500	3	1000	100	50	50000

CUADRO 3.1 RESULTADOS DE FISICO-QUIMICOS ETAPA 3

ESTACION	pH	CONDUCTIVIDAD ELECTRICA µ mhos/cm	CLORUROS mg/L	SOLIDOS DISUELTOS mg/L	DUREZA mg/L	SULFATOS mg/L	NITROGENO AMONIACAL mg/L	OXIGENO DISUELTO mg/L
5b	8.0	1637	215	1201	389	386	0.128	10.39
6	7.9	1860	225	1201	384	371	0.195	10.23
6a	8.0	4017	1061	3114	938	578	0.193	10.23
6b	7.9	385	10	331	236	16	0.064	9.1
7	8.1	1042	115	747	289	230	0.387	11.7
7a	7.7	923	78	705	389	197	1.548	6.6
7b	7.0	399	12	330	280	21	0	8.4
8	8.0	1128	103	657	301	210	0.129	9.4
8a	8.1	421	58	371	276	45	0.064	9.9
8b	7.8	400	39	231	277	67	0.129	9.8
8c	7.9	574	43	312	113	29	0.064	9
8d	7.8	315	44	262	298	18	0.387	8.4
8e	8.1	894	44	680	297	192	0.064	10.3

MAXIMOS
PERMISIBLES
NORMAS
MEXICANAS:

VIDA ACUATICA	6-9						0.06	MIN 5.0
CONSUMO HUMANO	6-9	1000	250	500		500	1	MIN 4.0
RIEGO AGRICOLA	6-9	* 1000	147.5	*500		130	5.0	MIN 3.2
USO PECUARIO	6-9	1000		1000		100	2.0	MIN 4.0

* NOTA: LOS VALORES DE CONDUCTIVIDAD ELECTRICA
> 500 NO EFECTOS NOCIVOS EN NINGUN CULTIVO.
500-1000 NO EFECTOS EN CULTIVOS SENSIBLES.
1000-2000 PARA COSECHAS QUE REQUIEREN MANEJO ESPECIAL.
2000-5000 PARA PLANTAS TOLERANTES EN SUELOS PERMEABLES.

CUADRO 3.2 RESULTADOS DE METALES PESADOS EN AGUA ETAPA 3

ESTACION	PLATA µg/L	ARSENICO µg/L	CADMIO µg/L	CROMO µg/L	COBRE µg/L	MERCURIO µg/L	NIQUEL µg/L	PLOMO µg/L	SELENIO µg/L	ZINC µg/L
5b	5.9 *42	10.6	2.9 *3.3	<10.0	35 *37	0.2	15 *498	6 *38	<1.0	281
6	7.5 *41	7.0	4.7 *3.3	<10.0	42 *37	0.3	26 *493	16 *18	<1.0	95
6a	13.8 *190	3.7	5.1 *6.6	<10.0	39 *80	0.5	14 *1048	17 *55	<1.0	0
6b	2 *18	0.9	1.6 *2.2	<10.0	30 *25	0	8 *327	12 *10	<1.0	0
7	3 *25	1.6	2.1 *2.6	<10.0	26 *29	0.2	10 *387	16 *12	<1.0	14
7a	6 *42	<1.0	1.8 *3.3	<10.0	35 *38	0.2	7 *498	13 *18	<1.0	0
7b	2.5 *24	<1.0	1.6 *2.6	<10.0	35 *29	0.4	11 *377	13 *12	<1.0	1
8	3.2 *27	<1.0	2.1 *2.7	<10.0	28 *30	1.3	11 *401	16 *13	<1.0	3
8a	2.2 *23	<1.0	1.2 *2.5	<10.0	25 *28	0.4	0 *373	12 *12	<1.0	2
8b	2.8 *23	<1.0	1.2 *2.5	<10.0	23 *28	0.3	0 *373	10 *12	<1.0	5.3
8c	2.7 *5.0	<1.0	1.1 *1.2	<10.0	24 *13	0.3	6 *174	5 *4.0	<1.0	2
8d	0.5 *27	<1.0	2.0 *2.7	<10.0	25 *30	0.3	3 *397	9 *13	<1.0	10
8e	2.2 *26	<1.0	2.1 *2.7	<10.0	32 *30	0.4	3 *396	14 *13	<1.0	2

MAXIMOS PERMISIBLES NORMAS MEXICANAS:

	PLATA	ARSENICO	CADMIO	CROMO	COBRE	MERCURIO	NIQUEL	PLOMO	SELENIO	ZINC
VIDA ACUATICA	*	200	*	10	*	0.01	*	*	8	
CONSUMO HUMANO	50	50	10	50	1000	1	10	50	10	5000
RIEGO AGRICOLA		100	10	100	200		200	5000	20	2000
USO PECUARIO		200	20	100	500	3	1000	100	50	50000

CUADRO 4.1 RESULTADOS DE ANALISIS FISICOQUIMICOS EN AGUA ETAPA 4

ESTACION	pH	CONDUCTIVIDAD ELECTRICA µ mhos/cm	CLORUROS mg/L	SOLIDOS DISUELTOS mg/L	SOLIDOS SUSPENDIDOS mg/L	DUREZA mg/L	SULFATOS mg/L	NITROGENO AMONIACAL mg/L	OXIGENO DISUELTO mg/L	TURBIEDAD NTU	FENOLES mg/L	CIANUROS mg/L
9	8.52	1040	127	680	38	272	238	0.032	7.44	3	0.017	<0.02
9a	7.53	2040	527	1253	56	543	289	5.93	3.65	21	0.054	<0.02
9b	8.1	926	85	646	14	302	120	0.334	7.9	8	0.065	<0.02
13	8.09	1060	117	680	52	284	179	0.141	4.04	4	0.038	<0.02
10a	8.64	6333	841	8144	54	1505	2130	3	7.97	13	0.033	<0.02
11	8.40	1080	132	672	14	289	121	0.076	7.1	2	0.057	<0.02
11a	8.70	801	97	583	284	209	225	0.219	6.8	150	0.148	<0.02
11b	8.48	9400	1561	7124	301	2003	2620	8	9.1	21	0.09	<0.02
11c	7.30	2130	367	1136	118	491	452	7.908	0.91	61	0.045	<0.02
12	8.58	1110	130	721	22	282	231	0.252	7.1	7	0.003	<0.02
12a	8.38	3640	367	2432	256	1328	1263	0.904	9.6	35	0.026	<0.02
12b	7.97	887	82	480	112	178	63	0	6.38	85	0.091	<0.02
12c	8.17	2230	714	1882	120	395	399	0.044	16.36	40	0.026	<0.02

MAXIMOS PERMISIBLES NORMAS MEXICANAS:

VIDA ACUATICA	6-9							0.06	MIN 5.0		0.1	0.005
CONSUMO HUMANO	6-9	1000	250	500			500	1	MIN 4.0		0.3	0.02
RIEGO AGRICOLA	6-9	*1000	147.5	*500			130	5.0	MIN 3.2		---	---
USO PECUARIO	6-9	1000		1000			300	2.0	MIN 4.0		---	---

* NOTA: LOS VALORES DE CONDUCTIVIDAD ELECTRICA
> 500 NO EFECTOS NOCIVOS EN NINGUN CULTIVO.
500-1000 NO EFECTOS EN CULTIVOS SENSIBLES.
1000-2000 PARA COSECHAS QUE REQUIEREN MANEJO ESPECIAL.
2000-5000 PARA PLANTAS TOLERANTES EN SUELOS PERMEABLES.

CUADRO 4.2 RESULTADOS DE METALES PESADOS EN AGUA ETAPA 4

ESTACION	PLATA µg/L	ARSENICO µg/L	CADMIO µg/L	CROMO µg/L	COBRE µg/L	MERCURIO µg/L	NIQUEL µg/L	PLOMO µg/L	SELENIO µg/L	ZINC µg/L
9	<30 *23	5.1	12.4 *2.9	<10	<10 *28	<0.5	<50 *368	<80 *11	<0.5	<10
9a	<30 *74	3.1	46 *4.3	<10	<10 *50	<0.5	<50 *658	<80 *27	<0.5	<10
9b	<30 *41	1.8	4.7 *3.2	<10	<10 *37	<0.5	<50 *490	<80 *18	<0.5	<10
10	<30 *24	3.8	3.8 *2.6	<10	<10 *29	<0.5	<50 *381	<80 *12	<0.5	<10
10a	<30 *470	4.7	59 *9.9	<10	<10 *125	<0.5	<50 *1433	<80 *107	<0.5	<10
11	<30 *25	4.7	5 *2.6	<10	<10 *29	<0.5	<50 *387	<80 *12	<0.5	<10
11a	<30 *14	2.9	5 *2.0	<10	<10 *22	<0.5	<50 *291	<80 *8	<0.5	<10
11b	<30 *703	1.1	140.7 *11.9	<10	<10 *153	<0.5	<50 *1990	<80 *144	<0.5	<10
11c	<30 *63	1.1	32.2 *4.0	<10	<10 46	<0.5	<50 *606	<80 *24	<0.5	<10
12	<30 *24	2.4	0.9 *2.6	<10	<10 *29	<0.5	<50 *381	<80 *12	<0.5	<10
12a	<30 *347	1.2	5.6 *8.6	<10	<10 *108	<0.5	<50 *1406	<80 *86	<0.5	<10
12b	<30 *11	1.0	5.1 *1.8	<10	<10 *19	<0.5	<50 *257	<80 *7	<0.5	<10
12c	<30 *44	2.6	66 *3.4	<10	<10 *39	<0.5	<50 *508	<80 *19	<0.5	<10

MAXIMOS
PERMISIBLES
NORMAS
MEXICANAS:

VIDA ACUATICA	*	200	*	10	*	0.01	*	*	8	
CONSUMO HUMANO	50	50	10	50	1000	1	10	50	10	5000
RIEGO AGRICOLA		100	10	100	200		200	5000	20	2000
USO PECUARIO		200	20	100	500	3	1000	100	50	50000

Table 11
Analytical Data - Sediment

Parameter[a]	Station 1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
DATE	111292	111192	111192	111292	111392	111392	111392	111492	111592	111592	020893	020893
TIME	0900	1600	1000	1400	1000	1200	1600	0900	1200	1200	1040	1322
CONVENTIONALS												
acid volatile sulfide (mg/kg)	51	3,140	79	362	83	10	137	34	91	72	65	244
total organic carbon (mg/kg)	2,200	157,400	2,780	6,300	4,600	2,900	11,000	5,400	6,500	5,500	4,800	16,500
particle size distribution (% of dry wt.)												
clay, <0.0039 mm	5	13	8	5	26	9	9	5	28	40	6	20
silt, 0.0039-0.0625 mm	6	75	10	12	66	24	28	15	64	58	19	67
sand, 0.0625-2.0 mm	90	12	82	83	8	67	63	80	8	2	75	13
gravel, >2.0 mm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
PHENOLS AND CRESOLS (µg/kg)												
parachlorometa cresol	<700	14,100	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
pentachlorophenol	<5.0	<25	<25	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
phenol (C_6H_5OH) single compound	<1,400	4,600	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<1,400	<8,800	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
2-nitrophenol	<1,400	<8,800	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
2,4-dichlorophenol	<1,400	<8,800	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
2,4-dimethylphenol	<1,400	<8,800	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
2,4-dinitrophenol	<2,800	<18,000	<5,300	<18,000	<3,500	<2,900	<3,500	<2,700	<4,100	<4,900	<2,900	<4,300
2,4,6-trichlorophenol	<1,400	<8,800	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
4-nitrophenol	<2,800	<18,000	<5,300	<18,000	<3,500	<2,900	<3,500	<2,700	<4,100	<4,900	<2,900	<4,300
4,6-dinitro-ortho-cresol	<2,800	<18,000	<5,300	<18,000	<3,500	<2,900	<3,500	<2,700	<4,100	<4,900	<2,900	<4,300
ETHERS (µg/kg)												
bis(2-chloroethyoxy) methane	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
bis(2-chloroethyl) ether	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
bis(2-chloroisopropyl) ether	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
4-bromophenyl phenyl ether	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
4-chlorophenyl phenyl ether	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
HALOGENATED ALIPHATICS (µg/kg)												
bromodichloromethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
bromoform	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
carbon tetrachloride	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
chloroethane	<800	<1,100	<800	<1,200	<1,000	<700	<1,000	<800	<1,300	<1,500	<800	<1,400

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
chloroform	<400	<500	600	900	400	<300	<400	<300	<600	<600	<400	<600
dibromochloromethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
dichlorodifluoromethane	<800	<1,100	<800	<1,200	<1,000	<700	<1,000	<800	<1,300	<1,500	<800	<1,400
hexachlorobutadiene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
hexachlorocyclopentadiene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
hexachloroethane	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
methyl bromide	<800	<1,100	<800	<1,200	<1,000	<700	<1,000	<800	<1,300	<1,500	<800	<1,400
methyl chloride	<800	<1,100	<800	<1,200	<1,000	<700	<1,000	<800	<1,300	<1,500	<800	<1,400
methylene chloride	1,800	<500	3,200	4,000	2,300	<300	1,200	<300	<600	<600	<400	<600
tetrachloroethylene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
trichloroethylene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
trichlorofluoromethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
vinyl chloride	<800	<1,100	<800	<1,200	<1,000	<700	<1,000	<800	<1,300	<1,500	<800	<1,400
1,1-dichloroethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,1-dichloroethylene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,1,1-trichloroethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,1,2-trichloroethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,1,2,2-tetrachloroethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,2-dichloroethane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,2-dichloropropane	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,2-trans-dichloroethylene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,3-trans-dichloropropene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,3-cis-dichloropropene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
POLYCYCLIC AROMATIC HYDROCARBONS (µg/kg)												
acenaphthene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
acenaphthylene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
anthracene/phenanthrene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
benzo(A) anthracene 1,2-benzanthracene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
benzo(B) fluoranthene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
benzo(GHI) perylene 1,12-benzoperylene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
benzo(K) fluoranthene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
benzo-A-pyrene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
chrysene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
fluoranthene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
fluorene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
indeno(1,2,3-CD) pyrene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
naphthalene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<400	<400	<600
pyrene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
1,2,5,6-dibenzanthracene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
MONOCYCLIC AROMATICS (µg/kg)												
benzene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
chlorobenzene	<400	600	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
ethylbenzene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
hexachlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
nitrobenzene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
styrene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
toluene	500	900	1,300	2,400	800	<300	800	<300	<600	<600	<400	<600
xylene	<1,000	<1,300	<1,000	<1,400	1,200	<800	<1,200	<900	<1,600	<1,800	<1,000	<1,700
1,2-dichlorobenzene	<400	500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,2,4-trichlorobenzene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,3-dichlorobenzene	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
1,4-dichlorobenzene	<400	1,000	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
2,4-dinitrotoluene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
2,6-dinitrotoluene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
NITROSAMINES AND OTHER N COMPOUNDS (µg/kg)												
acrylonitrile	<1,600	<2,200	<1,600	<2,300	<2,000	<1,400	<2,000	<1,500	<2,600	<2,900	<1,700	<2,700
benzidine	<1,400	<8,800	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
n-nitrosodi-N-propylamine	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
n-nitrosodimethylamine	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
n-nitrosodiphenylamine	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
1,2-diphenylhydrazine	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
3,3-dichlorobenzidine	<1,400	<8,800	<2,700	<8,800	<1,800	<1,500	<1,800	<1,400	<2,100	<2,500	<1,500	<2,200
METALS (mg/kg)												
aluminum	3,560	4,640	5,340	4,210	12,000	5,950	5,540	5,990	15,100	19,500	7,340	15,800
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	1.73	7.74	2.57	1.93	7.93	8.77	3.05	4.47	8.74	7.63	5.18	7.70
beryllium	0.22	<0.43	0.28	0.26	0.73	0.29	0.55	0.37	0.77	0.85	0.44	0.68
cadmium	0.10	2.40	0.35	0.25	0.37	0.24	0.11	0.26	0.37	0.41	0.26	0.29
chromium	4.79	45.10	7.75	5.32	9.64	5.95	7.08	6.66	10.40	15.40	8.62	12.60
copper	4.61	292.00	19.20	12.50	12.00	5.90	2.82	6.13	10.10	15.50	4.79	8.23
lead	4.20	80.60	12.40	7.80	10.40	9.53	7.00	7.80	10.70	9.40	8.91	12.30
mercury	0.02	1.51	0.06	0.06	0.02	0.04	0.03	0.05	0.04	0.04	0.08	0.05
nickel	3.34	16.70	4.40	4.05	12.50	7.21	3.27	6.21	11.60	18.90	6.60	9.44
selenium	0.70	4.49	0.96	1.11	1.75	1.69	1.08	1.47	2.28	1.85	1.60	2.23
silver	<0.08	35.50	0.24	0.61	<0.07	<0.08	<0.07	<0.07	<0.08	<0.11	0.02	<0.15
thallium	<0.30	<0.70	<0.41	<0.39	<0.26	<0.29	<0.22	<0.25	<0.34	<0.48	<0.21	0.37
zinc	15.3	392.0	26.9	33.2	48.3	32.0	28.7	43.0	50.4	68.3	38.7	50.3

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
PESTICIDES (µg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
alpha benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
atrazine	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
beta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<6.0	67.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
chlorfenvinphos	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
chlorothalonil	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorpyrifos	<10	22.0	<10	7.7	<10	<10	<10	<10	<10	<10	<10	<10
p,p' DDD	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
p,p' DDE	<3.0	<3.0	<3.0	6.5	<3.0	3.5	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
p,p' DDT	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
delta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
diazinon	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
dibromochloropropane (dbcp)	<400	<500	<400	<500	<400	<300	<400	<300	<600	<600	<400	<600
dicamba	<10	<50	<50	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dichlorophenoxyacetic acid (2,4-D)	<50	<250	<250	<50	<50	<50	<50	<50	<50	<50	<50	<50
dicofol (kelthane)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
dieldrin	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dinoseb	<10	<50	<50	<10	<10	<10	<10	<10	<10	<10	<10	<10
endosulfan alpha	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan beta	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan sulfate	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin aldehyde	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
gamma-bhc (lindane)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
guthion	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
heptachlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
heptachlor epoxide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
isophorone	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
malathion	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
metolachlor	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
mirex	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
parathion	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
picloram	<10	<50	<50	<10	<10	<10	<10	<10	<10	<10	<10	<10
simazine	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	1	1a	2	2a	3	3a	3b	4	5	5a	5b	6
toxaphene	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4,5-TP (silvex)	<10	<50	<50	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB's AND RELATED COMPOUNDS (μg/kg)												
arochlor 1016	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1221	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1232	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1242	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1248	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1254	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1260	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2-chloronaphthalene	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
PHTHALATE ESTERS (μg/kg)												
bis(2-ethylhexyl) phthalate	<700	<4,400	<1,400	8,100	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
di-n-butyl phthalate	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
di-n-octyl phthalate	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
diethyl phthalate	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
dimethyl phthalate	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
n-butyl benzyl phthalate	<700	<4,400	<1,400	<4,400	<900	<800	<900	<700	<1,100	<1,300	<800	<1,100
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

a - all concentrations expressed in terms of dry weight of sediment

* - lab unable to produce satisfactory results

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
DATE	020893	020993	021093	021093	020993	021093	021193	021193	021193	021293	021293	022293
TIME	1645	0920	1640	1505	1502	1000	1735	0930	1000	1125	1210	0752
CONVENTIONALS												
acid volatile sulfide (mg/kg)	186	44	71	928	20	163	222	147	13	18	11	171
total organic carbon (mg/kg)	39,900	63,000	5,740	63,100	38,400	14,700	97,500	52,800	7,000	26,800	6,370	13,800
particle size distribution (% of dry wt.)												
clay, <0.0039 mm	4	15	10	25	6	10	25	9	20	10	20	10
silt, 0.0039-0.0625 mm	9	53	31	67	19	39	47	34	37	28	41	16
sand, 0.0625-2.0 mm	85	32	59	8	72	50	22	57	18	61	32	68
gravel, >2.0 mm	2	<1	<1	<1	3	1	6	1	25	1	<1	6
PHENOLS AND CRESOLS (μg/kg)												
parachlorometa cresol	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
pentachlorophenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
phenol (C_6H_5OH) single compound	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
2-nitrophenol	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
2,4-dichlorophenol	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
2,4-dimethylphenol	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
2,4-dinitrophenol	<3,000	<7,400	<3,100	<5,900	<3,500	<3,700	<6,900	<3,900	<3,700	<3,200	<2,900	<3,400
2,4,6-trichlorophenol	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
4-nitrophenol	<3,000	<7,400	<3,100	<5,900	<3,500	<3,700	<6,900	<3,900	<3,700	<3,200	<2,900	<3,400
4,6-dinitro-ortho-cresol	<3,000	<7,400	<3,100	<5,900	<3,500	<3,700	<6,900	<3,900	<3,700	<3,200	<2,900	<3,400
ETHERS (μg/kg)												
bis(2-chloroethyoxy) methane	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
bis(2-chloroethyl) ether	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
bis(2-chloroisopropyl) ether	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
4-bromophenyl phenyl ether	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
4-chlorophenyl phenyl ether	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
HALOGENATED ALIPHATICS (μg/kg)												
bromodichloromethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
bromoform	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
carbon tetrachloride	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
chloroethane	<900	<1,900	<900	<2,000	<1,100	<1,200	<2,400	<1,200	<1,200	<1,000	<900	<1,100

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
chloroform	<400	1,600	600	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
dibromochloromethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
dichlorodifluoromethane	<900	<1,900	<900	<2,000	<1,100	<1,200	<2,400	<1,200	<1,200	<1,000	<900	<1,100
hexachlorobutadiene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
hexachlorocyclopentadiene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
hexachloroethane	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
methyl bromide	<900	<1,900	<900	<2,000	<1,100	<1,200	<2,400	<1,200	<1,200	<1,000	<900	<1,100
methyl chloride	<900	<1,900	<900	<2,000	<1,100	<1,200	<2,400	<1,200	<1,200	<1,000	<900	<1,100
methylene chloride	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
tetrachloroethylene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
trichloroethylene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
trichlorofluoromethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
vinyl chloride	<900	<1,900	<900	<2,000	<1,100	<1,200	<2,400	<1,200	<1,200	<1,000	<900	<1,100
1,1-dichloroethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,1-dichloroethylene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,1,1-trichloroethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,1,2-trichloroethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,1,2,2-tetrachloroethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,2-dichloroethane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,2-dichloropropane	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,2-trans-dichloroethylene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,3-trans-dichloropropene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,3-cis-dichloropropene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
POLYCYCLIC AROMATIC HYDROCARBONS (µg/kg)												
acenaphthene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
acenaphthylene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
anthracene/phenanthrene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
benzo(A) anthracene 1,2-benzanthracene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
benzo(B) fluoranthene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
benzo(GHI) perylene 1,12-benzoperylene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
benzo(K) fluoranthene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
benzo-A-pyrene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
chrysene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
fluoranthene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
fluorene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
indeno(1,2,3-CD) pyrene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
naphthalene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
pyrene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
1,2,5,6-dibenzanthracene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
MONOCYCLIC AROMATICS (µg/kg)												
benzene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
chlorobenzene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
ethylbenzene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
hexachlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
nitrobenzene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
styrene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
toluene	<400	1,300	500	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
xylene	<1,100	<2,300	<1,100	<2,400	<1,300	<1,400	<2,800	<1,500	<1,400	<1,100	<1,000	<1,300
1,2-dichlorobenzene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,2,4-trichlorobenzene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,3-dichlorobenzene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
1,4-dichlorobenzene	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
2,4-dinitrotoluene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
2,6-dinitrotoluene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
NITROSAMINES AND OTHER N COMPOUNDS (µg/kg)												
acrylonitrile	<1,800	<3,800	<1,800	<4,000	<2,200	<2,300	<4,700	<2,400	<2,300	<1,900	<1,700	<2,100
benzidine	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
n-nitrosodi-N-propylamine	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
n-nitrosodimethylamine	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
n-nitrosodiphenylamine	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
1,2-diphenylhydrazine	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
3,3-dichlorobenzidine	<1,500	<3,700	<1,600	<3,000	<1,800	<1,900	<3,500	<2,000	<1,900	<1,600	<1,500	<1,700
METALS (mg/kg)												
aluminum	2,450	2,950	8,390	12,100	4,670	10,800	6,890	4,340	14,100	6,080	8,930	4,730
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	1.44	1.61	3.92	4.46	4.54	5.28	2.51	2.30	2.96	2.31	3.62	3.98
beryllium	<0.18	<0.42	0.44	0.57	0.26	0.55	<0.44	<0.21	0.66	0.24	0.49	0.29
cadmium	0.18	0.15	0.20	0.53	0.20	0.26	0.19	0.19	0.32	0.22	0.21	0.09
chromium	3.73	3.27	8.12	43.90	4.32	9.29	5.46	3.66	13.20	6.02	9.56	4.38
copper	1.45	2.50	5.68	20.80	3.72	7.00	2.90	2.52	10.20	4.16	6.46	2.70
lead	2.87	3.27	9.37	29.70	10.80	10.60	4.82	3.02	13.40	4.86	10.30	7.28
mercury	<0.04	<0.03	0.04	0.20	<0.04	0.05	<0.04	0.04	0.06	<0.03	0.04	0.02
nickel	2.07	2.09	6.35	8.98	3.67	7.75	4.60	3.04	10.90	4.70	7.53	4.06
selenium	0.89	0.52	0.51	0.56	0.32	0.66	0.49	0.36	1.95	0.25	1.35	1.53
silver	<0.14	<0.25	<0.10	0.83	0.23	<0.16	<0.24	<0.17	<0.13	<0.14	<0.11	<0.07
thallium	<0.10	<0.23	0.24	<0.22	0.20	0.35	<0.25	<0.17	0.29	<0.13	0.25	0.17
zinc	7.33	17.1	37.1	92.3	19.9	37.0	18.0	11.8	49.0	17.8	38.9	24.0

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
PESTICIDES (µg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
alpha benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
atrazine	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
beta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
chlorfenvinphos	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
chlorothalonil	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorpyrifos	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
p,p' DDD	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
p,p' DDE	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	4.0
p,p' DDT	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
delta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
diazinon	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
dibromochloropropane (dbcp)	<400	<800	<400	<800	<500	<500	<1,000	<500	<500	<400	<400	<500
dicamba	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dichlorophenoxyacetic acid (2,4-D)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
dicofol (kelthane)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
dieldrin	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dinoseb	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
endosulfan alpha	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan beta	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan sulfate	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin aldehyde	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
gamma-bhc (lindane)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
guthion	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
heptachlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
heptachlor epoxide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
isophorone	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
malathion	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
metolachlor	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
mirex	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
parathion	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
picloram	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
simazine	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	6a	6b	7	7a	7b	8	8a	8b	8c	8d	8e	9
toxaphene	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4,5-TP (silvex)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB's AND RELATED COMPOUNDS (μg/kg)												
arochlor 1016	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1221	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1232	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1242	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1248	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1254	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1260	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2-chloronaphthalene	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
PHTHALATE ESTERS (μg/kg)												
bis(2-ethylhexyl) phthalate	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
di-n-butyl phthalate	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
di-n-octyl phthalate	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
diethyl phthalate	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
dimethyl phthalate	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
n-butyl benzyl phthalate	<800	<1,900	<800	<1,500	<900	<1,000	<1,800	<1,000	<1,000	<800	<800	<900
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

a - all concentrations expressed in terms of dry weight of sediment

* - lab unable to produce satisfactory results

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
DATE	032293	032293	032393	032393	032493	032393	032493	032593	032493	032693	032593	032693
TIME	1116	1330	0845	1614	0835	1753	1640	1000	1343	1200	1700	1805
CONVENTIONALS												
acid volatile sulfide (mg/kg)	1,040	38	227	1,250	113	1,130	301	397	221	16	68	253
total organic carbon (mg/kg)	24,100	17,500	8,550	14,100	9,480	15,500	8,600	191,000	10,600	11,900	12,400	13,400
particle size distribution (% of dry wt.)												
clay, <0.0039 mm	4	7	5	18	18	12	12	14	8	26	28	20
silt, 0.0039-0.0625 mm	62	74	12	47	56	27	35	49	24	62	66	45
sand, 0.0625-2.0 mm	34	7	78	26	26	61	51	37	66	10	6	7
gravel, >2.0 mm	<1	<1	5	8	1	<1	1	<1	2	3	<1	28
PHENOLS AND CRESOLS (µg/kg)												
parachlorometa cresol	1,200	<1,000	800	<1,000	<900	<4,100	<800	32,000	1,300	<900	<1,000	<1,200
pentachlorophenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
phenol (C_6H_5OH) single compound	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
2-nitrophenol	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
2,4-dichlorophenol	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
2,4-dimethylphenol	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
2,4-dinitrophenol	<3,700	<3,700	<3,000	<4,000	<3,400	<16,100	<3,100	<63,000	<3,100	<3,500	<4,000	<4,600
2,4,6-trichlorophenol	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
4-nitrophenol	<3,700	<3,700	<3,000	<4,000	<3,400	<16,100	<3,100	<63,000	<3,100	<3,500	<4,000	<4,600
4,6-dinitro-ortho-cresol	<3,700	<3,700	<3,000	<4,000	<3,400	<16,100	<3,100	<63,000	<3,100	<3,500	<4,000	<4,600
ETHERS (µg/kg)												
bis(2-chloroethyoxy) methane	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
bis(2-chloroethyl) ether	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
bis(2-chloroisopropyl) ether	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
4-bromophenyl phenyl ether	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
4-chlorophenyl phenyl ether	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
HALOGENATED ALIPHATICS (µg/kg)												
bromodichloromethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
bromoform	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
carbon tetrachloride	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
chloroethane	<1,200	<1,200	<900	<1,300	<1,000	<1,000	<900	<2,100	<1,000	<1,100	<1,300	<1,500

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
chloroform	<500	<500	<400	<500	<400	<400	<400	<900	2,600	<500	<500	<600
dibromochloromethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
dichlorodifluoromethane	<1,200	<1,200	<900	<1,300	<1,000	<1,000	<900	<2,100	<1,000	<1,100	<1,300	<1,500
hexachlorobutadiene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
hexachlorocyclopentadiene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
hexachloroethane	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
methyl bromide	<1,200	<1,200	<900	<1,300	<1,000	<1,000	<900	<2,100	<1,000	<1,100	<1,300	<1,500
methyl chloride	<1,200	<1,200	<900	<1,300	<1,000	<1,000	<900	<2,100	<1,000	<1,100	<1,300	<1,500
methylene chloride	<500	<500	<400	<500	<400	<400	<400	<900	1,200	<500	<500	<600
tetrachloroethylene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
trichloroethylene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
trichlorofluoromethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
vinyl chloride	<1,200	<1,200	<900	<1,300	<1,000	<1,000	<900	<2,100	<1,000	<1,100	<1,300	<1,500
1,1-dichloroethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,1-dichloroethylene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,1,1-trichloroethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,1,2-trichloroethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,1,2,2-tetrachloroethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,2-dichloroethane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,2-dichloropropane	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,2-trans-dichloroethylene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,3-trans-dichloropropene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,3-cis-dichloropropene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
POLYCYCLIC AROMATIC HYDROCARBONS (µg/kg)												
acenaphthene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
acenaphthylene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
anthracene/phenanthrene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
benzo(A) anthracene 1,2-benzanthracene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
benzo(B) fluoroanthene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
benzo(GHI) perylene 1,12-benzoperylene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
benzo(K) fluoranthene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
benzo-A-pyrene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
chrysene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
fluoranthene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
fluorene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
indeno(1,2,3-CD) pyrene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
naphthalene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
pyrene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
1,2,5,6-dibenzanthracene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
MONOCYCLIC AROMATICS (μg/kg)												
benzene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
chlorobenzene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
ethylbenzene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
hexachlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
nitrobenzene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
styrene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
toluene	2,000	<500	<400	<500	<400	<400	<400	33,000	4,400	<500	<500	<600
xylene	<1,400	<1,400	<1,100	<1,500	<1,200	<1,200	<1,100	<2,600	<1,100	<1,300	<1,500	<1,800
1,2-dichlorobenzene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,2,4-trichlorobenzene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,3-dichlorobenzene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
1,4-dichlorobenzene	<500	<500	<400	<500	<400	<400	<400	<900	<400	<500	<500	<600
2,4-dinitrotoluene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
2,6-dinitrotoluene	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
NITROSAMINES AND OTHER N COMPOUNDS (μg/kg)												
acrylonitrile	<2,300	<2,300	<1,800	<2,500	<2,000	<2,000	<1,800	<4,200	<1,800	<2,200	<2,500	<3,000
benzidine	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
n-nitrosodi-N-propylamine	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
n-nitrosodimethylamine	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
n-nitrosodiphenylamine	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
1,2-diphenylhydrazine	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
3,3-dichlorobenzidine	<1,900	<1,900	<1,500	<2,000	<1,700	<8,100	<1,600	<32,000	<1,600	<1,800	<2,000	<2,300
METALS (mg/kg)												
aluminum	7,220	9,410	4,290	11,100	7,250	7,560	8,880	10,900	5,470	16,500	19,100	10,200
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	4.74	4.05	3.05	5.20	4.99	4.02	6.11	2.60	3.22	4.42	4.62	4.72
beryllium	0.50	0.51	0.27	0.64	0.40	0.42	0.54	0.55	0.32	0.61	0.73	0.46
cadmium	0.42	0.25	0.06	0.24	0.23	0.47	0.16	2.31	0.27	0.33	0.19	0.46
chromium	11.70	7.60	4.00	11.10	6.35	8.87	9.22	18.00	5.97	12.90	17.50	7.81
copper	11.60	7.34	2.32	8.46	5.17	15.10	5.21	27.80	6.91	8.48	7.25	7.34
lead	30.10	13.20	7.56	18.60	13.50	50.70	18.40	32.40	15.10	14.60	14.90	12.10
mercury	0.14	0.06	0.03	0.13	0.04	0.09	0.05	0.04	0.06	0.03	0.04	0.02
nickel	8.66	7.34	3.60	10.60	6.97	8.36	8.55	10.90	6.19	12.20	13.30	9.66
selenium	<0.21	1.64	2.64	1.33	1.58	0.66	1.14	2.23	2.43	1.29	1.08	1.37
silver	0.93	0.14	<0.07	<0.10	<0.09	0.09	<0.07	0.30	0.21	<0.06	<0.07	<0.07
thallium	0.61	0.16	<0.13	0.25	0.16	<0.18	<0.14	<0.24	<0.15	0.17	0.17	0.17
zinc	112.0	40.5	21.9	67.9	34.6	154.0	58.9	184.0	53.5	47.8	57.8	38.2

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
PESTICIDES (µg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
alpha benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
atrazine	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
beta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<3.0	<3.0	<3.0	<3.0	<3.0	59.0	172.0	185.0	<3.0	<3.0	<3.0	<3.0
chlorfenvinphos	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
chlorothalonil	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorpyrifos	<10	<10	<10	<10	<10	<10	<10	94.0	<10	<10	<10	<10
p,p' DDD	<3.0	<3.0	<3.0	<3.0	<3.0	8.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
p,p' DDE	12.5	6.5	<1.5	22.0	6.0	27.0	13.0	<1.5	7.0	<1.5	<1.5	<1.5
p,p' DDT	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
delta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
diazinon	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
dibromochloropropane (dbcp)	<500	<500	<400	<400	<400	<400	<400	<900	<400	<500	<500	<600
dicamba	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dichlorophenoxyacetic acid (2,4-D)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
dicofol (kelthane)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
dieldrin	<2.0	<2.0	<2.0	<2.0	<2.0	6.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dinoseb	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
endosulfan alpha	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan beta	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan sulfate	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin aldehyde	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
gamma-bhc (lindane)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
guthion	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
heptachlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
heptachlor epoxide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
isophorone	<1,000	<1,000	<800	<900	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
malathion	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
metolachlor	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
mirex	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
parathion	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
picloram	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
simazine	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station											
	9a	9b	10	10a	11	11a	11b	11c	12	12a	12b	12c
toxaphene	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4,5-TP (silvex)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB's AND RELATED COMPOUNDS (µg/kg)												
arochlor 1016	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1221	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1232	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1242	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1248	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1254	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1260	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2-chloronaphthalene												
PHTHALATE ESTERS (µg/kg)												
bis(2-ethylhexyl) phthalate	1,400	<1,000	<800	<1,000	<900	<4,100	<800	65,000	<800	<900	<1,000	<1,200
di-n-butyl phthalate	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
di-n-octyl phthalate	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
diethyl phthalate	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
dimethyl phthalate	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
n-butyl benzyl phthalate	<1,000	<1,000	<800	<1,000	<900	<4,100	<800	<16,000	<800	<900	<1,000	<1,200
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

a - all concentrations expressed in terms of dry weight of sediment

* - lab unable to produce satisfactory results

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station								
	12d	12e	13	14	15	15a	16	17	18
DATE	011193	011293	011193	011293	011293	011293	011393	011493	011493
TIME	1045	1400	1400	1415	1700	1730	1000	1000	1500
CONVENTIONALS									
acid volatile sulfide (mg/kg)	740	130	68	76	81	890	53	34	48
total organic carbon (mg/kg)	29,800	14,300	6,900	2,870	4,210	17,900	3,460	5,200	3,900
particle size distribution (% of dry wt.)									
clay, <0.0039 mm	29	5	12	5	1	15	7	2	4
silt, 0.0039-0.0625 mm	66	38	32	12	4	41	17	24	10
sand, 0.0625-2.0 mm	5	45	56	83	95	44	76	74	86
gravel, >2.0 mm	<1	2	<1	<1	<1	<1	<1	<1	<1
PHENOLS AND CRESOLS (µg/kg)									
parachlorometa cresol	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
pentachlorophenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
phenol (C_6H_5OH) single compound	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
phenolics recoverable	*	*	*	*	*	*	*	*	*
2-chlorophenol	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
2-nitrophenol	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
2,4-dichlorophenol	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
2,4-dimethylphenol	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
2,4-dinitrophenol	<6,500	<4,300	<3,200	<2,900	<2,700	<7,400	<3,000	<2,900	<2,800
2,4,6-trichlorophenol	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
4-nitrophenol	<6,500	<4,300	<3,200	<2,900	<2,700	<7,400	<3,000	<2,900	<2,800
4,6-dinitro-ortho-cresol	<6,500	<4,300	<3,200	<2,900	<2,700	<7,400	<3,000	<2,900	<2,800
ETHERS (µg/kg)									
bis(2-chloroethyoxy) methane	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
bis(2-chloroethyl) ether	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
bis(2-chloroisopropyl) ether	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
4-bromophenyl phenyl ether	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
4-chlorophenyl phenyl ether	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
HALOGENATED ALIPHATICS (µg/kg)									
bromodichloromethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
bromoform	<900	<600	<400	<400	<300	<500	<400	<400	<400
carbon tetrachloride	<900	<600	<400	<400	<300	<500	<400	<400	<400
chloroethane	<2,000	<1,400	<1,000	<900	<800	<1,200	<900	<800	<800

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station								
	12d	12e	13	14	15	15a	16	17	18
chloroform	<900	<600	<400	<400	<300	<500	<400	<400	<400
dibromochloromethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
dichlorodifluoromethane	<2,000	<1,400	<1,000	<900	<800	<1,200	<900	<800	<800
hexachlorobutadiene	<900	<600	<400	<400	<300	<500	<400	<400	<400
hexachlorocyclopentadiene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<800
hexachloroethane	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<800
methyl bromide	<2,000	<1,400	<1,000	<900	<800	<1,200	<900	<800	<800
methyl chloride	<2,000	<1,400	<1,000	<900	<800	<1,200	<900	<800	<800
methylene chloride	<900	<600	<400	<400	<300	<500	<400	<400	<400
tetrachloroethylene	<900	<600	<400	<400	<300	<500	<400	<400	<400
trichloroethylene	<900	<600	<400	<400	<300	<500	<400	<400	<400
trichlorofluoromethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
vinyl chloride	<2,000	<1,400	<1,000	<900	<800	<1,200	<900	<800	<800
1,1-dichloroethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,1-dichloroethylene	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,1,1-trichloroethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,1,2-trichloroethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,1,2,2-tetrachloroethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,2-dichloroethane	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,2-dichloropropane	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,2-trans-dichloroethylene	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,3-trans-dichloropropene	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,3-cis-dichloropropene	<900	<600	<400	<400	<300	<500	<400	<400	<400
POLYCYCLIC AROMATIC HYDROCARBONS (μg/kg)									
acenaphthene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
acenaphthylene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
anthracene/phenanthrene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
benzo(A) anthracene 1,2-benzanthracene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
benzo(B) fluoranthene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
benzo(GHI) perylene 1,12-benzoperylene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
benzo(K) fluoranthene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
benzo-A-pyrene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
chrysene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
fluoranthene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
fluorene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
indeno(1,2,3-CD) pyrene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
naphthalene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
pyrene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
1,2,5,6-dibenzanthracene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station								
	12d	12e	13	14	15	15a	16	17	18
MONOCYCLIC AROMATICS (µg/kg)									
benzene	<900	<600	<400	<400	<300	<500	<400	<400	<400
chlorobenzene	<900	<600	<400	<400	<300	<500	<400	<400	<400
ethylbenzene	<900	<600	<400	<400	<300	<500	<400	<400	<400
hexachlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
nitrobenzene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
styrene	<900	<600	<400	<400	<300	<500	<400	<400	<400
toluene	<900	<600	<400	<400	<300	600	<400	<400	<400
xylene	<2,500	<1,700	<1,200	<1,000	<1,000	<1,400	<1,100	<1,000	<1,000
1,2-dichlorobenzene	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,2,4-trichlorobenzene	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,3-dichlorobenzene	<900	<600	<400	<400	<300	<500	<400	<400	<400
1,4-dichlorobenzene	<900	<600	<400	<400	<300	<500	<400	<400	<400
2,4-dinitrotoluene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
2,6-dinitrotoluene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
NITROSAMINES AND OTHER N COMPOUNDS (µg/kg)									
acrylonitrile	<4,100	<2,700	<2,000	<1,700	<1,600	<2,300	<1,800	<1,700	<1,600
benzidine	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
n-nitrosodi-N-propylamine	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
n-nitrosodimethylamine	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
n-nitrosodiphenylamine	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
1,2-diphenylhydrazine	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
3,3-dichlorobenzidine	<3,300	<2,200	<1,600	<1,500	<1,400	<3,700	<1,500	<1,500	<1,400
METALS (mg/kg)									
aluminum	15,900	8,560	5,990	4,750	2,100	7,650	6,260	3,870	3,310
antimony	*	*	*	*	*	*	*	*	*
arsenic	10.30	2.55	4.86	2.62	3.44	2.95	2.80	3.81	2.88
beryllium	0.69	0.42	0.33	0.24	0.14	0.43	0.31	0.25	0.23
cadmium	0.36	0.25	0.15	0.06	0.04	0.27	0.16	0.12	0.12
chromium	16.20	7.11	6.10	4.90	2.64	8.78	6.26	4.89	3.64
copper	14.50	6.10	3.70	2.05	1.09	11.00	3.32	2.21	2.20
lead	24.90	5.91	6.60	4.50	4.35	9.34	5.72	4.36	4.02
mercury	0.06	0.03	0.05	0.01	0.02	0.11	0.03	0.00	0.02
nickel	11.70	8.41	5.56	4.16	2.31	7.41	5.06	4.28	3.66
selenium	2.21	1.37	1.12	1.19	1.11	1.54	1.61	1.25	1.29
silver	<0.15	<0.11	<0.11	<0.09	<0.09	1.01	<0.09	<0.08	<0.09
thallium	0.48	0.31	0.19	<0.19	<0.19	<0.23	0.16	0.18	<0.16
zinc	67.6	28.0	23.9	18.5	12.9	39.8	27.2	10.8	16.9

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station								
	12d	12e	13	14	15	15a	16	17	18
PESTICIDES (µg/kg)									
aldicarb	*	*	*	*	*	*	*	*	*
aldrin	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
alpha benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
atrazine	<50	<50	<50	<50	<50	<50	<50	<50	<50
beta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
carbaryl	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*
chlordane	<3.0	<3.0	<3.0	<3.0	<3.0	33.0	<3.0	<3.0	<3.0
chlorfenvinphos	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
chlorothalonil	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorpyrifos	<10	<10	<10	<10	<10	<10	<10	<10	<10
p,p' DDD	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
p,p' DDE	35.0	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
p,p' DDT	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
delta benzene hexachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
diazinon	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
dibromochloropropane (dbcp)	<900	<600	<400	<400	<400	<400	<400	<400	<400
dicamba	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dichlorophenoxyacetic acid (2,4-D)	<50	<50	<50	<50	<50	<50	<50	<50	<50
dicofol (kelthane)	<50	<50	<50	<50	<50	<50	<50	<50	<50
dieldrin	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dinoseb	<10	<10	<10	<10	<10	<10	<10	<10	<10
endosulfan alpha	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan beta	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
endosulfan sulfate	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
endrin aldehyde	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
gamma-bhc (lindane)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
guthion	<50	<50	<50	<50	<50	<50	<50	<50	<50
heptachlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
heptachlor epoxide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
isophorone	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
malathion	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methomyl	*	*	*	*	*	*	*	*	*
methoxychlor	<10	<10	<10	<10	<10	<10	<10	<10	<10
metolachlor	<10	<10	<10	<10	<10	<10	<10	<10	<10
mirex	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
parathion	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
picloram	<10	<10	<10	<10	<10	<10	<10	<10	<10
simazine	<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 11 (continued)
Analytical Data - Sediment

Parameter[a]	Station								
	12d	12e	13	14	15	15a	16	17	18
toxaphene	<50	<50	<50	<50	<50	<50	<50	<50	<50
2,4,5-TP (silvex)	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB's AND RELATED COMPOUNDS (µg/kg)									
arochlor 1016	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1221	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1232	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1242	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1248	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1254	<20	<20	<20	<20	<20	<20	<20	<20	<20
arochlor 1260	<20	<20	<20	<20	<20	<20	<20	<20	<20
2-chloronaphthalene	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
PHTHALATE ESTERS (µg/kg)									
bis(2-ethylhexyl) phthalate	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
di-n-butyl phthalate	2,400	<1,100	<800	<800	<700	<1,900	<800	<800	<700
di-n-octyl phthalate	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
diethyl phthalate	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
dimethyl phthalate	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
n-butyl benzyl phthalate	<1,700	<1,100	<800	<800	<700	<1,900	<800	<800	<700
GENERAL INORGANICS (mg/kg)									
cyanide	3.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

[a] - all concentrations expressed in terms of dry weight of sediment
* - lab unable to produce satisfactory results

Table 11 (continued)

Analytical Data - Sediment
Comisión Nacional del Agua

CUADRO 1.3 RESULTADOS DE ANALISIS DE METALES PESADOS EN SEDIMENTOS ETAPA 1

ESTACION	PLATA mg/kg	COBRE mg/kg	NIQUEL mg/kg	ZINC mg/kg
1	0.93	4.69	2.70	8.68
1a	5.2	129.6	11.50	40.65
2	1.69	15.30	3.80	19.19
2a	1.43	8.74	3.00	24.20
3	1.56	4.91	6.00	11.18
3a	2.1	2.90	4.70	8.04
3b	1.52	0.86	4.30	4.69
4	1.66	2.85	3.90	10.61
5	1.66	1.21	5.40	6.79
5a	2.31	3.79	6.50	9.89

'UADRO 2.3 RESULTADOS DE ANALISIS DE METALES PESADOS EN SEDIMENTOS ETAPA 2

ESTACION DE MONITOREO	ARSENICO mg/kg	CADMIO mg/kg	COBRE mg/kg	MERCURIO mg/kg	NIQUEL mg/kg	PLATA mg/kg	PLOMO mg/kg	ZINC mg/kg	SELENIO mg/kg	CROMO mg/kg
12d	0.015	1.15	5.16	<0.0083	17.16	<0.5	22.33	42.33	0.03	7.55
12e	1.850	1.5	4.5	<0.0063	19.98	<0.5	15.66	38.50	0.06	9.00
13	4.056	1.15	5.16	<0.0083	24.00	<0.5	21.50	35.50	<0.0083	15.15
14	8.47	1.5	3.33	<0.0083	21.33	<0.5	21.00	35.50	<0.0083	9.50
15	2.41	1.33	5.83	<0.0083	18.50	0.53	20.50	35.50	<0.0083	9.50
15a	3.77	1.66	3.00	<0.0083	20.56	<0.5	25.16	27.00	<0.0083	8.15
16	4.82	1.66	5.16	<0.0083	25.50	0.83	26.50	53.83	<0.0083	13.55
17	4.07	1.66	4.33	0.015	22.56	<0.5	23.30	38.50	<0.0083	14.55
18	4.52	1.5	6.33	<0.0083	18.83	<0.5	21.50	34.65	<0.0083	5.65

CUADRO 3.3 RESULTADOS DE ANALISIS DE METALES PESADOS EN SEDIMENTOS ETAPA 3

ESTACION	ARSENICO mg/kg	CADMIO mg/kg	COBRE mg/kg	MERCURIO mg/kg	NIQUEL mg/kg	PLATA mg/kg	PLOMO mg/kg	ZINC mg/kg	SELENIO mg/kg	CROMO mg/kg
5b	3.215	0.306	1.025	0.09	1.82	0.963	3.638	0.694	<.006	< .063
6	0.925	0.306	0.738	0.08	1.606	0.931	3.6	0.706	<.006	< .063
6a	4.205	0.288	0.681	0.09	1.469	0.919	3.606	0.55	<.006	< .063
6b	1.233	0.288	0.688	0.06	1.575	0.925	3.438	0.6	<.006	< .063
7	0.833	0.294	0.656	0.06	2.044	0.919	3.575	0.744	<.006	< .063
7a	1.982	0.431	0.775	0.06	1.863	1.081	3.55	1.663	<.006	< .063
7b	0.745	0.288	0.631	0.07	1.756	0.919	3.419	0.431	<.006	< .063
8	0.925	0.3	0.513	0.05	1.619	0.875	3.4	0.419	<.006	< .063
8a	1.233	0.313	0.544	0.05	1.656	0.881	3.444	0.756	<.006	< .063
8b	1.233	0.306	0.919	0.07	1.456	0.925	3.619	0.713	<.006	< .063
8c	1.119	0.3	0.706	0.07	2.013	0.913	3.5	0.519	<.006	< .063
8d	1.02	0.295	0.513	0.05	1.923	0.815	2.845	0.431	<.006	< .063
8e	1.045	0.295	0.544	0.05	0.823	0.823	2.633	0.431	<.006	< .063

CUADRO 4.3 RESULTADOS DE ANALISIS DE METALES PESADOS EN AGUA EN SEDIMENTOS ETAPA 4

ESTACION DE MONITOREO	ARSENICO mg/kg	CADMIO mg/kg	COBRE mg/kg	MERCURIO mg/kg	NIQUEL mg/kg	PLATA mg/kg	PLOMO mg/kg	ZINC mg/kg	SELENIO mg/kg	CROMO mg/kg
9	3.31	1.33	3.83	<0.0083	15.83	<0.5	40	28.83	0.043	7.51
9a	2.860	1.33	9	0.053	20.66	1.11	20.83	129.15	0.015	15.16
9b	1.96	1.08	5.33	<0.0083	15.83	<0.5	18.15	61.66	0.015	6.00
10	3.47	0.83	3.16	<0.0083	13.83	<0.5	18.15	144.33	0.03	6.00
10a	3.01	1.15	6.83	0.023	18.50	0.53	28.33	57.83	0.03	12.50
11	1.62	1.50	6.00	<0.0083	20.66	<0.5	25.16	46.16	0.023	14.66
11a	2.66	1.50	5.83	<0.0083	16.50	<0.5	33.50	57.33	0.023	6.00
11b	1.82	1.15	6.33	0.015	15.83	<0.5	16.66	111.65	<0.0083	10.33
11c	2.56	1.50	6.33	<0.0083	19.83	<0.5	17.66	36.50	0.08	13.65
12	2.41	1.00	6.00	<0.0083	13.83	<0.5	16.33	48.00	<0.0083	11.00
12a	3.77	1.00	6.83	<0.0083	18.50	<0.5	17.66	40.50	0.03	11.66
12b	2.56	1.33	5.33	0.015	20.66	<0.5	19.16	50.00	0.015	15.66
12c	3.01	1.50	6.00	<0.0083	18.50	<0.5	17.33	34.65	0.045	10.33

Table 12
Analytical Data - Tissue

Parameter[a]	Station/Species 1				2				3		3a	
	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp fillets	channel catfish, whole	carp, whole	carp fillets
NUMBER OF SPECIMENS IN SAMPLE	5	5	5	5	5	5	7	1	1	18	5	5
DATE	111292	111292	111292	111292	111192	111192	111192	111192	111392	111392	111392	111392
TIME	0830	0830	0830	0830	0830	0830	0830	0830	0830	0830	1230	1230
CONVENTIONALS												
lipid content (%)	3.2	1.8	4.0	1.4	3.0	2.4	**	1.2	1.6	3.5	2.2	3.0
PHENOLS AND CRESOLS (mg/kg)												
parachlorometa cresol	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
pentachlorophenol	<20	<20	<20	<4.0	<20	<20	<20	<4.0	<4.0	<20	<4.0	<4.0
phenol (C_6H_5OH) single compound	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
2-nitrophenol	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
2,4-dichlorophenol	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
2,4-dimethylphenol	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
2,4-dinitrophenol	<20	<20	<20	<4.0	<20	<20	<20	<4.0	<4.0	<20	<4.0	<4.0
2,4,6-trichlorophenol	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
4-nitrophenol	<20	<20	<20	<4.0	<20	<20	<20	<4.0	<4.0	<20	<4.0	<4.0
4,6-dinitro-ortho-cresol	<20	<20	<20	<4.0	<20	<20	<20	<4.0	<4.0	<20	<4.0	<4.0
ETHERS (mg/kg)												
bis(2-chloroethyoxy) methane	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
bis(2-chloroethyl) ether	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
bis(2-chloroisopropyl) ether	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
4-bromophenyl phenyl ether	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
4-chlorophenyl phenyl ether	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
HALOGENATED ALIPHATICS (mg/kg)												
bromodichloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
bromoform	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chloroethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
chloroform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dibromochloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 1				Station/Species 2				Station/Species 3		Station/Species 3a	
	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp fillets	channel catfish, whole	carp, whole	carp fillets
hexachlorobutadiene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
hexachloroethane	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
methyl bromide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methylene chloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
tetrachloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
vinyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)												
acenaphthene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
acenaphthylene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
anthracene/phenanthrene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
benzo(B) fluoranthene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
benzo(GHI) perylene 1,12-benzoperylene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
benzo(K) fluoranthene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
benzo-A-pyrene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
chrysene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
fluoranthene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
fluorene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
indeno(1,2,3-CD) pyrene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
naphthalene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
1,2,5,6-dibenzanthracene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	1				2				3		3a	
	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp fillets	channel catfish, whole	carp, whole	carp fillets
MONOCYCLIC AROMATICS (mg/kg)												
benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	<0.02	<0.02	<0.02
nitrobenzene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<0.002	<0.002	<0.002	<0.002	<0.002
styrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<1.0	<1.0	<5.0	<1.0	<1.0
toluene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
xylene	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	0.04	0.06	0.05	<0.06	<0.06	<0.06	<0.06	<0.06
1,2,4-trichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-dinitrotoluene	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
								<1.0	<1.0	<5.0	<1.0	<1.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)												
acrylonitrile	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
n-nitrosodi-N-propylamine	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
n-nitrosodimethylamine	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
n-nitrosodiphenylamine	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
1,2-diphenylhydrazine	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
3,3-dichlorobenzidine	<10	<10	<10	<2.0	<10	<10	<10	<2.0	<2.0	<10	<2.0	<2.0
METALS (mg/kg)												
aluminum	27.6	<1.0	6.7	<1.2	8.3	<1.0	9.6	<1.0	<1.0	41.0	16.8	<1.0
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	0.053	0.040	<0.026	<0.028	0.044	0.049	0.064	<0.028	<0.028	<0.027	<0.028	<0.028
beryllium	<0.038	<0.037	<0.036	<0.048	<0.033	<0.037	<0.035	<0.034	<0.035	<0.034	<0.035	<0.038
cadmium	0.066	0.017	0.036	0.003	0.003	0.011	0.040	0.034	0.003	0.004	0.028	0.001
chromium	<0.040	0.046	<0.037	<0.039	0.120	0.030	<0.040	0.035	<0.157	0.104	0.047	<0.040
copper	1.850	0.759	0.661	0.243	1.630	0.792	1.070	0.213	0.681	0.778	0.084	0.622
lead	<0.152	<0.148	<0.140	<0.189	0.171	<0.145	0.324	<0.136	<0.137	<0.067	<0.137	<0.150
mercury	0.046	0.110	<0.023	0.062	<0.016	0.031	<0.023	0.019	0.190	0.057	0.140	0.089
nickel	0.108	<0.074	0.847	<0.095	0.176	<0.073	6.930	0.409	0.095	0.246	<0.069	<0.075
selenium	0.530	0.312	0.491	0.285	0.537	0.530	0.402	0.225	0.584	1.290	1.120	1.640
silver	<0.196	<0.187	<0.193	<0.194	<0.179	<0.181	<0.196	<0.188	<0.195	<0.175	<0.181	<0.199

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 1: carp, whole	1: carp fillets	1: channel catfish, whole	1: channel catfish fillets	2: carp, whole	2: carp fillets	2: channel catfish, whole	2: channel catfish fillets	3: carp fillets	3: channel catfish, whole	3a: carp, whole	3a: carp fillets
thallium	<0.080	<0.077	<0.074	<0.175	<0.075	<0.078	<0.080	<0.078	<0.079	<0.075	<0.116	<0.119
zinc	47.0	7.6	18.4	4.3	37.2	8.9	18.7	3.4	7.7	20.3	23.3	10.8
PESTICIDES (mg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDE	0.260	0.180	0.180	0.080	0.058	0.040	0.100	0.065	0.300	0.028	0.041	0.840
p,p' DDT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	*	*	*	*	*	*	*	*	*	*	*	*
2,4-dichlorophenoxyacetic acid (2,4-D)	*	*	*	*	*	*	*	*	*	*	*	*
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
dinoseb	*	*	*	*	*	*	*	*	*	*	*	*
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.004	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 1				2				3		3a	
	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp fillets	channel catfish, whole	carp, whole	carp fillets
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	*	*	*	*	*	*	*	*	*	*	*	*
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	*	*	*	*	*	*	*	*	*	*	*	*
PCB's AND RELATED COMPOUNDS (mg/kg)												
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1254	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PHTHALATE ESTERS (mg/kg)												
bis(2-ethylhexyl) phthalate	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
di-n-butyl phthalate	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
di-n-octyl phthalate	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
diethyl phthalate	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
dimethyl phthalate	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
n-butyl benzyl phthalate	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<1.0	<1.0	<5.0	<1.0	<1.0
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

a - all concentrations expressed in terms of wet weight of tissue
* - lab unable to produce satisfactory results
** - could not be analyzed due to insufficient sample volume

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	4				5			6				6a
	carp, whole	carp fillets	blue catfish, whole	blue catfish fillets	carp, whole	carp fillets	blue catfish, whole	carp, whole	carp fillets	white bass, whole	white bass fillets	carp, whole
NUMBER OF SPECIMENS IN SAMPLE	4	5	2	2	5	5	2	5	5	5	5	5
DATE	111492	111492	111492	111492	111592	111592	111592	020893	020693	020893	020893	020693
TIME	0930	0930	0930	0930	1030	1030	1030	1030	1030	1030	1030	1400
CONVENTIONALS												
lipid content (%)	2.3	0.3	1.5	<0.1	2.4	2.5	<0.1	14.3	3.9	1.6	*	8.5
PHENOLS AND CRESOLS (mg/kg)												
parachlorometa cresol	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
pentachlorophenol	<20	<4.0	<4.0	<4.0	<20	<4.0	<4.0	<20	<20	<20	<20	<20
phenol (C_6H_5OH) single compound	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<10	<10	<10	<10
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<10	<10	<10	<10
2-nitrophenol	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<10	<10	<10	<10
2,4-dichlorophenol	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<10	<10	<10	<10
2,4-dimethylphenol	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<10	<10	<10	<10
2,4-dinitrophenol	<20	<4.0	<4.0	<4.0	<20	<4.0	<4.0	<20	<10	<10	<10	<10
2,4,6-trichlorophenol	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<20	<20	<20	<20
4-nitrophenol	<20	<4.0	<4.0	<4.0	<20	<4.0	<4.0	<20	<10	<10	<10	<10
4,6-dinitro-ortho-cresol	<20	<4.0	<4.0	<4.0	<20	<4.0	<4.0	<20	<20	<20	<20	<20
ETHERS (mg/kg)												
bis(2-chloroethyoxy) methane	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroethyl) ether	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroisopropyl) ether	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-bromophenyl phenyl ether	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-chlorophenyl phenyl ether	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
HALOGENATED ALIPHATICS (mg/kg)												
bromodichloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
bromoform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chloroethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
chloroform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dibromochloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	4: carp, whole	4: carp fillets	4: blue catfish, whole	4: blue catfish fillets	5: carp, whole	5: carp fillets	5: blue catfish, whole	6: carp, whole	6: carp fillets	6: white bass, whole	6: white bass fillets	6a: carp, whole
hexachlorobutadiene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachloroethane	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl bromide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methylene chloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	<0.02	<0.02	<0.02	<0.02
tetrachloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.11
trichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
vinyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	0.07	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)												
acenaphthene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
acenaphthylene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
anthracene/phenanthrene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(B) fluoranthene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(OHI) perylene 1,12-benzoperylene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(K) fluoranthene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo-A-pyrene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
chrysene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluoranthene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluorene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
indeno(1,2,3-CD) pyrene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
naphthalene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,5,6-dibenzanthracene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 4: carp, whole	4: carp fillets	4: blue catfish, whole	4: blue catfish fillets	5: carp, whole	5: carp fillets	5: blue catfish, whole	6: carp, whole	6: carp fillets	6: white bass, whole	6: white bass fillets	6a: carp, whole
MONOCYCLIC AROMATICS (mg/kg)												
benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
nitrobenzene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
styrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
toluene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
xylene	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
1,2-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2,4-trichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,6-dinitrotoluene	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)												
acrylonitrile	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<10	<10	<10	<10
n-nitrosodi-N-propylamine	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodimethylamine	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodiphenylamine	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-diphenylhydrazine	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
3,3-dichlorobenzidine	<10	<2.0	<2.0	<2.0	<10	<2.0	<2.0	<10	<10	<10	<10	<10
METALS (mg/kg)												
aluminum	46.6	<1.0	8.4	<1.2	23.3	1.5	14.5	16.2	1.8	2.8	<0.8	37.5
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	0.080	<0.027	0.047	0.041	0.054	0.054	0.050	0.070	0.049	0.062	<0.017	0.042
beryllium	<0.034	<0.039	<0.039	<0.047	<0.035	<0.036	<0.038	<0.040	<0.039	<0.039	<0.034	<0.036
cadmium	0.033	0.002	0.003	0.003	0.044	0.001	0.007	0.010	<0.017	<0.009	<0.008	0.045
chromium	0.133	<0.038	0.079	0.023	0.022	<0.039	0.101	0.082	0.038	0.059	<0.034	0.220
copper	1.240	0.397	0.311	0.258	1.630	0.626	0.546	0.694	0.799	0.798	0.410	1.180
lead	0.107	<0.154	<0.077	<0.094	0.070	<0.144	0.119	<0.078	<0.078	<0.079	<0.116	0.063
mercury	0.150	0.150	0.075	0.130	0.150	0.110	0.053	<0.069	<0.082	0.163	0.296	<0.044
nickel	0.040	0.140	0.079	0.122	<0.068	0.107	0.174	0.104	<0.075	0.126	0.069	0.182
selenium	1.060	1.300	0.441	0.367	1.380	1.440	0.619	0.830	1.440	1.610	2.140	0.840
silver	<0.183	<0.192	<0.189	<0.187	<0.187	<0.197	<0.195	<0.066	<0.065	<0.066	<0.078	<0.064

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	4				5			6				6a
	carp, whole	carp fillets	blue catfish, whole	blue catfish fillets	carp, whole	carp fillets	blue catfish, whole	carp, whole	carp fillets	white bass, whole	white bass fillets	carp, whole
thallium	<0.075	<0.075	<0.079	<0.096	<0.076	<0.079	<0.079	<0.040	<0.039	0.043	<0.034	<0.036
zinc	41.6	6.2	10.2	3.2	44.8	8.6	14.7	25.6	8.9	6.0	3.1	65.1
PESTICIDES (mg/kg)												
aldicarb	•	•	•	•	•	•	•	•	•	•	•	•
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	•	•	•	•	•	•	•	•	•	•	•	•
carbofuran	•	•	•	•	•	•	•	•	•	•	•	•
chlordane	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDE	0.790	0.065	0.850	0.042	0.280	0.101	0.012	0.360	0.056	0.220	0.110	0.100
p,p' DDT	0.026	<0.010	0.035	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	•	•	•	•	•	•	•	•	•	•	•	•
2,4-dichlorophenoxyacetic acid (2,4-D)	•	•	•	•	•	•	•	•	•	•	•	•
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
dinoseb	•	•	•	•	•	•	•	•	•	•	•	•
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	•	•	•	•	•	•	•	•	•	•	•	•
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 4: carp, whole	4: carp fillets	4: blue catfish, whole	4: blue catfish fillets	5: carp, whole	5: carp fillets	5: blue catfish, whole	6: carp, whole	6: carp fillets	6: white bass, whole	6: white bass fillets	6a: carp, whole
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	*	*	*	*	*	*	*	*	*	*	*	*
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	*	*	*	*	*	*	*	*	*	*	*	*
PCB's AND RELATED COMPOUNDS (mg/kg)												
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1254	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PHTHALATE ESTERS (mg/kg)												
bis(2-ethylhexyl) phthalate	<5.0	<1.0	<1.0	99.7	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-butyl phthalate	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-octyl phthalate	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
diethyl phthalate	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
dimethyl phthalate	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-butyl benzyl phthalate	<5.0	<1.0	<1.0	<1.0	<5.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	4.0	<1.0

a - all concentrations expressed in terms of wet weight of tissue

* - lab unable to produce satisfactory results

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	6a: carp fillets	6a: channel catfish, whole	6a: channel catfish fillets	6b: carp, whole	6b: carp fillets	6b: channel catfish, whole	6b: channel catfish fillets	7: carp, whole	7: carp fillets	7: smallmouth bass, whole	7b: carp, whole	7b: carp fillets
NUMBER OF SPECIMENS IN SAMPLE	5	1	2	4	5	5	5	5	5	5	5	5
DATE	020893	020893	020893	020993	020993	020993	020993	021093	021093	021093	020993	020993
TIME	1400	1400	1400	0930	0930	0930	0930	1430	1430	1430	1500	1500
CONVENTIONALS												
lipid content (%)	3.1	6.0	1.1	2.5	3.6	0.9	0.8	9.7	11.2	2.0	7.3	15.2
PHENOLS AND CRESOLS (mg/kg)												
parachlorometa cresol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
pentachlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
phenol (C_6H_5OH) single compound	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-nitrophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dimethylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dinitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2,4,6-trichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-nitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
4,6-dinitro-ortho-cresol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
ETHERS (mg/kg)												
bis(2-chloroethyoxy) methane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroethyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroisopropyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-bromophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-chlorophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
HALOGENATED ALIPHATICS (mg/kg)												
bromodichloromethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
bromoform	***	<0.02	<0.02	≤0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
chloroethane	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05
chloroform	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
dibromochloromethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 6a			6b				7			7b	
	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	smallmouth bass, whole	carp, whole	carp fillets
hexachlorobutadiene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl bromide	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05
methyl chloride	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05
methylene chloride	***	<0.02	<0.02	<0.02	<0.02	0.12	<0.02	***	0.03	0.03	<0.02	<0.02
tetrachloroethylene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
trichloroethylene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
vinyl chloride	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)												
acenaphthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
acenaphthylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
anthracene/phenanthrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(B) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(GHI) perylene 1,12-benzoperylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(K) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo-A-pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chrysene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluorene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
indeno(1,2,3-CD) pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
naphthalene	<5.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,5,6-dibenzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	6a			6b				7			7b	
	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	smallmouth bass, whole	carp, whole	carp fillets
MONOCYCLIC AROMATICS (mg/kg)												
benzene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
chlorobenzene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
ethylbenzene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
nitrobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
styrene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
toluene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
xylene	***	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	***	<0.06	<0.06	<0.06	<0.06
1,2-dichlorobenzene	<5.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
1,2,4-trichlorobenzene	<5.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<5.0	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<5.0	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	***	<0.02	<0.02	<0.02	<0.02
2,6-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
								<5.0	<5.0	<5.0	<5.0	<5.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)												
acrylonitrile	***	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	***	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
n-nitrosodi-N-propylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodimethylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodiphenylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-diphenylhydrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
3,3-dichlorobenzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
METALS (mg/kg)												
aluminum	<0.9	7.3	1.1	13.9	<1.0	2.5	5.7	39.8	1.6	2.3	<1.0	2.0
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	0.137	0.027	<0.020	0.044	0.037	<0.020	<0.020	0.109	0.024	<0.019	0.019	0.147
beryllium	<0.037	<0.040	<0.040	<0.034	<0.039	<0.039	<0.040	<0.039	<0.038	<0.037	<0.040	<0.040
cadmium	<0.008	0.018	<0.009	0.021	<0.017	<0.010	<0.010	0.042	0.042	<0.009	<0.009	<0.009
chromium	<0.039	0.041	<0.040	0.126	<0.039	0.052	<0.040	0.113	<0.038	<0.037	0.091	<0.040
copper	1.120	0.436	0.365	1.220	1.560	0.396	0.323	2.040	1.330	0.776	1.670	1.310
lead	0.081	<0.080	<0.040	0.076	<0.078	<0.078	<0.039	<0.077	<0.039	<0.082	0.037	<0.080
mercury	<0.083	<0.085	0.149	0.092	0.173	<0.077	0.120	<0.066	0.081	0.162	<0.076	<0.074
nickel	<0.076	0.087	0.134	0.162	0.190	0.146	0.087	0.142	<0.075	0.099	0.101	<0.080
selenium	1.280	0.515	1.090	0.961	0.946	0.637	0.873	1.080	0.865	1.040	0.648	0.704
silver	<0.066	<0.066	<0.064	<0.066	<0.066	<0.065	<0.065	<0.064	<0.065	<0.066	<0.061	<0.066

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	6a			6b				7			7b	
	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	smallmouth bass, whole	carp, whole	carp fillets
thallium	<0.037	<0.040	<0.040	<0.034	0.073	<0.039	<0.040	<0.039	<0.038	<0.037	<0.040	<0.040
zinc	14.7	9.9	4.2	45.1	7.5	13.8	3.7	42.4	15.8	16.9	50.6	17.9
PESTICIDES (mg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.180	<0.010	0.032	0.130
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.009	0.031	<0.010	<0.010	0.028
p,p' DDE	0.070	<0.005	0.110	0.030	0.061	0.008	0.022	0.130	0.300	0.042	0.046	0.270
p,p' DDT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	*	*	*	*	*	*	*	*	*	*	*	*
2,4-dichlorophenoxyacetic acid (2,4-D)	*	*	*	*	*	*	*	*	*	*	*	*
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.011	<0.006	<0.006	0.009
dinoseb	*	*	*	*	*	*	*	*	*	*	*	*
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 6a carp fillets	6a channel catfish, whole	6a channel catfish fillets	6b carp, whole	6b carp fillets	6b channel catfish, whole	6b channel catfish fillets	7 carp, whole	7 carp fillets	7 smallmouth bass, whole	7b carp, whole	7b carp fillets
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	*	*	*	*	*	*	*	*	*	*	*	*
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	*	*	*	*	*	*	*	*	*	*	*	*
PCB's AND RELATED COMPOUNDS (mg/kg)												
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1254	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.110	<0.040	<0.040	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.130
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<0.040
												<5.0
PHTHALATE ESTERS (mg/kg)												
bis(2-ethylhexyl) phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-butyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-octyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
diethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
dimethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-butyl benzyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
GENERAL INORGANICS (mg/kg)												
cyanide	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

a - all concentrations expressed in terms of wet weight of tissue
* - lab unable to produce satisfactory results
*** - sample lost due to lab accident

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	7b		8				8d				9	
	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	smallmouth bass, whole	smallmouth bass fillets	carp, whole	carp fillets
NUMBER OF SPECIMENS IN SAMPLE	5	5	5	5	5	5	2	1	5	1	5	5
DATE	020993	020993	021093	021093	021093	021093	021193	021193	021193	021193	032293	032293
TIME	1500	1500	1000	1000	1000	1000	1130	1130	1130	1130	0830	0830
CONVENTIONALS												
lipid content (%)	2.0	0.9	6.3	16.4	10.6	5.1	3.3	**	3.2	**	10.9	6.2
PHENOLS AND CRESOLS (mg/kg)												
parachlorometa cresol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
pentachlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	**	<20	<20
phenol (C_6H_5OH) single compound	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
2-nitrophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
2,4-dichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
2,4-dimethylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
2,4-dinitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	**	<20	<20
2,4,6-trichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
4-nitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	**	<20	<20
4,6-dinitro-ortho-cresol	<20	<20	<20	<20	<20	<20	<20	<20	<20	**	<20	<20
ETHERS (mg/kg)												
bis(2-chloroethyoxy) methane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
bis(2-chloroethyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
bis(2-chloroisopropyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
4-bromophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
4-chlorophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
HALOGENATED ALIPHATICS (mg/kg)												
bromodichloromethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
bromoform	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chloroethane	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
chloroform	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dibromochloromethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	7b		8				8d				9	
	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	smallmouth bass, whole	smallmouth bass fillets	carp, whole	carp fillets
hexachlorobutadiene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
hexachloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
methyl bromide	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methyl chloride	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methylene chloride	<0.02	<0.02	<0.02	0.03	***	0.23	<0.02	0.11	0.02	0.02	0.03	<0.02
tetrachloroethylene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichloroethylene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
vinyl chloride	<0.05	<0.05	<0.05	<0.05	***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)												
acenaphthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
acenaphthylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
anthracene/phenanthrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
benzo(B) fluoroanthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
benzo(GHI) perylene 1,12-benzoperylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
benzo(K) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
benzo-A-pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
chrysene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
fluorene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
indeno(1,2,3-CD) pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
naphthalene	<0.02	<0.02	<0.02	<0.02	<5.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
1,2,5,6-dibenzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	7b		8				8d				9	
	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	smallmouth bass, whole	smallmouth bass fillets	carp, whole	carp fillets
MONOCYCLIC AROMATICS (mg/kg)												
benzene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorobenzene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ethylbenzene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
nitrobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
styrene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
toluene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02
xylene	<0.06	<0.06	<0.06	<0.06	***	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
1,2-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<5.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2,4-trichlorobenzene	<0.02	<0.02	<0.02	<0.02	<5.0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	***	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
2,6-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)												
acrylonitrile	<0.1	<0.1	<0.1	<0.1	***	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
n-nitrosodi-N-propylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
n-nitrosodimethylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
n-nitrosodiphenylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
1,2-diphenylhydrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
3,3-dichlorobenzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	**	<10	<10
METALS (mg/kg)												
aluminum	1.9	<1.0	8.3	5.3	50.9	<1.0	29.8	1.4	2.6	**	30.6	<2.0
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	<0.020	<0.020	0.094	0.071	0.144	0.064	0.101	0.061	<0.020	**	0.229	0.225
beryllium	<0.040	<0.040	<0.040	<0.040	<0.038	<0.040	<0.039	<0.038	<0.040	**	<0.044	<0.044
cadmium	<0.010	<0.010	<0.010	0.011	<0.009	<0.010	0.036	<0.009	<0.011	**	0.039	<0.009
chromium	0.054	<0.040	0.084	<0.040	0.141	<0.040	0.125	<0.039	0.070	**	0.113	<0.041
copper	0.525	0.172	1.590	1.810	0.823	0.493	1.740	1.290	0.429	**	2.390	1.060
lead	<0.083	<0.046	<0.079	<0.077	0.058	<0.080	0.065	<0.100	<0.077	**	0.111	0.075
mercury	0.153	0.119	<0.076	<0.064	<0.077	<0.084	0.097	0.204	0.161	**	0.227	0.266
nickel	0.116	0.104	0.102	<0.080	0.233	0.085	0.183	<0.076	0.123	**	<0.119	<0.120
selenium	0.680	0.704	0.669	0.675	0.559	0.324	0.593	0.611	0.562	**	0.275	0.844
silver	<0.067	<0.066	<0.063	<0.065	<0.064	<0.069	<0.065	<0.097	<0.065	**	0.035	<0.033

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	7b		8				8d				9	
	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	smallmouth bass, whole	smallmouth bass fillets	carp, whole	carp fillets
thallium	0.046	<0.040	<0.036	<0.040	0.038	<0.040	<0.039	<0.039	<0.040	**	<0.037	<0.040
zinc	15.2	4.3	31.8	24.4	16.2	5.4	48.8	6.2	14.5	**	61.5	12.5
PESTICIDES (mg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	0.034	<0.010	0.026	0.033	<0.010	0.028	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	0.028	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDE	0.071	0.009	0.033	0.170	0.110	0.043	0.020	0.013	0.110	0.013	0.320	0.240
p,p' DDT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	*	*	*	*	*	*	*	*	*	*	*	*
2,4-dichlorophenoxyacetic acid (2,4-D)	*	*	*	*	*	*	*	*	*	*	*	*
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
dinoseb	*	*	*	*	*	*	*	*	*	*	*	*
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 7b: largemouth bass, whole	7b: largemouth bass fillets	8: carp, whole	8: carp fillets	8: channel catfish, whole	8: channel catfish fillets	8d: carp, whole	8d: carp fillets	8d: smallmouth bass, whole	8d: smallmouth bass fillets	9: carp, whole	9: carp fillets
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	*	*	*	*	*	*	*	*	*	*	*	*
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	*	*	*	*	*	*	*	*	*	*	*	*
PCB's AND RELATED COMPOUNDS (mg/kg)												
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.840	0.360
arochlor 1254	0.088	<0.040	<0.040	0.110	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
PHTHALATE ESTERS (mg/kg)												
bis(2-ethylhexyl) phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
di-n-butyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
di-n-octyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
diethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
dimethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
n-butyl benzyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**	<5.0	<5.0
GENERAL INORGANICS (mg/kg)												
cyanide	2.0	6.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**	<1.0	<1.0

[a] - all concentrations expressed in terms of wet weight of tissue
* - lab unable to produce satisfactory results
** - could not be analyzed due to insufficient sample volume
*** - sample lost due to lab accident

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	9		9b				10				11	
	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	channel catfish, whole	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets
NUMBER OF SPECIMENS IN SAMPLE	5	5	3	3	3	2	5	5	2	3	5	5
DATE	032293	032293	032293	032293	032293	032293	032293	032293	032293	032293	032493	032493
TIME	0830	0830	1100	1100	1100	1100	1500	1500	1500	1500	0830	0830
CONVENTIONALS												
lipid content (%)	10.3	10.3	9.5	4.2	0.7	7.6	8.9	9.4	11.8	7.3	4.4	1.4
PHENOLS AND CRESOLS (mg/kg)												
parachlorometa cresol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
pentachlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
phenol (C_6H_5OH) single compound	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-nitrophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dimethylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dinitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2,4,6-trichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-nitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
4,6-dinitro-ortho-cresol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
ETHERS (mg/kg)												
bis(2-chloroethyoxy) methane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroethyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroisopropyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-bromophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-chlorophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
HALOGENATED ALIPHATICS (mg/kg)												
bromodichloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
bromoform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chloroethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
chloroform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dibromochloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species: 9 channel catfish, whole	9 channel catfish fillets	9b carp, whole	9b carp fillets	9b largemouth bass, whole	9b channel catfish, whole	10 carp, whole	10 carp fillets	10 channel catfish, whole	10 channel catfish fillets	11 carp, whole	11 carp fillets
hexachlorobutadiene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl bromide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methylene chloride	<0.02	0.10	<0.02	0.11	0.09	0.12	<0.02	<0.02	<0.02	0.07	0.03	<0.02
tetrachloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
vinyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)												
acenaphthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
acenaphthylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
anthracene/phenanthrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(B) fluoroanthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(GHI) perylene 1,12-benzoperylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(K) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo-A-pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chrysene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluorene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
indeno(1,2,3-CD) pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
naphthalene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,5,6-dibenzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	9		9b				10				11	
	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	channel catfish, whole	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets
MONOCYCLIC AROMATICS (mg/kg)												
benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
nitrobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
styrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
toluene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
xylene	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
1,2-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2,4-trichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,6-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)												
acrylonitrile	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
n-nitrosodi-N-propylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodimethylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodiphenylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-diphenylhydrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
3,3-dichlorobenzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
METALS (mg/kg)												
aluminum	13.4	<2.0	28.5	2.7	<2.0	15.7	31.0	<2.0	9.6	<2.0	797.0	<2.0
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	0.100	<0.020	0.230	0.129	<0.020	0.031	0.211	0.166	0.093	<0.020	0.161	0.062
beryllium	<0.044	<0.048	<0.046	<0.047	<0.048	<0.047	<0.044	<0.044	<0.044	<0.043	<0.049	<0.049
cadmium	0.009	<0.009	0.008	<0.009	<0.009	0.008	0.034	<0.008	0.009	<0.010	0.027	<0.010
chromium	<0.040	<0.040	0.079	<0.040	0.292	0.038	0.061	<0.040	<0.090	0.081	0.374	0.058
copper	0.363	0.233	1.350	0.737	0.388	0.193	1.590	0.869	0.234	0.236	1.990	0.531
lead	0.243	<0.077	0.108	<0.085	<0.083	0.170	<0.091	<0.090	<0.085	<0.091	0.108	<0.079
mercury	0.117	0.166	0.170	0.304	0.375	0.098	0.132	0.185	0.082	0.101	0.171	0.321
nickel	<0.120	<0.120	<0.116	<0.117	0.202	<0.120	<0.118	<0.139	<0.119	<0.118	0.203	<0.120
selenium	0.547	0.279	0.410	0.537	0.772	0.351	0.808	0.793	0.618	0.344	0.859	0.767
silver	<0.033	<0.034	0.042	0.049	<0.033	<0.035	0.039	<0.034	<0.033	<0.033	0.039	<0.034

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	9		9b				10				11	
	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	channel catfish, whole	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets
thallium	<0.040	<0.039	<0.035	<0.040	<0.039	<0.038	<0.039	<0.040	<0.039	<0.040	<0.039	<0.040
zinc	14.1	5.1	29.4	10.7	15.2	10.4	49.3	13.2	9.4	4.5	15.2	7.9
PESTICIDES (mg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDE	0.140	0.055	0.120	0.100	0.140	0.051	0.240	0.220	0.051	0.049	0.096	0.083
p,p' DDT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	*	*	*	*	*	*	*	*	*	*	*	*
2,4-dichlorophenoxyacetic acid (2,4-D)	*	*	*	*	*	*	*	*	*	*	*	*
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
dinoseb	*	*	*	*	*	*	*	*	*	*	*	*
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 9 channel catfish, whole	9 channel catfish fillets	9b carp, whole	9b carp fillets	9b largemouth bass, whole	9b channel catfish, whole	10 carp, whole	10 carp fillets	10 channel catfish, whole	10 channel catfish fillets	11 carp, whole	11 carp fillets
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	*	*	*	*	*	*	*	*	*	*	*	*
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	*	*	*	*	*	*	*	*	*	*	*	*
PCB's AND RELATED COMPOUNDS (mg/kg)												
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	0.180	0.170	<0.040	<0.040	<0.040	<0.040	0.059	0.044	<0.040	<0.040	<0.040	<0.040
arochlor 1254	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.050	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PHTHALATE ESTERS (mg/kg)												
bis(2-ethylhexyl) phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-butyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-octyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
diethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
dimethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-butyl benzyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

a - all concentrations expressed in terms of wet weight of tissue
* - lab unable to produce satisfactory results

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	11: channel catfish, whole	11: channel catfish fillets	12: carp, whole	12: carp fillets	12: channel catfish, whole	12: channel catfish fillets	13: carp, whole	13: carp fillets	13: largemouth bass, whole	13: largemouth bass fillets	13: channel catfish, whole	14: carp, whole
NUMBER OF SPECIMENS IN SAMPLE	5	5	5	5	4	5	1	1	5	5	1	5
DATE	032493	032493	032493	032493	032493	032493	011193	011193	011193	011193	011193	011293
TIME	0830	0830	1400	1400	1400	1400	1417	1417	1417	1417	1417	1245
CONVENTIONALS												
lipid content (%)	6.7	2.5	6.9	7.6	10.9	4.6	2.8	1.1	<0.1	<0.1	*	1.0
PHENOLS AND CRESOLS (mg/kg)												
parachlorometa cresol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
pentachlorophenol	<20	<20	<20	<20	<20	<20	<4.0	<20	<20	<20	<20	<20
phenol (C_6H_5OH) single compound	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
2-nitrophenol	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
2,4-dichlorophenol	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
2,4-dimethylphenol	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
2,4-dinitrophenol	<20	<20	<20	<20	<20	<20	<4.0	<20	<20	<20	<20	<20
2,4,6-trichlorophenol	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
4-nitrophenol	<20	<20	<20	<20	<20	<20	<4.0	<20	<20	<20	<20	<20
4,6-dinitro-ortho-cresol	<20	<20	<20	<20	<20	<20	<4.0	<20	<20	<20	<20	<20
ETHERS (mg/kg)												
bis(2-chloroethyoxy) methane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroethyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroisopropyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-bromophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-chlorophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
HALOGENATED ALIPHATICS (mg/kg)												
bromodichloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
bromoform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chloroethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
chloroform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dibromochloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 11: channel catfish, whole	11: channel catfish fillets	12: carp, whole	12: carp fillets	12: channel catfish, whole	12: channel catfish fillets	13: carp, whole	13: carp fillets	13: largemouth bass, whole	13: largemouth bass fillets	13: channel catfish, whole	14: carp, whole
hexachlorobutadiene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl bromide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methylene chloride	0.09	0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
tetrachloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
vinyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)												
acenaphthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
acenaphthylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
anthracene/phenanthrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(B) fluoroanthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(GHI) perylene 1,12-benzoperylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(K) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo-A-pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
chrysene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluorene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
indeno(1,2,3-CD) pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
naphthalene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,5,6-dibenzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	11		12				13					14
	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	channel catfish, whole	carp, whole
MONOCYCLIC AROMATICS (mg/kg)												
benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
nitrobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
styrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
toluene	<0.02	<0.02	0.03	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
xylene	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
1,2-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2,4-trichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,6-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)												
acrylonitrile	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
n-nitrosodi-N-propylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodimethylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodiphenylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-diphenylhydrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
3,3-dichlorobenzidine	<10	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10	<10
METALS (mg/kg)												
aluminum	141.0	<2.0	35.5	2.0	170.0	<2.0	<1.9	<2.0	<1.9	<1.7	4.4	9.3
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	0.029	<0.020	0.089	0.108	0.095	<0.020	0.112	0.044	<0.027	<0.025	<0.027	0.070
beryllium	<0.047	<0.048	<0.046	<0.048	<0.047	<0.048	<0.042	<0.043	<0.042	<0.039	<0.043	<0.045
cadmium	0.023	<0.009	0.012	<0.009	<0.009	<0.010	0.010	<0.009	<0.005	<0.004	0.015	0.018
chromium	0.083	0.044	0.487	0.061	0.159	<0.040	0.049	0.098	0.122	0.050	0.085	0.052
copper	0.496	0.263	1.710	0.845	0.608	0.181	1.190	0.684	0.289	0.279	0.369	1.290
lead	<0.084	<0.087	0.201	<0.083	0.149	<0.079	<0.113	<0.117	<0.113	<0.104	<0.115	<0.079
mercury	0.170	0.115	0.125	0.228	0.116	0.146	<0.066	0.090	0.235	0.375	<0.067	<0.069
nickel	<0.119	<0.118	<0.118	<0.120	<0.120	<0.160	0.205	1.100	0.380	1.910	0.116	<0.079
selenium	0.471	0.202	0.657	0.673	0.375	0.279	0.662	0.807	0.901	0.654	0.334	0.696
silver	<0.033	<0.035	0.049	<0.044	0.037	<0.034	<0.034	<0.033	<0.034	<0.035	<0.036	<0.033

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	11		12				13					14
	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	channel catfish, whole	carp, whole
thallium	<0.039	<0.040	<0.039	<0.039	<0.039	<0.040	0.053	0.040	0.042	0.051	<0.039	<0.040
zinc	15.2	5.4	76.0	11.8	11.8	5.2	24.8	6.5	10.7	3.8	13.1	33.8
PESTICIDES (mg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<0.010	<0.010	0.140	0.200	<0.010	0.062	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDE	0.280	0.043	0.100	0.200	0.120	0.033	0.094	0.036	0.099	0.027	0.093	0.180
p,p' DDT	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	*	*	*	*	*	*	*	*	*	*	*	*
2,4-dichlorophenoxyacetic acid (2,4-D)	*	*	*	*	*	*	*	*	*	*	*	*
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
dinoseb	*	*	*	*	*	*	*	*	*	*	*	*
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter*	Station/Species											
	11		12				13					14
	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	channel catfish, whole	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	channel catfish, whole	carp, whole
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	•	•	•	•	•	•	•	•	•	•	•	•
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	•	•	•	•	•	•	•	•	•	•	•	•
PCB's AND RELATED COMPOUNDS (mg/kg)												
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	0.100	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1254	0.180	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
PHTHALATE ESTERS (mg/kg)												
bis(2-ethylhexyl) phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-butyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-octyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
diethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
dimethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-butyl benzyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	<1.0

* - all concentrations expressed in terms of wet weight of tissue
• - lab unable to produce satisfactory results

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 14: carp fillets	14: channel catfish, whole	14: blue catfish fillets	14: largemouth bass, whole	14: largemouth bass fillets	15: carp, whole	15: carp fillets	15: largemouth bass, whole	15: largemouth bass fillets	16: carp, whole	16: carp fillets	16: channel catfish whole
NUMBER OF SPECIMENS IN SAMPLE	5	2	1	5	5	3	4	5	5	3	3	5
DATE	011293	011293	011293	011293	011293	011293	011293	011293	011293	011693	011693	011693
TIME	1245	1245	1245	1245	1245	1600	1600	1600	1600	1030	1030	1030
CONVENTIONALS												
lipid content (%)	0.1	*	3.3	0.9	0.4	1.5	0.5	0.5	0.4	5.8	1.7	4.2
PHENOLS AND CRESOLS (mg/kg)												
parachlorometa cresol	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
pentachlorophenol	<20	<20	<20	<20	<20	<40	<20	<20	<4.0	<20	<20	<4.0
phenol (C_6H_5OH) single compound	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
phenolics recoverable	*	*	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
2-nitrophenol	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
2,4-dichlorophenol	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
2,4-dimethylphenol	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
2,4-dinitrophenol	<20	<20	<20	<20	<20	<40	<20	<20	<4.0	<20	<20	<4.0
2,4,6-trichlorophenol	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
4-nitrophenol	<20	<20	<20	<20	<20	<40	<20	<20	<4.0	<20	<20	<4.0
4,6-dinitro-ortho-cresol	<20	<20	<20	<20	<20	<40	<20	<20	<4.0	<20	<20	<4.0
ETHERS (mg/kg)												
bis(2-chloroethyoxy) methane	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
bis(2-chloroethyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
bis(2-chloroisopropyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
4-bromophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
4-chlorophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
HALOGENATED ALIPHATICS (mg/kg)												
bromodichloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
bromoform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chloroethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
chloroform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03
dibromochloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 14					15				16		
	carp fillets	channel catfish, whole	blue catfish fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	channel catfish whole
hexachlorobutadiene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
hexachloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
methyl bromide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methylene chloride	<0.02	0.04	<0.02	0.04	0.02	0.11	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
tetrachloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
vinyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)												
acenaphthene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
acenaphthylene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
anthracene/phenanthrene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
benzo(B) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
benzo(GHI) perylene 1,12-benzoperylene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
benzo(K) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
benzo-A-pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
chrysene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
fluorene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
indeno(1,2,3-CD) pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
naphthalene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
1,2,5,6-dibenzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	14					15				16		
	carp fillets	channel catfish, whole	blue catfish fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	channel catfish whole
MONOCYCLIC AROMATICS (mg/kg)												
benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
nitrobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
styrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
toluene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
xylene	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.02
1,2-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.06
1,2,4-trichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
2,6-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)												
acrylonitrile	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
n-nitrosodi-N-propylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
n-nitrosodimethylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
n-nitrosodiphenylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
1,2-diphenylhydrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
3,3-dichlorobenzidine	<10	<10	<10	<10	<10	<20	<10	<10	<2.0	<10	<10	<2.0
METALS (mg/kg)												
aluminum	<2.0	51.5	<1.9	<1.8	<1.9	4.1	<2.0	<2.3	<1.9	81.8	<1.9	70.6
antimony	*	*	*	*	*	*	*	*	*	*	*	*
arsenic	0.050	0.074	<0.027	0.048	<0.027	0.037	<0.028	<0.027	<0.027	0.073	0.033	0.052
beryllium	<0.045	<0.039	<0.043	<0.040	<0.043	<0.044	<0.044	<0.043	<0.042	<0.041	<0.044	<0.044
cadmium	<0.005	0.012	<0.004	0.004	<0.004	0.010	<0.005	<0.005	<0.009	0.012	<0.004	0.007
chromium	0.040	0.268	<0.039	0.081	0.051	<0.040	<0.039	0.148	<0.040	0.499	<0.080	0.197
copper	0.531	0.708	0.266	0.917	0.255	0.962	1.010	0.423	0.245	1.370	0.741	1.370
lead	<0.080	0.104	<0.075	<0.072	<0.077	<0.079	<0.078	<0.076	<0.075	0.096	0.176	0.116
mercury	0.193	0.139	0.548	<0.056	0.271	0.128	0.319	0.102	0.756	0.208	0.628	0.126
nickel	<0.080	0.223	<0.077	0.082	<0.077	0.082	<0.078	0.249	0.072	0.489	<0.086	0.112
selenium	0.626	0.396	0.115	0.725	0.650	0.540	0.637	0.789	0.565	0.658	0.560	0.439
silver	<0.032	**	<0.033	<0.032	<0.033	<0.032	<0.032	<0.033	<0.034	0.088	<0.034	0.036

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 14: carp fillets	14: channel catfish, whole	14: blue catfish fillets	14: largemouth bass, whole	14: largemouth bass fillets	15: carp, whole	15: carp fillets	15: largemouth bass, whole	15: largemouth bass fillets	16: carp, whole	16: carp fillets	16: channel catfish whole
thallium	0.039	<0.036	<0.039	<0.047	0.061	<0.040	0.057	0.039	0.055	0.040	<0.039	<0.039
zinc	7.2	25.9	4.6	12.1	4.3	42.4	11.1	13.9	5.0	43.0	13.5	14.4
PESTICIDES (mg/kg)												
aldicarb	*	*	*	*	*	*	*	*	*	*	*	*
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	*	*	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*	*	*
chlordane	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDE	0.048	0.150	0.370	0.110	0.022	0.150	0.110	0.110	0.093	0.190	0.290	0.103
p,p' DDT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	*	*	*	*	*	*	*	*	*	*	*	*
2,4-dichlorophenoxyacetic acid (2,4-D)	*	*	*	*	*	*	*	*	*	*	*	*
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
dinoseb	*	*	*	*	*	*	*	*	*	*	*	*
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	*	*	*	*	*	*	*	*	*	*	*	*
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species											
	14					15				16		
	carp fillets	channel catfish, whole	blue catfish fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	channel catfish whole
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	*	*	*	*	*	*	*	*	*	*	*	*
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	*	*	*	*	*	*	*	*	*	*	*	*
PCB's AND RELATED COMPOUNDS (mg/kg)												
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1254	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
PHTHALATE ESTERS (mg/kg)												
bis(2-ethylhexyl) phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
di-n-butyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
di-n-octyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
diethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
dimethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
n-butyl benzyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<1.0	<5.0	<5.0	<1.0
GENERAL INORGANICS (mg/kg)												
cyanide	<1.0	2.0	1.0	<1.0	<1.0	<1.0	2.0	<1.0	1.0	<1.0	1.0	<1.0

a - all concentrations expressed in terms of wet weight of tissue
* - lab unable to produce satisfactory results
** - could not be analyzed due to insufficient sample volume

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 16	17				18				
	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	channel catfish fillets
NUMBER OF SPECIMENS IN SAMPLE	5	5	4	5	5	4	4	4	5	1
DATE	011693	011593	011593	011593	011593	011593	011593	011593	011593	011593
TIME	1030	1445	1445	1445	1445	1000	1000	1000	1000	1000
CONVENTIONALS										
lipid content (%)	1.3	0.6	1.1	1.0	0.4	0.2	1.6	1.3	0.3	1.1
PHENOLS AND CRESOLS (mg/kg)										
parachlorometa cresol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
pentachlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
phenol (C_6H_5OH) single compound	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
phenolics recoverable	*	*	*	*	*	*	*	*	*	*
2-chlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-nitrophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dimethylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-dinitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2,4,6-trichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-nitrophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
4,6-dinitro-ortho-cresol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
ETHERS (mg/kg)										
bis(2-chloroethyoxy) methane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroethyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-chloroisopropyl) ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-bromophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-chlorophenyl phenyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
HALOGENATED ALIPHATICS (mg/kg)										
bromodichloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
bromoform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
carbon tetrachloride	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chloroethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
chloroform	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dibromochloromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
dichlorodifluoromethane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 16	17				18				
	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	channel catfish fillets
hexachlorobutadiene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorocyclopentadiene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
hexachloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
methyl bromide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
methylene chloride	<0.02	0.02	0.03	<0.02	<0.02	0.11	<0.02	<0.02	<0.02	<0.02
tetrachloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trichlorofluoromethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
vinyl chloride	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,1-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2-trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-dichloropropane	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2-trans-dichloroethylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-trans-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-cis-dichloropropene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)										
acenaphthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
acenaphthylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
anthracene/phenanthrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(A) anthracene 1,2-benzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(B) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(GHI) perylene 1,12-benzoperylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo(K) fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
benzo-A-pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chrysene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
fluorene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
indeno(1,2,3-CD) pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
naphthalene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,5,6-dibenzanthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 16	17				18				
	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	channel catfish fillets
MONOCYCLIC AROMATICS (mg/kg)										
benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
hexachlorobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
nitrobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
styrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
toluene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
xylene	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
1,2-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,2,4-trichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,3-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,4-dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,6-dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
NITROSAMINES AND OTHER N COMPOUNDS (mg/kg)										
acrylonitrile	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
benzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
n-nitrosodi-N-propylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodimethylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-nitrosodiphenylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-diphenylhydrazine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
3,3-dichlorobenzidine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
METALS (mg/kg)										
aluminum	<1.9	54.4	<1.9	<3.0	<1.9	3.2	<1.8	3.2	1.9	39.5
antimony	*	*	*	*	*	*	*	*	*	*
arsenic	<0.027	0.113	0.046	0.039	<0.028	0.054	<0.026	0.088	<0.028	<0.028
beryllium	<0.044	<0.045	<0.043	<0.045	<0.044	<0.040	<0.042	<0.043	<0.044	<0.045
cadmium	0.007	**	0.009	0.005	<0.005	0.019	0.005	<0.004	<0.008	0.034
chromium	<0.080	**	<0.080	0.169	<0.080	0.064	<0.080	<0.038	<0.039	<0.099
copper	0.299	0.903	1.010	1.090	0.199	1.050	1.200	1.340	0.157	0.346
lead	0.186	0.104	0.057	0.129	<0.078	<0.071	<0.074	<0.076	<0.078	0.066
mercury	0.275	<0.066	0.322	0.157	0.588	<0.081	0.160	<0.070	0.434	0.078
nickel	0.685	**	<0.160	<0.159	<0.083	<0.072	<0.335	0.116	<0.078	<0.102
selenium	0.238	0.317	0.476	0.469	0.583	0.494	0.320	0.597	0.561	0.268
silver	<0.037	**	<0.036	<0.034	<0.037	<0.034	<0.034	<0.025	<0.033	<0.039

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species: 16 channel catfish fillets	17 carp, whole	17 carp fillets	17 largemouth bass, whole	17 largemouth bass fillets	18 carp, whole	18 carp fillets	18 largemouth bass, whole	18 largemouth bass fillets	18 channel catfish fillets
thallium	<0.039	<0.040	0.038	<0.040	0.039	<0.036	0.037	<0.038	0.053	<0.040
zinc	6.0	34.1	12.0	14.5	5.0	31.6	21.1	8.5	4.3	5.6
PESTICIDES (mg/kg)										
aldicarb	*	*	*	*	*	*	*	*	*	*
aldrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
alpha benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
atrazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
beta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
carbaryl	*	*	*	*	*	*	*	*	*	*
carbofuran	*	*	*	*	*	*	*	*	*	*
chlordane	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chlorfenvinphos	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
chlorothalonil	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
chlorpyrifos	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
p,p' DDD	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010
p,p' DDE	0.330	0.032	0.280	0.220	0.046	0.017	0.120	0.078	0.028	0.016
p,p' DDT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
delta benzene hexachloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
diazinon	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibromochloropropane (dbcp)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
dicamba	*	*	*	*	*	*	*	*	*	*
2,4-dichlorophenoxyacetic acid (2,4-D)	*	*	*	*	*	*	*	*	*	*
dicofol (kelthane)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
dieldrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
dinoseb		*	*	*	*	*	*	*	*	*
endosulfan alpha	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan beta	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endosulfan sulfate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
endrin	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
endrin aldehyde	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
gamma-bhc (lindane)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
guthion	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
heptachlor	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
heptachlor epoxide	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
isophorone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
malathion	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
methomyl	*	*	*	*	*	*	*	*	*	*
methoxychlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Table 12 (continued)
Analytical Data - Tissue

Parameter[a]	Station/Species 16	17				18				
	channel catfish fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	carp, whole	carp fillets	largemouth bass, whole	largemouth bass fillets	channel catfish fillets
metolachlor	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
mirex	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
parathion	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
picloram	*	*	*	*	*	*	*	*	*	*
simazine	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
toxaphene	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,4,5-TP (silvex)	*	*	*	*	*	*	*	*	*	*
PCB's AND RELATED COMPOUNDS (mg/kg)										
arochlor 1016	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1221	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1232	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1242	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1248	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1254	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
arochlor 1260	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
2-chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PHTHALATE ESTERS (mg/kg)										
bis(2-ethylhexyl) phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-butyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
di-n-octyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
diethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
dimethyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-butyl benzyl phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
GENERAL INORGANICS (mg/kg)										
cyanide	2.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.0	<1.0	<1.0	<1.0

a - all concentrations expressed in terms of wet weight of tissue

* - lab unable to produce satisfactory results

** - could not be analyzed due to insufficient sample volume

Table 13
Toxic Chemicals That Occurred at Detectable Levels

Parameter	Matrix Detected In*		
	Water	Sediment	Tissue
CONVENTIONALS			
ammonia (unionized)	22/45 (48.9%)		
residual chlorine	2/45 (4.4%)		
PHENOLS AND CRESOLS			
parachlorometa cresol	3/45 (6.7%)	5/45 (11.1%)	
phenol (C_6H_5OH) single compound	1/45 (2.2%)	1/45 (2.2%)	
phenolics recoverable	4/17 (23.5%)		
HALOGENATED ALIPHATICS			
bromodichloromethane	1/45 (2.2%)		
chloroform	2/45 (4.4%)	1/45 (2.2%)	1/92 (1.1%)
methylene chloride	1/45 (2.2%)	6/45 (13.3%)	27/92 (29.3%)
tetrachloroethylene	1/45 (2.2%)		
trichlorofluoromethane			2/92 (2.2%)
1,1,1-trichloroethane	1/45 (2.2%)		1/92 (1.1%)
POLYCYCLIC AROMATIC HYDROCARBONS			
naphthalene	2/45 (4.4%)		
MONOCYCLIC AROMATICS			
benzene	1/45 (2.2%)		
chlorobenzene		1/45 (2.2%)	
ethylbenzene	1/45 (2.2%)		
hexachlorobenzene			1/94 (1.1%)
toluene	5/45 (11.1%)	12/45 (26.7%)	3/94 (3.3%)
xylene	2/45 (4.4%)	1/45 (2.2%)	
1,2-dichlorobenzene	1/45 (2.2%)	1/45 (2.2%)	4/94 (4.2%)
1,4-dichlorobenzene	4/45 (8.9%)	1/45 (2.2%)	
METALS			
aluminum	1/45 (2.2%)	45/45 (100%)	54/93 (58.1%)
antimony	45/45 (100%)		
arsenic	30/45 (66.7%)	45/45 (100%)	59/93 (63.4%)
beryllium		40/45 (88.9%)	
cadmium	8/45 (17.8%)	45/45 (100%)	50/92 (54.3%)
chromium	4/45 (8.9%)	45/45 (100%)	53/92 (57.6%)
copper	23/45 (51.1%)	45/45 (100%)	93/93 (100%)
lead	5/45 (11.1%)	45/45 (100%)	26/93 (27.9%)
mercury	2/45 (4.4%)	40/45 (88.9%)	70/93 (75.3%)
nickel	7/45 (15.6%)	45/45 (100%)	47/92 (51.1%)
selenium	14/45 (31.1%)	44/45 (97.8%)	93/93 (100%)
silver	5/45 (11.1%)	12/45 (26.7%)	9/92 (9.8%)
thallium	4/45 (8.9%)	18/45 (40.0%)	18/93 (19.4%)
zinc	15/45 (33.3%)	45/45 (100%)	93/93 (100%)

Table 13 (continued)
Toxic Chemicals That Occurred at Detectable Levels

Parameter	Matrix Detected In*		
	Water	Sediment	Tissue
PESTICIDES			
chlordane		5/45 (11.1%)	10/94 (10.6%)
chlorpyrifos		3/45 (6.7%)	
p,p' DDD		1/45 (2.2%)	6/94 (6/4%)
p,p' DDE		11/45 (24.4%)	93/94 (98.9%)
p,p' DDT			3/94 (3.2%)
diazinon	2/45 (4.4%)		
dieldrin		1/45 (2.2%)	2/94 (2.1%)
gamma-bhc (lindane)	1/45 (2.2%)		2/94 (2.1%)
PCB's AND RELATED COMPOUNDS			
arochlor 1248			7/94 (7.4%)
arochlor 1254			6/94 (6.4%)
PHTHALATE ESTERS			
bis(2-ethylhexyl) phthalate	1/45 (2.2%)	3/45 (6.7%)	1/94 (1.1%)
diethyl phthalate	1/45 (2.2%)		
di-n-butyl phthalate		1/45 (2.2%)	
GENERAL INORGANICS			
cyanide	7/45 (15.6%)	1/45 (2.2%)	13/94 (13.8%)

* - values represent number of samples parameter was detected in/number of samples for which valid analytical results were obtained, followed by percent detection in parentheses

Table 14
Summary of Screening Level Exceedances, by Parameter*

Parameter	Station	Matrix	Screening Level(s) Exceeded	Exceedance Factor
unionized ammonia	2a	water	aquatic life acute	2.6X
			aquatic life chronic	13.6X
	7a	water	aquatic life chronic	1.0X
	9a	water	aquatic life chronic	4.1X
	11c	water	aquatic life chronic	6.2X
residual chlorine	1a	water	aquatic life acute	63.2X
			aquatic life chronic	109.1X
	2	water	aquatic life acute[a]	1.1X[a]
			aquatic life chronic[a]	1.8X[a]
parachlorometa cresol	1a	sediment	third highest level observed[b]	10.8X[b]
	2a	water	national 85th percentile	1.1X
	11c	sediment	second highest level observed[c]	2.3X[c]
phenol	1a	sediment	d	d
	2a	water	national 85th percentile	1.2X
phenolics recoverable	2a	water	national 85th percentile	1.5X
chloroform	1a	water	national 85th percentile	1.4X
methylene chloride	1	sediment	aquatic life threshold	16.4X
	2	sediment	aquatic life threshold	23.0X
	2a	sediment	aquatic life threshold	12.7X
	3	sediment	aquatic life threshold	10.0X
	3b	sediment	aquatic life threshold	2.2X
	12	sediment	aquatic life threshold	2.3X
toluene	2	sediment	aquatic life threshold	1.9X
	2a	sediment	aquatic life threshold	1.5X
	12	sediment	aquatic life threshold	1.7X
antimony	10a	water	national 85th percentile	1.4X
			human health	5.6X
arsenic	1a	water	human health	5.1X
	2	sediment	aquatic life threshold	1.1X
	2a	water	human health	3.3X
	3	sediment	aquatic life threshold	2.1X
	3a	water	national 85th percentile	2.1X
		sediment	aquatic life threshold	3.7X
	3b	water	national 85th percentile	1.1X
	4	water	national 85th percentile	1.4X
		sediment	aquatic life threshold	1.0X
	5	water	national 85th percentile	1.6X
		sediment	aquatic life threshold	1.6X
	5a	sediment	aquatic life threshold	1.7X
	5b	sediment	aquatic life threshold	1.3X
	9a	water	human health	2.8X
	11c	water	human health	1.5X
	14	sediment	aquatic life threshold	1.1X
	15a	water	human health	1.9X
cadmium	1	tissue (carp)	USFWS 85th percentile	1.3X
chromium	1	sediment	aquatic life threshold	3.5X
	2	sediment	aquatic life threshold	4.5X
	2a	sediment	aquatic life threshold	1.4X
	3	sediment	aquatic life threshold	3.4X
	3a	sediment	aquatic life threshold	3.3X
	3b	sediment	aquatic life threshold	1.03X

Table 14 (continued)
Summary of Screening Level Exceedances, by Parameter*

Parameter	Station	Matrix	Screening Level(s) Exceeded	Exceedance Factor
chromium	4	sediment	aquatic life threshold	2.0X
	5	sediment	aquatic life threshold	2.6X
	5a	sediment	aquatic life threshold	4.5X
	5b	sediment	aquatic life threshold	2.9X
	6	sediment	aquatic life threshold	1.2X
	6a	tissue (carp)	USFWS predator protection limit	1.1X
	7	sediment	aquatic life threshold	2.3X
	7a	sediment	aquatic life threshold	1.1X
	8	sediment	aquatic life threshold	1.01X
	8c	sediment	aquatic life threshold	3.0X
	8e	sediment	aquatic life threshold	2.3X
	9b	tissue (largemouth bass)	USFWS predator protection limit	1.46X
	10a	sediment	aquatic life threshold	1.3X
	11	sediment	aquatic life threshold	1.1X
		tissue (carp)	USFWS predator protection limit	1.9X
	11b	sediment	aquatic life threshold	1.7X
	12	tissue (carp)	USFWS predator protection limit	2.4X
	12a	water	aquatic life chronic[e]	1.4X[e]
		sediment	aquatic life threshold	1.7X
	12b	sediment	aquatic life threshold	2.3X
	13	sediment	aquatic life threshold	1.4X
	14	sediment	aquatic life threshold	2.7X
		tissue (channel catfish)	USFWS predator protection limit	1.3X
	15	sediment	aquatic life threshold	1.0X
	16	sediment	aquatic life threshold	2.9X
		tissue (carp)	USFWS predator protection limit	2.5X
	17	sediment	aquatic life threshold	1.5X
	18	sediment	aquatic life threshold	1.5X
copper	1	tissue (carp)	USFWS 85th percentile	1.9X
	1a	sediment	national 85th percentile	5.6X
	2	sediment	aquatic life threshold	2.0X
		tissue (carp)	USFWS 85th percentile	1.6X
	4	tissue (carp)	USFWS 85th percentile	1.2X
	5	tissue (carp)	USFWS 85th percentile	1.6X
	6a	tissue (carp)	USFWS 85th percentile	1.2X
	6b	tissue (carp)	USFWS 85th percentile	1.2X
	7	tissue (carp)	USFWS 85th percentile	2.0X
	7b	tissue (carp)	USFWS 85th percentile	1.7X
	8	tissue (carp)	USFWS 85th percentile	1.6X
	8d	tissue (carp)	USFWS 85th percentile	1.7X
	9	tissue (carp)	USFWS 85th percentile	2.4X
	9b	tissue (carp)	USFWS 85th percentile	1.4X
	10	tissue (carp)	USFWS 85th percentile	1.6X
	11	tissue (carp)	USFWS 85th percentile	2.0X
	12	tissue (carp)	USFWS 85th percentile	1.7X
	13	tissue (carp)	USFWS 85th percentile	1.2X
	14	tissue (carp)	USFWS 85th percentile	1.3X
	16	tissue (carp)	USFWS 85th percentile	1.4X
		tissue (channel catfish)	USFWS 85th percentile	1.4X
	17	tissue (largemouth bass)	USFWS 85th percentile	1.1X
	18	tissue (carp)	USFWS 85th percentile	1.1X
		tissue (largemouth bass)	USFWS 85th percentile	1.3X
lead	2	sediment	aquatic life threshold	1.4X
		tissue (channel catfish)	USFWS predator protection limit	1.1X
	9	tissue (channel catfish)	USFWS 85th percentile	1.1X
mercury	1a	sediment	national 85th percentile	2.0X
	2	sediment	aquatic life threshold	1.0X
	2a	water	human health	11.5X
	3a	tissue (carp)	USFWS predator protection limit	1.4X

Table 14 (continued)
Summary of Screening Level Exceedances, by Parameter*

Parameter	Station	Matrix	Screening Level(s) Exceeded	Exceedance Factor
mercury	4	tissue (carp)	USFWS predator protection limit	1.5X
	5	tissue (carp)	USFWS predator protection limit	1.5X
	6	tissue (white bass)	USFWS predator protection limit	1.6X
	7	tissue (smallmouth bass)	USFWS predator protection limit	1.6X
	7b	tissue (largemouth bass)	USFWS predator protection limit	1.5X
	8d	tissue (smallmouth bass)	USFWS predator protection limit	1.6X
	9	tissue (carp)	USFWS 85th percentile	1.3X
			USFWS predator protection limit	2.3X
		tissue (channel catfish)	USFWS predator protection limit	2.4X
	9b	tissue (carp)	USFWS 85th percentile	1.0X
		tissue (channel catfish)	USFWS predator protection limit	1.7X
		tissue (largemouth bass)	USFWS 85th percentile	2.2X
	10a	tissue (carp)	USFWS predator protection limit	1.3X
	11	tissue (carp)	USFWS 85th percentile	1.01X
			USFWS predator protection limit	1.7X
		tissue (channel catfish)	USFWS 85th percentile	1.0X
			USFWS predator protection limit	1.7X
	12	tissue (carp)	USFWS predator protection limit	1.3X
		tissue (channel catfish)	USFWS predator protection limit	1.2X
	13	tissue (largemouth bass)	USFWS 85th percentile	1.4X
			USFWS predator protection limit	2.4X
	14	tissue (channel catfish)	USFWS predator protection limit	1.4X
	15	tissue (largemouth bass)	USEPA fish tissue value	1.3X
		tissue (largemouth bass)	USFWS predator protection limit	1.02X
		tissue (carp)	USFWS predator protection limit	1.3X
	15a	water	human health	23.8X
	16	tissue (carp)	USEPA fish tissue value	1.05X
		tissue (carp)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	2.1X
		tissue (channel catfish)	USFWS predator protection limit	1.3X
	17	tissue (largemouth bass)	USFWS predator protection limit	1.6X
nickel	1	sediment	aquatic life threshold	3.0X
	2	sediment	aquatic life threshold	3.2X
	2a	sediment	aquatic life threshold	1.3X
	3	sediment	aquatic life threshold	5.4X
	3a	sediment	aquatic life threshold	5.0X
	4	sediment	aquatic life threshold	2.3X
	5	sediment	aquatic life threshold	3.6X
	5a	sediment	aquatic life threshold	6.9X
	5b	sediment	aquatic life threshold	2.8X
	6	sediment	aquatic life threshold	1.1X
	7	sediment	aquatic life threshold	2.2X
	8	sediment	aquatic life threshold	1.1X
	8c	sediment	aquatic life threshold	3.1X
	8e	sediment	aquatic life threshold	2.3X
	10a	sediment	aquatic life threshold	1.5X
	11	sediment	aquatic life threshold	1.5X
	11a	sediment	aquatic life threshold	1.1X
	11b	sediment	aquatic life threshold	2.0X
	12	sediment	aquatic life threshold	1.2X
	12a	sediment	aquatic life threshold	2.1X
	12b	sediment	aquatic life threshold	2.2X
	12c	sediment	aquatic life threshold	1.4X
	12e	sediment	aquatic life threshold	1.2X
	13	sediment	aquatic life threshold	1.6X
	14	sediment	aquatic life threshold	2.9X
	15	sediment	aquatic life threshold	1.1X
	16	sediment	aquatic life threshold	2.9X
	17	sediment	aquatic life threshold	1.7X
	18	sediment	aquatic life threshold	1.9X

Table 14 (continued)
Summary of Screening Level Exceedances, by Parameter*

Parameter	Station	Matrix	Screening Level(s) Exceeded	Exceedance Factor
selenium	1	tissue (carp)	USFWS predator protection limit	1.1X
	1a	sediment	national 85th percentile	1.3X
	2	tissue (carp)	USFWS predator protection limit	1.1X
	3	tissue (channel catfish)	USFWS 85th percentile	1.8X
			USFWS predator protection limit	2.6X
	3a	tissue (carp)	USFWS 85th percentile	1.5X
			USFWS predator protection limit	2.2X
	4	tissue (carp)	USFWS 85th percentile	1.5X
			USFWS predator protection limit	2.1X
	5	tissue (carp)	USFWS 85th percentile	1.9X
			USFWS predator protection limit	2.8X
		tissue (blue catfish)	USFWS predator protection limit	1.2X
	5a	water	aquatic life chronic	1.1X
	6	tissue (white bass)	TDH risk assessment value	1.1X
		tissue (carp)	USFWS 85th percentile	1.1X
			USFWS predator protection limit	1.7X
		tissue (white bass)	USFWS 85th percentile	2.2X
			USFWS predator protection limit	3.2X
	6a	tissue (carp)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	1.7X
		tissue (channel catfish)	USFWS predator protection limit	1.03X
	6b	tissue (carp)	USFWS 85th percentile	1.3X
			USFWS predator protection limit	1.9X
		tissue (channel catfish)	USFWS predator protection limit	1.3X
	7	tissue (carp)	USFWS 85th percentile	1.4X
			USFWS predator protection limit	2.1X
		tissue (smallmouth bass)	USFWS 85th percentile	1.4X
			USFWS predator protection limit	2.1X
	7b	tissue (carp)	USFWS predator protection limit	1.3X
		tissue (largemouth bass)	USFWS predator protection limit	1.4X
	8	tissue (carp)	USFWS predator protection limit	1.3X
		tissue (channel catfish)	USFWS predator protection limit	1.1X
	8d	tissue (carp)	USFWS predator protection limit	1.2X
		tissue (smallmouth bass)	USFWS predator protection limit	1.1X
	9	tissue (channel catfish)	USFWS predator protection limit	1.1X
	9b	water	aquatic life chronic	2.9X
			national 85th percentile	1.4X
			human health	1.4X
		tissue (largemouth bass)	USFWS predator protection limit	1.5X
	10	tissue (carp)	USFWS predator protection limit	1.6X
		tissue (channel catfish)	USFWS predator protection limit	1.2X
	11	water	aquatic life chronic	1.1X
		tissue (carp)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	1.7X
	11a	water	aquatic life chronic	1.02X
	11c	water	aquatic life chronic	2.1X
			national 85th percentile	1.1X
	12	tissue (carp)	USFWS predator protection limit	1.3X
	12a	water	aquatic life chronic	2.1X
			national 85th percentile	1.03X
			human health	1.03X
	12b	water	aquatic life chronic	2.7X
			national 85th percentile	1.4X
			human health	1.4X
	12c	water	aquatic life chronic	2.2X
			national 85th percentile	1.1X
			human health	1.1X
	13	tissue (largemouth bass)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	1.8X
		tissue (carp)	USFWS predator protection limit	1.3X

Table 14 (continued)
Summary of Screening Level Exceedances, by Parameter*

Parameter	Station	Matrix	Screening Level(s) Exceeded	Exceedance Factor
selenium	14	tissue (carp)	USFWS predator protection limit	1.4X
		tissue (largemouth bass)	USFWS predator protection limit	1.5X
	15	tissue (largemouth bass)	USFWS 85th percentile	1.1X
			USFWS predator protection limit	1.6X
		tissue (carp)	USFWS predator protection limit	1.1X
	16	tissue (carp)	USFWS predator protection limit	1.3X
	18	tissue (largemouth bass)	USFWS predator protection limit	1.2X
silver	1a	sediment	national 85th percentile	11.8X
	7b	water	aquatic life acute[f]	5.2X[f]
			aquatic life chronic[f]	9.8X[f]
	8a	water	aquatic life acute[f]	3.2X[f]
			aquatic life chronic[f]	5.9X[f]
	8b	water	aquatic life acute[f]	3.2X[f]
			aquatic life chronic[f]	5.9X[f]
	8c	water	aquatic life acute[f]	3.7X[f]
			aquatic life chronic[f]	6.9X[f]
	12	water	aquatic life acute[f]	3.2X[f]
			aquatic life chronic[f]	5.9X[f]
thallium	10a	water	human health	1.3X
zinc	1	tissue (carp)	USFWS 85th percentile	1.4X
	1a	sediment	national 85th percentile	2.3X
	2	tissue (carp)	USFWS 85th percentile	1.1X
	4	tissue (carp)	USFWS 85th percentile	1.2X
	5	tissue (carp)	USFWS 85th percentile	1.3X
	6a	tissue (carp)	USFWS 85th percentile	1.9X
	6b	tissue (carp)	USFWS 85th percentile	1.3X
	7	tissue (carp)	USFWS 85th percentile	1.2X
	7b	tissue (carp)	USFWS 85th percentile	1.5X
	8b	tissue (carp)	USFWS 85th percentile	1.4X
	9	tissue (carp)	USFWS 85th percentile	1.8X
	10	tissue (carp)	USFWS 85th percentile	1.4X
	11c	sediment	national 85th percentile	1.1X
	12	tissue (carp)	USFWS 85th percentile	2.2X
	15	tissue (carp)	USFWS 85th percentile	1.2X
	16	tissue (carp)	USFWS 85th percentile	1.3X
chlordane	11a	sediment	aquatic life threshold	7.6X
	11b	sediment	aquatic life threshold	40.0X
			national 85th percentile	2.2X
	11c	sediment	aquatic life threshold	1.9X
			national 85th percentile	2.4X
	12	tissue (carp)	USEPA fish tissue value	2.5X
		tissue (carp)	Texas 85th percentile	3.5X
	15a	sediment	aquatic life threshold	3.7X
p,p' DDE	10a	sediment	national 85th percentile	1.2X
	11a	sediment	national 85th percentile	1.5X
	12d	sediment	national 85th percentile	1.9X
DDT (total)	3	tissue (carp)	USEPA fish tissue value	1.0X
	3a	tissue (carp)	USEPA fish tissue value	2.8X
	7	tissue (carp)	USEPA fish tissue value	1.1X
	14	tissue (blue catfish)	USEPA fish tissue value	1.2X
	16	tissue (channel catfish)	USEPA fish tissue value	1.1X
diazinon	11a	water	aquatic life acute	2.0X
			aquatic life chronic	2.3X
	12d	water	aquatic life acute	26.3X

Table 14 (continued)
Summary of Screening Level Exceedances, by Parameter*

Parameter	Station	Matrix	Screening Level(s) Exceeded	Exceedance Factor
diazinon	12d	water	aquatic life chronic	30.7X
dieldrin	7	tissue (carp)	USEPA fish tissue value	1.6X
	7b	tissue (carp)	USEPA fish tissue value	1.3X
	11a	sediment	national 85th percentile	1.1X
gamma-bhc (lindane)	3	tissue (channel catfish)	USEPA national mean	1.5X
PCB's (total)	7	tissue (carp)	USEPA fish tissue value	11X
	7b	tissue (carp)	USEPA fish tissue value	13X
	8	tissue (carp)	USEPA fish tissue value	11X
	9	tissue (carp)	USEPA fish tissue value	36X
		tissue (channel catfish)	USEPA fish tissue value	17X
		tissue (carp)	USFWS geometric mean	14X
			USFWS predator protection limit	8.4X
		tissue (channel catfish)	USFWS geometric mean	3.0X
			USFWS predator protection limit	1.8X
	10	tissue (carp)	USEPA fish tissue value	4.4X
	11	tissue (channel catfish)	USFWS geometric mean	1.7X
			USFWS predator protection limit	2.8X
bis(2-ethylhexyl) phthalate	11c	water	aquatic life chronic	3.3X
			national 85th percentile	2.0X
		sediment	national 85th percentile	7.3X
diethyl phthalate	15a	water	aquatic life chronic	2.7X
di-n-butyl phthalate	12d	sediment	national 85th percentile	6.9X
cyanide	12d	water	aquatic life chronic	1.8X
	14	water	aquatic life chronic	1.8X

* - includes certain chemicals for which screening levels do not exist, but which occurred at conspicuously high concentrations

a - represents a potential exceedance; instream concentration, which was too low to quantify, was estimated at 20 μg/L

b - no screening level exists, but observed concentration was conspicuously elevated, being the second highest in the study and exceeding the third highest by a factor of 10.8X

c - no screening level exists, but observed concentration was conspicuously elevated, being the greatest in the study and exceeding the second highest by a factor of 2.3X

d - no screening level exists, but observed concentration was conspicuously elevated; this was the only site in the study where parameter was detected in this matrix

e - represents a potential exceedance; screening level concentration is for hexavalent chromium, whereas measured concentration represented total dissolved chromium

f - represents a potential exceedance; screening level concentration is for silver in free ion form, whereas measured concentration represented total dissolved silver

Table 15
Summary of Screening Level Exceedances, by Station*

Station	Parameter	Matrix	Screening Level(s) Exceeded	Exceedance Factor
1	methylene chloride	sediment	aquatic life threshold	16.4X
	cadmium	tissue (carp)	USFWS 85th percentile	1.3X
	chromium	sediment	aquatic life threshold	3.5X
	copper	tissue (carp)	USFWS 85th percentile	1.9X
	nickel	sediment	aquatic life threshold	3.0X
	selenium	tissue (carp)	USFWS predator protection limit	1.1X
	zinc	tissue (carp)	USFWS 85th percentile	1.4X
1a**	residual chlorine	water	aquatic life acute	63.2X
			aquatic life chronic	109.1X
	parachlorometa cresol	sediment	third highest level observed[b]	10.8X[b]
	phenol	sediment	d	d
	chloroform	water	national 85th percentile	1.4X
	arsenic	water	human health	5.1X
	copper	sediment	national 85th percentile	5.6X
	mercury	sediment	national 85th percentile	2.0X
	selenium	sediment	national 85th percentile	1.3X
	silver	sediment	national 85th percentile	11.8X
	zinc	sediment	national 85th percentile	2.3X
2	residual chlorine	water	aquatic life acute[a]	1.1X[a]
			aquatic life chronic[a]	1.8X[a]
	methylene chloride	sediment	aquatic life threshold	23.0X
	toluene	sediment	aquatic life threshold	1.9X
	arsenic	sediment	aquatic life threshold	1.1X
	chromium	sediment	aquatic life threshold	4.5X
	copper	sediment	aquatic life threshold	2.0X
		tissue (carp)	USFWS 85th percentile	1.6X
	lead	sediment	aquatic life threshold	1.4X
		tissue (channel catfish)	USFWS predator protection limit	1.1X
	mercury	sediment	aquatic life threshold	1.0X
	nickel	sediment	aquatic life threshold	3.2X
	selenium	tissue (carp)	USFWS predator protection limit	1.1X
	zinc	tissue (carp)	USFWS 85th percentile	1.1X
2a**	unionized ammonia	water	aquatic life acute	2.6X
			aquatic life chronic	13.6X
	parachlorometa cresol	water	national 85th percentile	1.1X
	phenol	water	national 85th percentile	1.2X
	phenolics recoverable	water	national 85th percentile	1.5X
	methylene chloride	sediment	aquatic life threshold	12.7X
	toluene	sediment	aquatic life threshold	1.5X
	arsenic	water	human health	3.3X
	chromium	sediment	aquatic life threshold	1.4X
	mercury	water	human health	11.5X
	nickel	sediment	aquatic life threshold	1.3X
3	methylene chloride	sediment	aquatic life threshold	10.0X
	arsenic	sediment	aquatic life threshold	2.1X
	chromium	sediment	aquatic life threshold	3.4X
	nickel	sediment	aquatic life threshold	5.4X
	selenium	tissue (channel catfish)	USFWS 85th percentile	1.8X
			USFWS predator protection limit	2.6X
	DDT (total)	tissue (carp)	USEPA fish tissue value	1.0X
	gamma-bhc (lindane)	tissue (channel catfish)	USEPA national mean	1.5X
3a	arsenic	water	national 85th percentile	2.1X
		sediment	aquatic life threshold	3.7X
	chromium	sediment	aquatic life threshold	3.3X
	mercury	tissue (carp)	USFWS predator protection limit	1.4X
	nickel	sediment	aquatic life threshold	5.0X
	selenium	tissue (carp)	USFWS 85th percentile	1.5X

Table 15 (continued)
Summary of Screening Level Exceedances, by Station*

Station	Parameter	Matrix	Screening Level(s) Exceeded	Exceedance Factor
3a	selenium	tissue (carp)	USFWS predator protection limit	2.2X
	DDT (total)	tissue (carp)	USEPA fish tissue value	2.8X
3b**	methylene chloride	sediment	aquatic life threshold	2.2X
	arsenic	water	national 85th percentile	1.1X
	chromium	sediment	aquatic life threshold	1.03X
4	arsenic	water	national 85th percentile	1.4X
		sediment	aquatic life threshold	1.0X
	chromium	sediment	aquatic life threshold	2.0X
	copper	tissue (carp)	USFWS 85th percentile	1.2X
	mercury	tissue (carp)	USFWS predator protection limit	1.5X
	nickel	sediment	aquatic life threshold	2.3X
	selenium	tissue (carp)	USFWS 85th percentile	1.5X
			USFWS predator protection limit	2.1X
	zinc	tissue (carp)	USFWS 85th percentile	1.2X
5	arsenic	water	national 85th percentile	1.6X
		sediment	aquatic life threshold	1.6X
	chromium	sediment	aquatic life threshold	2.6X
	copper	tissue (carp)	USFWS 85th percentile	1.6X
	mercury	tissue (carp)	USFWS predator protection limit	1.5X
	nickel	sediment	aquatic life threshold	3.6X
	selenium	tissue (carp)	USFWS 85th percentile	1.9X
			USFWS predator protection limit	2.8X
		tissue (blue catfish)	USFWS predator protection limit	1.2X
	zinc	tissue (carp)	USFWS 85th percentile	1.3X
5a**	arsenic	sediment	aquatic life threshold	1.7X
	chromium	sediment	aquatic life threshold	4.5X
	nickel	sediment	aquatic life threshold	6.9X
	selenium	water	aquatic life chronic	1.1X
5b**	arsenic	sediment	aquatic life threshold	1.3X
	chromium	sediment	aquatic life threshold	2.9X
	nickel	sediment	aquatic life threshold	2.8X
6	chromium	sediment	aquatic life threshold	1.2X
	mercury	tissue (white bass)	USFWS predator protection limit	1.6X
	nickel	sediment	aquatic life threshold	1.1X
	selenium	tissue (white bass)	TDH risk assessment value	1.1X
		tissue (carp)	USFWS 85th percentile	1.1X
			USFWS predator protection limit	1.7X
		tissue (white bass)	USFWS 85th percentile	2.2X
			USFWS predator protection limit	3.2X
6a	chromium	tissue (carp)	USFWS predator protection limit	1.1X
	copper	tissue (carp)	USFWS 85th percentile	1.2X
	selenium	tissue (carp)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	1.7X
		tissue (channel catfish)	USFWS predator protection limit	1.03X
	zinc	tissue (carp)	USFWS 85th percentile	1.9X
6b	copper	tissue (carp)	USFWS 85th percentile	1.2X
	selenium	tissue (carp)	USFWS 85th percentile	1.3X
			USFWS predator protection limit	1.9X
		tissue (channel catfish)	USFWS predator protection limit	1.3X
	zinc	tissue (carp)	USFWS 85th percentile	1.3X
7	chromium	sediment	aquatic life threshold	2.3X
	copper	tissue (carp)	USFWS 85th percentile	2.0X

Table 15 (continued)
Summary of Screening Level Exceedances, by Station*

Station	Parameter	Matrix	Screening Level(s) Exceeded	Exceedance Factor
7	mercury	tissue (smallmouth bass)	USFWS predator protection limit	1.6X
	nickel	sediment	aquatic life threshold	2.2X
	selenium	tissue (carp)	USFWS 85th percentile	1.4X
			USFWS predator protection limit	2.1X
		tissue (smallmouth bass)	USFWS 85th percentile	1.4X
			USFWS predator protection limit	2.1X
	zinc	tissue (carp)	USFWS 85th percentile	1.2X
	DDT (total)	tissue (carp)	USEPA fish tissue value	1.1X
	dieldrin	tissue (carp)	USEPA fish tissue value	1.6X
	PCBs (total)	tissue (carp)	USEPA fish tissue value	11X
7a**	unionized ammonia	water	aquatic life chronic	1.0X
	chromium	sediment	aquatic life threshold	1.1X
7b	copper	tissue (carp)	USFWS 85th percentile	1.7X
	mercury	tissue (largemouth bass)	USFWS predator protection limit	1.5X
	selenium	tissue (carp)	USFWS predator protection limit	1.3X
		tissue (largemouth bass)	USFWS predator protection limit	1.4X
	silver	water	aquatic life acute[f]	5.2X[f]
			aquatic life chronic[f]	9.8X[f]
	zinc	tissue (carp)	USFWS 85th percentile	1.5X
	dieldrin	tissue (carp)	USEPA fish tissue value	1.3X
	PCBs (total)	tissue (carp)	USEPA fish tissue value	13X
8	chromium	sediment	aquatic life threshold	1.01X
	copper	tissue (carp)	USFWS 85th percentile	1.6X
	nickel	sediment	aquatic life threshold	1.1X
	selenium	tissue (carp)	USFWS predator protection limit	1.3X
		tissue (channel catfish)	USFWS predator protection limit	1.1X
	PCBs (total)	tissue (carp)	USEPA fish tissue value	11X
8a**	silver	water	aquatic life acute[f]	3.2X[f]
			aquatic life chronic[f]	5.9X[f]
8b**	silver	water	aquatic life acute[f]	3.2X[f]
			aquatic life chronic[f]	5.9X[f]
	zinc	tissue (carp)	USFWS 85th percentile	1.4X
8c**	chromium	sediment	aquatic life threshold	3.0X
	nickel	sediment	aquatic life threshold	3.1X
8d	copper	tissue (carp)	USFWS 85th percentile	1.7X
	mercury	tissue (smallmouth bass)	USFWS predator protection limit	1.6X
	selenium	tissue (carp)	USFWS predator protection limit	1.2X
		tissue (smallmouth bass)	USFWS predator protection limit	1.1X
8e**	chromium	sediment	aquatic life threshold	2.3X
	nickel	sediment	aquatic life threshold	2.3X
	silver	water	aquatic life acute[f]	3.7X[f]
			aquatic life chronic[f]	6.9X[f]
9	copper	tissue (carp)	USFWS 85th percentile	2.4X
	lead	tissue (channel catfish)	USFWS 85th percentile	1.1X
	mercury	tissue (carp)	USFWS 85th percentile	1.3X
			USFWS predator protection limit	2.3X
		tissue (channel catfish)	USFWS predator protection limit	2.4X
	selenium	tissue (channel catfish)	USFWS predator protection limit	1.1X
	zinc	tissue (carp)	USFWS 85th percentile	1.8X
	PCBs (total)	tissue (carp)	USEPA fish tissue value	36X
		tissue (channel catfish)	USEPA fish tissue value	17X
		tissue (carp)	USFWS geometric mean	14X
			USFWS predator protection limit	8.4X

Table 15 (continued)
Summary of Screening Level Exceedances, by Station*

Station	Parameter	Matrix	Screening Level(s) Exceeded	Exceedance Factor
9	PCBs (total)	tissue (channel catfish)	USFWS geometric mean	3.0X
			USFWS predator protection limit	1.8X
9a**	unionized ammonia	water	aquatic life chronic	4.1X
	arsenic	water	human health	2.8X
9b	chromium	tissue (largemouth bass)	USFWS predator protection limit	1.46X
	copper	tissue (carp)	USFWS 85th percentile	1.4X
	mercury	tissue (carp)	USFWS 85th percentile	1.0X
		tissue (channel catfish)	USFWS predator protection limit	1.7X
		tissue (largemouth bass)	USFWS 85th percentile	2.2X
	selenium	water	aquatic life chronic	2.9X
			national 85th percentile	1.4X
			human health	1.4X
		tissue (largemouth bass)	USFWS predator protection limit	1.5X
10	copper	tissue (carp)	USFWS 85th percentile	1.6X
	selenium	tissue (carp)	USFWS predator protection limit	1.6X
		tissue (channel catfish)	USFWS predator protection limit	1.2X
	zinc	tissue (carp)	USFWS 85th percentile	1.4X
	PCBs (total)	tissue (carp)	USEPA fish tissue value	4.4X
10a**	antimony	water	national 85th percentile	1.4X
			human health	5.6X
	chromium	sediment	aquatic life threshold	1.3X
	mercury	tissue (carp)	USFWS predator protection limit	1.3X
	nickel	sediment	aquatic life threshold	1.5X
	thallium	water	human health	1.3X
	p,p' DDE	sediment	national 85th percentile	1.2X
11	chromium	sediment	aquatic life threshold	1.1X
		tissue (carp)	USFWS predator protection limit	1.9X
	copper	tissue (carp)	USFWS 85th percentile	2.0X
	mercury	tissue (carp)	USFWS 85th percentile	1.01X
			USFWS predator protection limit	1.7X
		tissue (channel catfish)	USFWS 85th percentile	1.0X
			USFWS predator protection limit	1.7X
	nickel	sediment	aquatic life threshold	1.5X
	selenium	water	aquatic life chronic	1.1X
		tissue (carp)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	1.7X
	PCBs (total)	tissue (channel catfish)	USFWS geometric mean	1.7X
			USFWS predator protection limit	2.8X
11a**	nickel	sediment	aquatic life threshold	1.1X
	selenium	water	aquatic life chronic	1.02X
	chlordane	sediment	aquatic life threshold	7.6X
	p,p' DDE	sediment	national 85th percentile	1.5X
	diazinon	water	aquatic life acute	2.0X
			aquatic life chronic	2.3X
	dieldrin	sediment	national 85th percentile	1.1X
11b**	chromium	sediment	aquatic life threshold	1.7X
	nickel	sediment	aquatic life threshold	2.0X
	chlordane	sediment	aquatic life threshold	40.0X
			national 85th percentile	2.2X
11c**	unionized ammonia	water	aquatic life chronic	6.2X
	parachlorometa cresol	sediment	second highest level observed[c]	2.3X[c]
	arsenic	water	human health	1.5X
	selenium	water	aquatic life chronic	2.1X

Table 15 (continued)
Summary of Screening Level Exceedances, by Station*

Station	Parameter	Matrix	Screening Level(s) Exceeded	Exceedance Factor
11c**	selenium	water	national 85th percentile	1.1X
	zinc	sediment	national 85th percentile	1.1X
	chlordane	sediment	aquatic life threshold	1.9X
			national 85th percentile	2.4X
	bis(2-ethylhexyl) phthalate	water	aquatic life chronic	3.3X
			national 85th percentile	2.0X
		sediment	national 85th percentile	7.3X
12	methylene chloride	sediment	aquatic life threshold	2.3X
	toluene	sediment	aquatic life threshold	1.7X
	chromium	tissue (carp)	USFWS predator protection limit	2.4X
	copper	tissue (carp)	USFWS 85th percentile	1.7X
	mercury	tissue (carp)	USFWS predator protection limit	1.3X
		tissue (channel catfish)	USFWS predator protection limit	1.2X
	nickel	sediment	aquatic life threshold	1.2X
	selenium	tissue (carp)	USFWS predator protection limit	1.3X
	silver	water	aquatic life acute[f]	3.2X[f]
			aquatic life chronic[f]	5.9X[f]
	zinc	tissue (carp)	USFWS 85th percentile	2.2X
	chlordane	tissue (carp)	USEPA fish tissue value	2.5X
		tissue (carp)	Texas 85th percentile	3.5X
12a**	chromium	water	aquatic life chronic[e]	1.4X[e]
		sediment	aquatic life threshold	1.7X
	nickel	sediment	aquatic life threshold	2.1X
	selenium	water	aquatic life chronic	2.1X
			national 85th percentile	1.03X
			human health	1.03X
	di-n-butyl phthalate	sediment	national 85th percentile	6.9X
12b**	chromium	sediment	aquatic life threshold	2.3X
	nickel	sediment	aquatic life threshold	2.2X
	selenium	water	aquatic life chronic	2.7X
			national 85th percentile	1.4X
			human health	1.4X
12c**	nickel	sediment	aquatic life threshold	1.4X
	selenium	water	aquatic life chronic	2.2X
			national 85th percentile	1.1X
			human health	1.1X
12d**	p,p' DDE	sediment	national 85th percentile	1.9X
	diazinon	water	aquatic life acute	26.3X
			aquatic life chronic	30.7X
	cyanide	water	aquatic life chronic	1.8X
12e**	nickel	sediment	aquatic life threshold	1.2X
13	chromium	sediment	aquatic life threshold	1.4X
	copper	tissue (carp)	USFWS 85th percentile	1.2X
	mercury	tissue (largemouth bass)	USFWS 85th percentile	1.4X
			USFWS predator protection limit	2.4X
	nickel	sediment	aquatic life threshold	1.6X
	selenium	tissue (largemouth bass)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	1.8X
		tissue (carp)	USFWS predator protection limit	1.3X
14	arsenic	sediment	aquatic life threshold	1.1X
	chromium	sediment	aquatic life threshold	2.7X
		tissue (channel catfish)	USFWS predator protection limit	1.3X
	copper	tissue (carp)	USFWS 85th percentile	1.3X
	mercury	tissue (channel catfish)	USFWS predator protection limit	1.4X

Table 15 (continued)
Summary of Screening Level Exceedances, by Station*

Station	Parameter	Matrix	Screening Level(s) Exceeded	Exceedance Factor
14	nickel	sediment	aquatic life threshold	2.9X
	selenium	tissue (carp)	USFWS predator protection limit	1.4X
		tissue (largemouth bass)	USFWS predator protection limit	1.5X
	DDT (total)	tissue (blue catfish)	USEPA fish tissue value	1.2X
	cyanide	water	aquatic life chronic	1.8X
15	chromium	sediment	aquatic life threshold	1.0X
	mercury	tissue (largemouth bass)	USEPA fish tissue value	1.3X
			USFWS predator protection limit	1.02X
		tissue (carp)	USFWS predator protection limit	1.3X
	nickel	sediment	aquatic life threshold	1.1X
	selenium	tissue (largemouth bass)	USFWS 85th percentile	1.1X
			USFWS predator protection limit	1.6X
		tissue (carp)	USFWS predator protection limit	1.1X
	zinc	tissue (carp)	USFWS 85th percentile	1.2X
15a**	arsenic	water	human health	1.9X
	mercury	water	human health	23.8X
	chlordane	sediment	aquatic life threshold	3.7X
	diethyl phthalate	water	aquatic life chronic	2.7X
16	chromium	sediment	aquatic life threshold	2.9X
		tissue (carp)	USFWS predator protection limit	2.5X
	copper	tissue (carp)	USFWS 85th percentile	1.4X
		tissue (channel catfish)	USFWS 85th percentile	1.4X
	mercury	tissue (carp)	USEPA fish tissue value	1.05X
		tissue (carp)	USFWS 85th percentile	1.2X
			USFWS predator protection limit	2.1X
		tissue (channel catfish)	USFWS predator protection limit	1.3X
	nickel	sediment	aquatic life threshold	2.9X
	selenium	tissue (carp)	USFWS predator protection limit	1.3X
	zinc	tissue (carp)	USFWS 85th percentile	1.3X
	DDT (total)	tissue (channel catfish)	USEPA fish tissue value	1.1X
17	chromium	sediment	aquatic life threshold	1.5X
	copper	tissue (largemouth bass)	USFWS 85th percentile	1.1X
	mercury	tissue (largemouth bass)	USFWS predator protection limit	1.6X
	nickel	sediment	aquatic life threshold	1.7X
18	chromium	sediment	aquatic life threshold	1.5X
	copper	tissue (carp)	USFWS 85th percentile	1.1X
		tissue (largemouth bass)	USFWS 85th percentile	1.3X
	nickel	sediment	aquatic life threshold	1.9X
	selenium	tissue (largemouth bass)	USFWS predator protection limit	1.2X

* - includes certain chemicals for which screening levels do not exist, but which occurred at conspicuously high concentrations

** - tissue not analyzed at this site

a - represents a potential exceedance; instream concentration, which was too low to quantify, was estimated at 20 μg/L

b - no screening level exists, but observed concentration was conspicuously elevated, being the second highest in the study and exceeding the third highest by a factor of 10.8X

c - no screening level exists, but observed concentration was conspicuously elevated, being the greatest in the study and exceeding the second highest by a factor of 2.3X

d - no screening level exists, but observed concentration was conspicuously elevated; this was the only site in the study where parameter was detected in this matrix

e - represents a potential exceedance; screening level concentration is for hexavalent chromium, whereas measured concentration represented total dissolved chromium

f - represents a potential exceedance; screening level concentration is for silver in free ion form, whereas measured concentration represented total dissolved silver

Table 16
Toxicity Testing Results - *Ceriodaphnia dubia*

Station	Date	Water						Sediment					
		mortality			reproduction			mortality			reproduction		
		con.[a]	sam.[a]	sig.[b]	con.[c]	sam.[c]	sig.[b]	con.[a]	sam.[a]	sig.[b]	con.[c]	sam.[c]	sig.[b]
						Mainstem Stations							
1	11/12/92	0	100	y	18.7	---	---	10	0	n	18.4	19.5	n
2	11/11/92	0	0	n	18.7	15.9	n	10	0	n	18.4	18.9	n
3	11/13/92	0	0	n	18.7	19.3	n	10	0	n	18.4	18.2	n
4	11/14/92	0	10	n	18.7	17.4	n	10	0	n	18.4	21.5	n
5	11/15/92	0	0	n	18.7	18.4	n	10	0	n	18.4	19.2	n
5b	2/8/93	0	0	n	21.6	21.4	n	0	0	n	20.4	20.6	n
6	2/8/93	0	0	n	21.6	20.3	n	0	0	n	20.4	20.2	n
7	2/10/93	0	10	n	21.6	18.7	n	0	0	n	20.4	22.6	n
8	2/10/93	0	0	n	21.6	20.2	n	0	0	n	20.4	22.5	n
9	3/22/93	0	0	n	22.1	21.9	n	0	0	n	20.9	20.5	n
10	3/23/93	0	10	n	22.1	20.5	n	0	0	n	20.9	22.3	n
11	3/24/93	0	0	n	22.1	18.5	n	0	0	n	20.9	21.7	n
12	3/24/93	0	0	n	22.1	21.5	n	0	0	n	20.9	20.3	n
13	1/11/93	0	0	n	20.1	18.6	n	0	0	n	20.7	24.6	n
14	1/12/93	0	0	n	20.1	19.3	n	0	0	n	20.7	18.5	n
15	1/12/93	0	0	n	20.1	19.9	n	0	10	n	20.7	18.4	n

Table 16 (continued)
Toxicity Testing Results - *Ceriodaphnia dubia*

Station	Date	Water						Sediment					
		mortality			reproduction			mortality			reproduction		
		con.[a]	sam.[a]	sig.[b]	con.[c]	sam.[c]	sig.[b]	con.[a]	sam.[a]	sig.[b]	con.[c]	sam.[c]	sig.[b]
16	1/13/93	0	0	n	20.1	20.5	n	0	0	n	20.7	20.6	n
17	1/14/93	0	20	n	20.1	20.4	n	0	0	n	20.7	19.6	n
18	1/14/93	0	0	n	20.1	19.1	n	0	0	n	20.7	19.1	n
Tributary Stations													
1a	11/11/92	0	100	y	18.7	---	---	10	100	y	18.4	---	---
2a	11/12/92	0	100	y	18.7	---	---	10	0	n	18.4	20.1	n
3a	11/13/92	0	0	n	18.7	19.4	n	10	100	y	18.4	---	---
3b	11/13/92	0	0	n	18.7	20.8	n	10	0	n	18.4	20.8	n
5a	11/15/92	0	10	n	18.7	17.0	n	10	0	n	18.4	19.2	n
6a	2/8/93	0	0	n	21.6	5.4	y	0	0	n	20.4	25.5	n
6b	2/9/93	0	0	n	21.6	16.0	y	0	0	n	20.4	16.1	y
7a	2/10/93	0	0	n	21.6	16.0	y	0	0	n	20.4	21.6	n
7b	2/9/93	0	0	n	21.6	15.3	y	0	0	n	20.4	19.8	n
8a	2/11/93	0	0	n	21.6	19.7	n	0	0	n	20.4	19.8	n
8b	2/11/93	0	0	n	21.6	20.8	n	0	0	n	20.4	20.1	n
8c	2/11/93	0	10	n	21.6	21.4	n	0	10	n	20.4	23.0	n
8d	2/12/93	0	0	n	21.6	22.2	n	0	0	n	20.4	18.7	n
8e	2/12/93	0	0	n	21.6	20.5	n	0	0	n	20.4	19.9	n

Table 16 (continued)
Toxicity Testing Results - Ceriodaphnia dubia

Station	Date	Water						Sediment					
		mortality			reproduction			mortality			reproduction		
		con.[a]	sam.[a]	sig.[b]	con.[c]	sam.[c]	sig.[b]	con.[a]	sam.[a]	sig.[b]	con.[c]	sam.[c]	sig.[b]
9a	3/22/93	0	0	n	22.1	16.5	y	0	0	n	20.9	18.5	n
9b	3/22/93	0	0	n	22.1	20.1	n	0	0	n	20.9	21.6	n
10a	3/23/93	0	50	y	22.1	9.6	y	0	20	n	20.9	18.6	n
11a	3/23/93	0	100	y	22.1	---	---	0	10	n	20.9	18.3	n
11b	3/24/93	0	100	y	22.1	---	---	0	0	n	20.9	22.9	n
11c	3/25/93	0	40	y	22.1	4.3	y	0	100	y	20.9	---	---
12a	3/26/93	0	0	n	22.1	20.9	n	0	0	n	20.9	24.4	n
12b	3/25/93	0	0	n	22.1	21.9	n	0	0	n	20.9	23.4	n
12c	3/26/93	0	0	n	22.1	21.2	n	0	0	n	20.9	20.5	n
12d	1/11/93	0	100	y	20.1	---	---	0	10	n	20.7	20.3	n
12e	1/12/93	0	0	n	20.1	17.9	n	0	10	n	20.7	23.0	n
15a	1/13/93	0	20	n	20.1	2.1	y	0	0	n	20.7	18.7	n

[a] - percentage of organisms affected
[b] - whether or not test results were significantly different from the control ($p > 0.95$) (y = yes; n = no)
[c] - mean number of young produced per female
(abbreviations: con. = control; sam. = sample; sig. = significance)

Table 17
Toxicity Testing Results - *Pimephales promelas*

Station	Date	Water			Sediment		
		control[a]	sample[a]	significance[b]	control[a]	sample[a]	significance[b]
				Mainstem Stations			
1	11/12/92	7	0	n	7	0	n
2	11/11/92	7	10	n	7	10	n
3	11/13/92	7	0	n	7	3	n
4	11/14/92	7	3	n	7	10	n
5	11/15/92	7	3	n	7	0	n
5b	2/8/93	3	3	n	7	0	n
6	2/8/93	3	3	n	7	7	n
7	2/10/93	3	7	n	7	7	n
8	2/10/93	3	0	n	7	0	n
9	3/22/93	7	0	n	3	3	n
10	3/23/93	7	0	n	3	0	n
11	3/24/93	7	7	n	3	0	n
12	3/24/93	7	7	n	3	100	y
13	1/11/93	7	3	n	7	7	n
14	1/12/93	7	0	n	7	0	n
15	1/12/93	7	3	n	7	3	n
16	1/13/93	7	0	n	7	0	n
17	1/14/93	7	10	n	7	7	n

Table 17 (continued)
Toxicity Testing Results - *Pimephales promelas*

Station	Date	Water			Sediment		
		control[a]	sample[a]	significance[b]	control[a]	sample[a]	significance[b]
18	1/14/93	7	0	n	7	0	n
				Tributary Stations			
1a	11/11/92	7	100	y	7	100	y
2a	11/12/92	7	100	y	7	27	n
3a	11/13/92	7	3	n	7	7	n
3b	11/13/92	7	10	n	7	7	n
5a	11/15/92	7	0	n	7	3	n
6a	2/8/93	3	7	n	7	0	n
6b	2/9/93	3	7	n	7	17	n
7a	2/10/93	3	10	n	7	0	n
7b	2/9/93	3	7	n	7	10	n
8a	2/11/93	3	7	n	7	0	n
8b	2/11/93	3	0	n	7	10	n
8c	2/11/93	3	3	n	7	10	n
8d	2/12/93	3	3	n	7	7	n
8e	2/12/93	3	7	n	7	0	n
9a	3/22/93	7	100	y	3	17	n
9b	3/22/93	7	3	n	3	3	n

Table 17 (continued)
Toxicity Testing Results - *Pimephales promelas*

Station	Date	Water			Sediment		
		control[a]	sample[a]	significance[b]	control[a]	sample[a]	significance[b]
10a	3/23/93	7	7	n	3	10	n
11a	3/23/93	7	20	n	3	7	n
11b	3/24/93	7	10	n	3	7	n
11c	3/25/93	7	17	n	3	100	y
12a	3/26/93	7	0	n	3	10	n
12b	3/25/93	7	0	n	3	17	n
12c	3/26/93	7	7	n	3	10	n
12d	1/11/93	7	100	y	7	3	n
12e	1/12/93	7	13	n	7	10	n
15a	1/13/93	7	20	n	7	40	y

[a] - percentage of organisms affected; effects include the combined number of dead (unhatched) embryos, dead larvae, and organisms exhibiting terata and abnormal swimming behavior

[b] - whether or not test results were significantly different from the control ($p > 0.95$) (y = yes; n = no)

Table 18
Summary of Rio Grande Toxicity Testing Results from USEPA/TNRCC TOXNET Program, 1991-Present*

Station	Number of Water Toxicity Tests Conducted	Number of Sediment Eluate Toxicity Tests Conducted	Significant Effects
1	3	2	none
2	7	4	*Ceriodaphnia dubia* reproduction reduced in one water sample; *Ceriodaphnia dubia* survival reduced in one water sample; *Ceriodaphnia dubia* reproduction reduced in one sediment eluate sample
4	7	3	fathead minnow survival reduced in one water sample
32.7 km downstream from sta. 8	4	3	none
10	8	3	*Ceriodaphnia dubia* reproduction reduced in two water samples
12	8	3	*Ceriodaphnia dubia* reproduction reduced in one water sample; *Ceriodaphnia dubia* survival reduced in one sediment eluate sample
16	4	3	none
11.2 km upstream from sta. 18	4	0	none
18	4	3	none

* - testing performed by USEPA Region 6 Laboratory, Houston; methodologies and test organisms same as in present study

Table 19
Benthic Macroinvertebrate Data

Parameter	Station										
	1	2	3	4	5	6	7	8	8	9	10
DATE	111292	111192	111392	111492	111592	020893	021093	021093	021093	032293	032393
TIME	0900	1600	1000	0900	1200	1322	1640	1000	1000	0752	0845
SAMPLING METHOD	snags	Surber	Surber	Surber	Surber	Surber	Surber	Surber	snags	Surber	Surber
COMMUNITY INDICES											
Number of Species	42	32	19	50	15	33	64	51	39	50	65
Number of Individuals/m²	17,054	2,446	4,869	9,273	495	910	3,985	6,656	9,985	1,408	22,637
Diversity	3.53	3.38	0.46	4.00	2.78	3.93	4.51	3.42	3.06	4.05	4.49
Redundancy	0.36	0.35	0.93	0.30	0.37	0.27	0.27	0.41	0.44	0.33	0.26
Equitability	0.65	0.68	0.11	0.71	0.71	0.78	0.75	0.60	0.58	0.72	0.75
EPT Index	7	7	7	15	6	13	15	10	5	15	20
TNRCC Mean Point Score	3.00	2.83	1.50	3.17	2.83	3.67	3.33	2.50	2.50	3.50	3.33
Ohio ICI	30	26	27	43	24	46	36	30	22	42	41
FUNCTIONAL FEEDING GROUPS (% of community)											
Grazers	2.41	3.52	1.62	10.20	7.25	22.45	20.80	7.89	7.38	42.97	9.76
Gatherers	17.37	22.54	1.77	16.65	43.48	27.28	20.86	9.71	32.42	26.71	17.33
Filterers	37.16	4.84	95.73	36.83	3.62	35.74	8.02	4.72	0.00	6.80	19.95
Miners	19.75	47.70	0.13	24.07	25.72	3.94	25.52	60.00	16.29	14.63	27.83
Shredders	10.34	14.16	0.13	3.54	16.30	0.94	22.14	15.95	40.92	3.64	13.29
Predators	12.97	7.25	0.61	8.72	3.62	9.65	2.66	1.72	2.99	5.25	11.84
TAXON	NUMBER OF INDIVIDUALS/m²										
COELENTERATA											
Hydra sp.	12								41		
TURBELLARIA											
Dugesia tigrina		469		3			328	443	2,149	41	610
NEMERTEA											
Prostoma rubrum	12		4				40	19	117	2	7

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station										
	1	2	3	4	5	6	7	8	8	9	10
NEMATODA											
unidentified species				24			5	185	15	2	36
HIRUDINEA											
Helobdella stagnalis											
Helobdella triserialis								4	10		
OLIGOCHAETA											
Aeolosoma sp.									41		
Branchiura sowerbyi										4	
Chaetogaster cristallinus								17	56		
Chaetogaster diaphanus									36		
Chaetogaster diastrophus											
Dero digitata											
Dero trifida	29	65						6			
Ilyodrilus templetoni		99						646	10		
Limnodrilus hoffmeisteri		459						2,521			
Limnodrilus sp.				3			8		10		4
Limnodrilus udekemianus		17						129			
Lumbricidae							51				
Nais behningi										2	
Nais pardalis	147			3				19		4	7
Nais simplex							100	6	10		
Nais variabilis	252			3			277	88	203		36
Pristina aequiseta											
Pristina americana											
Pristina leidyi										2	
Pristina osborni											
Pristina sima		17		22			22				
Sparganophilus tamesis		4					5	136		4	47
Stephensoniana trivandrana								41			
Waspa mobilis								13			
GASTROPODA											
Cincinnatia cincinnatiensis											
Cochliopina riograndensis							16	2			
Elimia comalensis							140	424	381		
Ferrissia rivularis	6	4					8	2	30		14
Melanoides granifera											
Physella virgata	12	13					116		10	4	
Pyrgophorus spinosus											

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station									
	1	2	3	4	5	6	7	8	8	9	10
PELECYPODA											
Corbicula fluminea							239	108		60	563
Pisidium casertanum							11	78			
Pisidium compressum							3	121			
AMPHIPODA											
Hyalleia azteca							718	870	3,877		
CLADOCERA											
Daphnia sp.								17			
COPEPODA											
Macrocyclops sp.									10		
DECAPODA											
Palaemonetes vulgaris											
MYSIDACEA											
Neomysis sp.											
OSTRACODA											
Candona sp.							3				
Cypridopsis vidua							3	2	10		
Herpetocypris sp.							5	2	5		
Ilyocypris sp.											4
Limnocythere sp.							3				
Stenocypris sp.							3				
HYDRACARINA											
Atractides sp.											
Brachypoda sp.							16				
Hydrozetes sp.											
Sperchon sp.							3				
unidentified species				3							
COLEOPTERA											
Chrysomelidae											
Cyphon sp.											
Dubiraphia sp.								6			
Enochrus sp.											
Helichus suturalis				293		51					

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station										
	1	2	3	4	5	6	7	8	8	9	10
Heterelmis sp.				57		5					4
Hexacylloepus ferrugineus							3	6			43
Hydrochus sp.											
Laccophilus nr *terminalis*			7								
Lutrochus luteus											
Macrelmis texanus						3	48			6	90
Microcylloepus pusillus				3			118		249	19	179
Ochthebius sp.	6		7	3							
Paracymus sp.											
Paracymus subcupreus			4								
Psephenus texanus							38	2	20		7
Saldidae			4								
Staphylinidae											
Stenelmis cheryl										4	
Stenelmis occidentalis										9	32
Stenelmis sp.				35		5	3		5		
DIPTERA											
Ablabesmyia mallochi											
Ablabesmyia sp.											
Atrichopogon sp.											
Axarus sp.											
Brachydeutera sp.				3			91				
Cardiocladius sp.		90									
Chironomini genus A		9									
Chironomini genus B											
Chironomus decorus gr.		127									
Cladotanytarsus mancus gr.	53										
Cladotanytarsus sp. gr. A										30	187
Cladotanytarsus vanderwulpi gr.	53										
Conchapelopia sp.										11	463
Cricotopus (Cricotopus) bicinctus gr.	2,054	28		83	18		13			24	463
Cricotopus (Cricotopus) tremulus gr.	1,180	659	11	248	136	8	221	222	320	6	649
Cricotopus (Cricotopus) trifascia gr.							35	11		47	2,960
Cricotopus (Isocladius) intersectus gr.											
Cryptochironomus fulvus gr.				124		5				4	187
Dasyhelea sp.											
Dicrotendipes neomodestus	205			164	18			11		17	
Dicrotendipes nervosus Type I											
Dicrotendipes sp.	106										
Einfeldia sp. gr. C						5					

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station										
	1	2	3	4	5	6	7	8	8	9	10
Geranomyia sp.							22				
Glyptotendipes sp. gr. A											
Goeldichironomus holoprasinus gr.											
Goeldichironomus pictus gr.											
Hemerodromia sp.	59	4									32
Labrundinia neopilosella	106										
Labrundinia sp.											
Limnophila sp.											
Limnophora sp.							3				
Nanocladius distinctus											
Nanocladius minimus				40							
Nanocladius rectinervis	53					8				13	
Nilothauma sp.											187
Orthocladius (Eudactylocladius) sp.				331							187
Orthocladius (Euorthocladius) sp.											93
Orthocladius (Orthocladius) nr *clarki*							323	93	1,067	4	
Orthocladius (Orthocladius) nr *dentifer*	358						22	140	20	24	1,389
Orthocladius (Orthocladius) sp.				1,074	29	13	22				
Parachironomus arcuatus gr.											
Parachironomus frequens gr.											
Paracladius sp.									41		
Paracladopelma camptolabis gr.	53										
Parakiefferiella nr *bathophila*	822	9	4	826	179	5	8	24	483	41	1,019
Pedionomus beckae											
Pentaneura sp.	153						8	11	20	6	370
Polypedilum convictum		9	4	455	11	5		24	41	26	2,591
Polypedilum illinoense	258								61	4	
Polypedilum nr *scalaenum* sp. B	153					5		11			187
Probezzia sp.									41		
Pseudochironomus sp.							8			67	1,482
Rheotanytarsus exiguus gr.							8			4	1,758
Sarcophaga dux				3							
Simulium nr *bivittatum*	6	6	4,600	22	14	24					14
Simulium nr *trivittatum*	12										
Simulium nr *vittatum*		4						9			90
Simulium sp.							5			4	
Stenochironomus sp.	358			40							
Tabanus sp.											4
Tanytarsus glabrescens gr.	53	54		702							
Tanytarsus guerlus gr.	106	17									
Tanytarsus nr *coffmani*											

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station										
	1	2	3	4	5	6	7	8	8	9	10
Telopelopia sp.	1,491			40	7	5					
Thienemanniella nr *fusca*	153										
Thienemanniella nr *xena*	516	9		83		5			142		
Thienemanniella sp.									41		
Thienemannimyia sp.											276
Tribelos sp.											
EPHEMEROPTERA											
Acentrella carolina				32	7	38	151	24	5	2	187
Acentrella insignificans		52									
Baetis ephippiatus			4								
Baetodes edmundsi				11			8				
Brachycercus sp.			4								4
Caenis latipennis											
Callibaetis sp.					4						
Camelobaetidius mexicanus			4				27	2		4	4
Centroptilum sp.			7								
Choroterpes (Neochoroterpes) mexicanus			126	65	11	43				54	
Fallceon quilleri	393	24	7	59	43	3	215	82	249	17	147
Heptagenia sp.	235	6									
Isonychia sicca manca							3			4	233
Leptohyphes apache gr.				3							
Leptohyphes packeri							3	4		39	14
Rhithrogena sp.						16					
Stenonema sp.											
Thraulodes gonzalesi				172	7	54	30	9		200	29
Traverella presidiana				794		86	16				
Tricorythodes albilineatus gr.	1,056	15		307		151	86	26	81	71	395
Tricorythodes curvatus gr.											22
HEMIPTERA											
Ambrysus circumcinctus				19							11
Belostoma sp.			4								
Cryphocricos hungerfordi							5			2	68
Corixidae						3	3				
Limnocoris lutzi											7
Merragata sp.			4	439							
Rhagovelia sp.		2									
LEPIDOPTERA											
Parapoynx sp.											

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station 1	2	3	4	5	6	7	8	8	9	10
Parargyractis sp.				8		3	19	13	5	2	129
Synclita sp.											
MEGALOPTERA											
Corydalus cornutus				5		5	3				11
NEUROPTERA											
Climacia areolaris											
ODONATA											
Argia sp. A	100	73				35		2		4	4
Argia sp. B							13				
Brechmorhoga mendax				5							25
Enallagma sp.	100			3							
Erpetogomphus sp.	12	6	7	70	7	32	3	2		32	237
Gomphus (Gomphurus) externus											
Hetaerina sp.	53										
TRICHOPTERA											
Cheumatopsyche sp.		4	61	164	4	16	35			4	377
Cyrnellus fraternus											
Helicopsyche sp.	6						32	2		2	11
Hydropsyche sp.											25
Hydroptila sp.	23	11		124		3	199	15	41	420	452
Ithytrichia sp.				5							
Leptonema sp.											126
Mayatrichia ayama				22		48					4
Nectopsyche candida	29										
Nectopsyche gracilis				5		3	3	4	30	2	4
Neotrichia sp.											
Neureclipsis sp.											
Ochrotrichia sp.				73						41	2,379
Oecetis sp.							8	2		2	68
Polycentropus sp.							3				
Protoptila sp.						16					47
Smicridea sp.	6,215	80		2,204		199				6	1,353

Table 19 (continued)
Benthic Macroinvertebrate Data

Parameter	Station 11	12	12	13	14	15	16	17	18
DATE	032493	032493	032493	011193	011293	011293	011393	011493	011493
TIME	0835	1343	1343	1400	1415	1700	1000	1000	1500
SAMPLING METHOD	Surber	Surber	snags	snags	Surber	snags	snags	snags	snags
COMMUNITY INDICES									
Number of Species	46	41	27	35	39	29	40	34	31
Number of Individuals/m²	1,903	14,801	18,300	2,534	443	7,947	35,642	42,517	8,977
Diversity	3.88	3.89	3.28	3.60	4.24	3.08	3.79	3.10	3.43
Redundancy	0.34	0.28	0.32	0.36	0.29	0.39	0.29	0.39	0.32
Equitability	0.70	0.73	0.69	0.70	0.80	0.63	0.71	0.61	0.69
EPT Index	17	5	2	7	10	8	6	5	6
TNRCC Mean Point Score	3.50	2.67	2.17	3.17	3.67	2.33	2.50	2.33	2.33
Ohio ICI	38	22	14	30	36	30	24	28	28
FUNCTIONAL FEEDING GROUPS (% of community)									
Grazers	22.91	3.45	1.50	8.06	23.31	4.44	1.18	0.92	2.06
Gatherers	24.59	4.84	6.54	23.15	13.67	6.90	2.19	2.14	3.00
Filterers	28.97	1.55	0.06	3.84	22.82	5.76	5.77	23.58	32.04
Miners	7.50	70.99	63.15	29.62	20.47	69.63	77.15	54.36	56.66
Shredders	3.91	8.09	15.87	21.44	7.92	7.57	10.26	16.52	2.16
Predators	12.12	11.07	12.88	13.90	11.81	5.69	3.45	2.48	4.06
TAXON	NUMBER OF INDIVIDUALS/m²								
COELENTERATA *Hydra* sp.	3	133	23					36	
TURBELLARIA *Dugesia tigrina*	5	535	613		2	17	27		
NEMERTEA *Prostoma rubrum*		172	40		45	11	7	4	141

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station								
	11	12	12	13	14	15	16	17	18
NEMATODA									
unidentified species	3	36	104		2			36	459
HIRUDINEA									
Helobdella stagnalis		32							
Helobdella triserialis		22							
OLIGOCHAETA									
Aeolosoma sp.		309	1,122						276
Branchiura sowerbyi	5								
Chaetogaster cristallinus									
Chaetogaster diaphanus							2,601		
Chaetogaster diastrophus				6					
Dero digitata		850							
Dero trifida		771	1,284				5,723	503	94
Ilyodrilus templetoni									
Limnodrilus hoffmeisteri		1,543							
Limnodrilus sp.				6					
Limnodrilus udekemianus									
Lumbricidae									
Nais behningi									
Nais pardalis				6	30	706	5,203	11,034	2,100
Nais simplex									
Nais variabilis		771	4,008	6		94			365
Pristina aequiseta							3,122	36	1,006
Pristina americana		388							
Pristina leidyi		79	162						94
Pristina osborni				6					
Pristina sima									
Sparganophilus tamesis									
Stephensoniana trivandrana									
Waspa mobilis		79							
GASTROPODA									
Cincinnatia cincinnatiensis	5				2	6			
Cochliopina riograndensis					2				
Elimia comalensis									
Ferrissia rivularis	11	283	6	6		6			
Melanoides granifera					11				
Physella virgata	13	68	127		2	11	14	148	
Pyrgophorus spinosus					2				

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station								
	11	12	12	13	14	15	16	17	18
PELECYPODA									
Corbicula fluminea	428	230			6				
Pisidium casertanum									
Pisidium compressum									
AMPHIPODA									
Hyallela azteca					17				
CLADOCERA									
Daphnia sp.									
COPEPODA									
Macrocyclops sp.									
DECAPODA									
Palaemonetes vulgaris					6				
MYSIDACEA									
Neomysis sp.					4				
OSTRACODA									
Candona sp.									
Cypridopsis vidua				19					
Herpetocypris sp.									
Ilyocypris sp.									
Limnocythere sp.				52					
Stenocypris sp.									
HYDRACARINA									
Atractides sp.							7		
Brachypoda sp.									
Hydrozetes sp.				6					
Sperchon sp.									
unidentified species									
COLEOPTERA									
Chrysomelidae		4		58				4	
Cyphon sp.							74	18	
Dubiraphia sp.									
Enochrus sp.								4	
Helichus suturalis									

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station 11	12	12	13	14	15	16	17	18
Heterelmis sp.		4	116	6		6	81		
Hexacylloepus ferrugineus									
Hydrochus sp.								4	
Laccophilus nr *terminalis*									
Lutrochus luteus					2				
Macrelmis texanus	3				2				
Microcylloepus pusillus	3	57	156		4	11	108	112	112
Ochthebius sp.							7		
Paracymus sp.							14		
Paracymus subcupreus									
Psephenus texanus	5								
Saldidae									
Staphylinidae							54		
Stenelmis cheryl									
Stenelmis occidentalis				6	2				
Stenelmis sp.		36					14		
DIPTERA									
Ablabesmyia mallochi				13		254			
Ablabesmyia sp.							196		
Atrichopogon sp.								94	
Axarus sp.									12
Brachydeutera sp.		29							
Cardiocladius sp.									
Chironomini genus A									
Chironomini genus B								157	171
Chironomus decorus gr.							196		
Cladotanytarsus mancus gr.									
Cladotanytarsus sp. gr. A									
Cladotanytarsus vanderwulpi gr.									
Conchapelopia sp.	5		98	52					
Cricotopus (Cricotopus) bicinctus gr.	5		1,712	564	11	861	2,588		12
Cricotopus (Cricotopus) tremulus gr.									
Cricotopus (Cricotopus) trifascia gr.									
Cricotopus (Isocladius) intersectus gr.								3,910	
Cryptochironomus fulvus gr.		122							
Dasyhelea sp.	3				17		7		
Dicrotendipes neomodestus		122	706	194		3,041	3,784	315	12
Dicrotendipes nervosus Type I								1,407	41
Dicrotendipes sp.									
Einfeldia sp. gr. C									

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station								
	11	12	12	13	14	15	16	17	18
Geranomyia sp.				6	2			166	6
Glyptotendipes sp. gr. A				13			3,189	7,978	24
Goeldichironomus holoprasinus gr.					2				
Goeldichironomus pictus gr.									94
Hemerodromia sp.	3			13	2				
Labrundinia neopilosella									
Labrundinia sp.			98						
Limnophila sp.						17	7		6
Limnophora sp.							20		
Nanocladius distinctus	5	366				50	1,993	1,564	159
Nanocladius minimus									
Nanocladius rectinervis			301			99		939	488
Nilothauma sp.									
Orthocladius (Eudactylocladius) sp.					2		196		
Orthocladius (Euorthocladius) sp.									
Orthocladius (Orthocladius) nr *clarki*		2,077	98						
Orthocladius (Orthocladius) nr *dentifer*	11	1,711	602	39	50	657	797		
Orthocladius (Orthocladius) sp.									
Parachironomus arcuatus gr.			98						94
Parachironomus frequens gr.								157	
Paracladius sp.									
Paracladopelma camptolabis gr.									
Parakiefferiella nr *bathophila*									
Pedionomus beckae								157	
Pentaneura sp.									
Polypedilum convictum	51	2,935	405	58	2		196		
Polypedilum illinoense	135	610	5,633	512	2	508	1,993	2,503	53
Polypedilum nr *scalaenum* sp. B									
Probezzia sp.									
Pseudochironomus sp.	57	244							
Rheotanytarsus exiguus gr.				13	17	155	1,196	157	
Sarcophaga dux									
Simulium nr *bivittatum*	8						7		
Simulium nr *trivittatum*									
Simulium nr *vittatum*									
Simulium sp.			6	13					
Stenochironomus sp.			405					315	118
Tabanus sp.									
Tanytarsus glabrescens gr.				19		811	797	36	65
Tanytarsus guerlus gr.									
Tanytarsus nr *coffmani*						50			

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station								
	11	12	12	13	14	15	16	17	18
Telopelopia sp.							196		
Thienemanniella nr *fusca*						408		625	
Thienemanniella nr *xena*			301	19			399		
Thienemanniella sp.									
Thienemannimyia sp.				84					
Tribelos sp.									24
EPHEMEROPTERA									
Acentrella carolina									
Acentrella insignificans									
Baetis ephippiatus									
Baetodes edmundsi									
Brachycercus sp.	105	4							
Caenis latipennis									6
Callibaetis sp.								13	
Camelobaetidius mexicanus	13								
Centroptilum sp.									
Choroterpes (Neochoroterpes) mexicanus									
Fallceon quilleri	51	4		285	15	50	20		
Heptagenia sp.									
Isonychia sicca manca	62								
Leptohyphes apache gr.									
Leptohyphes packeri					2				
Rhithrogena sp.									
Stenonema sp.				26		11	7	4	
Thraulodes gonzalesi	374			6	6				
Traverella presidiana	22								
Tricorythodes albilineatus gr.	5	7		318	24	77	203		
Tricorythodes curvatus gr.	8								
HEMIPTERA									
Ambrysus circumcinctus									
Belostoma sp.									
Cryphocricos hungerfordi	11								
Corixidae								36	
Limnocoris lutzi	30								
Merragata sp.	5	4							
Rhagovelia sp.									
LEPIDOPTERA									
Parapoynx sp.	3								

Table 19 (continued)
Benthic Macroinvertebrate Data

Taxon	Station 11	12	12	13	14	15	16	17	18
Parargyractis sp.		4			4				
Synclita sp.							14		
MEGALOPTERA									
Corydalus cornutus		4							
NEUROPTERA									
Climacia areolaris				6					
ODONATA									
Argia sp. A	27	11			2				
Argia sp. B									
Brechmorhoga mendax	8								
Enallagma sp.									
Erpetogomphus sp.	38								
Gomphus (Gomphurus) externus	3	4							
Hetaerina sp.		4							
TRICHOPTERA									
Cheumatopsyche sp.									
Cyrnellus fraternus							74	364	18
Helicopsyche sp.	16				4				
Hydropsyche sp.	11					11	311	9,492	2,376
Hydroptila sp.	51	100	69	6	47	6		184	6
Ithytrichia sp.				19	4	6			
Leptonema sp.									
Mayatrichia ayama	3								
Nectopsyche candida									
Nectopsyche gracilis					2	6			
Neotrichia sp.									94
Neureclipsis sp.	3								
Ochrotrichia sp.	223								
Oecetis sp.	11				2				
Polycentropus sp.									
Protoptila sp.	3	39							
Smicridea sp.	51		6	65	78	6	203		453

TABLE 20. Fishes collected at selected sites in the Rio Grande basin by Texas Parks and Wildlife Department and Comision Nacional del Agua. Fishes were sampled in 1992-1993 by seining and electrofishing.

		SITES																								
Scientific name	Common name	1	2	3	3A	4	5	6	6A	6B	7	7B	8	8D	9	9B	10	11	12	12D	13	14	15	16	17	18
Lepisosteus oculatus	Spotted gar												1												1	
Lepisosteus osseus	Longnose gar				3		3	1		4													1			
Anguilla rostrata	American eel																					1				
Dorosoma cepedianum	Gizzard shad	36	50		27	4	3	8		12		9		46	3	2	3	45	4		81	3	3		3	
Dorosoma petenense	Threadfin shad				6																5				3	
Cyprinella lutrensis	Red shiner	386	92	270	173	154	68	307	25					75	119	163	251	75	153	2	8	26	120	40	21	
Cyprinella proserpina	Proserpine shiner								44	207		4														
Cyprinella venusta	Blacktail shiner								94	159		8	7	100	102	142	188	24	23							
Cyprinus carpio	Common carp	14	22	1	68	18	26	10	28	18	32	20	21	3	16	6	17	10	17		2	10	7	6	9	8
Dionda episcopa	Roundnose minnow												7	10	1	3										
Macrhybopsis aestivalis	Speckled chub			6	10	2	5	6	2									29	2							
Notropis amabilis	Texas shiner								47	11	2			13		1	5									
Notropis braytoni	Tamaulipas shiner			1	7	1	6	26	15									7								
Notropis jemezanus	Rio Grande shiner						2	5							46	4		1								
Notropis stramineus	Sand shiner									60																
Pimephales promelas	Fathead minnow			1																						
Pimephales vigilax	Bullhead minnow	198	64						1						7	30	1	15	24		3	1	1			
Rhinichthys cataractae	Longnose dace				3	1	25	59																		
Carpiodes carpio	River carpsucker	8	3	2	6	10	37	21														14	9	1		
Cycleptus elongatus	Blue sucker				13	33	4												2							
Ictiobus bubalus	Smallmouth buffalo							1													2	1	2			
Moxostoma austrinum	Mexican redhorse											2														
Moxostoma congestum	Gray redhorse								2	3		10	7	14	41	16	7		7							
Astyanax mexicanus	Mexican tetra			3	1							18		31	2	9			1	1	18	54	116	108	2	
Ictalurus furcatus	Blue catfish			4		14	5															1		1	2	
Ictalurus punctatus	Channel catfish	27	16	47		4			3	12			10		12	3	5	10	10		1	2	2	11	1	1
Ictalurus lupus	Headwater catfish															2										
Pylodictis olivaris	Flathead catfish	2			2		1		1						1			1								
Strongylura marina	Atlantic needlefish																				1					
Cyprinodon variegatus	Sheepshead minnow																			88						4
Fundulus grandis	Gulf killifish																			4				4		
Fundulus zebrinus	Plains killifish				1																					
Gambusia affinis	Western mosquitofish	11	779	90	83	159					63		11	245	3	2	15	1		7		1	1		4	
Poecilia formosa	Amazon molly																			251						65
Poecilia latipinna	Sailfin molly																			38	1					7
Menidia beryllina	Inland silverside				9						3	4	10			23				8	5	2	25	16	17	18
Morone chrysops	White bass		6					23											1		3	2	2		1	
Lepomis auritus	Redbreast sunfish									25		2		9	8	2	2				4					
Lepomis cyanellus	Green sunfish				1								2	2		2					3					
Lepomis gulosus	Warmouth										1		2	1		1			1		3	1				
Lepomis macrochirus	Bluegill sunfish	1			2									3	1	3	5	1	5		17	16	11	2	18	11
Lepomis megalotis	Longear sunfish	1	1			1				5	8		3	4	7	18			2							
Lepomis microlophus	Redear sunfish																				5	5			1	
Micropterus dolomieu	Smallmouth bass									8	7			9	5											
Micropterus salmoides	Largemouth bass		1					1		5		13	2	2	1	5			3	1	38	33	27	4	13	23
Etheostoma grahami	Rio Grande darter								8		10		1	6	3	3										
Stizostedion vitreum	Walleye	1																								
Aplodinotus grunniens	Freshwater drum							3													4					
Cichlasoma cyanoguttatum	Rio Grande cichlid									3	2	2		1		5				3	3		2			3
Tilapia aurea	Blue tilapia				7		1			1		16			1	15	1			2	5	5	2		1	6
Agonostomus monticola	Mountain mullet																					2			3	
Mugil cephalus	Striped mullet																					1	1		4	45
Gobiomorus dormitor	Bigmouth sleeper																					22	9	1	20	16

TABLE 21. Similarity index calculated for fishes collected from the Rio Grande and tributaries by the Texas Parks and Wildlife Department and Comision Nacional del Agua. Fishes were sampled in 1992-1993 using seines and electrofishing gear.

	SITES																								
	1	2	3	3A	4	5	6	6A	6B	7	7B	8	8D	9	9B	10	11	12	12D	13	14	15	16	17	18
1	1.000																								
2	0.762	1.000																							
3	0.476	0.500	1.000																						
3A	0.483	0.357	0.500	1.000																					
4	0.609	0.636	0.727	0.600	1.000																				
5	0.417	0.348	0.522	0.710	0.720	1.000																			
6	0.333	0.522	0.435	0.516	0.560	0.692	1.000																		
6A	0.435	0.364	0.455	0.333	0.417	0.400	0.320	1.000																	
6B	0.308	0.400	0.160	0.242	0.296	0.286	0.286	0.444	1.000																
7	0.300	0.316	0.211	0.222	0.286	0.091	0.091	0.286	0.417	1.000															
7B	0.174	0.273	0.182	0.333	0.167	0.240	0.240	0.333	0.667	0.286	1.000														
8	0.333	0.435	0.261	0.258	0.320	0.077	0.154	0.400	0.429	0.545	0.240	1.000													
8D	0.414	0.429	0.286	0.389	0.333	0.194	0.258	0.400	0.606	0.593	0.533	0.645	1.000												
9	0.600	0.552	0.345	0.432	0.387	0.375	0.313	0.516	0.588	0.357	0.516	0.563	0.757	1.000											
9B	0.471	0.485	0.303	0.439	0.343	0.278	0.278	0.400	0.579	0.500	0.571	0.667	0.829	0.810	1.000										
10	0.609	0.545	0.364	0.400	0.417	0.320	0.240	0.583	0.593	0.286	0.500	0.400	0.600	0.710	0.686	1.000									
11	0.696	0.545	0.545	0.533	0.583	0.560	0.480	0.667	0.296	0.190	0.250	0.320	0.400	0.645	0.457	0.667	1.000								
12	0.538	0.640	0.400	0.424	0.519	0.357	0.429	0.519	0.467	0.250	0.444	0.500	0.606	0.647	0.421	0.593	0.593	1.000							
12D	0.182	0.286	0.286	0.345	0.174	0.167	0.167	0.087	0.231	0.300	0.436	0.250	0.345	0.333	0.176	0.261	0.174	0.231	1.000						
13	0.375	0.452	0.258	0.462	0.242	0.235	0.412	0.242	0.389	0.267	0.485	0.353	0.513	0.500	0.364	0.485	0.364	0.556	0.438	1.000					
14	0.500	0.581	0.452	0.482	0.424	0.353	0.412	0.242	0.278	0.267	0.364	0.353	0.410	0.500	0.364	0.485	0.424	0.556	0.375	0.687	1.000				
15	0.552	0.643	0.429	0.656	0.400	0.387	0.516	0.267	0.424	0.296	0.467	0.323	0.444	0.541	0.390	0.533	0.467	0.545	0.483	0.667	0.821	1.000			
16	0.455	0.476	0.571	0.414	0.435	0.333	0.333	0.261	0.231	0.200	0.348	0.333	0.345	0.400	0.235	0.348	0.348	0.462	0.455	0.438	0.625	0.621	1.000		
17	0.414	0.500	0.429	0.500	0.400	0.323	0.323	0.200	0.303	0.222	0.400	0.387	0.333	0.466	0.341	0.467	0.400	0.485	0.414	0.615	0.821	0.722	0.821	1.000	
18	0.261	0.273	0.182	0.267	0.167	0.160	0.160	0.167	0.370	0.286	0.417	0.320	0.267	0.323	0.229	0.333	0.250	0.296	0.609	0.485	0.485	0.600	0.522	0.533	1.000

TABLE 22. Ratings of sites on the Rio Grande upstream of Falcon Reservoir and on the Rio Conchos using a modified Index of Biotic Integrity.

	SITES																									
Metric	1		2		3		3A		4		5		6		7		8		9		10		11		12	
1. Total number of species	11	3	10	3	10	3	18	5	12	3	13	3	13	3	9	3	13	3	19	5	12	3	12	3	15	5
2. Number of minnow species	2	1	2	1	4	3	4	3	4	3	5	3	5	3	1	1	2	1	5	3	4	3	6	5	4	3
3. % of individuals in most abundant species	56.35	1	75.41	1	63.53	1	41.00	3	39.65	5	36.56	5	65.18	1	49.22	3	25.00	5	31.40	5	50.20	3	34.25	5	60.00	1
4. Total number of individuals																										
a. Individuals per hour electrofishing	340	5	181	3	--		296	5	120	3	114	3	86	1	72	1	133	3	159	3	121	3	229	5	144	3
b. Individuals per seine haul	67	3	103	5	61	3	36	3	47	3	16	1	47	3	6	1	5	1	36	3	66	3	16	1	21	1
Mean		4		4		3		4		3		2		2		1		2		3		3		3		2
5. % diseased individuals	0.00	5	0.00	5	0.00	5	1.42	1	0.00	5	1.00	3	0.85	3	0.00	5	0.00	5	0.26	5	0.20	5	0.00	5	2.75	1
6. % of individuals as introduced species	2.19	5	2.61	5	0.24	5	18.01	1	4.49	5	14.52	1	7.01	3	30.47	1	33.33	1	34.83	1	41.60	1	15.53	1	16.08	1
Total IBI score		19		19		20		17		24		17		15		14		17		22		18		22		13

TABLE 23. Ratings of Rio Grande sites downstream of Falcon Reservoir and on Arroyo Los Olmos using a modified Index of Biotic Integrity.

		SITES													
	Metric	12D		13		14		15		16		17		18	
1.	Total number of species	11	3	21	5	21	5	18	5	11	3	18	5	12	3
2.	% of individuals as estuarine/marine species	96.05	1	3.3	5	13.79	5	10.26	5	10.82	5	35.48	3	74.88	1
3.	% of individuals in most abundant species	61.98	1	38.21	5	26.60	5	35.19	5	55.67	1	16.94	5	31.40	5
4.	Total number of individuals														
	a. Individuals per hour electrofishing	--		82	1	98	1	74	1	49	1	97	1	132	3
	b. Individuals per seine haul	101	5	--		5	1	33	1	18	1	5	1	13	1
	Mean		5		1		1		1		1		1		2
5.	% diseased individuals	0.24	5	0.47	5	1.97	1	0.00	5	0.00	5	0.00	5	0.48	5
6.	% of individuals as introduced species	0.49	5	8.96	3	10.84	3	3.23	5	3.09	5	9.68	3	6.76	3
	Total IBI score		20		24		20		26		20		22		19

TABLE 24. Ratings of middle reach tributaries on the Rio Grande using a modified Index of Biotic Integrity.

		SITE									
	Metric	6A		6B		7B		8D		9B	
1.	Total number of species	12	3	15	5	12	3	18	5	23	5
2.	Number of minnow species	7	5	4	3	2	1	4	3	6	5
3.	% of individuals in most abundant species	34.81	5	38.84	5	18.52	5	42.68	3	35.43	5
4.	Total number of individuals										
	a. Individuals per hour electrofishing	110	1	213	3	246	5	350	5	307	5
	b. Individuals per seine haul	26	1	62	3	2	1	48	3	62	3
	Mean		1		3		3		4		4
5.	% diseased individuals	0.00	5	0.19	5	0.00	5	0.00	5	0.65	3
6.	% of individuals as introduced species	45.19	1	39.59	1	42.59	1	21.08	1	35.87	1
			20		22		18		21		23

Table 25
Ranking of Mainstem Sites Based on Seventeen Components of the Toxic Chemical Evaluation*

Station	Station Description	Rank
12	downstream from Laredo/Nuevo Laredo	1.0
7	upstream from Del Rio/Acuna	2.0
2	downstream from El Paso/Juarez	3.0
16	downstream from Hidalgo/Reynosa	4.0
3	upstream from Presidio/Ojinaga	5.0
5	at mouth of Santa Elena Canyon	6.5
14	downstream from Anzalduas Dam	6.5
8	downstream from Del Rio/Acuna	8.0
1	upstream from El Paso/Juarez	9.0
17	upstream from Brownsville/Matamoros	10.0
11	upstream from Laredo/Nuevo Laredo	11.0
4	downstream from Presidio/Ojinaga	12.0
10	downstream from Eagle Pass/Piedras Negras	13.0
6	at Foster Ranch near Langtry	14.5
15	upstream from Hidalgo/Reynosa	14.5
18	downstream from Brownsville/Matamoros	16.0
13	upstream from Anzalduas Dam	17.0
9	upstream from Eagle Pass/Piedras Negras	18.0

* - a rank of "1.0" reflects adverse implications; "18.0" reflects favorable implications

Table 26
Ranking of Tributary Sites Based on Twelve Components of the Toxic Chemical Evaluation*

Station	Station Description	Rank
1a	El Paso PSB Haskell Street WWTP outfall	1.0
11c	Arroyo el Coyote	2.0
2a	Juarez sewage discharge canal	3.0
11a	Zacate Creek	4.0
12d	Arroyo Los Olmos	5.0
15a	Anhelo Drain	6.0
10a	Manadas Creek	7.0
9a	unnamed tributary 3.6 km below Piedras Negras	8.0
11b	Chacon Creek	9.0
3a	Rio Conchos	10.0
8e	Maverick Canal	11.0
12c	Rio San Juan	12.0
12a	Rio Salado	13.0
7b	San Felipe Creek	14.0
12b	Rio Alamo	15.0
5a	Terlingua Creek	16.0
7a	Arroyo de las Vacas	17.0
12e	Puertecitos Drain	18.0
3b	Alamito Creek	19.0
8c	Las Moras Creek	20.0
6b	Devils River	21.0
8a	Pinto Creek	22.0
9b	Rio Escondido	23.0
8b	Rio San Diego	24.0
6a	Pecos River	25.0
8d	Rio San Rodrigo	26.0

* - a rank of "1.0" reflects adverse implications; "26.0" reflects favorable implications

APPENDIX B

Figures

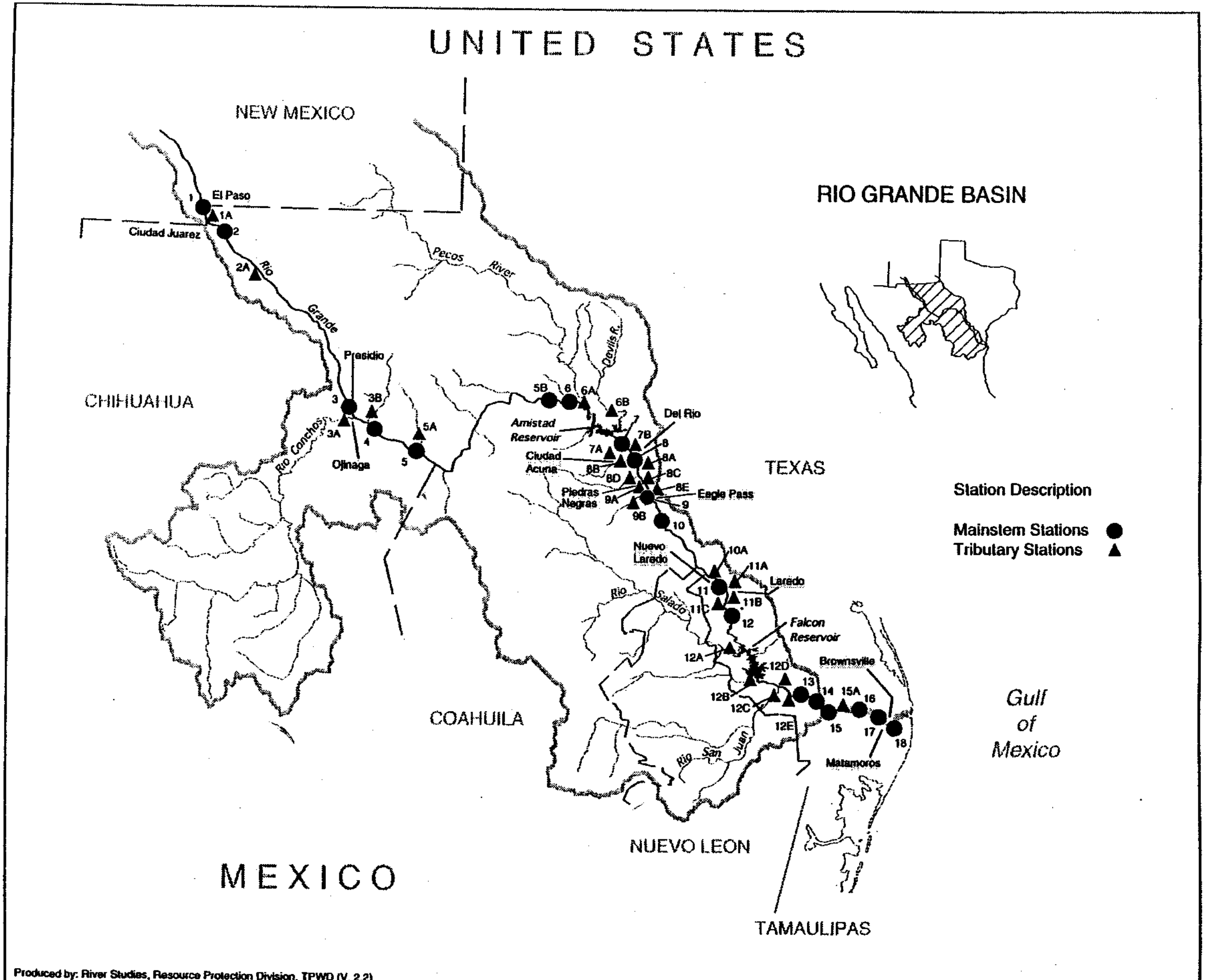


Figure 1. See table 1 for site descriptions.

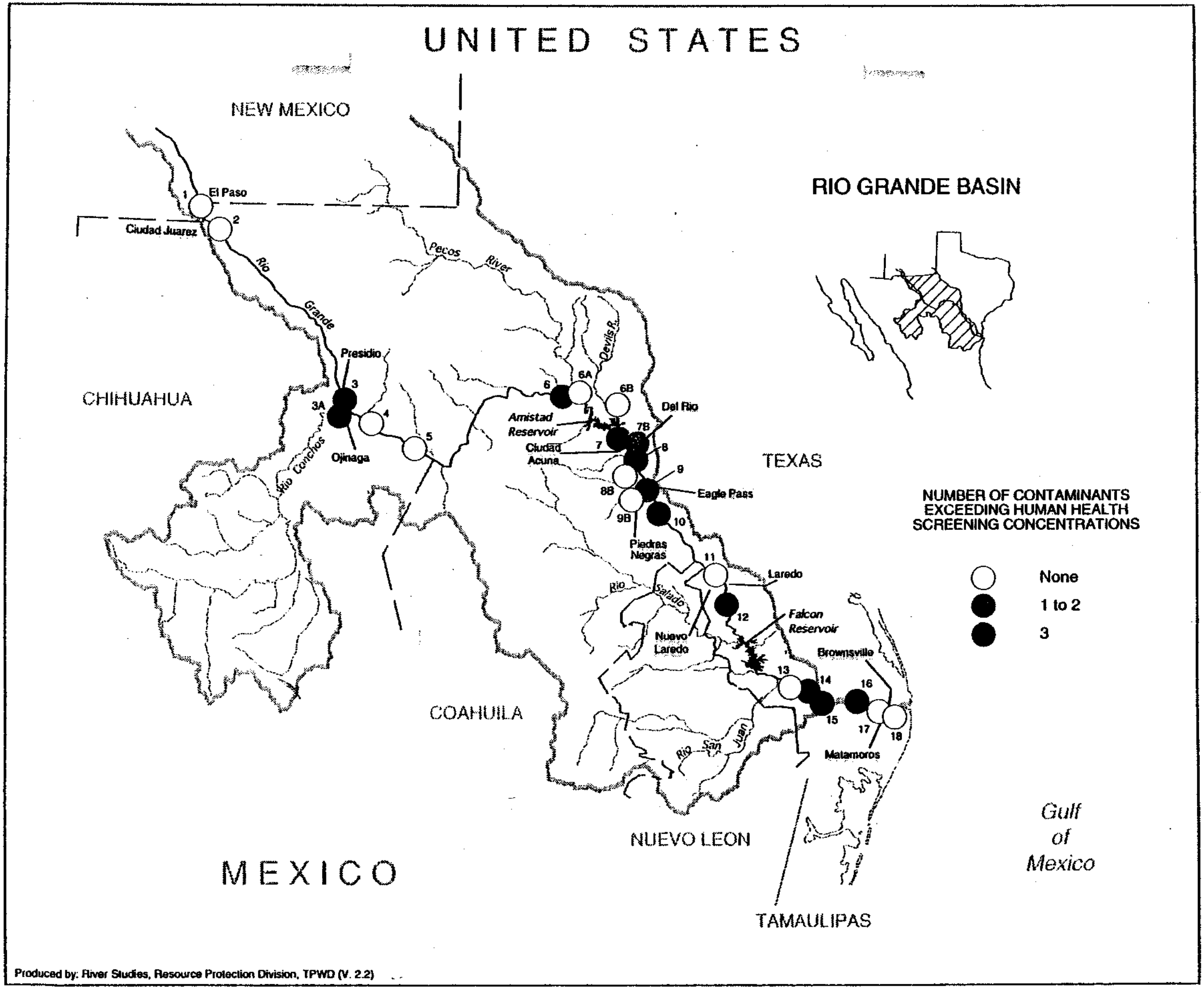


Figure 2. Sites with contaminant concentrations in fish fillets exceeding human health screening levels. See table 1 for site descriptions.

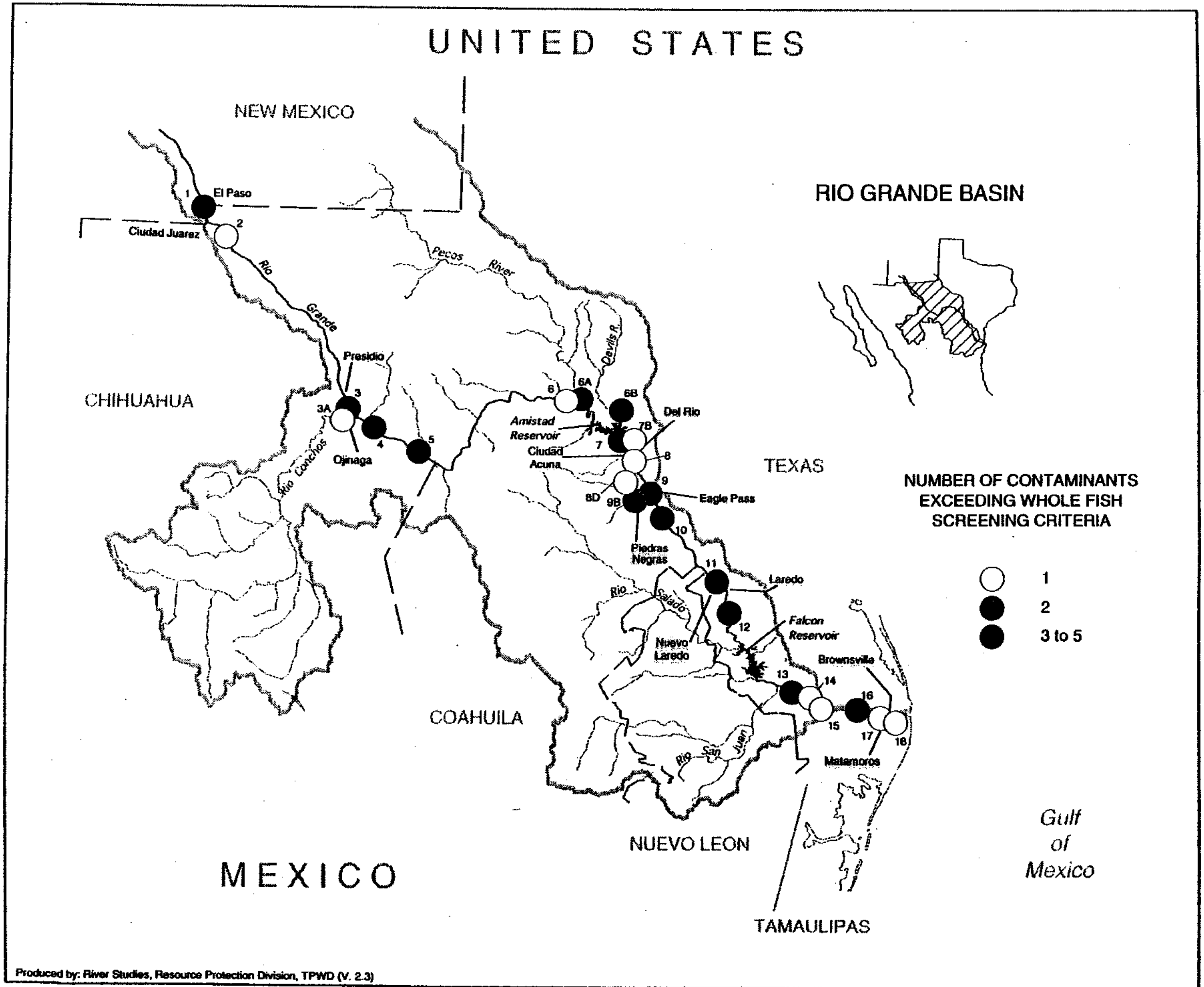


Figure 3. Sites with contaminant concentrations in whole fish exceeding 85th percentiles or mean concentrations. See table 1 for site descriptions.

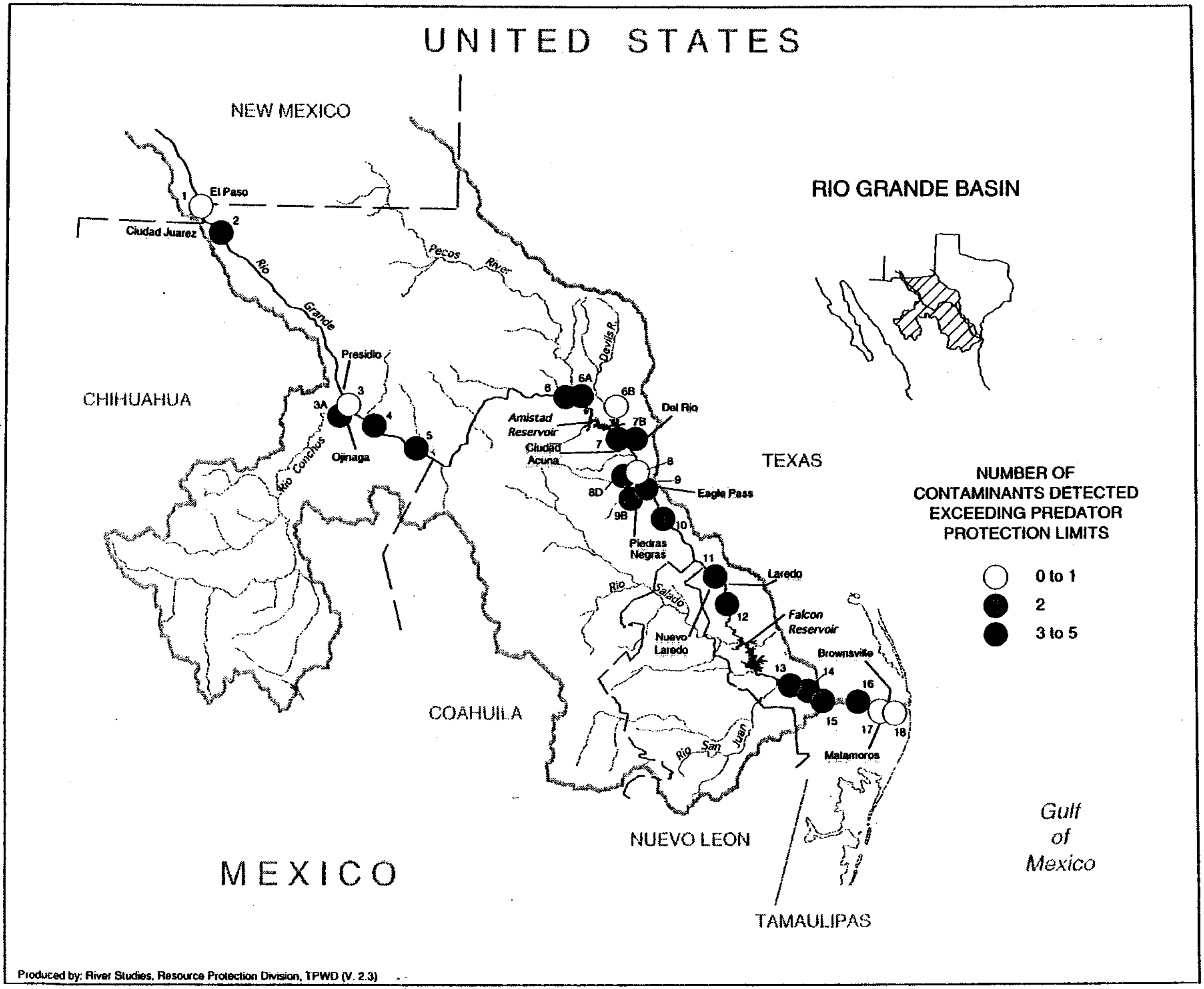
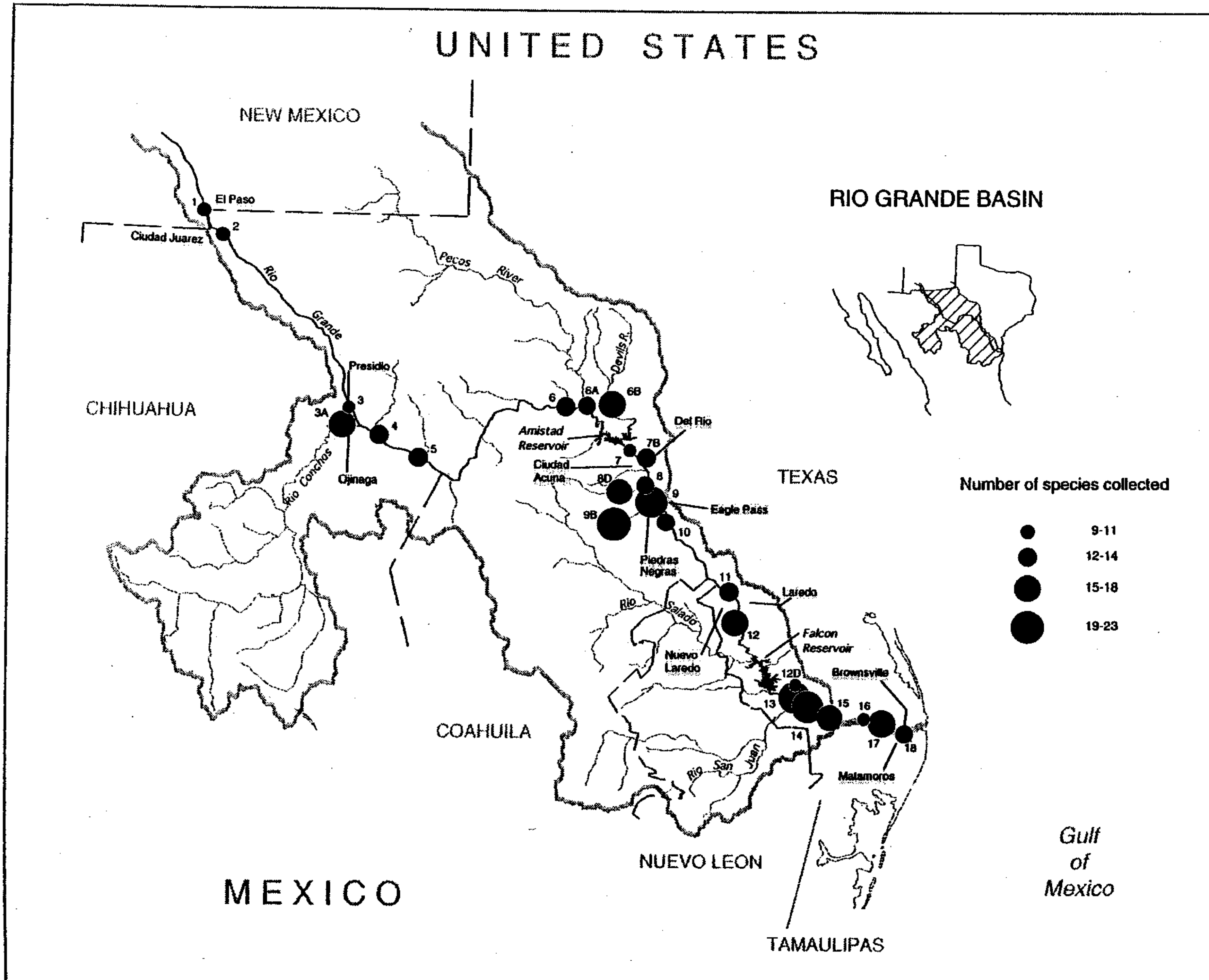


Figure 4. Sites with contaminant concentrations in whole fish exceeding predator protection limits. See table 1 for site descriptions.



Produced by: River Studies, Resource Protection Division, TPWD (V. 2.2)

Figure 5. Number of fishes collected at selected sites. See table 1 for site descriptions.

APPENDIX C

Quality Assurance Measures

The study was conducted in accordance with a quality assurance project plan (TNRCC, 1992b) approved by USEPA Region 6 on January 4, 1993. Quality assurance procedures are described in detail in that document. An evaluation of specific data quality measures is summarized below.

Field Blanks

Field blanks were analyzed at a frequency of about 10% (one per survey; 4 blanks/45 ambient water samples). Blanks consisted of type 2 deionized water furnished by the lab, carried to the field and handled and preserved identically to ambient water samples. Analyses were performed for volatile organics, semivolatile organics, pesticides, and metals. Results are presented in the following table.

Analytical Data - Field Blanks[a]

Parameter[b]	1st survey (Nov. 1992)	2nd survey (Jan. 1993)	3rd survey (Feb. 1993)	4th survey (Mar. 1993)
METALS				
antimony	6.4 (6.4X)	7.8 (7.8X)	7.8 (7.8X)	9.2 (9.2X)
nickel	8.0 (1.7X)	ND	ND	ND
selenium	ND	ND	5.8 (2.9X)	ND
silver	ND	ND	3.4 (3.4X)	ND
zinc	5.5 (1.1X)	ND	ND	ND

a - values in table represent concentration in μg/L, followed in parentheses by factor by which concentration exceeded minimum detection limit
b - only parameters that occurred above detection limits are included in table
ND - not detected

No organics were detected in any of the blanks, but five metals did occur above detection limits. Nickel, selenium, silver, and zinc each were detected in one blank, while antimony was detected in all four blanks.

Possible factors responsible for metals in the blanks included: (1) pre-contamination of type 2 deionized water furnished by the lab; (2) pre-contamination of metals-grade HNO_3 preservative furnished by the lab; (3) leaching of metals from peristaltic pump tubing, in-line filters, or sample container walls; (4) contamination from the atmosphere or the gloves of sample collectors; and (5) contamination in the lab during analytical procedures.

Judging from the frequency of occurrence, factors (4) or (5) probably were responsible for nickel, selenium, silver, and zinc contamination, while factors (1) through (3) were most likely responsible for antimony contamination. Further evaluation strongly suggests that type 2 deionized water was the main source of antimony, as concentrations in the blanks exceeded those in ambient water samples. This observation was brought to the attention of the lab, to enable them to check their type 2 deionized water supply for antimony. This will allow corrective action to be taken, if necessary, to eliminate recurrences.

Possible effects of nickel, selenium, silver, and zinc contamination on analytical results are considered negligible, based on minimal frequency of occurrence and relatively low concentrations in the blanks. A similar conclusion applies to antimony. Despite the fact that it occurred at relatively high concentrations in all the blanks, the apparent source was type 2 deionized water, which was not present in ambient water samples and therefore did not affect them.

In conclusion, the field blank evaluation indicated that toxic chemical contamination of ambient water samples during collection, preservation, handling, and lab analysis was minimal, and that the probability that analytical results from the study were appreciably affected by procedural contamination was low.

Precision

Data precision was evaluated through analysis of duplicate water samples, which were employed at a frequency of about 10% (one per survey; 4 duplicates/45 ambient samples). Duplicates represented split samples from selected sites that were collected, handled, and preserved using standard procedures. Parameters analyzed included volatile organics, semivolatile organics, pesticides, and metals. Results are presented in the table below.

Analytical Data - Duplicate Samples

Parameter[a]	Survey/Station	Duplicate Values (µg/L) 1	2	Mean (µg/L)	Standard Deviation	Coefficient of Variation[b] (%)	Target Coefficient of Variation (%)
METALS							
antimony	1st/5a	1.7	5.8	3.75	2.05	54.7	6.8
	2nd/17	5.9	1.7	3.8	2.1	55.3	6.8
	3rd/8	1.0	4.9	2.95	1.95	66.1	6.8
	4th/12	1.5	2.1	1.8	0.3	16.7	6.8
arsenic	2nd/17	4.2	3.2	3.7	0.5	13.5	11.2
	3rd/8	4.8	3.7	4.25	0.55	12.9	11.2
	4th/12	2.7	3.2	2.95	0.25	8.5	11.2
copper	2nd/17	2.8	2.4	2.6	0.2	7.7	2.5
	4th/12	<1.6[c]	1.6	1.6	0	0	2.5
lead	1st/5a	<1.0[c]	1.2	1.1	0.1	9.1	5.8
nickel	1st/5a	<4.7[c]	7.3	6.0	1.3	21.7	4.5
selenium	1st/5a	5.5	5.9	5.7	0.2	3.5	6.8
	4th/12	<4.0[c]	8.7	6.35	2.35	37.0	6.8

Analytical Data - Duplicate Samples (continued)

Parameter[a]	Survey/Station	Duplicate Values (µg/L) 1	2	Mean (µg/L)	Standard Deviation	Coefficient of Variation[b] (%)	Target Coefficient of Variation (%)
silver	4th/12	2.9	<2.7[c]	2.8	0.1	3.6	3.1
zinc	1st/5a	<5.0[c]	6.4	5.7	0.7	12.3	3.3
	2nd/17	5.8	5.8	5.8	0	0	3.3
						Mean 20.2 Max 66.1 Min 0	

a - only parameters that occurred above detection limits are included in table
b - calculated as (100)(standard deviation)/mean
c - detection limit value was employed in calculations

Eight metals were the only parameters that occurred above detection limits. Coefficients of variation for duplicate values generally exceeded target levels by small to moderate amounts. However, the precision targets are for laboratory duplicates, whereas field duplicates were employed in this study. Because field duplicates are inherently more variable, the degrees by which target levels were exceeded are not considered unacceptable. It was concluded that precision was satisfactory for the purposes of this study.

Accuracy

Blanks, spikes, and quality control samples were analyzed in accordance with requirements of USEPA-accredited laboratories, as described in the quality assurance project plan. Results were not reported by the lab, but any problems incurred were noted on ambient sample forms.

The laboratory was unable to achieve specified accuracy requirements for certain parameters. These instances are denoted by single asterisks in Tables 10, 11, and 12. Corresponding data were not utilized; their omission is accounted for in the "Completeness" subsection below.

There were only two other instances of questionable data accuracy, both involving pesticide concentrations associated with GC/MS semivolatile organics analysis. For one batch of 14 water samples, the endrin spike precision statistic was outside quality control limits. For one batch of 10 sediment samples, aldrin spike recovery was outside quality control limits.

However, pesticides were also analyzed by another technique, Nickel 63 Detector analysis, from which data utilized for this report for almost all of the pesticides, including endrin and aldrin, were derived. The latter technique is more sensitive and utilizes much lower detection limits than the former technique. Since the GC/MS semivolatile organics data in question were not utilized, the aforementioned spike sample excursions were inconsequential.

Completeness

A target of 90% completeness was established in the quality assurance project plan. As shown in the following table, the target level was achieved, with a margin of +3.3%.

Data Completeness Summary

	Water		Sediment		Tissue		Benthos		Nekton	
	T*	A*	T	A	T	A	T	A	T	A
(A) # of stations	40 [a]	45 [b]	40 [a]	45 [b]	24 [c]	24 [c]	18 [d]	18 [d]	24 [e]	25 [e]
(B) # of samples	40 [f]	45 [f]	40 [f]	45 [f]	96 [g]	94 [h]	18 [f]	20 [i]	24 [f]	25 [f]
(C) # of parameters	177 [j]	167 [k]	166 [l]	150 [k]	162 [m]	141 [k]	1 [n]	1 [n]	1 [o]	1 [o]
(D) # of data points	7,080 [p]	7,482 [q]	6,640 [p]	6,750 [q]	15,552 [p]	13,083 [q]	18 [p]	20 [q]	24 [p]	25 [q]

(E) total # of data points targeted = 29,314

(F) total # of data points achieved = 27,360

OVERALL COMPLETENESS = (F)/(E) X 100 = 93.3%

* - T = targeted; A = achieved
a - 18 major mainstem stations and 22 tributary stations
b - 18 major mainstem stations, one supplementary mainstem station, and 26 tributary stations
c - 18 major mainstem stations and six tributary stations
d - 18 major mainstem stations
e - 18 major mainstem stations and seven tributary stations
f - one sample per station
g - four samples per station
h - number of samples per station varied from one to four, depending on the availability of appropriate fish species
i - one sample per station plus two duplicates
j - 161 toxic chemicals, 13 field/conventional parameters, one flow measurement, and two toxicity measurements
k - represents the maximum achieved; varied from sample to sample, depending on how many valid values were reported by the lab
l - 161 toxic chemicals, three conventional parameters, and two toxicity measurements
m - 161 toxic chemicals and one conventional parameter
n - represents comprehensive evaluation of macrobenthic community structure
o - represents comprehensive evaluation of nekton community structure
p - (B) X (C)
q - (B) X (C) minus missing data points

Representativeness

Station siting, sampling of an array of media (water, sediment, fish tissue, biota), and use of approved field and analytical methods ensured that measurement data did represent actual instream conditions. The ability to accurately characterize an entire system is dependent on the number of sampling sites and types of analyses employed. In this regard, the study was meticulously designed to achieve maximal representativeness, within the scope of available resources.

Comparability

Data comparability was ensured through the employment of standard field and laboratory techniques described in the quality assurance project plan. Analytical methods were derived from USEPA approval lists published in the *Federal Register*. Procedures were consistent among surveys, except in rare instances where slight modifications proved necessary. Any divergences are described in the methods section of this report. None were utilized that would have affected data comparability.

APPENDIX D

Evaluation of Water Quality Data by Comisión Nacional del Agua (1973 to 1993)

MEXICO

NATIONAL WATER COMMISSION
SUBDIRECTORATE GENERAL FOR WATER ADMINISTRATION, QUALITY NANAGEMENT, WATER REUSE, AND ENVIRONMENTAL IMPACT

NATIONAL WATER QUALITY MONITORING NETWORK
EVALUATION OF WATER QUALITY - RIO BRAVO

DESCRIPTION

The Rio Grande basin is located in the states of Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas on the Mexican side, and in the state of Texas on the U.S. side; states in which both governments share the waters. It is therefore important to understand and know the quality of its waters, and for this purpose, the government of Mexico, through its National Water Commission (CNA), has conducted continuous monitoring since the 1970's with monitoring stations registered in the national network.

WATER QUALITY

This document presents the trends from 1976 to 1993 in some of the significant physical and chemical parameters, and in the Indices of Water Quality, relative to the quality of the Rio Grande at 12 stations in the National Monitoring Network, for their classification in accordance with the "Ecological Criteria for Water Quality" of Mexico and the Water Quality Index.

The evaluated monitoring sites are: 1) Cd. Juarez, 2) Ojinaga, 3) Amistad Dam, 4) Acuna, 5) Piedras Negras, 6) Nuevo Laredo, 7) Falcon Dam, 8) Miguel Aleman, 9) Camargo, 10) Reynosa, 11) Nuevo Progreso, and, 12) Matamoros. The locations of these sites are presented in the annexed form, in a table and in a chart.

The parameters analyzed are: Biochemical Oxygen Demand, Chemical Oxygen Demand, Fecal Coliform, Sulfates, Total Dissolved Solids, and Specific Conductivity.

BIOCHEMICAL OXYGEN DEMAND:
The values for this parameter tend to increase during the period 1976 to 1993 in the river reach between Cd. Juarez and Ojinaga to 11 and 15 mg/l; and then decrease to less than 3 mg/l in the following reach to Cd. Acuna, and then continue in a constant average around this value all the way to Matamoros. The water quality is acceptable for most water uses.

CHEMICAL OXYGEN DEMAND:
In the whole reach from Cd. Juarez to Matamoros, the value for this parameter remains at an average of less than 20 mg/l which makes the waters of the Rio Grande acceptable for any use, except in the reach from Cd. Miguel Aleman to Nuevo Progreso where the value increases well above 45 mg/l on average, which restricts certain water uses, principally potable water supply.

FECAL COLIFORM:
The presence of this parameter stands out in most of the monitoring sites, and it is considered that it should not appear in water used for potable water supply purposes, and restricted for other uses.

SULFATES:
In general, sulfates appear on average at a value below 250 mg/l, a value which makes the water acceptable for all uses.

TOTAL DISSOLVED SOLIDS:
The majority of the values, on average, are above 500 mg/l, making this water not acceptable for potable water supply purposes, and, as far as irrigation is concerned, it can only be used for certain special tolerant crops; it is likewise acceptable for cattle.

SPECIFIC CONDUCTIVITY:
For this parameter, the above comments for Total Dissolved Solids also apply.

INDEX OF WATER QUALITY:
In order to know the state of the water regarding its quality and use, CNA applies an Index of Water Quality considering 18 physical, chemical, and bacteriological parameters, which for a better understanding by the general public, ranges from zero (0) for the worst case to 100 for the optimum quality.

Attached are water quality index results for the 12 monitoring sites for the period 1976-1993, as well as the scale for classifying water uses.

SEE ATTACHED TABLE AND MAP

COMISION NACIONAL DEL AGUA
SUBDIRECCION GENERAL DE ADMINISTRACION DEL AGUA
GERENCIA DE CALIDAD Y REUSO DEL AGUA E IMPACTO AMBIENTAL

RED NACIONAL DE MONITOREO DE LA CALIDAD DEL AGUA

REGION HIDROLOGICA No. 24 : CUENCA DEL RIO BRAVO *** AÑO 1993 ***

	ESTACIONES DE MONITOREO EN OPERACION (**)	CUERPO DE AGUA	ESTADO	CLAVE (S.I.C.A.)	AÑO DE INICIO	COORDENADAS GEOGRAFICAS LATITUD N	COORDENADAS GEOGRAFICAS LONGITUD W
1	TRATADO INTERNACIONAL CD. JUAREZ	BRAVO	CHIHUAHUA	00CH24IG0370100	1986	31°46'20"	106°29'58"
2	PUENTE ZARAGOZA WATERFILL	BRAVO	CHIHUAHUA	00CH24IG0370101	1987	31°40'36"	106°19'30"
3	PUENTE FORT HANCKOCK	BRAVO	CHIHUAHUA	00CH24ID0530100	1987	31°16'30"	105°51'00"
4	RIO CONCHOS PUENTE OJINAGA	CONCHOS (*)	CHIHUAHUA	00CH24JA0520001	1975	29°32'40"	104°28'35"
5	RIO BRAVO PUENTE PRESIDIO	BRAVO	CHIHUAHUA	00CH24HF0520001	1975	29°33'23"	104°23'40"
6	PRESA DE LA AMISTAD	BRAVO	COAHUILA	04CO24GA0020001	1976	29°27'00"	101°03'00"
7	REPRESA DE LA AMISTAD	BRAVO	COAHUILA	04CO24 A0020002	1976	29°25'00"	101°02'00"
8	REPRESA DEL RIO	BRAVO	COAHUILA	04CO24 D0020001	1976	29°21'00"	100°56'00"
9	1 KM AGUAS ABAJO CD.ACUÑA	BRAVO	COAHUILA	00CO24FC0020001	1976	29°18'00"	100°53'00"
10	RIO SAN DIEGO	SAN DIEGO (*)	COAHUILA	00CO24FC0140001	1976	29°04'00"	100°40'00"
11	RIO SAN RODRIGO	SAN RODRIGO (*)	COAHUILA	00CO24FB0140001	1976	28°53'00"	100°37'00"
12	PUENTE INTERNACIONAL PIEDRAS NEGRAS	BRAVO	COAHUILA	00CO24FA0250001	1977	28°42'00"	100°30'00"
13	RIO ESCONDIDO	ESCONDIDO (*)	COAHUILA	00CO24FA0250002	1976	28°40'00"	100°31'00"
14	AGUAS ABAJO RIO ESCONDIDO	BRAVO	COAHUILA	00CO24FA0250003	1976	28°37'00"	100°27'00"
15	ANTES DE COLECTOR ALAZANAS	BRAVO	TAMAULIPAS	00TM24EB0270100	1984	27°32'50"	99°29'00"
16	PUENTE INTERNAL. NUEVO LAREDO	BRAVO	TAMAULIPAS	00TM24EA0270001	1975	27°30'00"	99°30'00"
17	AGUAS ABAJO DEL DREN MINA	BRAVO	TAMAULIPAS	00TM24EB0270101	1981	27°30'00"	99°29'00"
18	AGUAS ABAJO ARROYO EL COYOTE	BRAVO	TAMAULIPAS	00TM24EA0270100	1983	27°24'45"	99°29'15"
19	RIO SALADO	SALADO (*)	TAMAULIPAS	00TM24DA0140002	1975	26°50'00"	99°33'30"
20	PRESA FALCON	BRAVO	TAMAULIPAS	00TM24DA0140003	1976	26°33'30"	99°09'30"
21	PUENTE RIO ALAMO	ALAMO (*)	TAMAULIPAS	00TM24CD0240001	1976	26°27'00"	99°09'00"
22	PUENTE INTERNACIONAL MIGUEL ALEMAN	BRAVO	TAMAULIPAS	00TM24CA0250001	1975	26°24'30"	99°00'50"
23	DREN RANCHERIAS	DREN (*)	TAMAULIPAS	27TM24CA0070001	1976	26°21'30"	98°55'00"
24	PUENTE INTERNACIONAL CD. CAMARGO	BRAVO	TAMAULIPAS	00TM24BA0070002	1976	26°33'00"	98°49'00"
25	PUENTE RIO SAN JUAN	SAN JUAN (*)	TAMAULIPAS	00TM24BA0070003	1976	26°18'30"	98°50'00"
26	DREN PUERTECITOS	DREN (*)	TAMAULIPAS	27TM24BA0070001	1976	26°17'00"	98°44'00"
27	DREN HUIZACHE	DREN (*)	TAMAULIPAS	27TM24AC0150001	1976	26°14'30"	98°38'30"
28	REPRESA ANZALDUAS	BRAVO	TAMAULIPAS	00TM24AC0320002	1976	26°09'30"	98°23'30"
29	PUENTE INTERNACIONAL REYNOSA	BRAVO	TAMAULIPAS	00TM24AB0320001	1975	26°05'30"	98°16'00"
30	REPRESA EL RETAMAL	BRAVO	TAMAULIPAS	04TM24AB0330001	1976	26°02'30"	98°03'30"
31	PUENTE INTERNACIONAL NUEVO PROGRESO	BRAVO	TAMAULIPAS	00TM24AB0330001	1976	26°04'00"	97°57'00"
32	PUENTE INTERNACIONAL VIEJO MATAMOROS	BRAVO	TAMAULIPAS	00TM24AA0220001	1976	25°53'00"	97°30'30"

(*) AFLUENTE DEL RIO BRAVO

(**) PERIODICIDAD DE MUESTREO: Chihuahua y Coahuila (6 muestras al año) ; Tamaulipas (4 muestras al año, excepto "Puente Internacional Viejo Matamoros" con 12 muestras)

PARAMETROS ANALITICOS COMUNES A LOS 3 ESTADOS : pH, DBO_5, COLOR, D.T., D.Ca, S.T., C.E., DQO, SO_4, ALC. T., Cl, SST, SDT, COLIS TOT. y COLIS FEC.

PARAMETROS ADICIONALES : Chihuahua y Tamaulipas (O.D., $P\text{-}PO_4$ T, SAAM, TURB., S.SED. y $N\text{-}NO_3$).
Chihuahua (TEMP. AGUA, G y A, $P\text{-}PO_4$ ORTO, ALC.FEN., $N\text{-}NO_2$, ACIDEZ T., HCO_3, STF, SSF, SDV, SDF, SSV, STV, ESTREPT. y CO_3).
Coahuila ($N\text{-}NH_3$, N-ORG., ALC.FEN., $N\text{-}NO_2$ y D.Mg).

MEXICO 1993
COMISION NACIONAL
DEL AGUA

MONITOREO DE LA
CALIDAD DEL AGUA
RIO BRAVO
[RIO GRANDE]