Special Publication SJ 91-SP8
REVISED

ASSESSMENT OF POTENTIAL SEDIMENT CONTAMINATION FOR THE RESTORATION OF LAKE APOPKA

Prepared For:

St. Johns River Water Management District
Highway 100 West
Palatka, Florida 32178

Prepared By:

D.S. Segal, M.S., and
C.D. Pollman, Ph.D.
KBN Engineering and Applied Sciences, Inc.
1034 N.W. 57th Street
Gainesville, Florida 322605

December 1992
86056B1

EXECUTIVE SUMMARY

Lake Apopka forms the headwaters of the Oklawaha chain of lakes, eutrophic to hypereutrophic water bodies located in central Florida approximately 25 km northwest of Orlando. Once a popular resort area noted for its game fishing, Lake Apopka is now ranked as the seventeenth-most eutrophic lake in Florida. This condition results largely from direct backpumping of nutrient-enriched irrigation water from muck farms on the northern shores of the lake into Lake Apopka and from past sewage treatment practices by the City of Winter Garden. The St. Johns River Water Management District (SJRWMD) has been charged by the Florida state legislature to assess the feasibility of restoring Lake Apopka to Class III water quality standards (Chapter 17-3, Florida Administrative Code). Priority issues in the restoration program outlined by the SJRWMD in the Lake Apopka Surface Water Improvement and Management (SWIM) Plan include poor water quality and excessive accumulation of flocculent organic sediments.

Dredging nutrient-rich sediments from Lake Apopka and reuse of the dried muck has been suggested as a restoration technique. The newly initiated Marsh Flow-way Project uses a restored 950-acre wetland to filter water from the lake, which will result in substantial deposition of lake sediments in the restored wetland. Artificial barriers to stabilize the sediment, reduce nutrient release, and improve plant habitat are also being considered as possible tools in lake restoration. A survey of levels and potential toxic effects of substances in Lake Apopka sediments was necessary to support these and other projects. This contamination assessment is especially important if dredged sediments are reused, such as for soil amendments, as a cost-recovery method for dredging.

The goals of this project were the following:

1. To analyze sediment samples from two depths at ten locations in Lake Apopka for the 152 elements and compounds on the EPA Target Compound List;

2. To tabulate the analytical results; and

3. To determine the potential toxic and deleterious effects of those elements or compounds on lake biota, fisheries, and other recreational uses of the lake.

An extensive literature search revealed a large number of aquatic toxicity studies which focused primarily on chronic and acute effects of pollutants in the water column. In contrast, the availability of similar guidelines or criteria for sediment-associated toxicity was much more limited, and criteria were available only for the Great Lakes, Canada, and Wisconsin. Because these criteria were developed for northern temperate systems, their applicability to Lake Apopka is uncertain. Therefore, for this survey, when contaminant concentrations exceeded both the north-temperate sediment criteria and the reported EPA threshold for toxicity in water, the contaminant was considered potentially toxic to the lake's biota.

Comparison of contaminant concentrations in bulk sediments with toxicity criteria developed for lake water generally provides a very conservative analysis. Sediment concentrations reflect not only the dissolved free forms, but also forms that are chemically bound to sediment particles, which often renders them less toxic. These comparisons should serve to identify potential contamination problems, but may also exaggerate actual toxicity risks.

In Lake Apopka sediments, 13 of the 152 elements and compounds occurred in sufficiently high concentrations to warrant detailed examination. Based on

these comparisons, copper and lead appear to pose the greatest threat of toxicity to Lake Apopka. Concentrations of arsenic and selenium exceed both the sediment threshold criteria and chronic aquatic threshold criteria but not the acute aquatic threshold criteria, and hence may be toxic to the lake's biota. Sediment concentrations of barium, beryllium, chromium, and zinc suggest potential toxicity as well, although the evidence for toxicity is less well established because of the lack of aquatic toxicity studies (barium, beryllium) or because levels in the sediments compared across media (sediments and water) did not consistently exceed established criteria (zinc and chromium). Phenol exceeded the lakewater criteria only. Concentrations of nickel are below established threshold criteria. Toxicity threshold data for vanadium, acetone, and benzoic acid were insufficient to determine the potential toxicity of these contaminants in Lake Apopka.

Although elevated levels of some elements and compounds appear to occur in Lake Apopka sediments, it is difficult to assess the effects these contaminants will have on the lake's biota because of the complex interactions that occur in biological systems. For example, the toxicity of many elements declines in hard water. The relatively high water hardness in Lake Apopka sediments should ameliorate potential toxic effects of these elements. However, because of the debilitating health effects that some contaminants cause, combined with the desire to restore Lake Apopka to a healthy sports fishery lake, it is suggested that further consideration be given to those elements and compounds that exceeded both sediment and lakewater threshold criteria values.

TABLE OF CONTENTS
(Page 1 of 2)

TABLE OF CONTENTS
(Page 2 of 2)

APPENDICES

LIST OF TABLES

LIST OF FIGURES
(Page 1 of 3)

LIST OF FIGURES
(Page 2 of 3)

LIST OF FIGURES
(Page 3 of 3)

1.0 INTRODUCTION

1.1 BACKGROUND

Lake Apopka forms the headwaters of the Oklawaha chain of lakes, a eutrophic to hypereutrophic chain of lakes located in central Florida approximately 25 km northwest of Orlando (Figure 1). Once a popular resort area noted for its game fishing, Lake Apopka is now ranked as the seventeenth-most eutrophic lake in Florida, largely because of poor sewage treatment practices adopted by the City of Winter Garden and direct backpumping of nutrient-enriched irrigation water into Lake Apopka and the Apopka-Beauclair Canal from low-lying muck farms on the northern shores of the lake (Pollman et al., 1988). Sewage discharge from Winter Garden on the south shore of Lake Apopka began around 1922 to 1927, followed by muck farm discharge beginning in 1942. Although Lake Apopka probably has always been productive, primary productivity historically was dominated by dense stands of macrophytes. Despite high rates of external nutrient inputs, macrophytes continued to dominate until 1947, when hurricanes destroyed large amounts of the bottom vegetation. Opportunistic algal blooms appeared almost immediately and have persisted unabated ever since.

In 1979, the U.S. Environmental Protection Agency (EPA) published a final Environmental Impact Statement (EIS) on the restoration of Lake Apopka. The final EIS recommended a phased restoration program consisting of short- and long-term objectives. Short-term objectives included continued monitoring of in-lake water quality and a demonstration project to examine lake drawdown as a restorative measure. Long-term objectives included "continued evaluation of restoration alternatives and methods which would address the lake's internal loading problem." The efficacy of the most promising technique, lake drawdown, was acknowledged to be uncertain, and, should drawdown prove infeasible, EPA suggested that "the possibility of dredging the lake and marketing the muck should be pursued (Pollman, et al., 1988)."

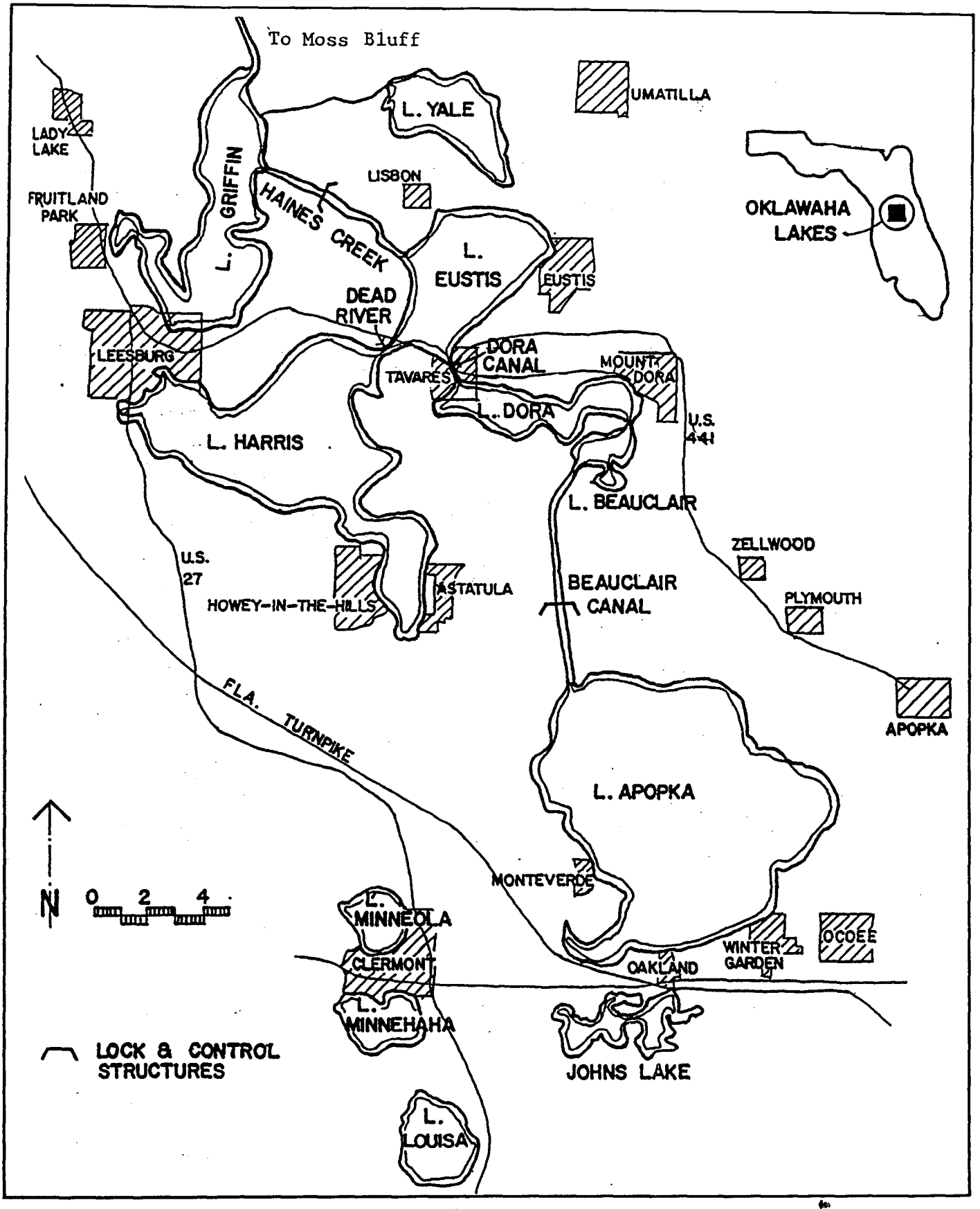


Figure 1 Location of lakes and urban areas in Upper Oklawaha River Basin.

Problems inherent in dredging as a general technique include short-term pulses of nutrient release and liberation of toxic materials (e.g., trace elements and organic pesticides) as a result of sediment resuspension, oxygen depletion, and potential effects to fisheries, wildlife, and benthic fauna. Sediment stabilization as a means of reducing continual nutrient release into the water column also has been considered as a possible lake restoration method. To better understand the potential success of restoring the water quality in Lake Apopka, an assessment of the contamination potential in the sediments is needed. This contamination assessment is especially necessary if the dredged sediments will be reused, such as for soil amendments; as a cost-recovery method for dredging.

The St. Johns River Water Management District (SJRWMD) has been charged by the Florida state legislature to assess the feasibility of restoring Lake Apopka to Class III water quality standards (Chapter 17-3, Florida Administrative Code). Success of lake restoration depends in part on minimizing the release of toxic compounds from the sediments, followed by either stabilization or removal of these bottom sediments from the lake. An assessment of toxic compounds in the mucky, flocculent sediments is needed to better evaluate the likelihood of successful restoration of Lake Apopka. The goals of this project are as follows:

1. To analyze sediment samples from Lake Apopka for the 152 elements and compounds on the EPA Target Compound List (EPA, 1982);
2. To tabulate the analytical results; and
3. To determine the potential toxic and deleterious effects of those elements or compounds on lake biota, fisheries, and other recreational uses.

1.2 TOXIC ELEMENTS AND COMPOUNDS

Polluted sediments in aquatic systems are widely regarded as a primary source of fish contamination (Nishimura and Kumagai, 1983; Johnson, 1987). Although direct relationships between sediment contaminants and concentrations in aquatic organisms have been documented, these

relationships often are complicated and difficult to assess because of the interaction of many chemical and biological parameters. For example, pH, alkalinity, and water hardness strongly regulate the toxicity threshold of certain pollutants (EPA, 1976). Some chemicals such as zinc are more toxic at a high temperature and low dissolved oxygen content. As in the case of arsenic and chromium, the valence state often influences the toxicity of an element to the aquatic environment. Toxicity of trace elements is a direct function of the activity of the free ionic metal; thus, complexion with dissolved organic carbon (DOC) also affects the toxicity of trace elements such as zinc and aluminum by reducing the free or unbound concentration. Biological parameters such as organism trophic level and feeding strategies (e.g., sediments vs. water column foragers) also influence exposure and toxicity potential.

An extensive literature search on aquatic toxicity studies revealed a vast array of study types (e.g., acute, chronic, and threshold criteria), test organisms, and measured parameters. While many results were reported as concentrations in the aqueous phase, others reported sediment concentrations, plant biomass concentrations, or concentrations in tissues or organs of specific aquatic species. By comparing the extensive and complex literature on aquatic toxicology with the sediment chemistry data from Lake Apopka, a prediction of the potential deleterious effects of those elements and compounds on lake biota, fisheries, and other recreational uses can be determined. Additionally, by characterizing the toxic environment of the sediments, a better prediction of the internal loading of toxicants can be determined. Results of aquatic toxicity studies often are presented using different matrices or media such as sediment vs. water. In turn, the lack of sediment toxicology information specific to subtropical lakes has precluded us from defining specific threshold values for sediments. Nonetheless, trace elements and xenobiotics bound to sediments generally are less toxic than dissolved species, and, as a first approximation, when contaminant concentrations in the bulk sediment phase were below the lowest reported threshold for

aquatic toxicity and below sediment threshold criteria established for the Great Lakes region, the occurrence in Lake Apopka sediments was considered not toxic.

Because the toxicity of trace elements and other contaminants principally is a function of the concentration of the *free* or chemically unbound species, comparing toxicity criteria established for water-to-bulk sediment concentrations is a very conservative approach toward assessing potential toxicity sediment contaminants, particularly when applied to organisms in the water column. [However, it should be noted that for some organic contaminants, there is some evidence that partitioning of organic contaminants in the solid phase may actually enhance their bioavailability (cf. Rodgers et al., 1987)]. This conservatism stems from the fact that bulk sediment concentrations reflect the *total* contaminant concentration, thus including both free aqueous forms (in the interstitial fluid) and chemically bound forms (via adsorption to sediment particles, complexed with organic matter, or removed from solution as chemical precipitates), the latter forms considered much less available for biological uptake. For Lake Apopka, such a conservative approach toward assessment is justified in light of (1) the inconclusive nature of published toxicological data for bulk sediment samples, and (2) the lack of established sediment threshold criteria for subtropical lakes.

2.0 METHODS

Sediment cores were collected from 10 locations in Lake Apopka in May 1989 (Figure 2). The core locations were selected primarily to afford representative spatial coverage of the lake. A piston corer similar in design to a Livingston corer was used to retrieve undisturbed bottom sediments. The core tube is made of clear acrylic, measuring 1 m long x 6.5 cm inner diameter. Each core was subdivided into two depth intervals, 0 to 10 cm and 10 to 20 cm. The cores were extruded immediately on-site into 500 mL amber glass bottles, supplied by Environmental Sciences and Engineering, Inc. (ESE), and stored at 4°C for transport. Samples were transported to Gainesville the following day and turned over to the custody of ESE for analysis. Representative composite samples from both of the sediment layers were used for chemical analyses.

All 20 sediment samples were analyzed for the 152 elements and compounds on the EPA Toxic Chemical Substance List. The samples were analyzed in accordance with procedures specified in Test Methods for Evaluating Solid Wastes (EPA, 1982). Sample extractions (where appropriate for the analyte) and analyses were conducted within the following timeframes (days):

Analyte Type	Extraction Holding Time	Analysis Holding Time
Cyanide	14	14
Phenols	15	28
GC/MS Volatile Organics		5
GC/MS Semivolatile Organics	7	22
Pesticides	5	14
Metals	14-28	29
Moisture Content		13

Analytical methods and quality control (QC) procedures are presented in Appendix A. Analytical values and a statistical summary of elements and compounds of concern are presented in Appendix B. A list of raw data for all 152 elements and compounds is given in Appendix C with the analytical procedure used for each element and compound.

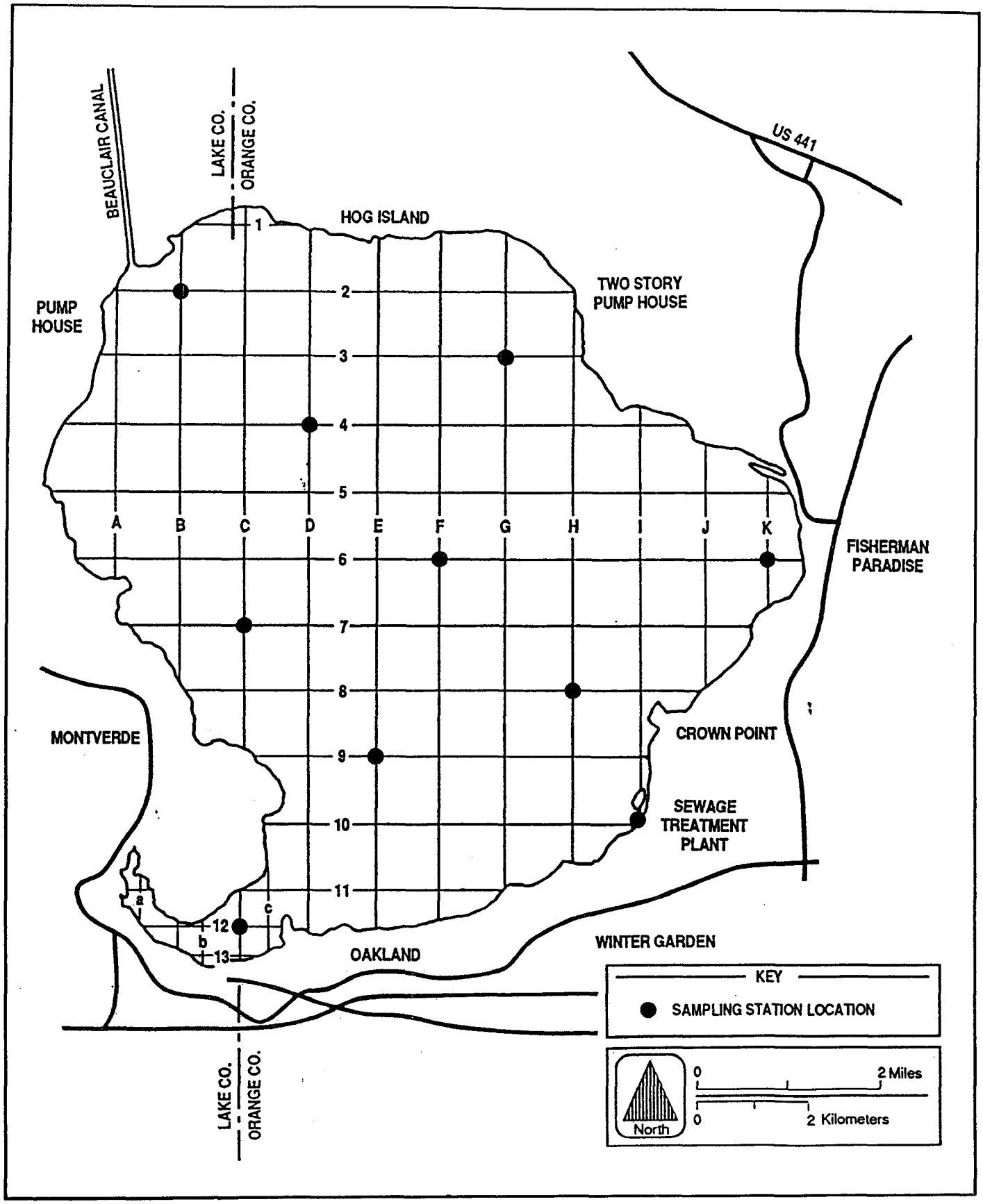


Figure 2 Map of Lake Apopka showing sediment sampling locations.

Literature searches were conducted using the Hazardous Substances Data Bank segment of the Tox-Line data base available through the National Library of Medicine. The search was conducted at the University of Florida in Gainesville, Florida, focusing on those compounds or elements detected in Lake Apopka sediments and not known to occur naturally in sediments. Several key word combinations, such as aquatic toxicity, threshold level values, nonhuman toxicity, sediments, fish, plants, animals, and water concentrations, in conjunction with the name of each element and compound, were used to generate a list of references and associated abstracts. In order to differentiate between anthropogenic and natural sources of an element, Lake Apopka and coastal Florida ratios of metal to aluminum (metal:aluminum) were compared (FDER, 1988). The comparisons were based on two assumptions: (1) no geochemical changes occur in metal:aluminum during flocculation and sedimentation processes in estuaries; and (2) metal:aluminum occurs in the same proportions in both Lake Apopka and coastal sediments. Additionally, metal:aluminum comparisons were made between Lake Apopka and two pristine Florida lakes (Lakes Annie and Sheelar).

3.0 RESULTS AND DISCUSSIONS

Of the 152 elements and compounds analyzed, 132 were below the detection limit (BDL) of the analytical procedure used. Although 20 compounds and elements were detected in the Lake Apopka sediments, seven (aluminum, calcium, iron, magnesium, manganese, potassium, and sodium) are commonly found in lake sediments and do not pose appreciable toxic risks to the lake's biota; these seven elements were not investigated further. The remaining 13 elements and compounds occurred in sufficiently high concentrations to warrant further investigation of their potential toxic hazards to the lake's biota. Those compounds and elements, which are discussed below, are arsenic, barium, beryllium, chromium, copper, lead, nickel, selenium, vanadium, zinc, acetone, benzoic acid, and phenol.

When conducting the literature search, a considerable volume of literature was found on the more common elements (e.g., arsenic, lead, and zinc); however, no aquatic toxicity information was located on acetone and benzoic acid. Given the available literature, concentrations of hazardous substances in the Lake Apopka sediments were compared with potentially toxic concentrations determined from pertinent literature. In some instances, summary papers were used. In those cases, the author cited in the summary paper was referenced as "cited in" without actually obtaining the original document.

3.1 ARSENIC

Arsenic concentrations in Lake Apopka ranged from 0.120 to 0.414 mg/kg (wet weight), with a median value of 0.206 mg/kg (Figure 3A); expressed as dry weight, the range was 6.82 to 12.7 mg/kg, with a median value of 9.62 mg/kg (Figure 3B). Wet-weight concentrations are intermediate between the acute and chronic aquatic threshold values reported by EPA (1976; Table 1). Arsenic concentrations in Lake Apopka sediments are below the sediment quality criteria reported by the Ontario Ministry of Environment (OME), but above that reported by EPA and Wisconsin Department of Natural Resources

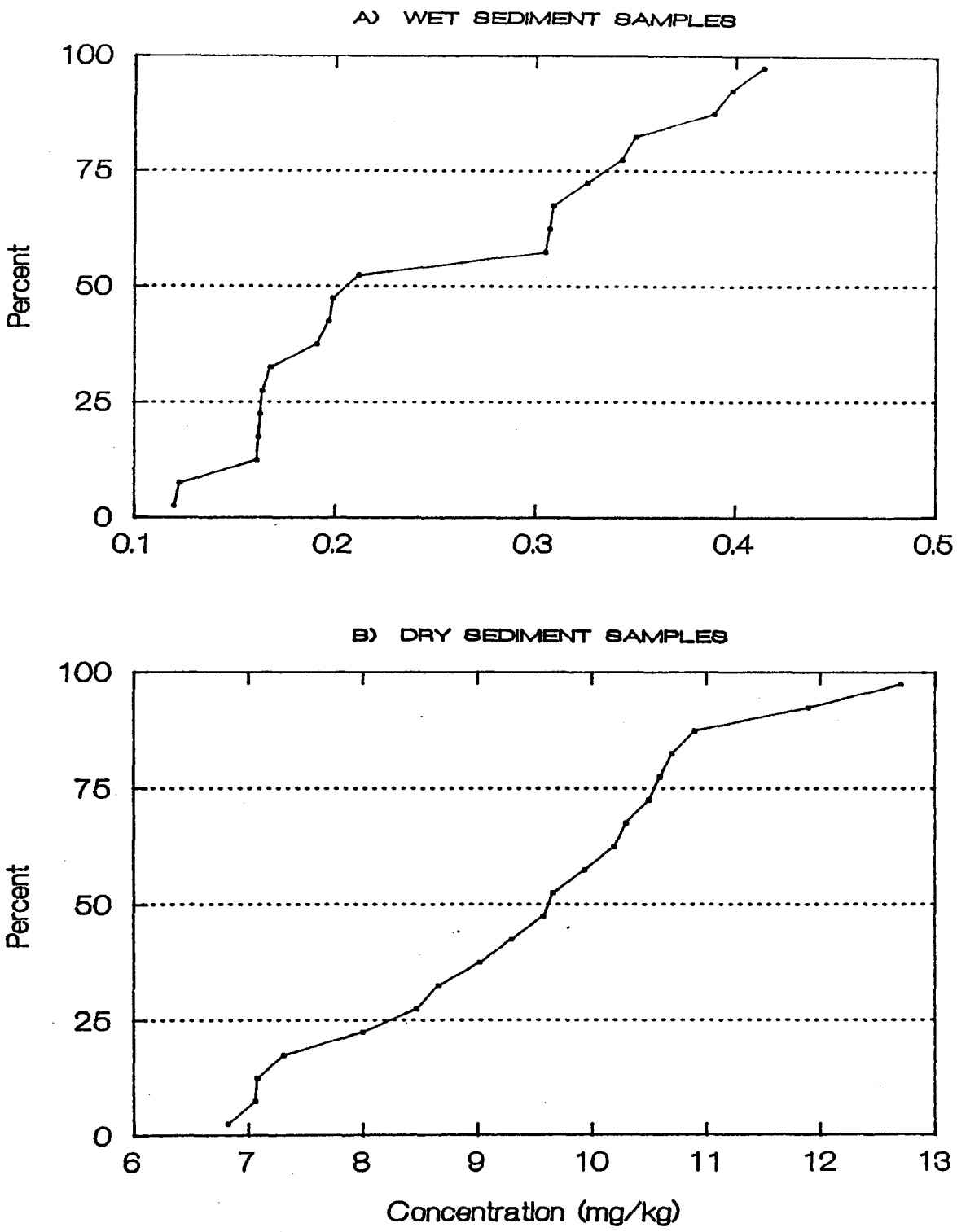


Figure 3. Cumulative distribution (as %; n = 20 samples) of arsenic concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

Table 1. Acute and Chronic Aquatic Toxicity Threshold Guidelines for Fresh Water (EPA, 1976). (Page 1 of 2)

Trace Element	Acute Threshold	Chronic Threshold	Observed Median	Observed Maximum
Arsenic	0.44	.04	0.206	0.414
Arsenic (V)	0.85	0.048	--	--
Arsenic (III)	.360	.190	--	--
Barium[a]	--	--	2.265	3.13
Beryllium	0.13	0.0053	0.018	0.038
Chromium	--	--	0.226	0.465
Chromium (VI)	0.016	0.011	--	--
Chromium (III)[b] mean	2.49	0.30	--	--
Copper[c] mean	0.03	0.02	0.489	1.30
Lead[d] mean	0.14	0.01	0.534	1.29
Nickel[e] mean	2.05	0.23	0.157	0.168
Selenium	0.260	0.035	0.047	0.103
Vanadium	--	--	0.164	0.406

Table 1. Acute and Chronic Aquatic Toxicity Threshold Guidelines for Fresh Water (EPA, 1976). (Page 2 of 2)

Trace Element	Acute Threshold	Chronic Threshold	Observed Median	Observed Maximum
Zinc[f] mean	0.17	0.15	1.175	2.29
Acetone	--	--	0.01	0.023
Benzoic acid	--	--	0.13	0.190
Phenol	0.01	0.0026	0.501	3.590

Note: Where appropriate, criteria values are given as a function of mean alkalinity (155 mg L^{-1} $CaCO_3$) for Lake Apopka (after Brezonik et al., 1981). Also included are median and maximum bulk (wet weight) sediment concentrations observed in Lake Apopka. All concentrations are in parts per million (mg L^{-1} for toxicity levels and mg kg^{-1} for sediment concentrations).

[a] A restrictive criterion for aquatic life appears unwarranted.

[b] Based on the equations $[e^{(0.819[\ln(\text{hardness})]+3.688}]/1000$ for acute threshold and $[e^{(0.819[\ln(\text{hardness})]+1.561}]/1000$ for chronic threshold.

[c] Based on the equations $[e^{(0.9422[\ln(\text{hardness})]-1.464}]/1000$ for acute threshold and $[e^{(0.8545[\ln(\text{hardness})]-1.465}]/1000$ for chronic threshold.

[d] Based on the equations $[e^{(1.273[\ln(\text{hardness})]-1.46}]/1000$ for acute threshold and $[e^{(1.273[\ln(\text{hardness})]-4.705}]/1000$ for chronic threshold.

[e] Based on the equations $[e^{(0.846[\ln(\text{hardness})]+3.3612}]/1000$ for acute threshold and $[e^{(0.846[\ln(\text{hardness})]+1.1645}]/1000$ for chronic threshold.

[f] Based on the equations $[e^{(0.8473[\ln(\text{hardness})]+0.8604}]/1000$ for acute threshold and $[e^{(0.8473[\ln(\text{hardness})]+0.7614}]/1000$ for chronic threshold.

(DNR) for dry weight (Table 2). Surber and Meehan (1931) reported that fish-food organisms generally can withstand approximately 1.73 mg/L of arsenious trioxide (1.3 mg/L arsenic) in a sodium arsenite solution. Similarly, EPA (1976) summarized that arsenic concentrations as low as 1.3 mg/L can adversely affect freshwater fish-food organisms, and concentrations as low as 4.3 mg/L impair the freshwater crustacean Daphnia. At a concentration of 4.0 mg/L, Gilderhus (1966) reported reduced survival and growth of bluegill, with immature fish affected more than adults. He also found substantial residues of arsenic in the water, bottom soil, and throughout the organs and flesh at the termination of a 16-week experiment. Other toxicological data revealed a wide range of arsenic toxicity, with early life stages being the most sensitive to arsenic toxicity. For example, short-term effects on toad embryos and larvae occurred at concentrations as low as 0.04 mg/L (EPA, 1976). Acute toxicity studies on fish indicate that the 96-hour LC_{50} value of arsenic for Coregonus is 17 mg/L and 18 mg/L for Puntius, a barb fish in the family Cyprinidae (Spehar et al., 1981). These values are higher than the concentrations reported in both the wet and dry sediment samples of Lake Apopka.

The available aquatic data indicate that juvenile forms are more sensitive than adults to arsenic. The relatively high concentrations of arsenic found in Lake Apopka sediments suggest that chronic and possibly acute toxicity may occur, particularly to juvenile fish and amphibians.

Arsenic accumulation in fish can occur from dietary and direct uptake from water or sediments (Phillips and Russo, 1978). Although arsenic is concentrated in some aquatic organisms, it does not appear to bioaccumulate along food chains (Ferguson and Gavis, 1972). Arsenic appears to have low toxicity when consumed as an organically bound species, with the toxicity being somewhat dependent on the valence state. Uptake and retention rates are also species-specific (EPA, 1976) and, for certain species,

Table 2. Sediment Quality Criteria and Sediment Disposal Classification Criteria (mg/kg dry weight) From Various Government Agencies

	EPA[a]	Wisconsin DNR[b]	OME Limit of Tolerance Level[c]	OME Restricted Land Use[d]
Arsenic	3-8	10	33	20
Barium	20-60	--	--	--
Chromium	25-75	100	111	120
Copper	25-55	100	114	100
Lead	40-60	50	250	500
Nickel	20-50	100	90	60
Selenium	--	--	--	2
Zinc	90-200	100	800	500

Note: EPA = U.S. Environmental Protection Agency.
OME = Ontario Ministry of Environment.
DNR = Wisconsin Department of Natural Resources.

[a] Used by EPA Region V for classifying sediments of Great Lakes Harbor. These concentrations are for moderately polluted sediments. Source: Anon., 1977a, cited in Baudo et al., 1990.

[b] Used by DNR. Source: Sullivan et al., 1985; cited in Baudo et al., 1990.

[c] Used by OME. The criteria are based on overt toxicity to benthic invertebrates and do not consider other potential effects such as bioaccumulation and subsequent effects on longer-lived species. Source: Persaud et al., 1989; cited in Baudo et al., 1990.

[d] Used by OME for subsequent sediment disposal. Source: Anon., 1988g; cited in Baudo et al., 1990.

age-dependent. Two species of catfish (Ictaluras nebulosis or brown bullhead and Ictaluras natalis or yellow bullhead) from Lake Apopka were analyzed and determined not to bioconcentrate arsenic (Gillespie, 1976). However, water-hyacinths from the lake had significant levels of arsenic, probably as a result of inadvertent uptake of arsenic along with phosphate.

Foley et al. (1978, cited in Lowe et al., 1985) found that, given equal exposure of arsenic, various fish species will uptake and eliminate arsenic in different amounts. Spehar et al. (1981) reported that, in a Lake Michigan study, arsenic concentrations in fish tissue were correlated with age and size for trout and with age for smelt. No correlation with age or length was found for alewife or yellow perch.

Arsenic toxicity depends on the valence state, with arsenic(III) often being more toxic to mammals and aquatic species than arsenic(V) (EPA, 1976). Contrary to this, another study reported that the algae Selenastrum capricornutum was 45 times more sensitive to arsenic(V) than to arsenic(III) (EPA, 1976). The cycling of arsenic in natural waters is mediated by biogeochemical processes occurring primarily in the sediments (Holm et al., 1979). Arsenic, which behaves much like phosphorus in its ability to be scavenged by suspended particulates, is removed from the water column by adsorbing to iron and aluminum sesquioxides and $Fe(OH)_3$. Once buried within the sediments, iron(III) is reduced to Fe(II) and becomes soluble, releasing the adsorbed arsenic into the interstitial water. Arsenic may then be reduced from arsenic(V) to the more toxic arsenic(III) and ultimately to AsH_3, which is gaseous.

3.2 BARIUM

Bulk (wet) sediment concentrations of barium ranged from 1.63 to 3.13 mg/kg, with a median value of 2.26 mg/kg (Figure 4A). Expressed in relation to dry weight, the range was 64.2 to 122.0 mg/kg, with a median value of 93.8 mg/kg (Figure 4B). Dry-weight concentrations in all the

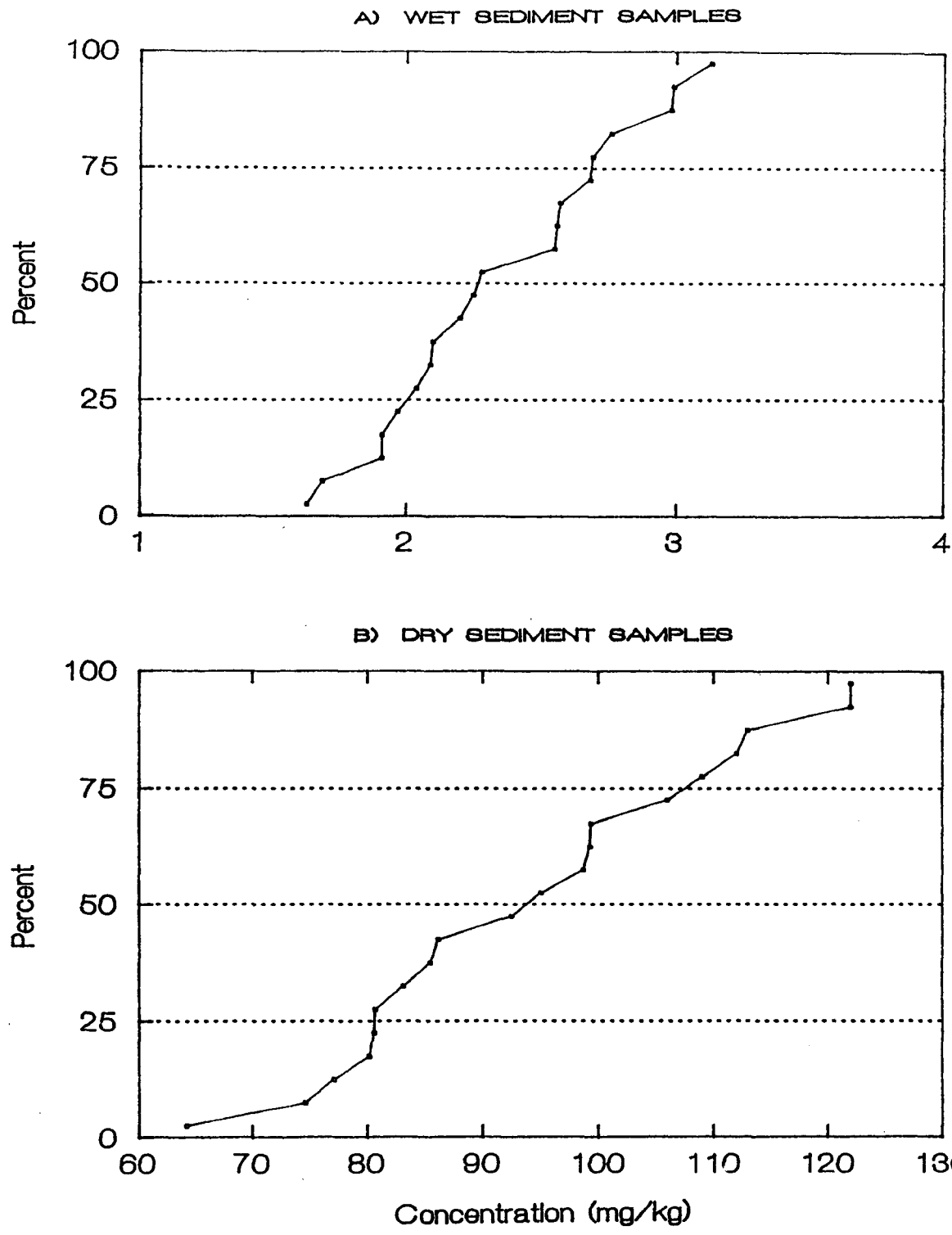


Figure 4. Cumulative distribution (as %; n = 20 samples) of barium concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

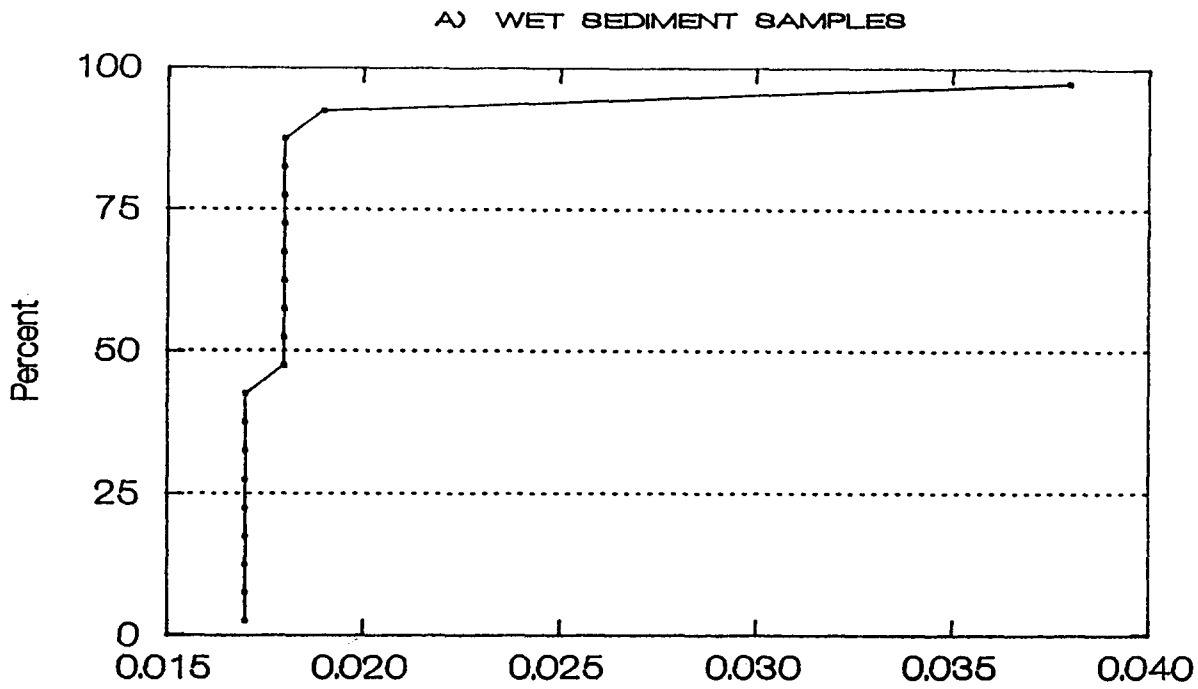
samples were higher than the EPA sediment quality criteria for barium (20 to 60 mg/kg dry weight, Table 2).

Biesinger and Christensen (1972) found that the 3-week LC_{50} of barium to Daphnia magna was 13.5 mg/L, with a 50 and 16 percent decline in reproduction at concentrations of 8.9 and 5.8 mg/L, respectively. Sulfate or carbonate in sufficient amount will precipitate the barium, rendering it virtually insoluble and nontoxic. The pH of Lake Apopka averages 8.9, and the mean alkalinity is 123 mg $CaCO_3$/L (Brezonik et al., 1981). Recognizing that the physical and chemical properties of barium generally prevent it from occurring in the toxic soluble form, a restrictive criterion for aquatic life appears unwarranted (EPA, 1976). Although the concentration in all the dry sediment samples exceeds 50 mg/kg, the high aqueous pH, high sulfate, and high carbonate concentrations probably limit any toxic effects to aquatic biota during sediment resuspension. The effects on benthic fauna and other detritivores, however, are unknown.

3.3 BERYLLIUM

Concentrations of beryllium in Lake Apopka expressed as wet weight ranged from 0.017 to 0.038 mg/kg, with a median value of 0.018 mg/kg (Figure 5A). The concentration at all sites was 0.017 to 0.018 mg/kg, with the exception of Site B2 at 0 to 10 cm (0.038 mg/kg). Dry-weight beryllium concentrations ranged from 0.436 to 2.54 mg/kg, with a median value of 0.712 mg/kg (Figure 5B). Sediment toxicity criteria apparently have not been developed, and this discussion by default focuses on aquatic toxicity data. EPA's recommended criteria of beryllium for acute and chronic exposure to aquatic organisms are 0.130 and 0.0053 mg/L, respectively (Table 1).

These criteria were derived from many studies using fathead minnows and bluegills (Tarzwell and Henderson, 1960, cited in EPA, 1976); salamander



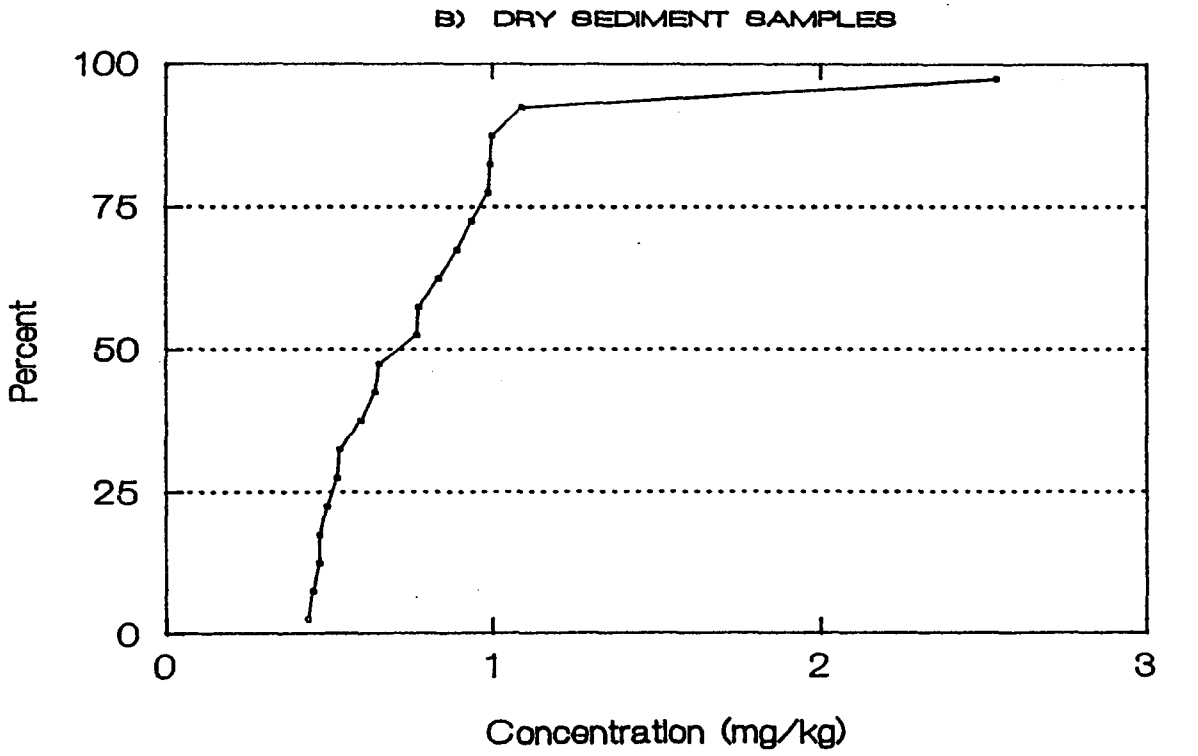


Figure 5. **Cumulative distribution (as %; n = 20 samples) of beryllium concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.**

larvae (Slonim and Ray, 1975); and guppies (Slonim and Slonim, 1973). Bulk concentrations found in all the Lake Apopka sediment samples (Figure 5) lie below acute criteria for beryllium aquatic toxicity (Table 1). Beryllium toxicity is inversely related to water hardness, with acute beryllium toxicity increasing as much as 100 times in soft water as compared to hard water. For example, Slonim and Slonim (1973) found that the 96-hour LC_{50} for guppies is 20.0 mg/L in hard water (400 mg/L as $CaCO_3$) compared to only 0.16 mg/L in soft water (22 mg/L as $CaCO_3$). Water in Lake Apopka is hard (mean hardness is 155 mg/L as $CaCO_3$; Tuschall et al., 1979) and should minimize the potential occurrence of beryllium toxicity.

3.4 CHROMIUM

Bulk sediment concentrations of chromium ranged from 0.11 to 0.465 mg/kg, with a median value of 0.226 mg/kg (Figure 6A). Dry-weight chromium concentrations ranged from 6.41 to 21.3 mg/kg, with a median value of 9.15 mg/kg (Figure 6B). The valence state influences the toxicity of chromium, with hexavalent chromium being more toxic than the trivalent form (EPA, 1976). Water hardness also affects chromium toxicity, with chromium being more toxic in soft water than in hard water (Buikema et al., 1974). The water quality criteria of chromium(VI) for protection of aquatic organisms are 0.016 and 0.011 mg/L for acute and chronic exposure, respectively (Table 1; EPA, 1976). For chromium(III), the criterion is based on water hardness. Using the mean water hardness of Lake Apopka (155 mg/L $CaCO_3$; Tuschall et al., 1979), the mean aquatic criteria of chromium(III) for protection of aquatic organisms are 2.49 and 0.30 mg/L for acute and chronic threshold levels, respectively (Table 1). Sediment quality criteria and disposal classification criteria for chromium are higher than that found in Lake Apopka sediments (Table 2). EPA criteria range from 25.0 to 75.0 mg/kg (dry weight) for moderately polluted sediments. The Ontario Ministry of Environment "limit of tolerance level" and the level for restricted land use application are 111 and 120 mg/kg (dry weight), respectively. In a chronic toxicity study using Daphnia

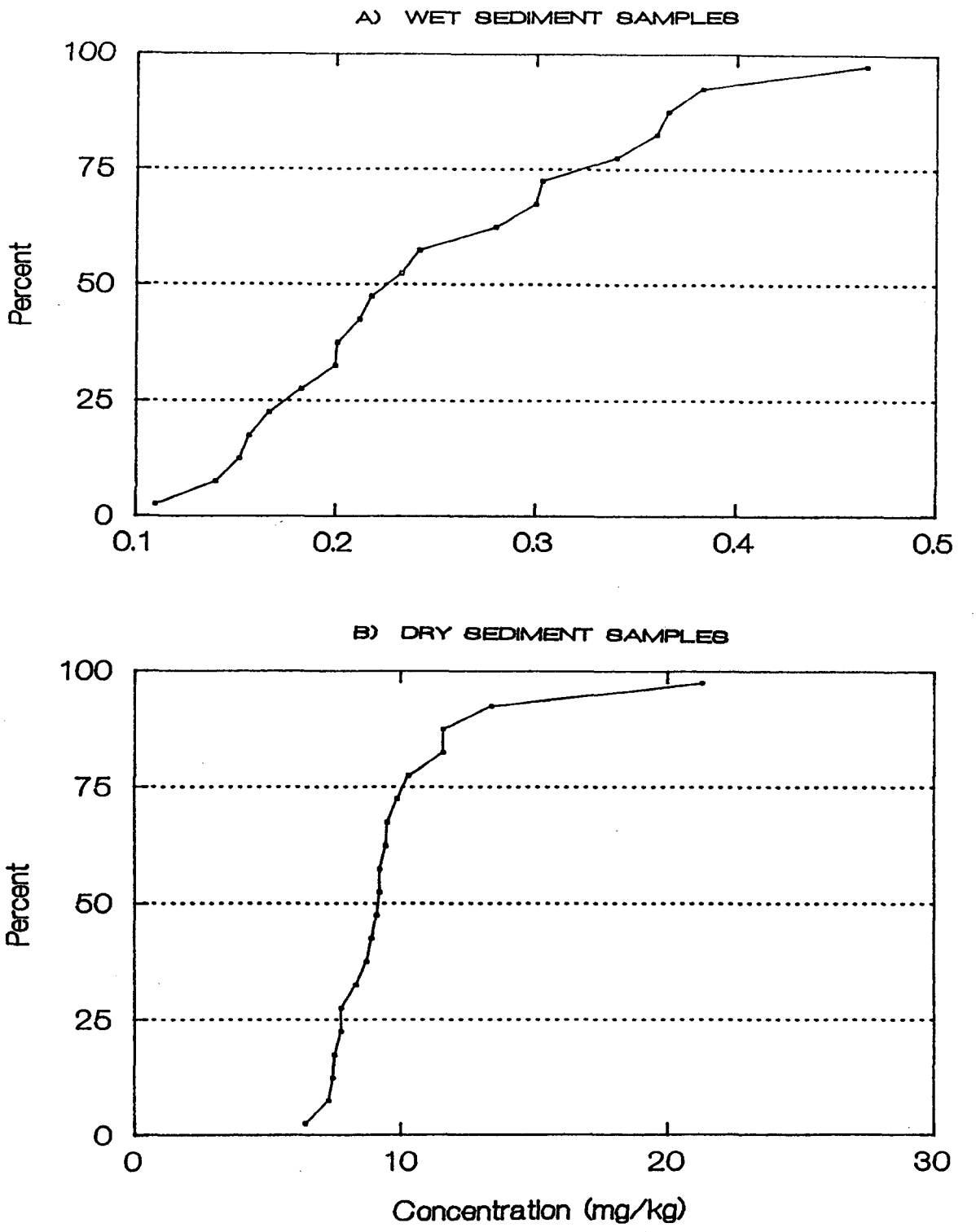


Figure 6. Cumulative distribution (as %; n = 20 samples) of chromium concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

magna, Biesinger and Christensen (1972) determined the 3-week LC_{50} to be 2.0 mg/L. A 50 and 16 percent decline in reproduction occurred at concentrations of 0.6 and 0.33 mg/L, respectively. The no-effect concentration of chromium on fathead minnows was found to be 1.0 mg/L in acute studies using both hexavalent and trivalent chromium (Pickering and Henderson, 1966). In a similar study, Benoit (1976) found the no-effect concentration ranged from 0.20 to 0.35 mg/L hexavalent chromium for brook trout and rainbow trout; however, Olson (1958) determined that the same concentration (0.20 mg/L) significantly reduced the growth and survival of chinook salmon. Trivalent chromium produced no detrimental effect on salmon when exposed to the same concentration.

In lakes with heavy chromium loading, Spehar et al. (1981) reported a negative correlation between fish size and muscle chromium concentration. In a separate study, Johnson (1987) found positive correlations between chromium loading rates in sediments and fish tissue concentrations.

Chromium enrichment in the sediments of some Florida lakes was documented by Thompson (1981), who showed the greatest enrichment occurring in lakes with the most watershed and shoreline disturbance. Enrichment in these lakes is probably from fertilizer runoff and septic tank effluent. The range in chromium concentrations in lake bottom sediments found by Thompson was 3.4 to 60.0 mg/kg. [Although not specified by Thompson, data collected from nearby Lake Barco (Bienert, unpublished data) suggest that Thompson's data were based on dry-weight measurements.]

Concentrations of chromium in Lake Apopka sediments (expressed as dry weight) are below the sediment quality criteria established by EPA, Wisconsin DNR, and OME (Table 2). Although chromium concentrations (expressed as wet weight) in fewer than half the samples collected exceed the chronic chromium aquatic toxicity threshold guidelines for fresh water (0.30 mg/L; Table 1), chromium concentrations should not pose toxicity

concern as evidenced by the appreciably higher sediment quality criteria reported in Table 2.

3.5 COPPER

Copper concentrations in Lake Apopka sediments ranged from 0.276 to 1.30 mg/kg (wet weight), with a median value of 0.489 mg/kg (Figure 7A); expressed as dry weight, the range was 16.8 to 37.7 mg/kg, with a median value of 19.95 mg/kg (Figure 7B). Three sediment samples are within the sediment quality criteria established by EPA for moderately polluted sediments (Table 2); values for the remaining sediment samples fell below these criteria. All Lake Apopka sediment samples are below the sediment quality criteria and sediment disposal classification criteria established by DNR and OME, respectively (Table 2).

Aqueous copper threshold criteria are derived as a function of water hardness (EPA, 1976). The aqueous criteria for acute and chronic threshold values specific to Lake Apopka are presented in Table 1. All of the bulk sediment samples exceed the copper criterion based on the mean and minimum water hardness in the lake by over an order of magnitude.

The accumulation of copper in sediments of Lake Apopka poses a potential copper toxicity threat to the aquatic biota. In a chronic bioassay study using fathead minnows, Pickering (1974) found that copper was the most toxic of the four heavy metals tested (using cadmium, copper, nickel, and zinc), and Warnick and Bell (1969) also determined that copper was the most toxic metal to the three aquatic insects used. High alkalinity and organic matter in Lake Apopka can mitigate the potential copper toxicity; however, the elevated levels of copper in sediments relative to both sediment quality criteria (Table 2) and aquatic toxicity threshold guidelines (Table 1) indicate a potential for chronic toxicity effects in Lake Apopka. Thompson (1981) found appreciable copper enrichment in the sediments of five out of seven Florida lakes sampled. He concluded that copper enrichment can occur from both human activities on the lake and floodplain.

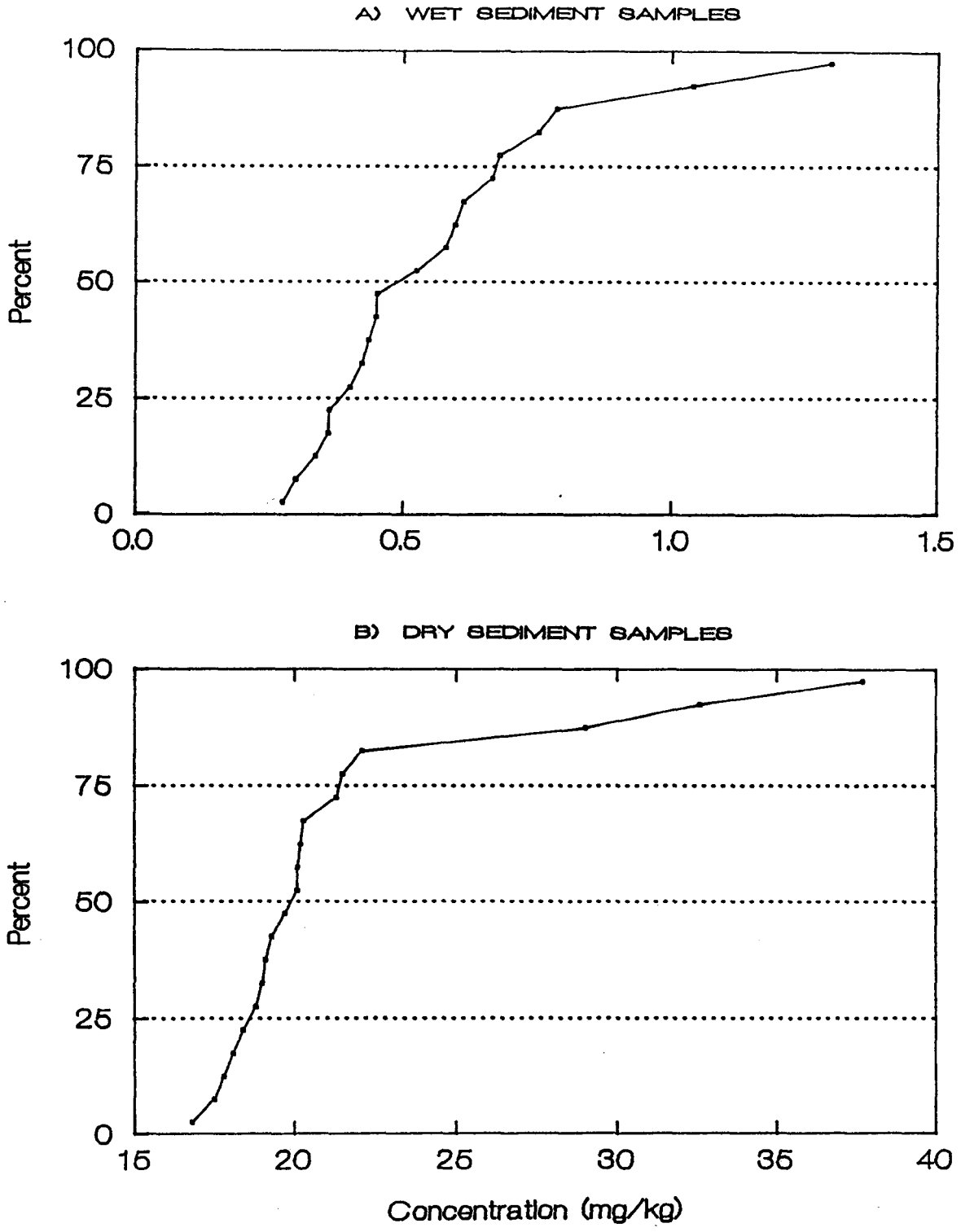


Figure 7. Cumulative distribution (as %; n = 20 samples) of copper concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

and from precipitation inputs. Copper sulfate, used as a biocide, has been applied to lakes to control algae. In some of these lakes, sediment concentrations as high as 0.531 mg/kg (moisture content not specified) have been detected (Bertine and Mendeck, 1978, cited in Thompson, 1981; Iskandar and Keeney, 1974). Many of the wet sediment samples and all of the dry sediment samples from Lake Apopka exceed the concentrations found in the biocide-treated lakes (Figure 7).

As suggested from EPA sediment criteria (Bando et al., 1990; Table 2), Lake Apopka sediments have low to moderately elevated and potentially toxic concentrations of copper. Unless the copper in the sediments is largely labile and water soluble, acute toxicity due to pulsed exposure (e.g., via sediment resuspension) is unlikely. Nonetheless, chronic toxicity effects cannot be dismissed, and careful monitoring should be conducted to periodically document copper levels in sediments as well as in water and biota.

3.6 LEAD

Expressed on a wet-weight basis, lead concentrations in Lake Apopka ranged from 0.469 to 1.29 mg/kg, with a median value of 0.534 mg/kg (Figure 8A). Expressed on a dry-weight basis, the range was 13.5 to 40.9 mg/kg, with a median value of 25.7 mg/kg (Figure 8B). Aqueous threshold toxicity criteria for lead, which are presented in Table 1, are based on water hardness. Sediment quality criteria, which are presented in Table 2, currently are expressed strictly as a function of contaminant concentrations. Bulk phase lead concentrations suggest the likelihood of aquatic toxicity, with the median concentration exceeding the aqueous acute threshold level by five times (Table 1). However, when compared with sediment quality criteria, only one sample (40.9 mg/kg dry weight) lies within the lead concentration range of 40 to 60 mg/kg established for moderately polluted sediments (Table 2).

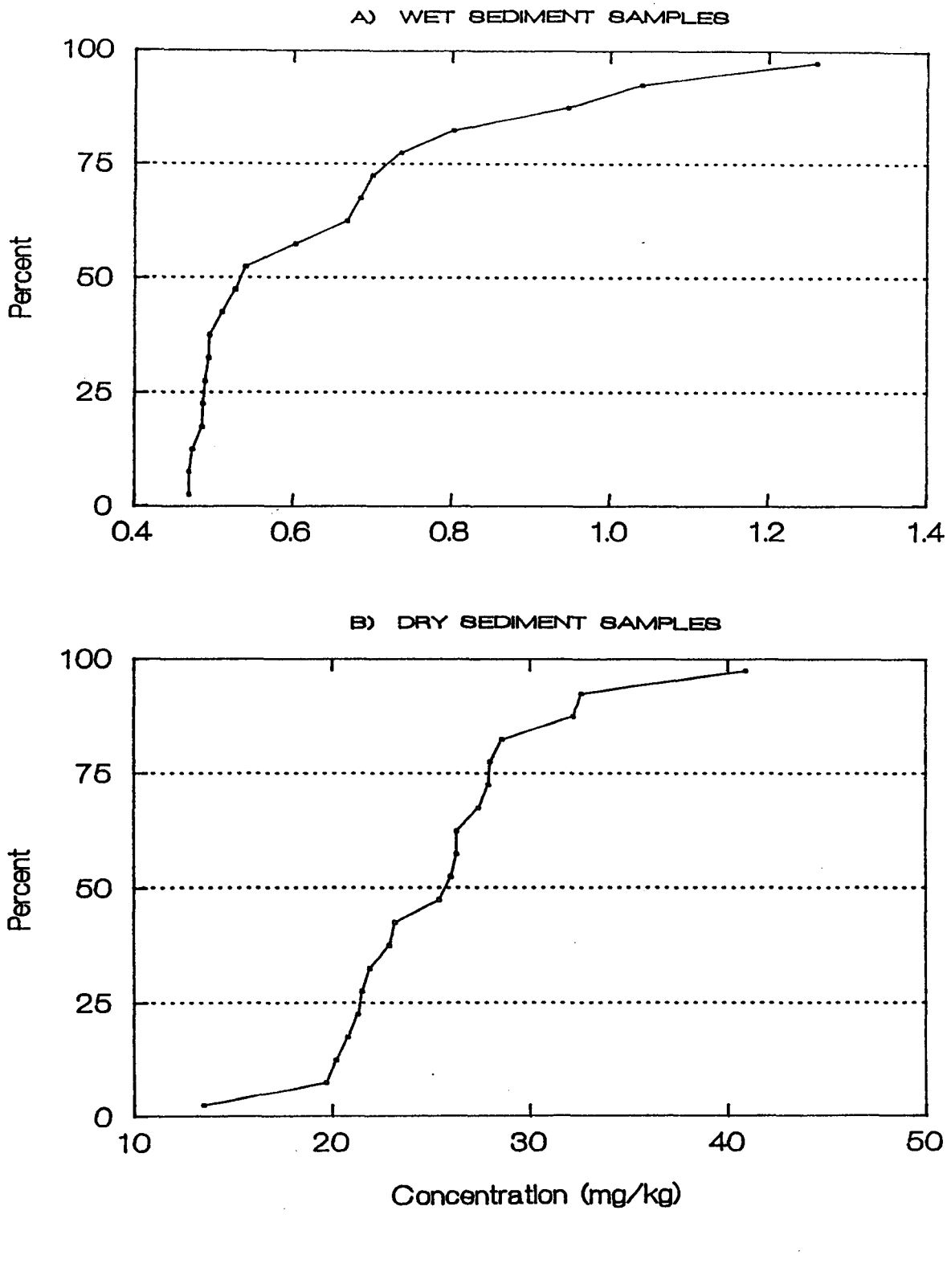


Figure 8. Cumulative distribution (as %; n = 20 samples) of lead concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

Thompson (1981) found that lead was the only metal studied that exhibited at least a twofold increase over precultural concentrations in sediments of Florida lakes. Concentrations ranged widely among lakes (12 to 65 mg/kg). Thompson suggested that enrichment was because of leaded gasoline, septic tank effluents, fertilizer runoff, and stormwater discharge.

Lead is a toxic metal that tends to accumulate in the tissue of man and other animals. High lead exposures produce severe neurological damage, anemia, and kidney dysfunction. Sublethal effects from low-level or long-term exposure can impair neurological and motor development and cause kidney damage in children.

Many acute aquatic toxicological studies on lead have been conducted. Brown (1968, cited in EPA, 1976) reported a 96-hour LC_{50} of 1 mg/L for rainbow trout in soft water. In hard water, Pickering and Henderson (1966, cited in EPA, 1976) determined that the 96-hour LC_{50} for fathead minnows is equal to 482 mg/L. Assimilation of lead in fish has been related to dissolved oxygen levels and temperature (Spehar et al., 1981). Additionally, feeding-pattern behavior strongly influences lead accumulation in fish. Schulz-Baldes et al. (1983) determined that because lead is strongly adsorbed onto seston particles, filter feeders exhibited much higher lead uptake rates. Buikema et al. (1974) reported that when lead was added to both hard and soft water, it immediately precipitated as large particles, presumably as lead carbonate. Most of these precipitate particles were too large to be ingested by rotifers and other small organisms but were large enough to affect the gills of fish. Mortality of rotifers did occur, nonetheless, and their demise was attributed to ingestion of small lead carbonate particles that were in suspension for a short period of time.

3.7 NICKEL

Nickel concentrations in Lake Apopka sediments ranged from 0.147 to 0.168 mg/kg expressed as wet weight (Figure 9A) and 3.87 to 10.40 mg/kg

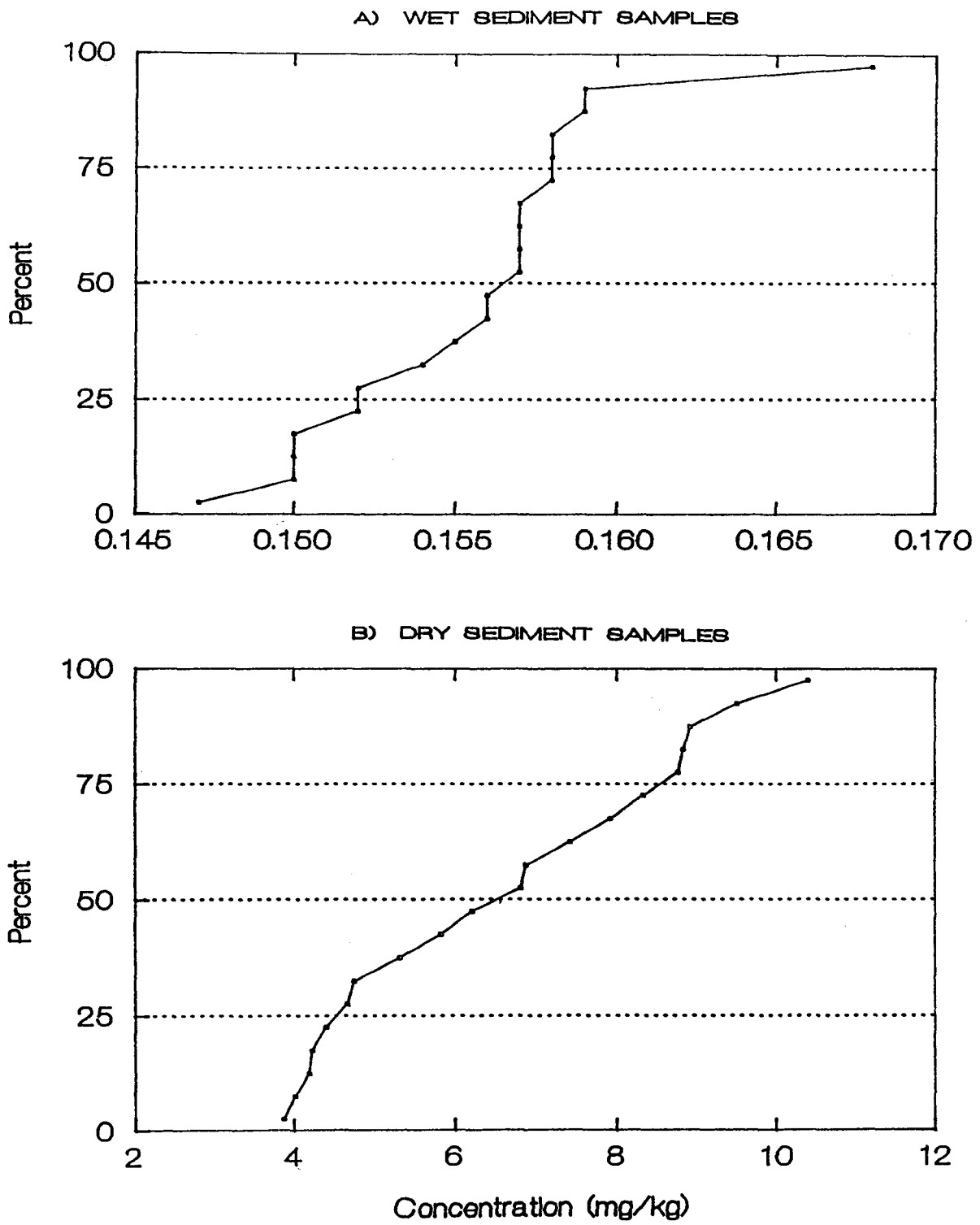


Figure 9. Cumulative distribution (as %; n = 20 samples) of nickel concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

expressed as dry weight (Figure 9B). Median concentrations were 0.157 and 6.515 mg/kg, respectively. Nickel enrichment in Florida lakes is reported to be widespread (Thompson, 1981). Nickel is a component of oil and is released into the atmosphere during the consumption of fossil fuels.

The toxicity of nickel to aquatic life is not clearly understood. McKee and Wolf (1963, cited in EPA, 1976) reported that nickel toxicity varies widely and is influenced by species, pH, synergistic effects, and other factors. Several acute studies report a wide range in toxicity levels for various aquatic species. Biesinger and Christensen (1972) found that the 3-week LC_{50} value for Daphnia magna in soft water was 0.130 mg/L nickel. Reproduction of Daphnia was impaired by 50 and 16 percent at concentrations of 0.095 and 0.030 mg/L, respectively. In an aquatic insect study, Warnick and Bell (1969) determined the 96-hour LC_{50} value to be 4.0 and 33.5 mg/L nickel for two different species. A wide range of toxicity values exists for fish studies as well. Jones (1939, cited in EPA, 1976) indicated that the lethal limit of nickel for sticklebacks in soft tap water was only 0.80 mg/L. Pickering and Henderson (1964, cited in EPA, 1976) reported that the 96-hour LC_{50} values for four fish species in soft water ranged from 4.6 to 9.8 mg/L, and in hard water the range was 39.2 to 42.4 mg/L for two fish species. Rehwoldt et al. (1971) reported a wider range in the 96-hour LC_{50} value for fish. Striped bass possessed the lowest at 6.2 mg/L, whereas banded killifish was the highest at 46.2 mg/L. In a chronic bioassay using fathead minnows, the no-effect concentration of nickel was determined to be 0.38 mg/L (Pickering, 1974).

Results from these and other studies suggest that chronic toxicity is inversely related to water hardness. Therefore, EPA (1976) devised an equation based on water hardness to determine acute and chronic aqueous threshold values. Threshold values specific to Lake Apopka are presented in Table 1. The median and maximum wet sediment concentration is less than the calculated aquatic and chronic threshold values for Lake Apopka (Table 1), indicating that aquatic toxicity effects related to ambient

levels of nickel in Lake Apopka sediments are not likely. Additionally, nickel concentrations in Lake Apopka sediment are below sediment quality criteria established by various agencies (Table 2). Thus, the possibility of nickel-related aquatic toxicity does not appear problematic in Lake Apopka sediments.

3.8 SELENIUM

Selenium concentrations in Lake Apopka sediments ranged from 0.024 to 0.103 mg/kg (wet weight), with a median value of 0.047 mg/kg (Figure 10A). Expressed on a dry-weight basis, selenium concentrations ranged from 1.49 to 2.57 mg/kg, with 1.915 mg/kg as the median value (Figure 10B). In studies on chronic aquatic toxicity, Spehar et al. (1981) reported that selenium concentrations of 0.28 mg/L had no effect on survival and reproduction of Daphnia, whereas Bringmann and Kuhn (1959, cited in EPA, 1976) determined a median 2-day threshold value of 2.5 mg/L for Daphnia. The median 4-day threshold values were 2.5 mg/L for the alga Scenedesmus, 90 mg/L for the bacterium Escherichia coli, and 183 mg/L for the protozoan Microregma (Bringmann and Kuhn, 1959, cited in EPA, 1976). Concentrations up to 40 mg/L of selenium had no effect on the hatching of fathead minnow eggs, but concentrations above 15 mg/L significantly reduced egg incubation times (Spehar et al., 1981).

Bulk phase selenium concentrations lie in the same range as acute and chronic aquatic toxicity threshold concentrations (0.260 and 0.035 mg/L, respectively; EPA, 1976). However, direct aquatic exposure at aqueous levels approaching 0.035 mg/L is predicated on virtually complete release of sediment-bound selenium into equivalent masses of water (e.g., release of 0.035 mg of selenium from 1 kg of bulk phase sediment to 1 kg or 1 liter of water); the likelihood of such exposure should be quite small. Nonetheless, levels of selenium in nearly half of the Lake Apopka sediments sampled approximate or exceed land use application criteria established by OME (2.0 mg/kg, Table 2; no other relevant sediment criteria exist), and

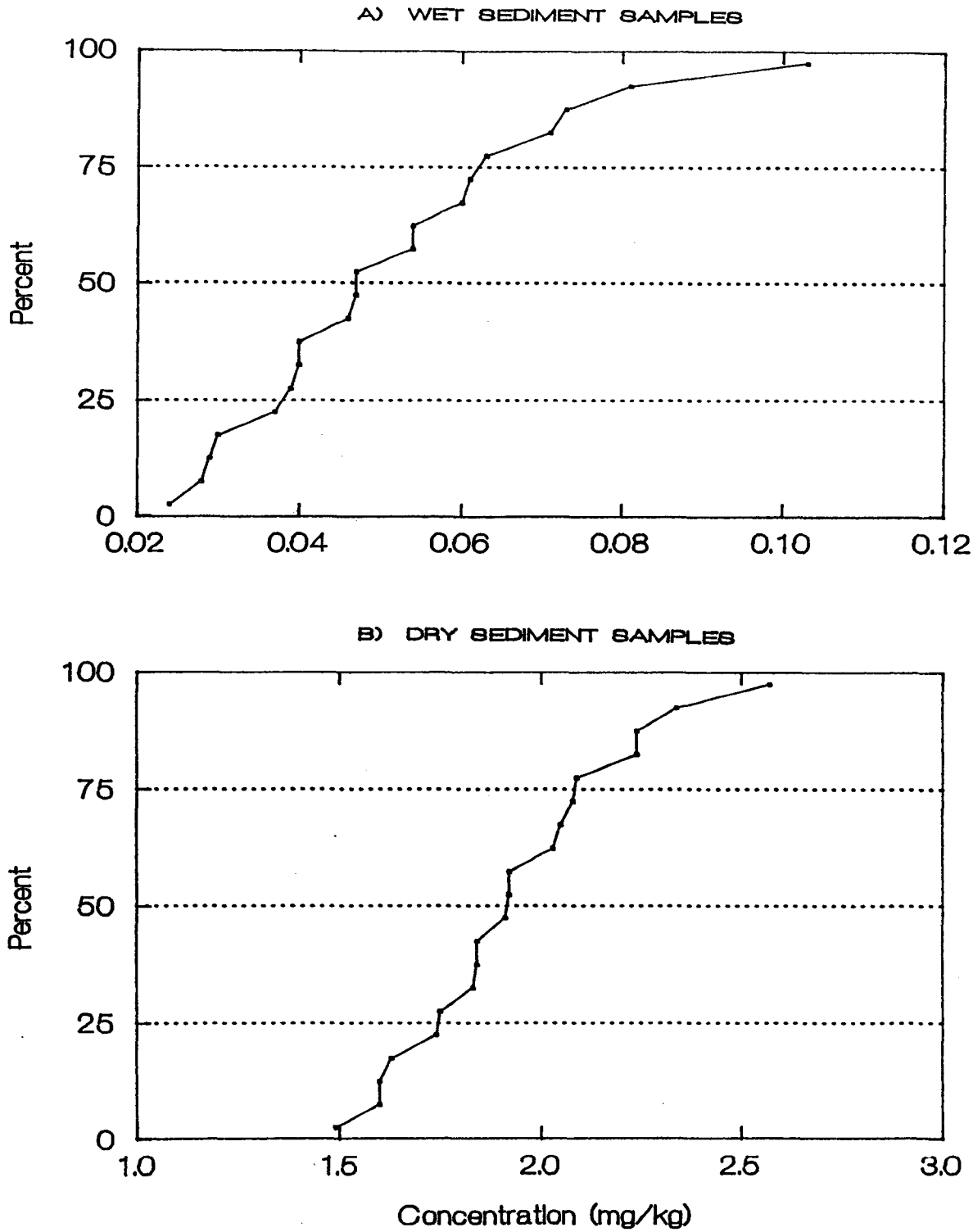


Figure 10. Cumulative distribution (as %; n = 20 samples) of selenium concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

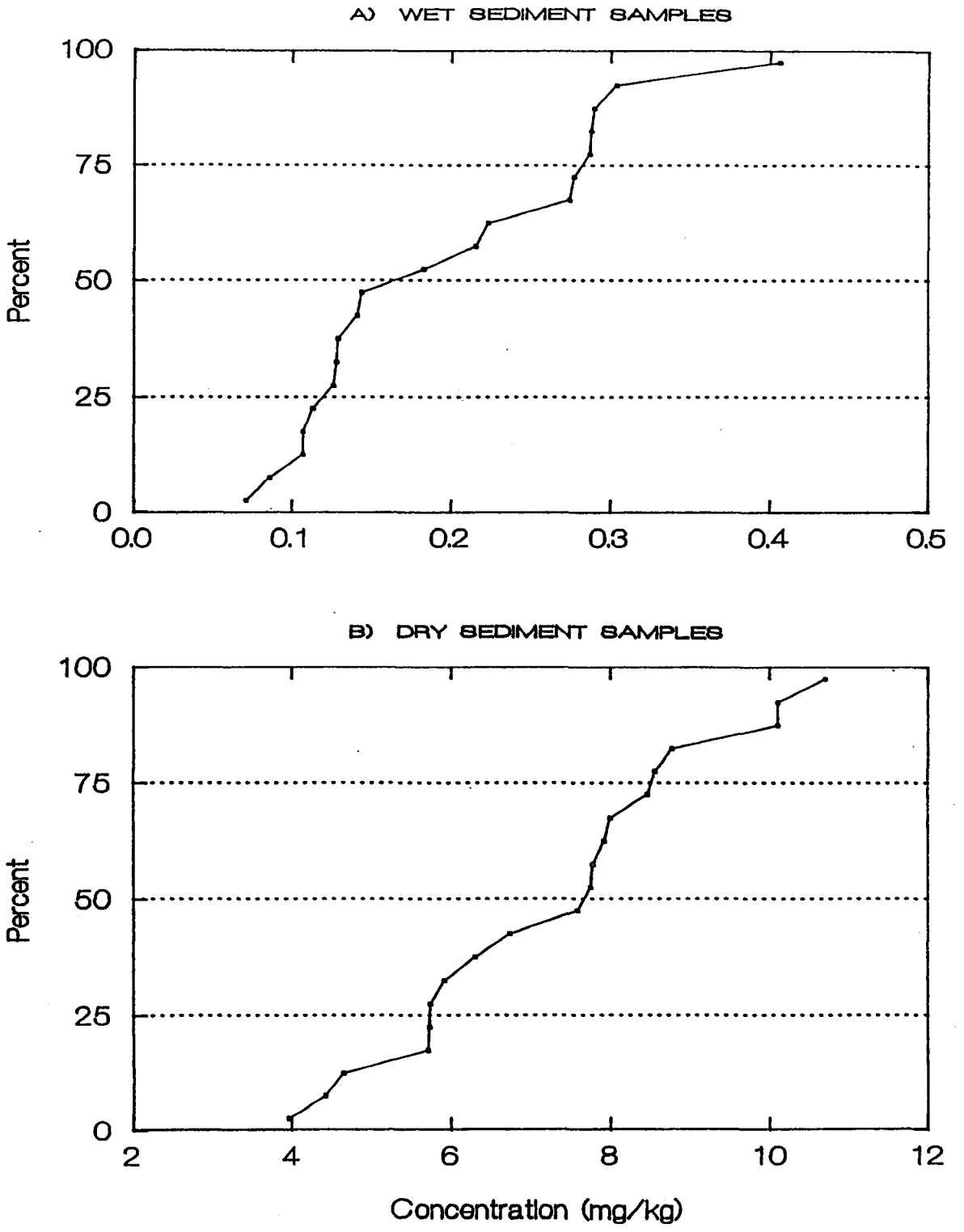


Figure 11. Cumulative distribution (as %; n = 20 samples) of vanadium concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

concern particularly about chronic toxicity effects cannot be categorically dismissed.

3.9 VANADIUM

Vanadium concentrations in Lake Apopka sediments ranged from 0.071 to 0.406 mg/kg (wet weight), with a median value of 0.164 mg/kg (Figure 11A). Expressed on a dry-weight basis, vanadium concentrations ranged from 3.96 to 10.70 mg/kg, with a median value of 7.665 mg/kg. Compared to the other elements, existing literature on vanadium toxicity on aquatic biota is scarce. However, background concentrations of vanadium in freshwater have been reported. Sugawara et al. (1956) reported 0.0009 mg/L as the vanadium concentration in freshwater, and Copeland and Ayers (1972) found that the vanadium concentration in Lake Michigan was 0.0002 mg/L. Vanadium enrichment at a concentration of 0.30 mg/L was detected in the Colorado River (Kopp and Kroner, 1968, cited in EPA, 1976). Because of the scarcity of literature on vanadium toxicity, especially in sediments, the potential effect of vanadium on Lake Apopka cannot be determined.

3.10 ZINC

Zinc concentrations in Lake Apopka sediments ranged from 0.686 to 2.29 mg/kg (wet weight), with a median value of 1.175 mg/kg (Figure 12A). On a dry-weight basis, the range was 32.0 to 80.8 mg/kg, with a median value of 41.75 mg/kg (Figure 12B). These concentrations are all below the relevant sediment quality criteria and sediment disposal classification criteria cited in Baudo et al. (1990; Table 2).

Low aqueous concentrations of zinc are reported to produce detrimental effects and avoidance reactions on aquatic organisms. Sprague (1964) reported that rainbow trout exhibited strong avoidance reactions to sublethal concentrations of zinc sulfide. The threshold avoidance level was 0.0056 mg/L of zinc, which was only 0.01 percent of the lethal threshold concentration. In relatively poorly buffered creek water (pH 6.8; calcium and magnesium concentrations of 1.7 and 1.0 mg/L,

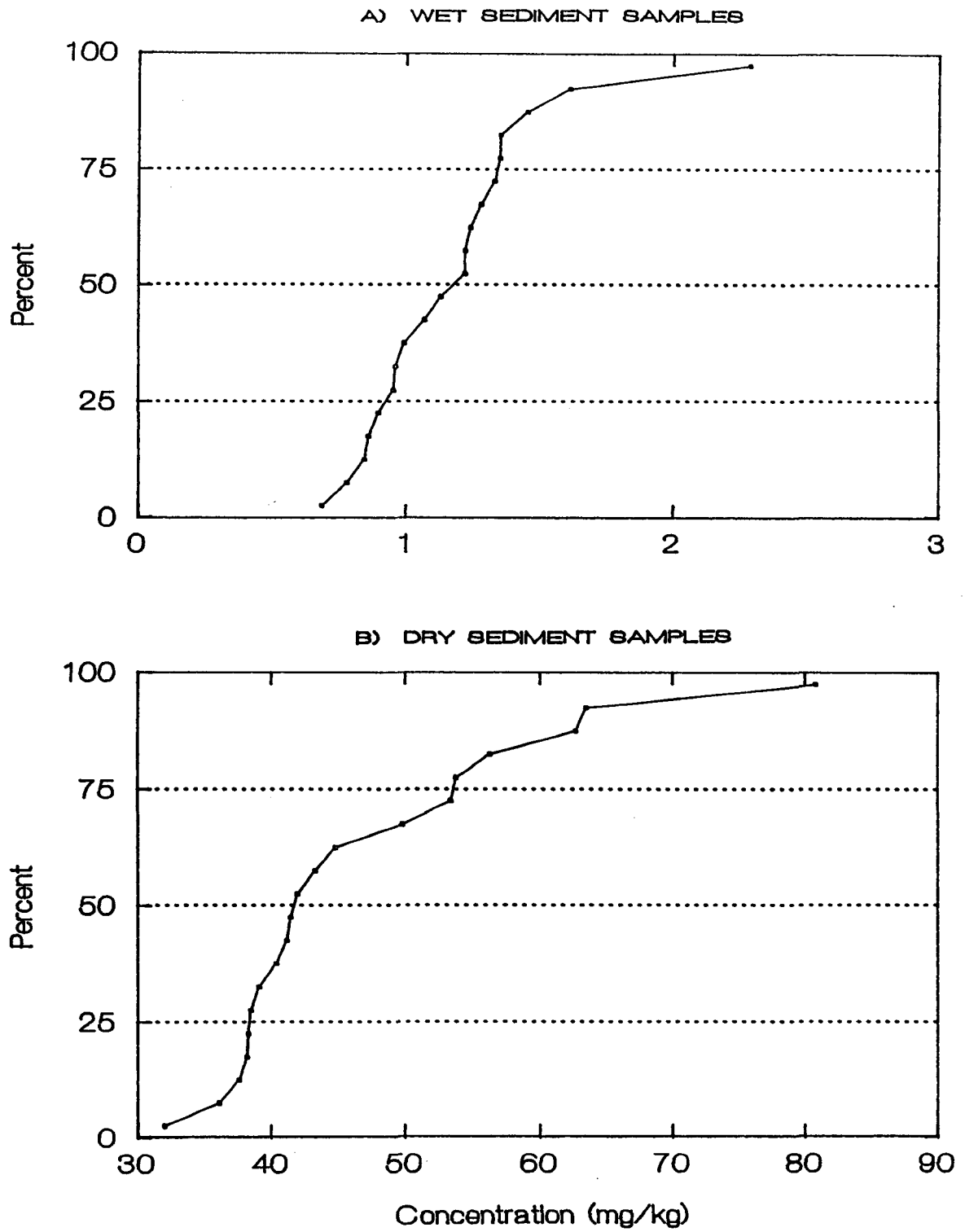


Figure 12. Cumulative distribution (as %; n = 20 samples) of zinc concentrations in sediments. Concentrations expressed as mg/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

respectively), Affleck (1952) found 54 percent mortality of rainbow trout fry in 28 days in a concentration of 0.010 mg/L. Biesinger and Christensen (1972) reported a 16 percent decline in reproduction of Daphnia at a concentration of 0.070 mg/L, whereas 0.158 mg/L was the 3-week LC_{50} value for Daphnia. A zinc concentration of 0.180 mg/L resulted in an 83 percent decrease in eggs produced by fathead minnows (Brungs, 1969, cited in EPA, 1976). Several toxicity comparisons were conducted using hard and soft water. In a bioassay with young pond snails, Wurtz (1962, cited in EPA, 1976) reported the 96-hour LC_{50} values with hard and soft water to be 0.434 and 0.303 mg/L, respectively. In a more striking example of the effects of water hardness on zinc toxicity, Pickering and Henderson (1966, cited in EPA, 1976) determined the 96-hour LC_{50} of fathead minnows in soft water to be 0.870 mg/L and in hard water to be 33 mg/L. Buikema et al. (1974) concluded that increasing water hardness decreased the toxicity of zinc. Based on these and other toxicological studies, EPA (1986) devised equations as a function of water hardness to predict the acute and chronic threshold toxicity levels.

In addition to water hardness, other environmental factors affect zinc toxicity on aquatic organisms. Both an increase in temperature and a decrease in dissolved oxygen increase the toxicity of zinc. In a review of the effect of zinc toxicity on fish, Skidmore (1964, cited in EPA, 1976) found that salts of the alkaline earth metals are antagonistic to the action of zinc salts, and salts of certain heavy metals are synergistic in soft water. Toxic concentrations of zinc cause a diverse change in physiology and morphology of fish. Zinc accumulation in fish also appears to be species-specific. Lowe et al. (1985) reported that the common carp accumulated more zinc than other fish species. Acute toxicity includes cellular breakdown and clogging of the gills, whereas symptoms of chronic zinc toxicity are general enfeeblement and widespread histological changes to many organs but not to gills. Retardation of growth and maturation also occurs from chronic exposure to elevated zinc concentrations.

Comparison of existing sediment criteria and observed concentrations of zinc in Lake Apopka sediments indicates that toxic effects to benthic infauna are unlikely. Nonetheless, solid phase concentrations are high, and episodic sediment resuspension hypothetically could release environmentally significant concentrations of zinc. Desorption of zinc bound to resuspended particles conceivably could elevate ambient zinc concentrations in the water column by 0.010 mg/L or more. Although the hard water of Lake Apopka should minimize the effects, potential toxicity could be greatest in summer when temperatures are higher and dissolved oxygen is lower near the sediment-water interface. More information is needed both on ambient aqueous concentrations of zinc and adsorption-desorption dynamics of zinc sorbed to Lake Apopka sediments.

3.11 ACETONE

Bulk phase concentrations of acetone in Lake Apopka sediments (wet weight) ranged from 0.010 to 0.023 mg/kg, with a median value of 0.010 mg/kg (Figure 13A). Only two samples (Site F6, 0-10 cm and Site G3, 0-10 cm) possessed concentrations above the detection limit of 0.010 mg/kg. On a dry-weight basis, the range was 0.25 to 1.3 mg/kg, with a median value of 0.375 mg/kg (Figure 13B). No sediment quality criteria, water quality criteria, or toxicity studies on acetone were found for comparison with the Lake Apopka sediment concentrations.

3.12 BENZOIC ACID

The range in concentrations of benzoic acid in Lake Apopka sediments (wet weight) was 0.090 to 0.190 mg/kg, with a median value of 0.130 mg/kg (Figure 14A). On a dry-weight basis, the range in benzoic acid concentrations was 2.80 to 7.40 mg/kg, with a median value of 550 mg/kg (Figure 14B). As in the case of acetone, no water quality criteria or toxicity studies on benzoic acid were found to compare with these sediment concentrations in Lake Apopka.

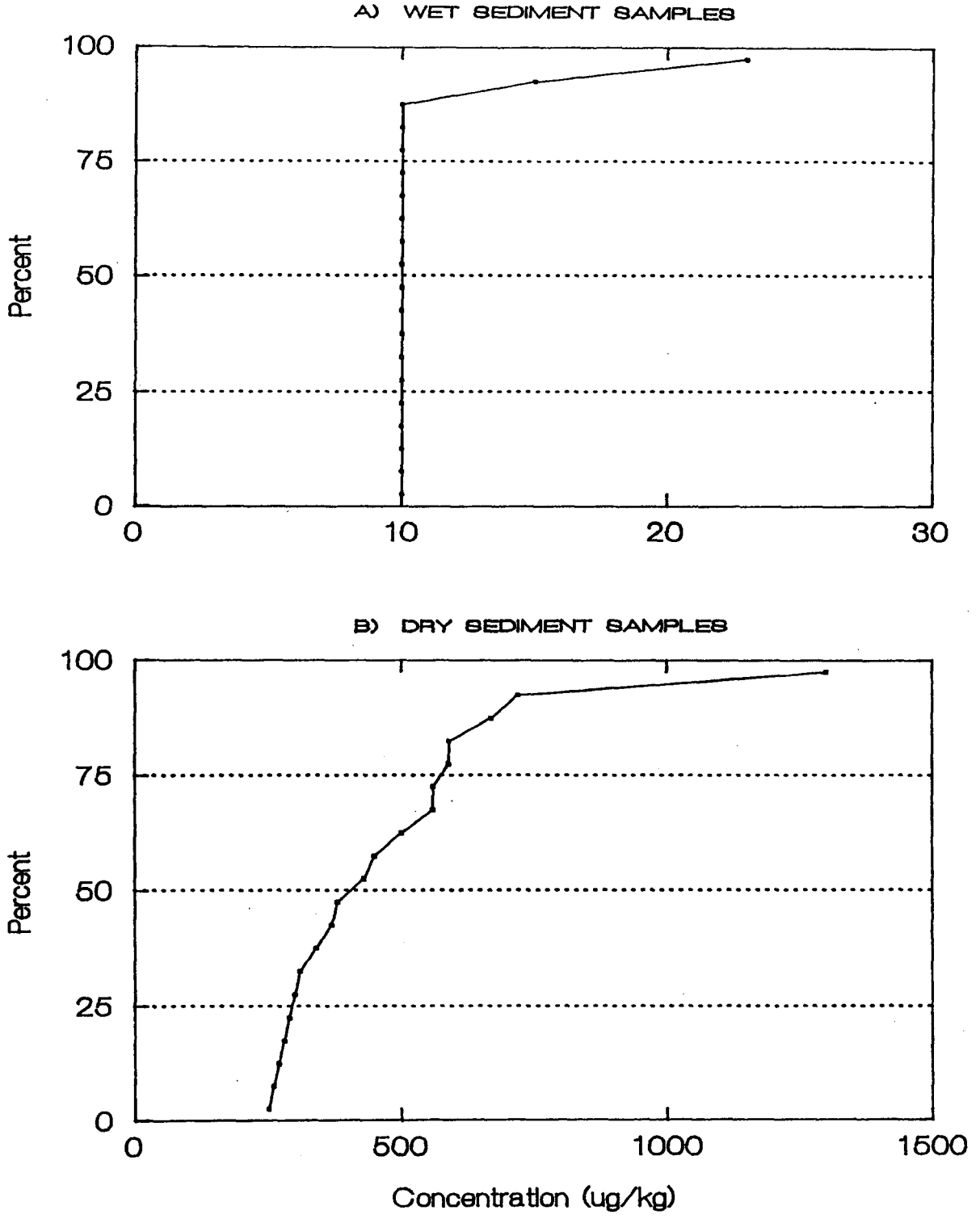


Figure 13. Cumulative distribution (as %; n = 20 samples) of acetone concentrations in sediments. Concentrations expressed as ug/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

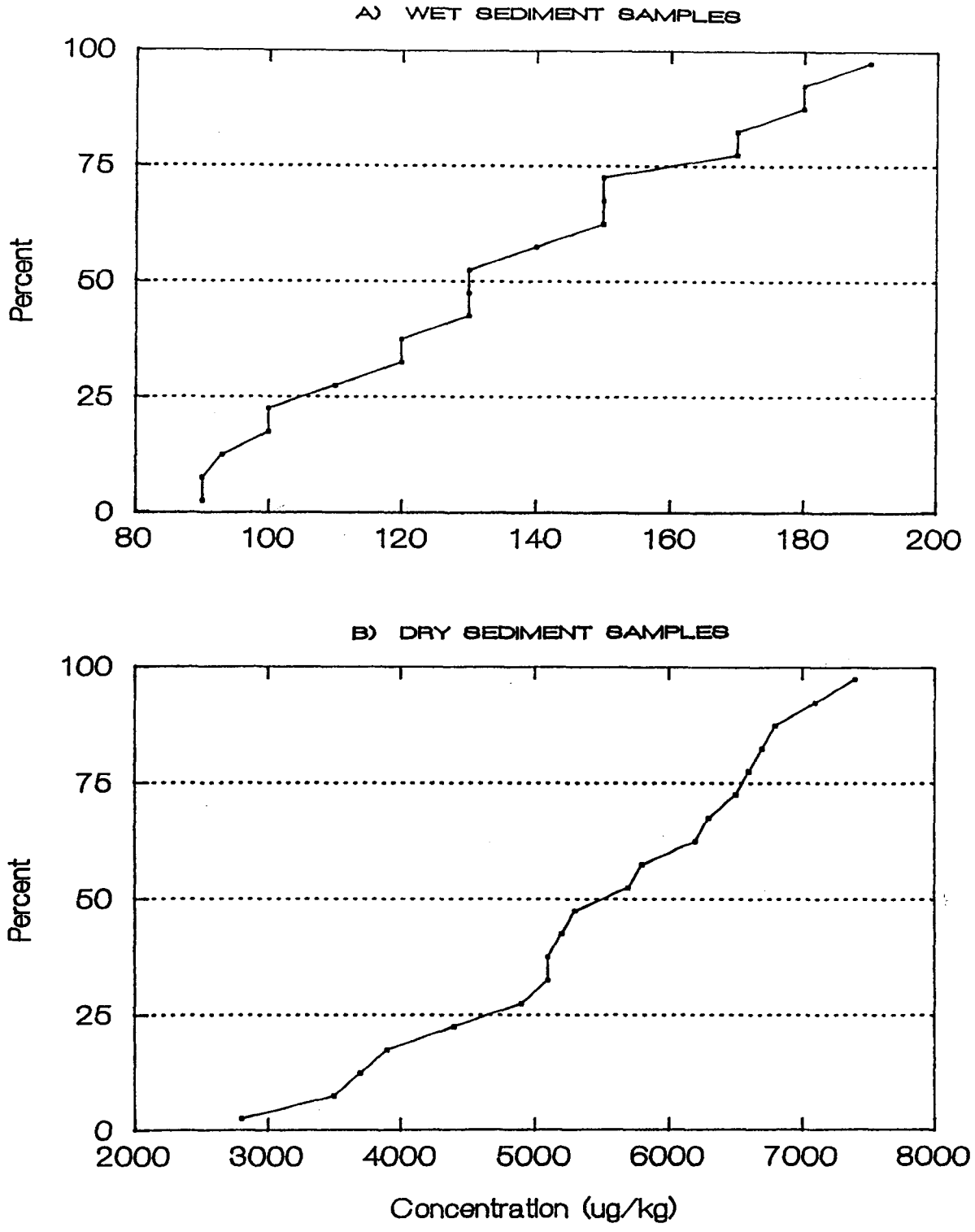


Figure 14. Cumulative distribution (as %; n = 20 samples) of benzoic acid concentrations in sediments. Concentrations expressed as ug/kg on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

3.13 PHENOL

Phenol concentrations in Lake Apopka sediments (wet weight) ranged from 0.135 to 3.59 mg/g, with a median value of 0.501 mg/g (Figure 15A). Concentrations of phenol on a dry-weight basis ranged from 5.150 to 187.0 mg/g, with a median value of 18.05 mg/g (Figure 15B).

Phenolic compounds can be lethal to fish at relatively low concentrations. Mitrovic et al. (1968, cited in EPA, 1976) reported that concentrations of 7.3 and 6.5 mg/L were lethal to rainbow trout in 2 hours and 12 hours, respectively. Pathological changes in fish gill tissue were found at concentrations in the range of 0.02 to 0.07 mg/L (EPA, 1976). However, in contrast, McKee and Wolfe (1963, cited in EPA, 1976) concluded that phenol concentrations of 0.20 mg/L would not interfere with fish and other aquatic life.

Phenolic compounds in aquatic systems can arise from distillation of coal and wood, livestock dips, human and organic wastes, chemical oxidation, microbial degradation of pesticides, and from naturally occurring sources and substances (EPA, 1976). The high phenolic concentrations in the sediments of Lake Apopka can result from many non-point pollution sources throughout the watershed, as well as from byproducts of organic matter decomposition.

EPA (1986) determined that the acute and chronic aqueous threshold values of phenol are 10.20 and 2.56 mg/L, respectively. No sediment quality criteria for phenol are reported. According to the toxicity studies above, phenol concentrations in the Lake Apopka sediments are high relative to concentrations in the aqueous phase. Because concentrations of phenol appear elevated in Lake Apopka, concerns relating to toxic effects of phenols on fish and other aquatic organisms may be warranted; nonetheless, such concerns must be considered in conjunction with the likelihood of natural sources of phenol through organic matter decomposition.

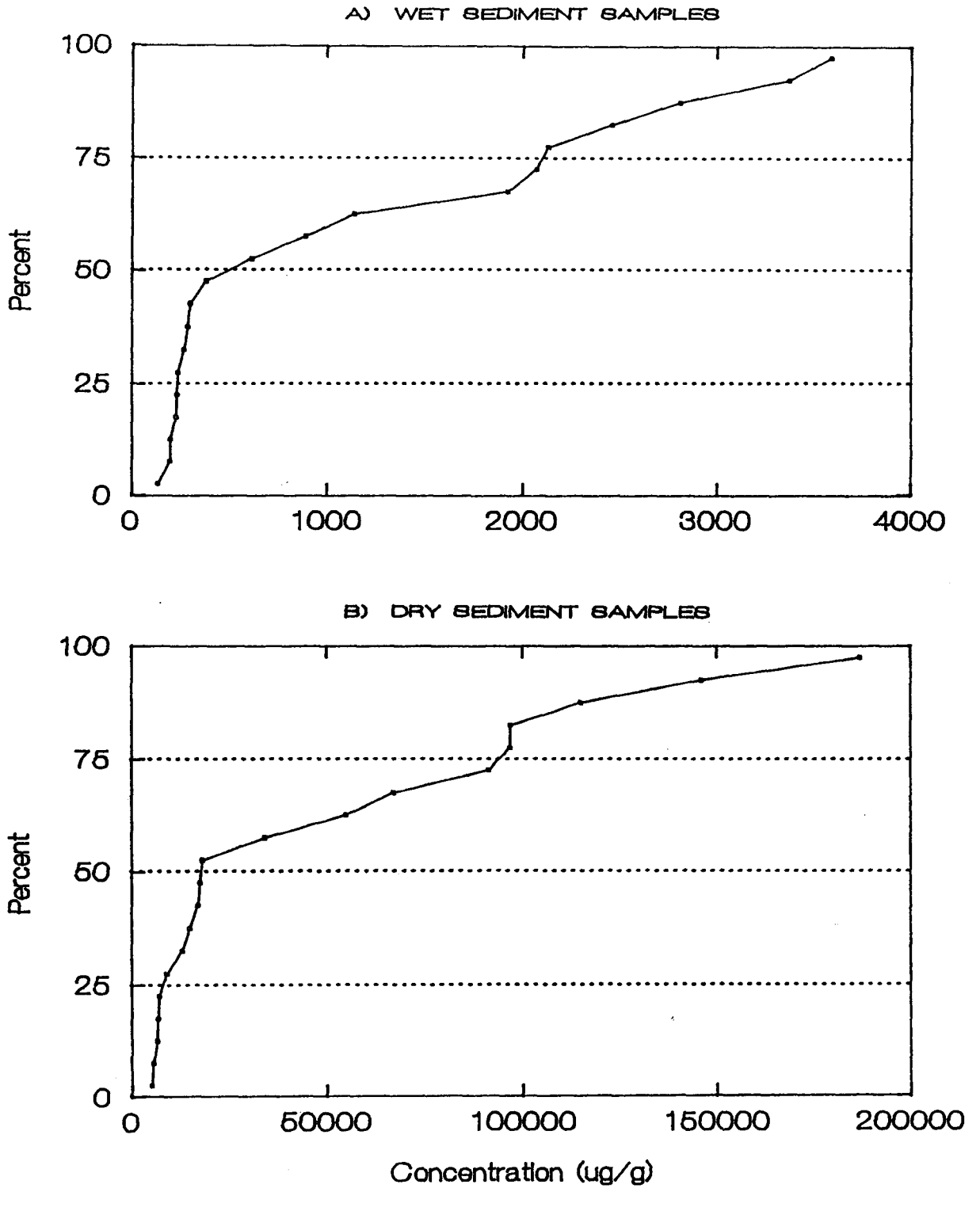


Figure 15. Cumulative distribution (as %; n = 20 samples) of phenol concentrations in sediments. Concentrations expressed as ug/g on wet (A) and dry (B) weight basis. Dry sediment concentrations calculated from percent moisture in wet sediment samples.

3.14 TRACE ELEMENT ENRICHMENT

The occurrence of trace elements in lake sediments arises from a number of mechanisms: (1) from allochthonous inputs of weathered, detrital material derived primarily from within the watershed; (2) from deposition and burial of contaminants associated with mainly anthropogenic emissions into the atmosphere, which are then scavenged by airborne particulates and subsequently deposited (e.g., volatile trace elements such as lead, zinc, and mercury that are emitted as gases during the combustion of fossil fuel and then rapidly adsorbed by fine particulates in the atmosphere and deposited perhaps hundreds of kilometers away from the original source); and (3) point and area sources within the immediate watershed (e.g., point-source discharges, agricultural and urban runoff).

Evaluating whether the occurrence of a particular trace element is elevated at a particular location is not a simple matter of comparing absolute concentrations of the study area to concentrations at other sites. Sediments in lakes typically occur as a continuum of varying particle sizes in direct response to the prevailing energetic environment at the sediment surface. Nearshore, erosional environments where wind-induced waves scour and transport fine sediments offshore consist of coarse, sandy sediments. In contrast, offshore depositional environments where wind-induced wave currents do not extend to the bottom of the lake consist of finer-grained clays and detrital material. Because trace elements are typically adsorbed to particulates, the occurrences of trace elements are usually associated with fine-grained rather than coarse sediments. Smaller-sized particulates have higher surface-area-to-mass ratios and accordingly adsorb higher relative amounts of dissolved contaminants.

In comparing sediment concentrations both within and between lakes, differences in the depositional environment must be accounted for. Examining elemental ratios relative to the occurrence of aluminum is one such normalization approach (Bertine and Goldberg, 1971, cited in Ferguson

and Gavis, 1972; Windom et al., 1989). The use of aluminum as a normalizing variable has the following advantages:

1. Aluminum is not emitted to the atmosphere by fossil fuel combustion;
2. The primary source of aluminum in lake sediments is from weathering of soils; and
3. Once deposited in the sediments, aluminum is not mobile.

Comparing the ratio of a particular trace element to aluminum in lake sediments with known backgrounds (i.e., uncontaminated sediments or watershed soils) can show whether the occurrence of the trace element is truly elevated. When examining the occurrence of known contaminants such as insecticides and other xenobiotic compounds, application of contaminant-to-aluminum ratios within the lake also can identify whether localized contamination has occurred (cf. Hakanson and Janson, 1983). Ratios of elements to aluminum for each sample location are presented in Appendix D.

FDER (1988) collected sediment samples from 103 stations in uncontaminated estuarine/coastal areas to determine if aluminum could be used to normalize metal concentrations in coastal Florida sediments, and if so, to determine the prediction limits of each ratio. Metal-to-aluminum ratios from Lake Apopka sediments were superimposed on the graphs devised by FDER (1988) for coastal sediments (Figures 16 through 21). For comparison between Lake Apopka and coastal Florida ratios, several assumptions were made: (1) No geochemical changes occur in metal-to-aluminum ratios during flocculation and sedimentation processes in estuaries; and (2) metal-to-aluminum ratios occur in the same proportions in both Lake Apopka and coastal sediments Given these assumptions, several patterns were observed. Arsenic, copper, and chromium occurred at levels in Lake Apopka similar to coastal sediments (Figures 16, 17, and 18). Nickel in Lake Apopka was depleted relative to coastal sediments (Figure 20), and lead and zinc were enriched relative to expected natural or background concentrations (Figures 19 and 21).

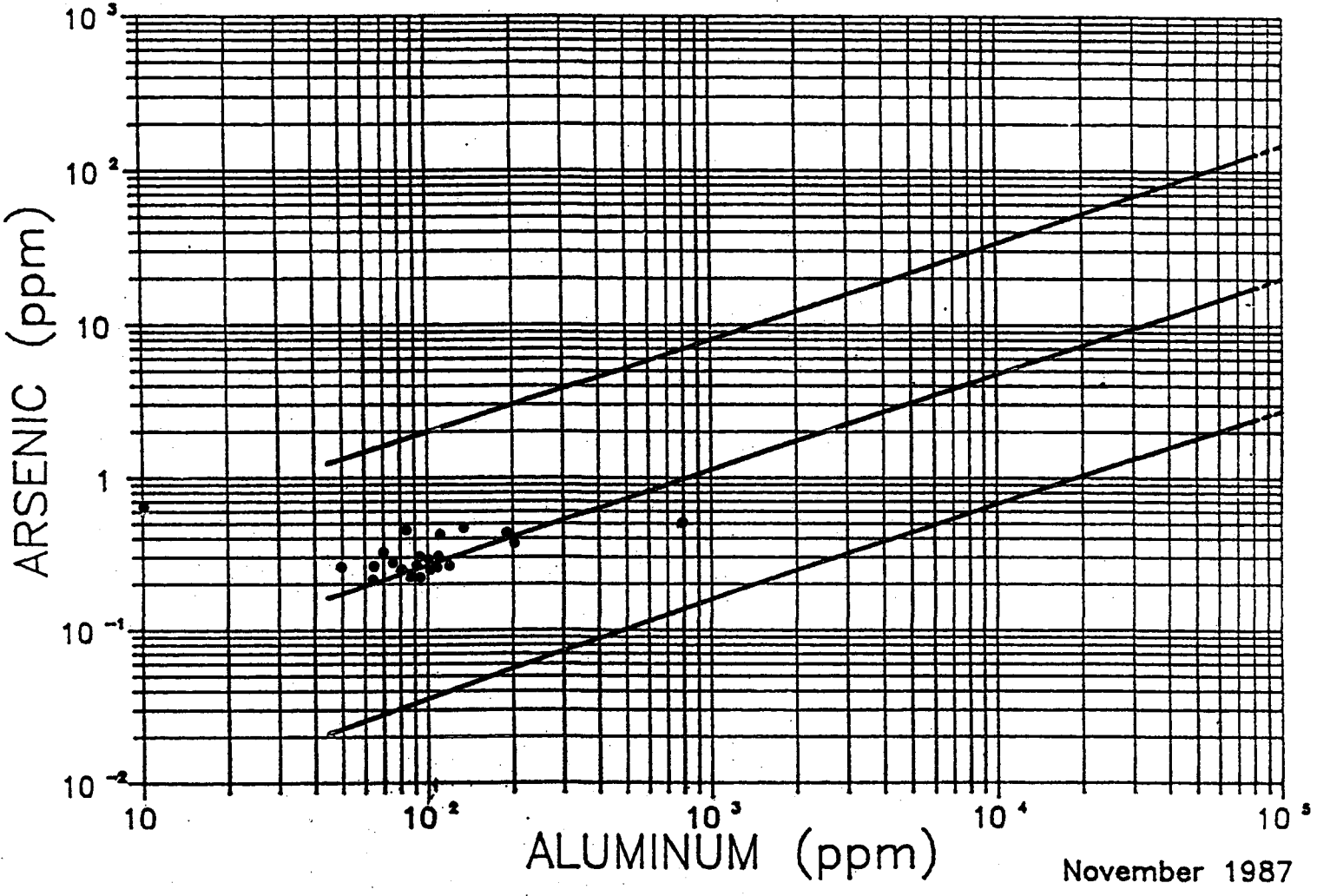


Figure 16 **Arsenic/aluminum regression line with 95% prediction limits derived from estuarine sediments (FDER, 1988). Dashed line indicates extrapolation. Data points represent values collected from Lake Apopka.**

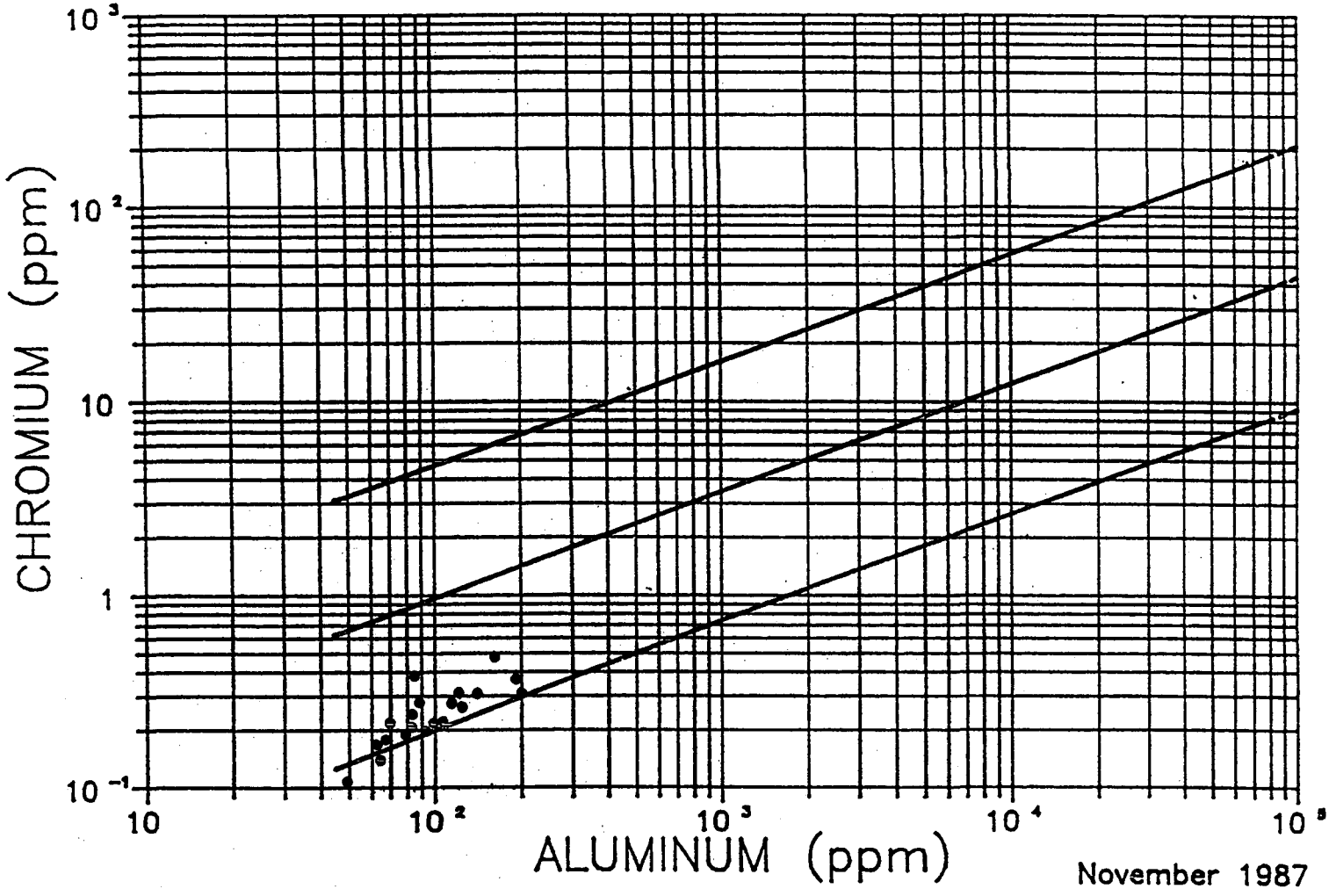


Figure 17 **Chromium/aluminum regression line with 95% prediction limits derived from estuarine sediments (FDER, 1988). Dashed line indicates extrapolation. Data points represent values collected from Lake Apopka.**

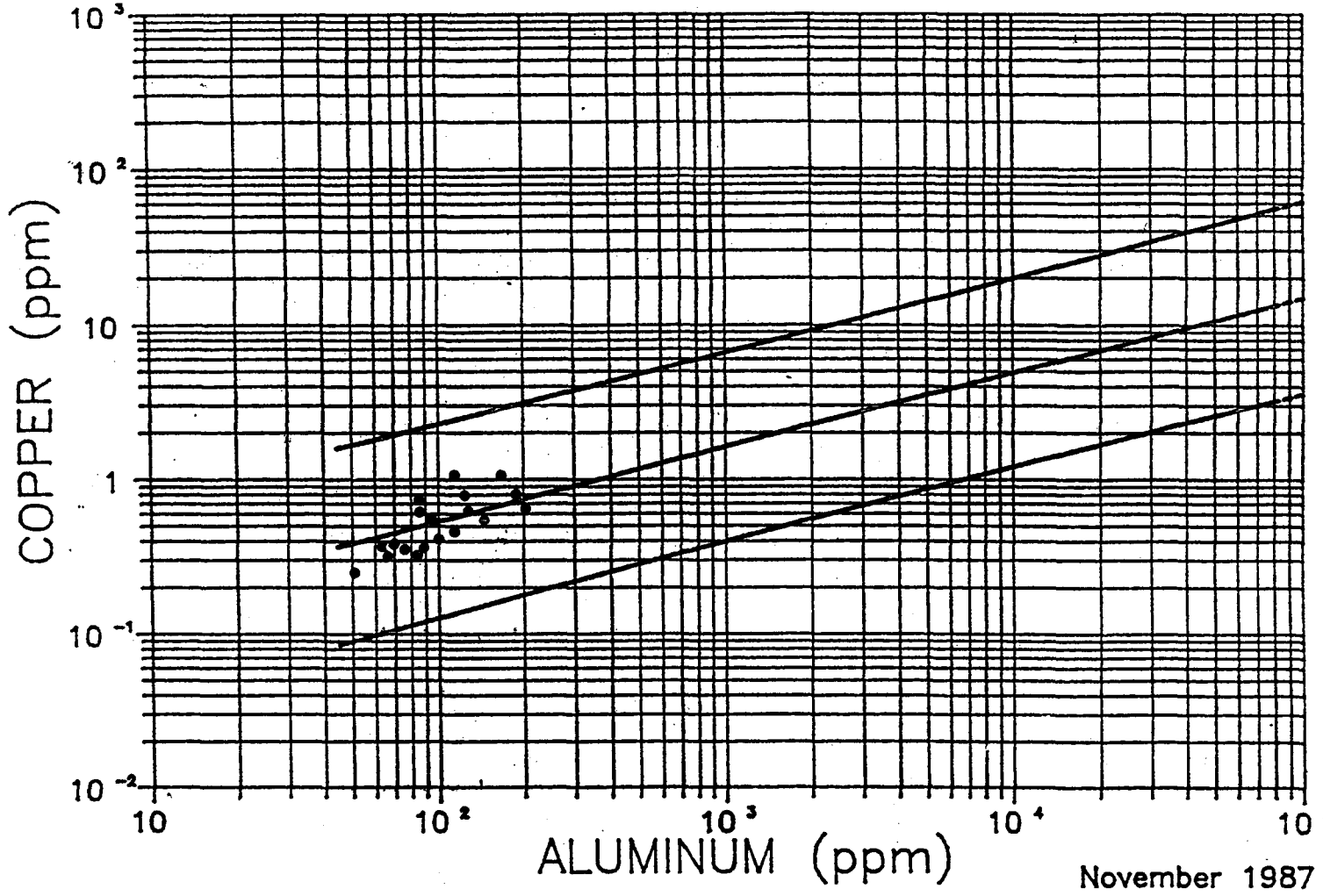


Figure 18 Copper/aluminum regression line with 95% prediction limits derived from estuarine sediments (FDER, 1988). Dashed line indicates extrapolation. Data points represent values collected from Lake Apopka.

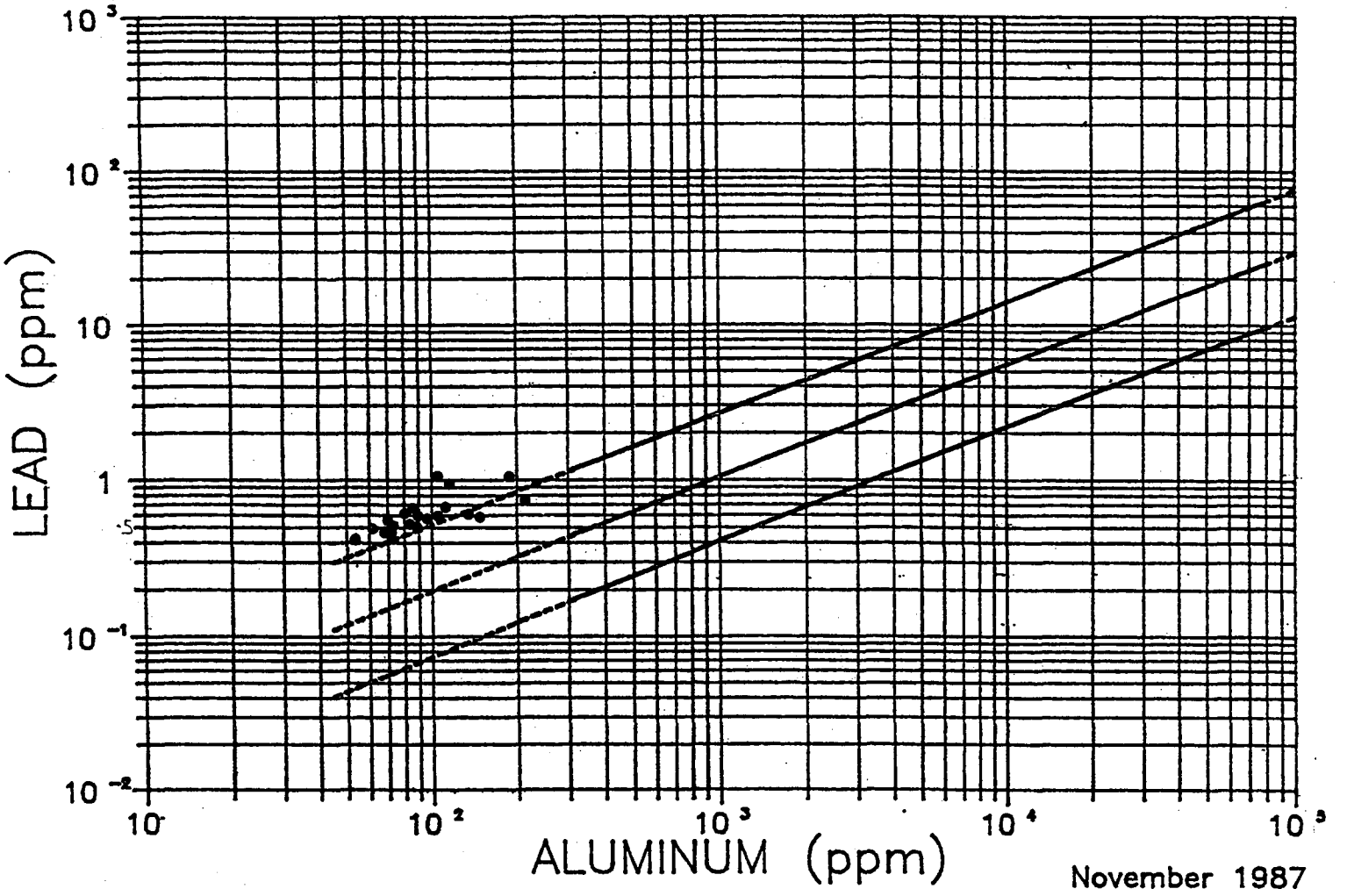


Figure 19 Lead/aluminum regression line with 95% prediction limits derived from estuarine sediments (FDER, 1988). Dashed line indicates extrapolation. Data points represent values collected from Lake Apopka.

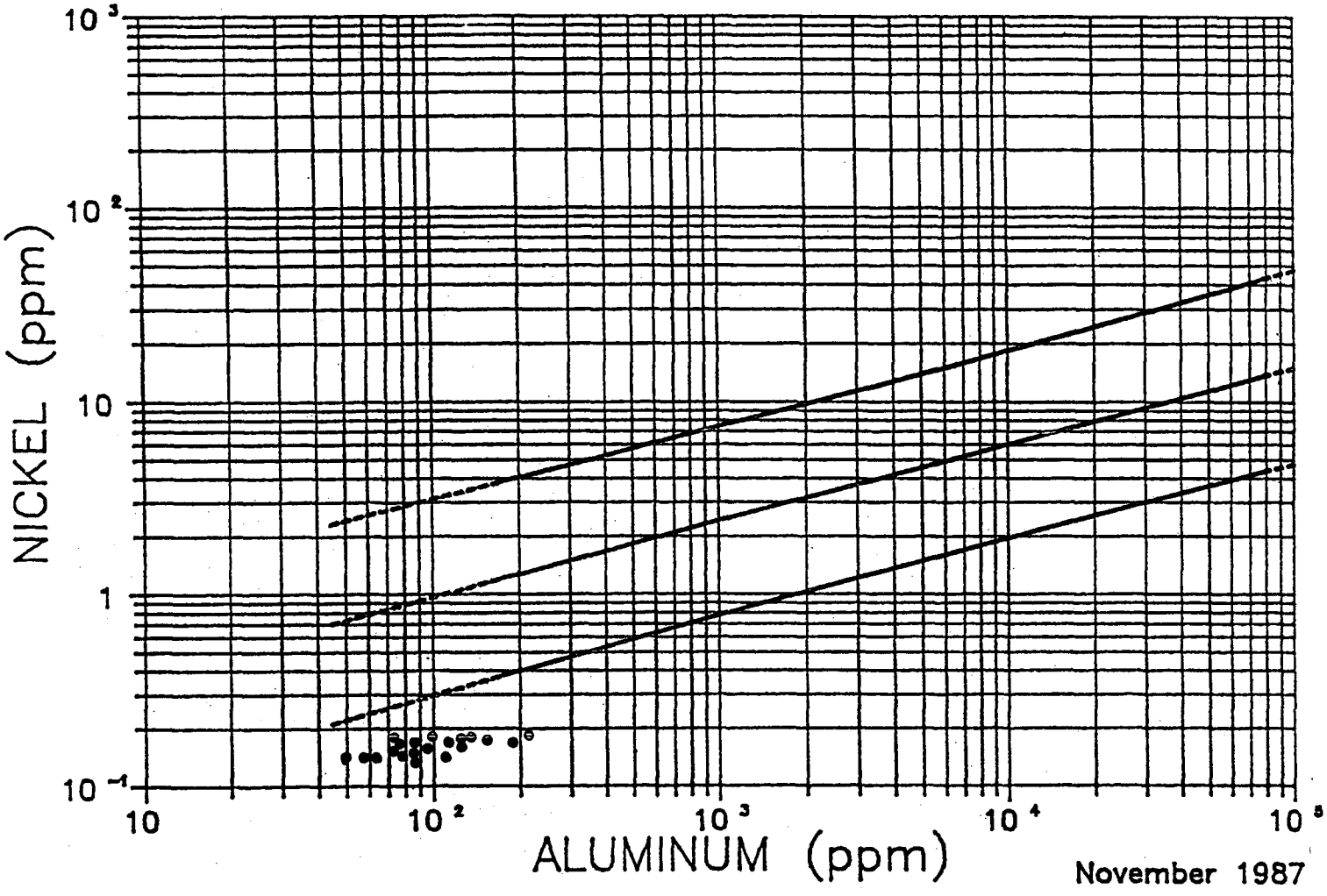


Figure 20 Nickel/aluminum regression line with 95% prediction limits derived from estuarine sediments (FDER, 1988). Dashed line indicates extrapolation. Data points represent values collected from Lake Apopka.

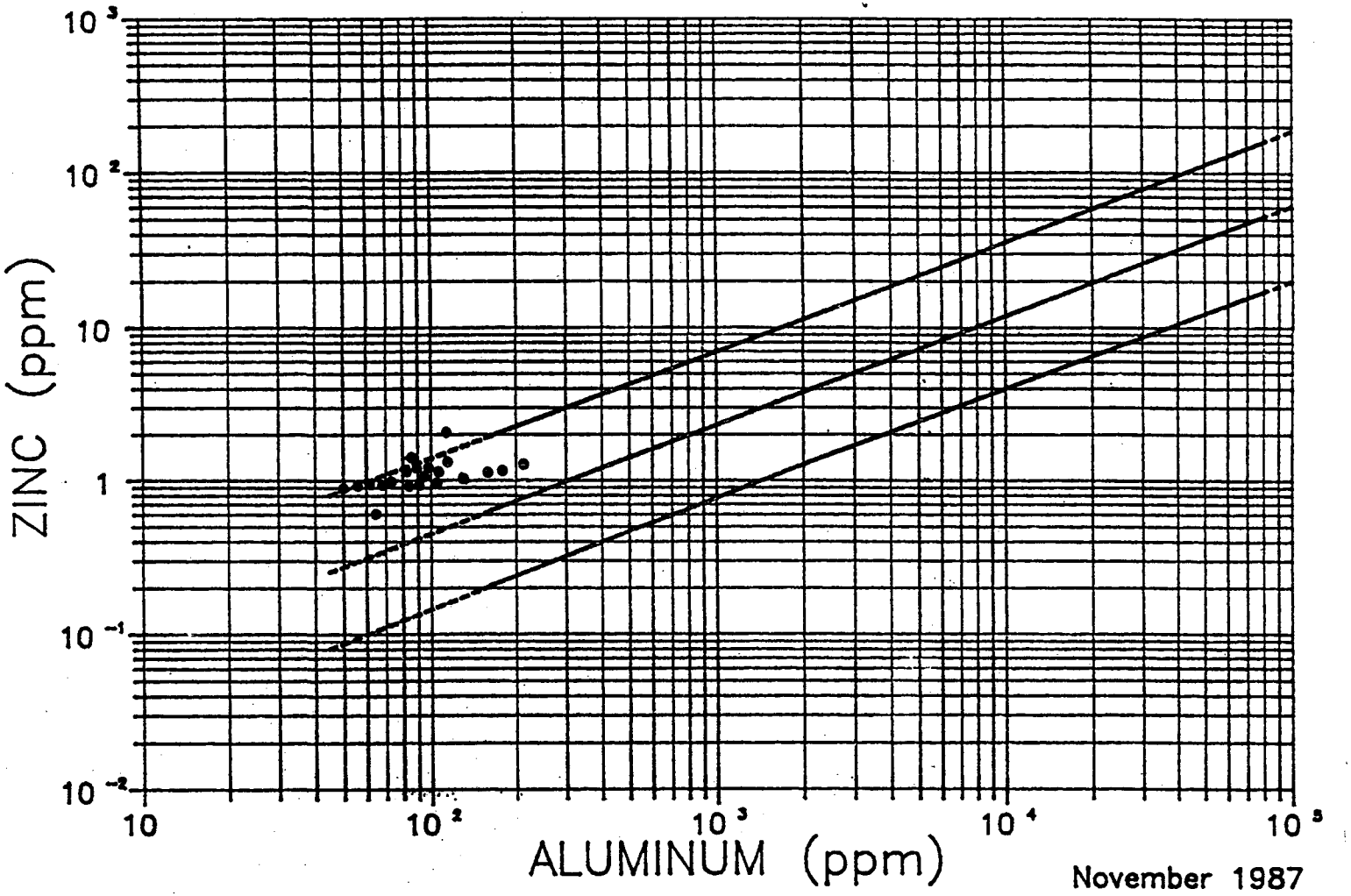


Figure 21 Zinc/aluminum regression line with 95% prediction limits derived from estuarine sediments (FDER, 1988). Dashed line indicates extrapolation. Data points represent values collected from Lake Apopka.

Because both assumptions could not be tested using the available data, comparisons between Lake Apopka and two pristine seepage lakes in north-central (Lake Sheelar) and south-central Florida (Lake Annie) (Thompson, 1981; Table 3) also were made. Because the primary inputs of trace elements to seepage lakes are by way of atmospheric deposition and erosional inputs of nearshore sands and some clays, they arguably define the most realistic background level to be expected for trace element concentrations in any Florida lake. Comparisons using chromium, copper, lead, nickel, and zinc indicate levels in Lake Apopka elevated above inferred background levels for all five elements. Arsenic was not included in Thompson's study. In Thompson's (1981) study, mild digestion was used to extract the samples. Mild digestion techniques do not completely release all metals from the sediment matrix and consequently underestimate the concentration of metals. Because aluminum in all likelihood is more tightly bound than other metals in the sediment matrix[1], mild digestion is more likely to underestimate the aluminum concentration, resulting in artificially high metal-to-aluminum ratios for the two pristine lakes. Elemental ratios in Lake Apopka were 1 to 11 times higher than in the two undisturbed Florida lakes (Table 3), indicating that Lake Apopka sediments may be contaminated by localized sources.

[1]Aluminum probably occurs as primary and secondary minerals (e.g., kaolinite and gibbsite), whereas atmospherically derived trace elements such as Pb and Zn occur as absorbed species on the surface of clay minerals. Sorbed species are more easily released into solution via mild digestion than primary minerals.

Table 3. Comparison of Element-to-Aluminum Ratios in Sediments Between Lake Apopka and Two Pristine Florida Lakes

Ratio	Lake Apopka	Lake Annie[a]	Lake Sheelar[a]	E:P[b]
Chromium:Aluminum	0.0020	0.0008	0.0011	1.82-2.50
Copper:Aluminum	0.0045	0.0004	0.0004	11.25
Lead:Aluminum	0.0054	0.0016	0.0008	3.37-6.75
Nickel:Aluminum	0.0014	0.0009	0.0007	1.56-2.00
Zinc:Aluminum	0.0099	0.0093	0.0032	1.07-3.09

Note: Arsenic was not sampled in Lakes Annie and Sheelar, and consequently could not be added to this table.

[a] From Thompson, 1981. The mean element-to-aluminum ratio (n=2) was used for both Lake Annie and Lake Sheelar.

[b] E:P (elevated-to-pristine) ratio represents the range in elevated element concentrations in Lake Apopka relative to two pristine Florida lakes.

4.0 CONCLUSIONS

An extensive literature search revealed a large number of aquatic toxicity studies. The vast majority of these studies focused on chronic and acute aquatic toxicity. In contrast, the availability of similar studies and the development of similar guidelines or criteria for sediment-associated toxicity is much more limited. Indeed, the development of sediment toxicity criteria is rather novel and to date has been developed for the Great Lakes, Canada, and Wisconsin only (Giesy and Hoke, 1990). Because these criteria were developed for northern temperate systems, their applicability to Lake Apopka is uncertain. One important consideration in comparing contaminant concentrations in Lake Apopka directly with sediment threshold criteria developed for other lakes relates to sediment organic content. The sediments in Lake Apopka contain very high concentrations of organic matter (average concentrations of 54.7 to 58.9 percent volatile solids and 29.0 to 31.6 percent total organic carbon in the upper and lower floc zones of the sediments, expressed as dry weight; Reddy et al., 1988). These concentrations are contrasted with, for example, much lower organic carbon concentrations of 2.0 to 5.4 percent reported by Jones and Bowser (1978) for Lakes Michigan and Superior. The effects of such high organic carbon concentrations in Lake Apopka sediments on toxicant bioavailability are unknown and probably vary among contaminants (cf. Rodgers et al., 1987).

The lack of specific threshold values for sediments in a more local region accordingly precluded defining specific threshold values for sediments. Therefore, as a first approximation, when contaminant concentrations exceeded sediment threshold criteria *and* contaminant concentrations in bulk sediments exceeded the reported EPA threshold for aquatic toxicity, it was concluded that the occurrence of these contaminants in Lake Apopka sediments was considered potentially toxic to the lake's biota. Comparison of contaminant concentrations in bulk sediments *vis-à-vis* with aquatic toxicity criteria introduces an element of conservatism in our analysis

because aquatic toxicity largely is a direct function of the concentration of the chemically unbound species rather than the total concentration.

Table 4 summarizes the potential toxicity of each element or compound relative to sediment threshold criteria, aquatic threshold criteria, and element-to-aluminum ratios. Based on these comparisons, copper and lead appear to pose the greatest threat of toxicity to Lake Apopka. Concentrations of arsenic and selenium exceed both the sediment threshold criteria and chronic aquatic threshold criteria but not the acute aquatic threshold criteria, and hence may be toxic to the lake's biota. Sediment concentrations of barium, beryllium, chromium, and zinc suggest potential toxicity as well, although the evidence for toxicity is less well established because of the lack of aquatic toxicity studies (barium, beryllium) or because levels in the sediments compared across media (sediments and water) did not consistently exceed established criteria (zinc and chromium). Concentrations of nickel are below established threshold criteria. Toxicity threshold data for vanadium, acetone, and benzoic acid were insufficient to determine the potential toxicity of these contaminants in Lake Apopka.

Although elevated levels of some elements and compounds appear to occur in Lake Apopka sediments, assessing the effects these contaminants will have on the lake's biota is confounded by the complex interactions that occur in biological systems. The toxicity of many trace elements declines in hard water, and the relatively high water hardness in Lake Apopka should help ameliorate the potential toxic effects of these elements. However, because of the debilitating health effects that some contaminants cause, combined with the desire to restore Lake Apopka to a healthy sports fishery lake, it is suggested that further consideration be given to those elements and compounds that exceed both sediment and aquatic threshold criteria values.

Table 4. Summary Comparison of Potential Contaminants With Sediment Threshold Criteria, Aqueous Threshold Criteria, and Ratios of Element to Aluminum

Potential Contaminants	Dry Weight Exceeds Sediment Threshold Criteria	Wet Weight Exceeds Aquatic Threshold Criteria	Element-to-Aluminum Ratio Exceeds Ratios for Pristine Lakes
Arsenic	Yes	Acute threshold - No Chronic threshold - Yes	INA
Barium	Yes	INA	INA
Beryllium	INA	Acute threshold - No Chronic threshold - Yes	INA
Chromium	No	Acute threshold - No Chronic threshold - Yes; some samples	Yes
Copper	Yes (3 samples)	Yes	Yes
Lead	Yes (1 sample)	Yes	Yes
Nickel	No	No	Yes
Selenium	Yes	Acute threshold - No Chronic threshold - Yes	INA
Vanadium	INA	INA	INA
Zinc	No	Yes	Yes
Acetone	INA	INA	INA
Benzoic Acid	INA	INA	INA
Phenol	INA	Yes	INA

INA = Information not available.

REFERENCES

Affleck, R.J. 1952. Zinc Poisoning in a Trout Hatchery. Australian Journal of Marine and Freshwater Research 3:142-169.

Anon. 1977. Ecological Evaluation of Proposed Discharge of Dredged or Fill Material into Navigable Water. Interim Guidance for Implementation of Section 404(b)(1) of Public Law 92-500 (Federal Water Pollution Control Act Amendments of 1972). Misc. Paper D-76-17. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS: 1-EZ.

Anon. 1988. Guidelines for the Management of Dredged Material. Ontario Ministry of Environment, Toronto, Ontario, Canada.

Benoit, D.A. 1976. Toxic Effects of Hexavalent Chromium on Brook Trout (Salvelinus fontinalis) and Rainbow Trout (Salmo gairdneri). Water Research 10:497-500.

Bertine, K.K. and Goldberg. 1971. Fossil Fuel Combustion and the Major Sedimentary Cycle. Science 173:233-235.

Bertine, K.K. and M.F. Mendeck. 1978. Industrialization of New Haven, Connecticut, as Recorded in Reservoir Sediments. Environmental Science and Technology 12:201-207.

Biesinger, K.E. and G.M. Christensen. 1972. Effects of Various Metals on Survival, Growth, Reproduction, and Metabolism of Daphnia magna. Journal Fisheries Research Board of Canada 29:1691-1700.

Brezonik, P. L., S. D. Preston, and T. L. Crisman. 1981. Limnological Studies on Lake Apopka and the Oklawaha Chain of Lakes: 4. Water Quality in 1980 and a Summary of the Four-Year Data Base. Department of Environmental Engineering Sciences, University of Florida, Gainesville, FL. Report No. ENV-07-81-02.

Bringmann, G. and R. Kuhn. 1959. The Toxic Effect of Wastewater on Aquatic Bacteria, Algae and Small Crustaceans. Gesundheits-Ingenieun 80:115-120.

Brown, V.M. 1968. The Calculation of the Acute Toxicity of Mixtures of Poisons to Rainbow Trout. Water Research 2:723-733.

Brungs, W.A. 1969. Chronic Toxicity of Zinc to the Fathead Minnow, Pimephales promelas Rafinesque. Transactions of the American Fisheries Society 98:272-279.

Buikema, A.L. Jr., J. Cairns, Jr., and G.W. Sullivan. 1974. Evaluation of Philodina Acuticornis (Rotifera) as a Bioassay Organism for Heavy Metals. Water Resources Bulletin 4:648-661.

Copeland, R.A. and J.C. Ayers. 1972. Trace Element Distributions in Water, Sediment, Phytoplankton, Zooplankton, and Benthos of Lake Michigan. Environmental Research Group, Inc., Ann Arbor, MI.

Ferguson, J.F. and J. Gavis. 1972. A Review of the Arsenic Cycle in Natural Waters. Water Research 6:1259-1274.

Florida Department of Environmental Regulation (FDER). A Guide to Interpretation of Metal Concentrations in Estuarine Sediments. Tallahassee, FL.

Foley, R.E., J.R. Spotila, J.P. Giesy, and C.H. Wall. 1978. Arsenic Concentrations in Water and Fish from Chautauqua Lake, New York. Environmental Biology of Fishes 3:361-367.

Forstner, U. and G.T.W. Wittmann. 1979. Metal Pollution in the Aquatic Environment. Springer-Verlag, New York, NY.

Giesy, J.P. and R.A. Hoke. 1990. Freshwater Sediment Quality Criteria: Toxicity Bioassessment, pp. 265-348. In R. Baudo, J. Giesy and H. Muntau [eds.], Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc., Chelsea, MI.

Gilderhus, P.A. 1966. Some Effects of Sublethal Concentrations of Sodium Arsenite on Bluegills and the Aquatic Environment. Transaction of the American Fisheries Society 95:289-296.

Gillespie, W.T. 1976. The Cycling and Distribution of Arsenic in Florida Waters. Master's Thesis, University of Florida, Gainesville, FL.

Hakanson, L. and M. Janson. 1983. Principles of Lake Sedimentology. Springer-Verlag.

Holm, T.R., M.A. Anderson, D.G. Iverson, and R.S. Stanforth. 1979. Heterogeneous Interactions of Arsenic in Aquatic Systems, pp. 711-736. In E.A. Jenne [ed.], Chemical Modeling in Aqueous System. ACS Symposium Series 93. American Chemical Society.

Iskandar, I.K. and D.R. Keeney. 1974. Concentration of Heavy Metals in Sediment Cores from Selected Wisconsin Lakes. Environmental Science and Technology 8:165-170.

Johnson, M.G. 1987. Trace Element Loadings to Sediments of Fourteen Ontario Lakes and Correlations with Concentrations in Fish. Canadian Journal of Fisheries and Aquatic Sciences 44:3-13.

Jones, B.F. and C.J. Bowser. 1978. The mineralogy and related chemistry of lake sediments, p. 179-235. *In* A. Lerman [ed.], Lakes: Chemistry, geology, and physics. Springer-Verlag. New York.

Jones, J.R.E. 1939. The Relation Between the Electrolytic Solution Pressures of the Metals and Their Toxicity to Stickleback. Journal of Experimental Biology 16:425-437.

Kopp, J.F. and R.C. Kroner. 1968. Trace Metals in Waters of the United States. Federal Water Pollution Control Administration Division of Pollution Surveillance.

Lowe, T.P., T.W. May, W.G. Brumbaugh, and D.A. Kane. 1985. National Contaminant Biomonitoring Program: Concentrations of Seven Elements in Freshwater Fish, 1978-1981. Archives of Environmental Contamination and Toxicology 14:363-388.

McKee, J.E. and H.W. Wolf. 1963. Water Quality Criteria. State Water Resources Control Board, Publication No. 3-1, Sacramento, CA.

Mitrovic, V.A., et al. 1968. Some Pathologic Effects of Sub-Acute and Acute Poisoning of Rainbow Trout by Phenol in Hard Water. Water Research 2:249.

Nishimura, H. and M. Kumagai. 1983. Mercury Pollution of Fishes in Minamata Bay and Surrounding Water: Analysis of Pathway of Mercury. Water, Air, and Soil Pollution 20:401-411.

Olson, P.A. 1958. Comparative Toxicity of Cr(VI) and Cr(III) in Salmon. Hanford Biology Research Annual Report for 1957, HW-53500:215.

Persaud, D., R. Jaagumagi and A. Hayton. 1989. Development of Provincial Sediment Quality Guidelines. Ontario Ministry of the Environment, Water Resources Branch, Aquatic Biology Section, Toronto, Ontario, Canada: 19 pp.

Pickering, Q.H. and C. Henderson. 1964. The Acute Toxicity of Some Heavy Metals to Different Species of Warmwater Fishes. Purdue University Extension Service 117:578.

Pickering, Q.H. and C. Henderson. 1966. The Acute Toxicty of Some Heavy Metals to Different Species of Warmwater Fishes. International Journal of Air and Water Pollution 10:453-463.

Pickering, Q.H. 1974. Chronic Toxicity of Nickel to the Fathead Minnow. Journal of Water Pollution Control Federation 46:760-765.

Phillips, G.R. and R.C. Russo. 1978. Metal Bioaccumulation in Fishes and Aquatic Invertebrates. U.S. Environmental Protection Agency, Ecology Services EPA-600/3-78-103.

Pollman, C.D., D.A. Graetz, F.V. Ramsey, K.P. Reddy, and T.J. Sullivan. 1988. Feasibility of Sediment Removal and Reuse for the Restoration of Lake Apopka. St. Johns River Water Management District Project Number 88048.

Reddy, K.R., D.A. Graetz, P.A. Moore, Jr., and C.D. Pollman. 1988. Internal nutrient budget for Lake Apopka, Phase I. Annual Report 1987-88. Institute of Food and Agricultural Sciences, Soil Science Department, University of Florida. Gainesville, Florida.

Rehwoldt, R., G. Bida and B. Nerrie. 1971. Acute Toxicity of Copper, Nickel, and Zinc Ions to Some Hudson River Fish Species. Bulletin of Environmental Contamination and Toxicology 6:445-448.

Rodgers, J.H., Jr., K.L. Dickson, F.Y. Saleh, and C.A. Staples. 1987. Bioavailability of sediment-bound chemicals to aquatic organisms - some theory, evidence and research needs, p. 245-266. *In* K.L. Dickson, A.W. Maki, W.A. Brungs [eds.], Fate and Effects of sediment-bound chemicals in aquatic systems. Pergamon.

Schulz-Baldes, M., E. Rehm, and H. Farke. 1983. Field Experiments on the Fate of Lead and Chromium in an Intertidal Benthic Mesocosm, the Bremerhaven Caissson. Marine Biology 75:307-318.

Skidmore, J.F. 1964. Toxicity of Zinc Compounds to Aquatic Animals, with Special Reference to Fish. Quarterly Review of Biology 39:227-248.

Slonim, A.R. and E.E. Ray. 1975. Acute Toxicity of Beryllium Sulfate to Salamander Larvae (Ambystoma spp.). Bulletin of Environmental Contamination and Toxicology 13:307-312.

Slonim, C.B. and A.R. Slonim. 1973. Effect of Water Hardness on the Tolerance of the Guppy to Beryllium Sulfate. Bulletin of Environmental Contamination and Toxicology 10:295-301.

Spehar, R.L., A.E. Lemke, Q.H. Pickering, T.H. Roush, R.C. Russo, and J.D., Yount. 1981. Effects of Pollution on Freshwater Fish. Water Pollution (53) 6:1028.

Sprague, J.B. 1964. Lethal Concentrations of Copper and Zinc for Young Atlantic Salmon. Journal of the Fisheries Research Board of Canada 21:17-26.

Sugawara, K., H. Naito, and S. Yamada. 1956. Geochemistry of Vanadium in Natural Waters. Journal of Earth Science, Nagoya University 4:44-61.

Sullivan, J., J. Ball, E. Brick, S. Hausmann, G. Pilarski and D. Sopcich. 1985. Report of the Technical Subcommittee on Determination of Dredge Material Suitability for In-Water Disposal. Wisconsin Department of Natural Resources, Madison, Wisconsin: 44 pp.

Surber, E.W. and L.O. Meehan. 1931. Lethal Concentrations of Arsenic for Certain Aquatic Organisms. Transaction of the American Fisheries Society 61:225-239.

Tarzwell, C.M. and C. Henderson. 1960. Toxicity of Less Common Metals to Fishes. Industrial Wastes 5:12.

Thompson, D.M. 1981. Distribution of Heavy Metals in Selected Florida Lake Sediments. Master's Thesis, University of Florida, Gainesville, FL.

Tuschall, J.R., T.L. Crisman, P.L. Brezonik, and J.N. Allinson. 1979. Limnological Studies on Lake Apopka and the Oklawaha Chain of Lakes: 2. Water Quality in 1978. Report to the Florida Department of Environmental Regulation, Tallahassee, FL. Department of Environmental Engineering Science, University of Florida, Gainesville, FL. Report No. ENV-07-79-02.

U.S. Environmental Protection Agency (EPA). 1976. Quality Criteria for Water. Washington, DC.

U.S. Environmental Protection Agency (EPA). 1982. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Washington, DC.

Warnick, S.L. and H.L. Bell. 1969. The Acute Toxicity of Some Heavy Metals to Different Species of Aquatic Insects. Journal of Water Pollution Control Federation 41:280-284.

Windom, H.L., S.J. Schropp, F.D. Calder, J.D. Ryan, R.G. Smith, Jr., L.C. Burney, F.G. Lewis, and C.H. Rawlinson. 1989. Natural Trace Metal Concentrations in Estuarine and Coastal Marine Sediments of the Southeastern United States. Environmental Science and Technology 23:314-320.

Wurtz, C.B. 1962. Zinc Effects on Freshwater Mollusks. The Nautilus 76:53-61.

APPENDIX A

METHODS FOR ANALYSIS OF EPA TARGET COMPOUND LIST IN LAKE APOPKA SEDIMENTS AND ASSOCIATED QUALITY CONTROL PROCEDURES

METHODS FOR ANALYSIS OF EPA TARGET COMPOUND LIST
IN LAKE APOPKA SEDIMENTS

I. GC/MS Semivolatile Organics:

A. EPA Method 3520 for extraction. This method employs a liquid/liquid continuous extraction. Method 3520 has been chosen over the EPA Method 3540 soxhlet extraction due to the high percentage of water and the desire by the State to analyze the whole sediment. Approximately 100 g of whole sediment will be extracted and concentrated to 0.5 mL of methylene chloride.

B. EPA Method 8270 will be used for analysis of the concentrated sediment extracts by GCMS for semivolatile organics (acid/base neutral extractables). Dioxin will be screened by this method.

II. GC/MS Volatile Organics:

EPA Method 8240 will be followed using the low level concentration option. This method employs a heated purge and trap option which allows for analysis of the whole sediment. Approximately 5 g of the whole sediment will be added to the purge and trap apparatus for analysis.

III. Metals:

A. Digestion procedures:

1. EPA Method 3050 will be used for digestion of the whole sediment. Normally 1 g of sediment is digested with nitric acid and hydrochloric acid and brought to a final volume of 100 mL. For these samples at least 10 grams of whole sediment will be digested to attempt to get approximately 1 g of dry sediment digested. This digestion procedure will be applicable to the metals analyzed by ICP (Inductively Coupled Plasma Spectroscopy).
2. The digestions for Arsenic and selenium will follow EPA Method 3050, but without hydrochloric acid. Ten grams of whole sediment will be digested rather than 1 g.

B. Analysis Procedures:

1. EPA Method 6010 will be used for analysis of the digestates for most of the metals by ICP.
2. EPA Method 7060 will be used for analysis of digestates for Arsenic.
3. EPA Method 7740 will be used for analysis of digestates for Selenium.
4. EPA Method 7471 will be used for analysis of Mercury.

IV. Cyanide and Phenols:

EPA Methods 9010 and 9066 will be used for the analysis of cyanide and phenols, respectively. Appoximately 20 g of whole sediment will be used in the reflux digestion/distillation for the two procedures rather than the required 2 to 5 g normally used for sediments.

V. Pesticides/PCB's:

A. EPA Method 3520 for extraction. This method employs a liquid/liquid continuous extraction. Method 3520 has been chosen over the EPA Method 3540 soxhlet extraction due to the high percentage of water and the desire by the State to analyze the whole sediment. Approximately 100 g of whole sediment will be extracted and concentrated to 1.0 mL of methylene chloride.

B. EPA Method 8080 will be used for analysis of pesticides and PCB's in the extracts.

QUALITY CONTROL PROCEDURES

GAS CHROMATOGRAPHY/MASS SPECTROMETRY MINIMUM QUALITY CONTROL

For GC/MS analyses of 5 to 20 samples, the following minimum QC checks will apply:

1. All samples spiked with surrogates.
2. At lease one duplicate spike in sample matrix (MSD) with selected actual analytes and surrogates will be analyzed.
3. At lease one QC check sample spike in blank matrix will be analyzed (spiked with surrogates and selected analytes).
4. At lease one method blank will be analyzed (spiked with surrogates).
5. One calibration standard will be run and a daily response factor within 35 percent of initial calibration response factor for selected calibration check compounds.
6. Instrument tuning protocols will be performed and will be within criteria before analysis.

GAS CHROMATOGRAPHY MINIMUM QUALITY CONTROL

For GC-nonvolatiles and high-performance liquid chromatography (HPLC) analyses of 5 to 20 samples, the following minimum requirements will apply:

1. All samples spiked with surrogate (dibutyl-chlorendate) for organochlorine pesticides and PCBs analysis only.
2. At least one spike in sample matrix (MS) with selected analytes will be analyzed.
3. At least one duplicate spike in sample matrix (MSD) with selected analytes will be analyzed.
4. At least one QC check sample (a spike with selected analytes into a blank matrix) will be analyzed (note that a surrogate will be added for PCBs only).
5. At least one method blank will be analyzed.
6. At lease three standards will be run for a standard curve.
7. Correlation coefficient of the standard curve will be equal to or greater than 0.995.

8. Samples will be within concentration range of standards.
9. Midlevel calibration standard repeated at the middle of run (if run covered more than a 12-hour period) and at the end of run, and response of 75 percent of the control analytes must be within 20 percent of initial response.

Note: An MS and MSD may not be performed for every analytical batch but will be performed at a rate of one MS and one MSD per 20 environmental samples.

TRACE METALS--ATOMIC ABSORPTION AND INDUCTIVELY COUPLED PLASMA (ICAP) SPECTROSCOPY MINIMUM QUALITY CONTROL

For each lot of 5 to 20 samples analyzed by AAS, the following QC checks will apply:

1. At least one spike in sample matrix (MS) will be analyzed.
2. At least one duplicate spike in sample matrix (MSD) will be analyzed.
3. At lease one QC check sample spike in blank matrix will be analyzed (spiked with all analytes).
4. At least one method blank will be analyzed.
5. At least three standards will be analyzed for a standard curve.
6. Correlation coefficient of the standard curve will be equal to or greater than 0.995.
7. Samples will be within concentration range of the standards.
8. A midlevel standard will be reanalyzed at the middle of the run (if there are more than 10 samples) and at the end of a run, and its response will be within 20 percent of true value.
9. At least one filter blank will be analyzed with all filtered samples.

For each lot of 5 to 20 samples analyzed by ICAP, the following QC checks will apply:

1. At least one spike in sample matrix (MS) with selected analytes will be analyzed.

2. At least one duplicate spike in sample matrix (MSD) with selected analytes will be analyzed.
3. At least one QC check sample spike in blank matrix will be analyzed (spiked with selected analytes).
4. At least one method blank will be analyzed.
5. At least one interference check standard will be analyzed.
6. At least one calibration standard will be analyzed.
7. Samples will be within concentration range of the instrument.
8. A calibration standard will be reanalyzed at the middle of the run (if there are more than 10 samples) and at the end of a run, and the responses of 75 percent of the calibration check analytes will be within 20 percent of true values.
9. At least one filter blank will be analyzed with all filtered samples.
10. Detection limits for analytes will be determined and checked to ensure that they meet limits specified for the field group.

APPENDIX B

ANALYTICAL VALUES AND STATISTICAL SUMMARY OF ELEMENTS AND COMPOUNDS OF CONCERN

Table B-1. Water Chemistry Data From Lake Apopka Sediments (Page 1 of 2)

Sample[a] Location	Station Depth (cm)	Sediment Type	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)
B2	0-10	Wet	0.161	1.63	0.038	0.110	0.276	40.4
B2	10-20	Wet	0.343	2.25	0.01700	0.201	0.596	78.2
C7	0-10	Wet	0.120	1.91	0.019	0.157	0.362	63.5
C7	10-20	Wet	0.350	2.55	0.01800	0.300	0.579	132.0
C12	0-10	Wet	0.199	1.97	0.01800	0.233	0.402	71.8
C12	10-20	Wet	0.414	2.57	0.01700	0.465	1.300	144.0
D4	0-10	Wet	0.162	1.91	0.01800	0.383	0.338	62.8
D4	10-20	Wet	0.212	2.68	0.01700	0.218	0.525	83.5
E9	0-10	Wet	0.163	2.28	0.01800	0.212	0.453	87.0
E9	10-20	Wet	0.326	2.99	0.01700	0.360	0.664	158.0
F6	0-10	Wet	0.123	2.20	0.01700	0.140	0.364	54.7
F6	10-20	Wet	0.307	2.76	0.01700	0.280	0.612	118.0
G3	0-10	Wet	0.168	2.56	0.01800	0.200	0.451	83.4
G3	10-20	Wet	0.398	3.13	0.01800	0.303	0.784	157.0
H8	0-10	Wet	0.191	2.09	0.01700	0.183	0.425	78.9
H8	10-20	Wet	0.389	2.98	0.01800	0.366	0.751	158.0
I10	0-10	Wet	0.197	2.04	0.01800	0.242	0.678	76.8
I10	10-20	Wet	0.305	2.69	0.01800	0.340	1.040	122.0
K6	0-10	Wet	0.164	1.69	0.01700	0.152	0.302	52.0
K6	10-20	Wet	0.309	2.10	0.01700	0.167	0.437	65.2
		Mean	0.25005	2.349	0.0186	0.2506	0.56695	94.36
		S.D.	0.10	0.43	0.00	0.09	0.25	37.36
		Min.	0.12	1.63	0.017	0.11	0.276	40.4
		Max.	0.414	3.13	0.038	0.465	1.3	158

Sample[a] Location	Station Depth (cm)	Sediment Type	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)
B2	0-10	Dry	10.700	109.00	2.540	7.300	18.400	2,690.0
B2	10-20	Dry	12.700	83.20	0.64200	7.460	22.100	2,900.0
C7	0-10	Dry	7.080	112.00	1.090	9.210	21.300	3,740.0
C7	10-20	Dry	10.600	77.10	0.53500	9.100	17.500	4,000.0
C12	0-10	Dry	9.940	98.70	0.89100	11.600	20.100	3,590.0
C12	10-20	Dry	10.300	64.20	0.43600	11.600	32.600	3,600.0
D4	0-10	Dry	9.020	106.00	0.98700	21.300	18.800	3,490.0
D4	10-20	Dry	7.310	92.50	0.59800	7.510	18.100	2,880.0
E9	0-10	Dry	7.060	99.30	0.77500	9.210	19.700	3,780.0
E9	10-20	Dry	9.300	85.50	0.47200	10.300	19.000	4,510.0
F6	0-10	Dry	6.820	122.00	0.93700	7.760	20.200	3,040.0
F6	10-20	Dry	9.580	86.20	0.52600	8.730	19.100	3,680.0
G3	0-10	Dry	8.000	122.00	0.83500	9.510	21.500	3,970.0
G3	10-20	Dry	10.200	80.20	0.45200	7.760	20.100	4,010.0
H8	0-10	Dry	8.660	95.10	0.76800	8.320	19.300	3,590.0
H8	10-20	Dry	10.500	80.60	0.47300	9.880	20.300	4,280.0
I10	0-10	Dry	10.900	113.00	0.99400	13.400	37.700	4,270.0
I10	10-20	Dry	8.470	74.60	0.49500	9.450	29.000	3,390.0
K6	0-10	Dry	9.660	99.40	1.00000	8.920	17.800	3,060.0
K6	10-20	Dry	11.900	80.70	0.65600	6.410	16.800	2,510.0
		Mean	9.44	94.07	0.81	9.74	21.47	3549.00
		S.D.	1.60	15.89	0.45	3.12	5.24	543.00
		Min	6.82	64.2	0.436	6.41	16.8	2510
		Max	12.7	122	2.54	21.3	37.7	4510

Table B-1. Water Chemistry Data From Lake Apopka Sediments (Page 2 of 2)

Sample[a] Location	Station Depth (cm)	Sediment Type	Lead (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	Acetone (ug/kg)	Benz. Acid (ug/kg)	Phenols (ug/kg)
B2	0-10	Wet	0.48900	0.15700	0.024	0.086	0.845	10.000	93	2810
B2	10-20	Wet	0.685	0.168	0.060	0.274	1.350	10.000	140	2,460
C7	0-10	Wet	0.48600	0.15600	0.030	0.144	1.070	10.000	110	303
C7	10-20	Wet	0.668	0.15700	0.063	0.290	1.240	10.000	130	240
C12	0-10	Wet	0.527	0.15800	0.047	0.215	0.897	10.000	100	135
C12	10-20	Wet	0.540	0.15500	0.103	0.406	1.280	10.000	150	231
D4	0-10	Wet	0.49400	0.15800	0.029	0.107	0.780	10.000	120	237
D4	10-20	Wet	0.603	0.15400	0.054	0.128	1.220	10.000	180	202
E9	0-10	Wet	0.49500	0.15900	0.047	0.107	0.955	10.000	130	3,370
E9	10-20	Wet	0.802	0.14700	0.073	0.277	1.350	10.000	170	1,920
F6	0-10	Wet	0.46900	0.15000	0.037	0.071	0.962	23	120	273
F6	10-20	Wet	0.700	0.15000	0.061	0.183	1.220	10.000	180	292
G3	0-10	Wet	0.48700	0.15600	0.039	0.141	1.130	15	150	385
G3	10-20	Wet	1.260	0.15700	0.081	0.304	1.610	10.000	170	201
H8	0-10	Wet	0.46900	0.15000	0.040	0.126	0.860	10.000	150	2,130
H8	10-20	Wet	1.040	0.157	0.071	0.287	1.330	10.000	190	3,590
I10	0-10	Wet	0.736	0.15900	0.040	0.113	1.450	10.000	130	2,070
I10	10-20	Wet	0.947	0.15800	0.054	0.288	2.290	10.000	100	618
K6	0-10	Wet	0.47400	0.15200	0.028	0.129	0.686	10.000	90.00	1,140
K6	10-20	Wet	0.511	0.15200	0.046	0.223	0.994	10.000	90.00	893
			0.6441	0.1555	0.05135	0.19495	1.17595	10.9	134.65	1175
			0.21	0.00	0.02	0.09	0.35	2.98	31.33	1145.29
			0.469	0.147	0.024	0.071	0.686	10	90	135
			1.26	0.168	0.103	0.406	2.29	23	190	3590

Sample[a] Location	Station Depth (cm)	Sediment Type	Lead (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	Acetone (µg/kg)	Benzoic Acid (µg/kg)	Phenols (µg/kg)
B2	0-10	Dry	32.60000	10.40000	1.600	5.740	56.300	670.00	6,200	187,000
B2	10-20	Dry	25.400	6.210	2.240	10.100	49.800	370.00	5,100	91,300
C7	0-10	Dry	28.60000	9.51000	1.740	8.460	62.700	590.00	6,500	17,800
C7	10-20	Dry	20.200	4.76000	1.920	8.770	37.600	300.00	3,900	7,270
C12	0-10	Dry	26.300	7.92000	2.340	10.700	44.800	500.00	5,100	6,730
C12	10-20	Dry	13.500	3.87000	2.570	10.100	32.000	250.00	3,700	5,770
D4	0-10	Dry	27.40000	8.77000	1.600	5.920	43.300	560.00	6,800	13,200
D4	10-20	Dry	20.800	5.32000	1.840	4.420	42.000	340.00	6,300	6,970
E9	0-10	Dry	21.50000	6.89000	2.050	4.650	41.500	430.00	5,700	146,000
E9	10-20	Dry	22.900	4.19000	2.090	7.920	38.500	290.00	4,900	54,900
F6	0-10	Dry	26.00000	8.33000	2.030	3.960	53.400	1,300	6,600	15,100
F6	10-20	Dry	21.900	4.67000	1.910	5.730	38.300	310.00	5,800	9,130
G3	0-10	Dry	23.20000	7.43000	1.840	6.730	53.800	720	7,100	18,300
G3	10-20	Dry	32.200	4.02000	2.080	7.780	41.200	260.00	4,400	5,150
H8	0-10	Dry	21.30000	6.82000	1.830	5.710	39.100	450.00	6,700	96,800
H8	10-20	Dry	28.000	4.230	1.920	7.750	36.100	270.00	5,200	97,000
I10	0-10	Dry	40.900	8.84000	2.240	6.300	80.800	560.00	7,400	115,000
I10	10-20	Dry	26.300	4.40000	1.490	8.000	63.500	280.00	2,800	17,200
K6	0-10	Dry	27.90000	8.92000	1.630	7.580	40.400	590.00	5300.00	67,100
K6	10-20	Dry	19.700	5.83000	1.750	8.560	38.200	380.00	3500.00	34,300
	25.33	6.57	1.94	7.24	46.67	471.00	5450.00	50601.00		
	5.68	2.04	0.27	1.88	11.64	237.67	1261.55	52795.99		
	13.5	3.87	1.49	3.96	32	250	2800	5150		
	40.9	10.4	2.57	10.7	80.8	1300	7400	187000		

[a]From Figure 2.

APPENDIX C

RAW DATA OF ALL 152 ELEMENTS AND COMPOUNDS

ANALYTICAL DETERMINATIONS PERFORMED BY ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

Note: The following abbreviations are used in the STORET METHOD column in this appendix.

GMS = gas chromatograph-mass spectrometry.
EC = gas chromatography with electron captive detection.
ICAP = inductively coupled argon plasma emission spectrophotometry.
GFAA = graphite furnace atomic absorption spectrophotometry.
CVAA = cold water vapor atomic absorption spectrophotometry.

Hunter/ESE, Inc. DATE 07/26/89 STATUS : Final wet weight PAGE 1
PROJECT NUMBER 3904023000 4120 PROJECT NAME LAKE APOPKA - UF
FIELD GROUP APOPKA PROJECT MANAGER J.J. VONDRICK
ALL LAB COORDINATOR JOE VONDRICK
SAMPLE ID/#

PARAMETERS	STORET	B2.0-10 APOPKA	B2.10-20 APOPKA	C7.0-10 APOPKA	C7.10-20 APOPKA	C12.0-10 APOPKA	C12.10-20 APOPKA	D4.0-10 APOPKA	D4.10-20 APOPKA	E9.0-10 APOPKA	E9.10-20 APOPKA
UNITS	METHOD	1	2	3	4	5	6	7	8	9	10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
CYANIDE,SED	721	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
UG/G- WET	1										
PHENOLS,SED	61565	2810	2460	303	240	135	231	237	202	3370	1920
UG/G- WET	1										
1,1,1-TRICHL'ETHANE	34509	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,1,2,2-TETRACHLORO	34519	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
ETHANE UG/KG-WET	GMS										
1,1,2-TRICHL'ETHANE	34514	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,1-DICHLOROETHANE	34499	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,1-DICHLOROETHYLENE	34504	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,2-DICHLOROETHANE	34534	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,2-DICHLOROPROPANE	34544	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
2-CHLOROETHYLVINYL	34579	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
ETHER UG/KG-WET	GMS										
2-HE ANONE	75166	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
ACETONE	75059	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
BENZENE	34237	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
BROMODICHLOROMETHANE	34330	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
BROMOFORM	34290	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
BROMOMETHANE	34416	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
CARBON DISULFIDE	78544	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CARBON TETRACHLORIDE	34299	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CHLOROBENZENE	34304	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CHLOROETHANE	34314	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
CHLOROFORM	34318	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CHLOROMETHANE	34421	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
CIS-1,3-DICHLORO	34702	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PROPENE UG/KG-WET	GMS										
DIBROMOCHLOROMETHANE	34309	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
ETHYLBENZENE	34374	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
METHYL ETHYL KETONE	75078	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
METHYL ISOBUT'KETONE	75169	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
METHYLENE CHLORIDE	34426	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
STYRENE	75192	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TETRACHLOROETHENE	34478	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TOLUENE	34483	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TRANS-1,2-DICHLORO	34549	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
ETHENE UG/KG-WET	GMS										
TRANS-1,3-DICHLORO	34697	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
PROPENE UG/KG-WET	GMS										
TRICHLOROETHENE	34487	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										

PARAMETERS	STORET	B2,0-10 APOPKA	B2,10-20 APOPKA	C7,0-10 APOPKA	C7,10-20 APOPKA	C12,0-10 APOPKA	C12,10-20 APOPKA	D4,0-10 APOPKA	D4,10-20 APOPKA	E9,0-10 APOPKA	E9,10-20 APOPKA
UNITS	METHOD	1	2	3	4	5	6	7	8	9	10
SAMPLE ID/#											
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
TRICHLOROFLUOROMETHANE UG/KG-WET	34491 GMS	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
VINYL ACETATE UG/KG-WET	98583 GMS	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
VINYL CHLORIDE UG/KG-WET	34495 GMS	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2,4-TRICH'BENZENE UG/KG-WET	34554 GMS	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
1,2-DICHLOROBENZENE UG/KG-WET	34539 GMS	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
1,3-DICHLOROBENZENE UG/KG-WET	34569 GMS	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
1,4-DICHLOROBENZENE UG/KG-WET	34574 GMS	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
2,4,5-TRICH'PHENOL UG/KG-WET	98587 GMS	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
2,4,6-TRICH'PHENOL UG/KG-WET	34624 GMS	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
2,4-DICHLOROPHENOL UG/KG-WET	34604 GMS	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
2,4-DIMETHYLPHENOL UG/KG-WET	34609 GMS	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
2,4-DINITROPHENOL UG/KG-WET	34619 GMS	<390	<390	<390	<390	<390	<390	<390	<390	<390	<390
2,4-DINITROTOLUENE UG/KG-WET	34614 GMS	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
2,6-DINITROTOLUENE UG/KG-WET	34629 GMS	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
2-CHLORONAPHTHALENE UG/KG-WET	34584 GMS	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
2-CHLOROPHENOL UG/KG-WET	34589 GMS	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
2-METHYL-4,6-DINITROPHENOL UG/KG-WET	34660 GMS	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
2-METHYLNAPHTHALENE UG/KG-WET	78868 GMS	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
2-METHYLPHENOL UG/KG-WET	78872 GMS	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
2-NITROANILINE UG/KG-WET	98588 GMS	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45
2-NITROPHENOL UG/KG-WET	34594 GMS	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
3,3-DICHL'BENZIDINE UG/KG-WET	34634 GMS	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
3-NITROANILINE,SED UG/KG-WET	98589 GMS	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
4-BROMOPHENYL PHENYL ETHER UG/KG-WET	34639 GMS	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
4-CHLORO-3-METHYL PHENOL UG/KG-WET	34455 GMS	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
4-CHLOROANILINE UG/KG-WET	78867 GMS	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
4-CHLOROPHENYLPHENYL ETHER UG/KG-WET	34644 GMS	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
4-METHYLPHENOL UG/KG-WET	78803 GMS	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
4-NITROANILINE UG/KG-WET	78870 GMS	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45
4-NITROPHENOL UG/KG-WET	34649 GMS	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
ACENAPHTHENE UG/KG-WET	34208 GMS	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
ACENAPHTHYLENE UG/KG-WET	34203 GMS	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
ANTHRACENE UG/KG-WET	34223 GMS	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
BENZO(A)ANTHRACENE UG/KG-WET	34529 GMS	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30

PARAMETERS	STORET	B2,0-10 APOPKA	B2,10-20 APOPKA	C7,0-10 APOPKA	C7,10-20 APOPKA	C12,0-10 APOPKA	C12,10-20 APOPKA	D4,0-10 APOPKA	D4,10-20 APOPKA	E9,0-10 APOPKA	E9,10-20 APOPKA
UNITS	METHOD	1	2	3	4	5	6	7	8	9	10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
BENZO(A)PYRENE	34250	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
BENZO(B)FLUORANTHENE	34233	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
BENZO(GHI)PERYLENE	34524	<48	<48	<48	<48	<48	<48	<48	<48	<48	<48
UG/KG-WET	GMS										
BENZO(K)FLUORANTHENE	34245	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
BENZOIC ACID	75315	93	140	110	130	100	150	120	180	130	170
UG/KG-WET	GMS										
BENZYL ALCOHOL	75212	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
BIS(2-CHL'ISOPROPYL)	34286	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
ETHER UG/KG-WET	GMS										
BIS(2-CHLOROETHOXY)	34281	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
METHANE UG/KG-WET	GMS										
BIS(2-CHLOROETHYL)	34276	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
ETHER UG/KG-WET	GMS										
BIS(2-ETHYLHEXYL)	39102	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
PHTHALATE UG/KG-WET	GMS										
BUTYLBENZYLPHTHALATE	34295	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
CHRYSENE	34323	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG- DRY	GMS										
DI-N-BUTYL PHTHALATE	39112	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
DI-N-OCTYL PHTHALATE	34599	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
DIBEN(A,H)ANTHRACENE	34559	<48	<48	<48	<48	<48	<48	<48	<48	<48	<48
UG/KG-WET	GMS										
DIBENZOFURAN	75647	<36	<36	<36	<36	<36	<36	<36	<36	<36	<36
UG/KG-WET	GMS										
DIETHYL PHTHALATE	34339	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
DIMETHYL PHTHALATE	34344	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
FLUORANTHENE	34379	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
FLUORENE	34384	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG- DRY	GMS										
HEXACHLOROBENZENE	39701	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
HEXACHLOROBUTADIENE	39705	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
HEXACHLOROCYCLOPENTA	34389	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
DIENE UG/KG-WET	GMS										
HEXACHLOROETHANE	34399	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
INDENO(1,2,3-CD)	34406	<48	<48	<48	<48	<48	<48	<48	<48	<48	<48
PYRENE UG/KG-WET	GMS										
ISOPHORONE	34411	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
N-NITROSODI-N-PROPYL	34431	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
AMINE UG/KG-WET	GMS										
N-NITROSODIPHE'AMINE	34436	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
NAPHTHALENE	34445	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
NITROBENZENE	34450	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
PENTACHLPHENOL	39061	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
UG/KG-WET	GMS										
PHENANTHRENE	34464	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
PHENOL	34695	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
PYRENE	34472	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										

PARAMETERS	STORET	B2.0-10	B2.10-20	C7.0-10	C7.10-20	C12.0-10	C12.10-20	D4.0-10	D4.10-20	E9.0-10	E9.10-20
		SAMPLE ID/#									
UNITS	METHOD	APOPKA 1	APOPKA 2	APOPKA 3	APOPKA 4	APOPKA 5	APOPKA 6	APOPKA 7	APOPKA 8	APOPKA 9	APOPKA 10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
2,3,7,8-TCDD	34678	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60
UG/KG-WET	GMS										
ALDRIN	39333	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,A	39076	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,B	34257	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,D	34262	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,G(LINDANE)	39783	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
CHLORDANE	39351	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
UG/KG-WET	EC										
DDD,PP'	39311	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
DDE,PP'	39321	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
DDT,PP'	39301	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
DIELDRIN	39383	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDOSULFAN SULFATE	34354	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDOSULFAN,A	34364	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDOSULFAN,B	34359	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDRIN	39393	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDRIN KETONE,SED	98591	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
UG/KG-WET	EC										
HEPTACHLOR	39413	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
HEPTACHLOR EPOXIDE	39423	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
METHOXYCHLOR,SED	39481	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
UG/KG-WET	EC										
PCB 1016	39514	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
UG/KG-WET	EC										
PCB-1221	39491	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1232	39495	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1242	39499	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1248	39503	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1254	39507	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1260	39511	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
TOXAPHENE	39403	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
UG/KG-WET	EC										
ALUMINUM,SED	1108	49.0	84.7	78.2	150	71.6	169	85.2	93.6	108	201
MG/KG-WET	ICAP										
ANTIMONY,SED	1098	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MG/KG-WET	ICAP										
ARSENIC,SED	1003	0.161	0.343	0.120	0.350	0.199	0.414	0.162	0.212	0.163	0.326
MG/KG-WET	GFAA										
BARIUM,SED	1008	1.63	2.25	1.91	2.55	1.97	2.57	1.91	2.68	2.28	2.99
MG/KG-WET	ICAP										
BERYLLIUM,SED	1013	0.038	<0.017	0.019	<0.018	<0.018	<0.017	<0.018	<0.017	<0.018	<0.017
MG/KG-WET	ICAP										
CADMIUM,SED	1028	<0.028	<0.028	<0.028	<0.029	<0.029	<0.028	<0.029	<0.028	<0.029	<0.027
MG/KG-WET	ICAP										
CALCIUM,SED	917	682	1150	1110	1660	1160	2180	1140	1560	1320	2210
MG/KG-WET	ICAP										

PROJECT NUMBER 3904023000 4120 PROJECT NAME LAKE APOPKA - UF
FIELD GROUP APOPKA PROJECT MANAGER J.J. VONDRICK
ALL LAB COORDINATOR JOE VONDRICK
SAMPLE ID/#

PARAMETERS	STORET	B2,0-10 APOPKA	B2,10-20 APOPKA	C7,0-10 APOPKA	C7,10-20 APOPKA	C12,0-10 APOPKA	C12,10-20 APOPKA	D4,0-10 APOPKA	D4,10-20 APOPKA	E9,0-10 APOPKA	E9,10-20 APOPKA
UNITS	METHOD	1	2	3	4	5	6	7	8	9	10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
CHROMIUM,SED	1029	0.110	0.201	0.157	0.300	0.233	0.465	0.383	0.218	0.212	0.360
MG/KG-WET	ICAP										
COBALT,SED	1038	<0.097	<0.095	<0.096	<0.097	<0.098	<0.096	<0.098	<0.096	<0.098	<0.091
MG/KG-WET	ICAP										
COPPER,SED	1043	0.276	0.596	0.362	0.579	0.402	1.30	0.338	0.525	0.453	0.664
MG/KG-WET	ICAP										
IRON,SED	1170	40.4	78.2	63.5	132	71.8	144	62.8	83.5	87.0	158
MG/KG-WET	ICAP										
LEAD,SED	1052	<0.489	0.685	<0.486	0.668	0.527	0.540	<0.494	0.603	<0.495	0.802
MG/KG-WET	ICAP										
MAGNESIUM,SED	924	68.0	105	97.5	139	96.6	131	99.6	127	118	158
MG/KG-WET	ICAP										
MANGANESE,SED	1053	1.27	2.54	1.81	2.89	2.00	2.75	1.89	2.54	2.34	3.40
MG/KG-WET	ICAP										
MERCURY,SED	71921	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MG/KG-WET	CVAA										
NICKEL,SED	1068	<0.157	0.168	<0.156	<0.157	<0.158	<0.155	<0.158	<0.154	<0.159	<0.147
MG/KG-WET	ICAP										
POTASSIUM,SED	938	13.4	15.2	22.1	19.6	16.1	12.2	18.1	15.3	15.2	16.6
MG/KG-WET	ICAP										
SELENIUM,SED	1148	0.024	0.060	0.030	0.063	0.047	0.103	0.029	0.054	0.047	0.073
MG/KG-WET	GFAA										
SILVER,SED	1078	<0.036	<0.036	<0.036	<0.036	<0.037	<0.036	<0.037	<0.036	<0.037	<0.034
MG/KG-WET	ICAP										
SODIUM,SED	934	29.5	29.6	28.3	30.1	28.3	31.0	28.9	34.5	30.4	31.5
MG/KG-WET	ICAP										
THALLIUM,SED	34480	<1.47	<1.45	<1.46	<1.47	<1.48	<1.45	<1.48	<1.45	<1.49	<1.38
MG/KG-WET	ICAP										
VANADIUM,SED	1088	0.086	0.274	0.144	0.290	0.215	0.406	0.107	0.128	0.107	0.277
MG/KG-WET	ICAP										
ZINC,SED	1093	0.845	1.35	1.07	1.24	0.897	1.28	0.780	1.22	0.955	1.35
MG/KG-WET	ICAP										
MOISTURE	70320	98.5	97.3	98.3	96.7	98.0	96.0	98.2	97.1	97.7	96.5
%WET WT	1										
ENDRIN ALDEHYDE	34369	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										

PARAMETERS	STORET	F6,0-10 APOPKA	F6,10-20 APOPKA	G3,0-10 APOPKA	G3,10-20 APOPKA	H8,0-10 APOPKA	H8,10-20 APOPKA	I10,0-10 APOPKA	I10,10-20 APOPKA	K6,0-10 APOPKA	K6,10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
		SAMPLE ID/#									
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
CYANIDE,SED	721	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
UG/G- WET	1										
PHENOLS,SED	61565	273	292	385	201	2130	3590	2070	618	1140	893
UG/G- WET	1										
1,1,1-TRICHL'ETHANE	34509	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,1,2,2-TETRACHLORO ETHANE	34519	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,1,2-TRICHL'ETHANE	34514	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,1-DICHLOROETHANE	34499	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,1-DICHLOROETHYLENE	34504	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,2-DICHLOROETHANE	34534	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
1,2-DICHLOROPROPANE	34544	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
2-CHLOROETHYLVINYL ETHER	34579	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
2-HEXANONE	75166	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
ACETONE	75059	23	<10	15	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
BENZENE	34237	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
BROMODICHLOROMETHANE	34330	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
BROMOFORM	34290	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
BROMOMETHANE	34416	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
CARBON DISULFIDE	78544	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CARBON TETRACHLORIDE	34299	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CHLOROBENZENE	34304	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CHLOROETHANE	34314	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
CHLOROFORM	34318	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
CHLOROMETHANE	34421	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
CIS-1,3-DICHLORO PROPENE	34702	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
DIBROMOCHLOROMETHANE	34309	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
ETHYLBENZENE	34374	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
METHYL ETHYL KETONE	75078	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
METHYL ISOBUT'KETONE	75169	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
METHYLENE CHLORIDE	34426	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
STYRENE	75192	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TETRACHLOROETHENE	34478	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TOLUENE	34483	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TRANS-1,2-DICHLORO ETHENE	34549	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TRANS-1,3-DICHLORO PROPENE	34697	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
TRICHLOROETHENE	34487	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										

PARAMETERS	STORET	F6,0-10	F6,10-20	G3,0-10	G3,10-20	H8,0-10	H8,10-20	I10,0-10	I10,10-20	K6,0-10	K6,10-20
		APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
TRICHLOROFLUOROMETHANE	34491	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
UG/KG-WET	GMS										
VINYL ACETATE	98583	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
VINYL CHLORIDE	34495	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
UG/KG-WET	GMS										
1,2,4-TRICH'BENZENE	34554	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
1,2-DICHLOROBENZENE	34539	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
1,3-DICHLOROBENZENE	34569	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
1,4-DICHLOROBENZENE	34574	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
2,4,5-TRICH'PHENOL	98587	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
2,4,6-TRICH'PHENOL	34624	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
2,4-DICHLOROPHENOL	34604	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
2,4-DIMETHYLPHENOL	34609	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
UG/KG-WET	GMS										
2,4-DINITROPHENOL	34619	<390	<390	<390	<390	<390	<390	<390	<390	<390	<390
UG/KG-WET	GMS										
2,4-DINITROTOLUENE	34614	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
2,6-DINITROTOLUENE	34629	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
2-CHLORONAPHTHALENE	34584	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
2-CHLOROPHENOL	34589	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
2-METHYL-4,6-DINITROPHENOL	34660	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
UG/KG-WET	GMS										
2-METHYLNAPHTHALENE	78868	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
2-METHYLPHENOL	78872	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
2-NITROANILINE	98588	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45
UG/KG-WET	GMS										
2-NITROPHENOL	34594	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
3,3-DICHL'BENZIDINE	34634	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
UG/KG-WET	GMS										
3-NITROANILINE,SED	98589	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
4-BROMOPHENYL PHENYL ETHER	34639	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
4-CHLORO-3-METHYL PHENOL	34455	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
4-CHLOROANILINE	78867	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
4-CHLOROPHENYLPHENYL ETHER	34644	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
4-METHYLPHENOL	78803	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
4-NITROANILINE	78870	<45	<45	<45	<45	<45	<45	<45	<45	<45	<45
UG/KG-WET	GMS										
4-NITROPHENOL	34649	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
UG/KG-WET	GMS										
ACENAPHTHENE	34208	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
ACENAPHTHYLENE	34203	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
ANTHRACENE	34223	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
BENZO(A)ANTHRACENE	34529	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										

PARAMETERS	STORET	F6,0-10 APOPKA	F6,10-20 APOPKA	G3,0-10 APOPKA	G3,10-20 APOPKA	H8,0-10 APOPKA	H8,10-20 APOPKA	I10,0-10 APOPKA	I10,10-20 APOPKA	K6,0-10 APOPKA	K6,10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
BENZO(A)PYRENE	34250	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
BENZO(B)FLUORANTHENE	34233	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
BENZO(GHI)PERYLENE	34524	<48	<48	<48	<48	<48	<48	<48	<48	<48	<48
UG/KG-WET	GMS										
BENZO(K)FLUORANTHENE	34245	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
BENZOIC ACID	75315	120	180	150	170	150	190	130	100	<90	<90
UG/KG-WET	GMS										
BENZYL ALCOHOL	75212	<90	<90	<90	<90	<90	<90	<90	<90	<90	<90
UG/KG-WET	GMS										
BIS(2-CHL'ISOPROPYL)	34286	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
ETHER UG/KG-WET	GMS										
BIS(2-CHLOROETHOXY)	34281	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
METHANE UG/KG-WET	GMS										
BIS(2-CHLOROETHYL)	34276	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
ETHER UG/KG-WET	GMS										
BIS(2-ETHYLHEXYL)	39102	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
PHTHALATE UG/KG-WET	GMS										
BUTYLBENZYLPHTHALATE	34295	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
CHRYSENE	34323	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG- DRY	GMS										
DI-N-BUTYL PHTHALATE	39112	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
DI-N-OCTYL PHTHALATE	34599	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
DIBEN(A,H)ANTHRACENE	34559	<48	<48	<48	<48	<48	<48	<48	<48	<48	<48
UG/KG-WET	GMS										
DIBENZOFURAN	75647	<36	<36	<36	<36	<36	<36	<36	<36	<36	<36
UG/KG-WET	GMS										
DIETHYL PHTHALATE	34339	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
DIMETHYL PHTHALATE	34344	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
FLUORANTHENE	34379	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
FLUORENE	34384	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG- DRY	GMS										
HEXACHLOROBENZENE	39701	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
HEXACHLOROBUTADIENE	39705	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
HEXACHLOROCYCLOPENTA	34389	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
DIENE UG/KG-WET	GMS										
HEXACHLOROETHANE	34399	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
UG/KG-WET	GMS										
INDENO(1,2,3-CD)	34406	<48	<48	<48	<48	<48	<48	<48	<48	<48	<48
PYRENE UG/KG-WET	GMS										
ISOPHORONE	34411	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
N-NITROSODI-N-PROPYL	34431	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
AMINE UG/KG-WET	GMS										
N-NITROSODIPHE'AMINE	34436	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
NAPHTHALENE	34445	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
NITROBENZENE	34450	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
PENTACHLPHENOL	39061	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
UG/KG-WET	GMS										
PHENANTHRENE	34464	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										
PHENOL	34695	<42	<42	<42	<42	<42	<42	<42	<42	<42	<42
UG/KG-WET	GMS										
PYRENE	34472	<21	<21	<21	<21	<21	<21	<21	<21	<21	<21
UG/KG-WET	GMS										

PARAMETERS	STORET	F6,0-10 APOPKA	F6,10-20 APOPKA	G3,0-10 APOPKA	G3,10-20 APOPKA	H8,0-10 APOPKA	H8,10-20 APOPKA	I10,0-10 APOPKA	I10,10-20 APOPKA	K6,0-10 APOPKA	K6,10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
2,3,7,8-TCDD	34678	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60
UG/KG-WET	GMS										
ALDRIN	39333	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,A	39076	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,B	34257	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,D	34262	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
BHC,G(LINDANE)	39783	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
CHLORDANE	39351	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
UG/KG-WET	EC										
DDD,PP'	39311	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
DDE,PP'	39321	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
DDT,PP'	39301	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
DIELDRIN	39383	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDOSULFAN SULFATE	34354	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDOSULFAN,A	34364	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDOSULFAN,B	34359	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDRIN	39393	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
ENDRIN KETONE,SED	98591	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
UG/KG-WET	EC										
HEPTACHLOR	39413	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
HEPTACHLOR EPOXIDE	39423	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										
METHOXYCHLOR,SED	39481	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
UG/KG-WET	EC										
PCB 1016	39514	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
UG/KG-WET	EC										
PCB-1221	39491	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1232	39495	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1242	39499	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1248	39503	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1254	39507	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
PCB-1260	39511	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
UG/KG-WET	EC										
TOXAPHENE	39403	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
UG/KG-WET	EC										
ALUMINUM,SED	1108	61.6	135	99.4	131	89.0	192	83.9	135	62.1	67.3
MG/KG-WET	ICAP										
ANTIMONY,SED	1098	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MG/KG-WET	ICAP										
ARSENIC,SED	1003	0.123	0.307	0.168	0.398	0.191	0.389	0.197	0.305	0.164	0.309
MG/KG-WET	GFAA										
BARIUM,SED	1008	2.20	2.76	2.56	3.13	2.09	2.98	2.04	2.69	1.69	2.10
MG/KG-WET	ICAP										
BERYLLIUM,SED	1013	<0.017	<0.017	<0.018	<0.018	<0.017	<0.018	<0.018	<0.018	<0.017	<0.017
MG/KG-WET	ICAP										
CADMIUM,SED	1028	<0.027	<0.027	<0.028	<0.028	<0.027	<0.028	<0.029	<0.029	<0.028	<0.028
MG/KG-WET	ICAP										
CALCIUM,SED	917	1190	1780	1450	2170	1370	2110	1140	2250	950	1340
MG/KG-WET	ICAP										

PARAMETERS	STORET	F6.0-10 APOPKA	F6.10-20 APOPKA	G3.0-10 APOPKA	G3.10-20 APOPKA	H8.0-10 APOPKA	H8.10-20 APOPKA	I10.0-10 APOPKA	I10.10-20 APOPKA	K6.0-10 APOPKA	K6.10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
SAMPLE ID/#											
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
CHROMIUM,SED	1029	0.140	0.280	0.200	0.303	0.183	0.366	0.242	0.340	0.152	0.167
MG/KG-WET	ICAP										
COBALT,SED	1038	<0.093	<0.093	<0.097	<0.097	<0.093	<0.096	<0.099	<0.098	<0.094	<0.094
MG/KG-WET	ICAP										
COPPER,SED	1043	0.364	0.612	0.451	0.784	0.425	0.751	0.678	1.04	0.302	0.437
MG/KG-WET	ICAP										
IRON,SED	1170	54.7	118	83.4	157	78.9	158	76.8	122	52.0	65.2
MG/KG-WET	ICAP										
LEAD,SED	1052	<0.469	0.700	<0.487	1.26	<0.469	1.04	0.736	0.947	<0.474	0.511
MG/KG-WET	ICAP										
MAGNESIUM,SED	924	97.3	143	122	165	116	164	97.9	117	89.3	107
MG/KG-WET	ICAP										
MANGANESE,SED	1053	1.95	3.01	2.62	4.04	2.25	3.66	1.91	2.54	1.75	2.56
MG/KG-WET	ICAP										
MERCURY,SED	71921	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MG/KG-WET	CVAA										
NICKEL,SED	1068	<0.150	<0.150	<0.156	<0.157	<0.150	0.157	<0.159	<0.158	<0.152	<0.152
MG/KG-WET	ICAP										
POTASSIUM,SED	938	16.6	17.3	23.4	18.1	18.4	15.2	21.3	17.3	22.4	19.0
MG/KG-WET	ICAP										
SELENIUM,SED	1148	0.037	0.061	0.039	0.081	0.040	0.071	0.040	0.054	0.028	0.046
MG/KG-WET	GFAA										
SILVER,SED	1078	<0.035	<0.035	<0.036	<0.036	<0.035	<0.036	<0.037	<0.037	<0.035	<0.035
MG/KG-WET	ICAP										
SODIUM,SED	934	36.2	34.5	36.2	32.6	28.7	31.0	27.4	32.6	27.2	29.1
MG/KG-WET	ICAP										
THALLIUM,SED	34480	<1.41	<1.40	<1.46	<1.47	<1.41	<1.46	<1.49	<1.48	<1.42	<1.42
MG/KG-WET	ICAP										
VANADIUM,SED	1088	0.071	0.183	0.141	0.304	0.126	0.287	0.113	0.288	0.129	0.223
MG/KG-WET	ICAP										
ZINC,SED	1093	0.962	1.22	1.13	1.61	0.860	1.33	1.45	2.29	0.686	0.994
MG/KG-WET	ICAP										
MOISTURE	70320	98.2	96.8	97.9	96.1	97.8	96.3	98.2	96.4	98.3	97.4
%WET WT	1										
ENDRIN ALDEHYDE	34369	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
UG/KG-WET	EC										

Hunter/ESE, Inc. DATE 07/20/89 STATUS : Final based on Dry Wt PAGE 1
PROJECT NUMBER 3904023000 4120 PROJECT NAME LAKE APOPKA - UF
FIELD GROUP APOPKA PROJECT MANAGER J.J. VONDRICK
ALL LAB COORDINATOR JOE VONDRICK

PARAMETERS	STORET	SAMPLE ID/# B2,0-10 APOPKA 1	B2,10-20 APOPKA 2	C7,0-10 APOPKA 3	C7,10-20 APOPKA 4	C12,0-10 APOPKA 5	C12,10-20 APOPKA 6	D4,0-10 APOPKA 7	D4,10-20 APOPKA 8	E9,0-10 APOPKA 9	E9,10-20 APOPKA 10
UNITS	METHOD										
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
CYANIDE,SED	721	<8	<5	<7	<4	<6	<3	<7	<4	<4	<3
UG/G- DRY	1										
PHENOLS,SED	61565	187000	91300	17800	7270	6730	5770	13200	6970	146000	54900
UG/G- DRY	1										
1,1,1-TRICHL'ETHANE	34509	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
1,1,2,2-TETRACHLORO	34519	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
ETHANE UG/KG-DRY	GMS										
1,1,2-TRICHL'ETHANE	34514	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
1,1-DICHLOROETHANE	34499	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
1,1-DICHLOROETHYLENE	34504	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
1,2-DICHLOROETHANE	34534	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
1,2-DICHLOROPROPANE	34544	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
2-CHLOROETHYLVINYL	34579	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
ETHER UG/KG-DRY	GMS										
2-HEXANONE	75166	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
UG/KG-DRY	GMS										
ACETONE	75059	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
UG/KG-DRY	GMS										
BENZENE	34237	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
BROMODICHLOROMETHANE	34330	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
BROMOFORM	34290	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
BROMOMETHANE	34416	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
UG/KG-DRY	GMS										
CARBON DISULFIDE	78544	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
CARBON TETRACHLORIDE	34299	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
CHLOROBENZENE	34304	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
CHLOROETHANE	34314	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
UG/KG-DRY	GMS										
CHLOROFORM	34318	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
CHLOROMETHANE	34421	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
UG/KG-DRY	GMS										
CIS-1,3-DICHLORO	34702	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
PROPENE UG/KG-DRY	GMS										
DIBROMOCHLOROMETHANE	34309	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
ETHYLBENZENE	34374	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
METHYL ETHYL KETONE	75078	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
UG/KG-DRY	GMS										
METHYL ISOBUT'KETONE	75169	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
UG/KG-DRY	GMS										
METHYLENE CHLORIDE	34426	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
STYRENE	75192	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
TETRACHLOROETHENE	34478	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
TOLUENE	34483	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										
TRANS-1,2-DICHLORO	34549	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
ETHENE UG/KG-DRY	GMS										
TRANS-1,3-DICHLORO	34697	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
PROPENE UG/KG-DRY	GMS										
TRICHLOROETHENE	34487	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
UG/KG-DRY	GMS										

PARAMETERS	STORET	B2,0-10	B2,10-20	C7,0-10	C7,10-20	C12,0-10	C12,10-20	D4,0-10	D4,10-20	E9,0-10	E9,10-20
		SAMPLE ID/#									
UNITS	METHOD	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA	APOPKA
		1	2	3	4	5	6	7	8	9	10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
TRICHLOROFLUOROMETHANE UG/KG-DRY	34491 GMS	<330	<190	<290	<150	<250	<130	<280	<170	<220	<140
VINYL ACETATE UG/KG-DRY	98583 GMS	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
VINYL CHLORIDE UG/KG-DRY	34495 GMS	<670	<370	<590	<300	<500	<250	<560	<340	<430	<290
1,2,4-TRICH'BENZENE UG/KG-DRY	34554 GMS	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
1,2-DICHLOROBENZENE UG/KG-DRY	34539 GMS	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
1,3-DICHLOROBENZENE UG/KG-DRY	34569 GMS	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
1,4-DICHLOROBENZENE UG/KG-DRY	34574 GMS	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
2,4,5-TRICH'PHENOL UG/KG-DRY	98587 GMS	<6000	<3300	<5300	<2700	<4500	<2300	<5000	<3100	<3900	<2600
2,4,6-TRICH'PHENOL UG/KG-DRY	34624 GMS	<6000	<3300	<5300	<2700	<4500	<2300	<5000	<3100	<3900	<2600
2,4-DICHLOROPHENOL UG/KG-DRY	34604 GMS	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
2,4-DIMETHYLPHENOL UG/KG-DRY	34609 GMS	<10000	<5600	<8800	<4500	<7500	<3800	<8300	<5200	<6500	<4300
2,4-DINITROPHENOL UG/KG-DRY	34619 GMS	<26000	<14000	<23000	<12000	<20000	<9800	<22000	<13000	<17000	<11000
2,4-DINITROTOLUENE UG/KG-DRY	34614 GMS	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
2,6-DINITROTOLUENE UG/KG-DRY	34629 GMS	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
2-CHLORONAPHTHALENE UG/KG-DRY	34584 GMS	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
2-CHLOROPHENOL UG/KG-DRY	34589 GMS	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
2-METHYL-4,6-DINITROPHENOL UG/KG-DRY	34660 GMS	<20000	<11000	<18000	<9100	<15000	<7500	<17000	<10000	<13000	<8600
2-METHYLNAPHTHALENE UG/KG-DRY	78868 GMS	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
2-METHYLPHENOL UG/KG-DRY	78872 GMS	<6000	<3300	<5300	<2700	<4500	<2300	<5000	<3100	<3900	<2600
2-NITROANILINE UG/KG-DRY	98588 GMS	<3000	<1700	<2600	<1400	<2300	<1100	<2500	<1600	<2000	<1300
2-NITROPHENOL UG/KG-DRY	34594 GMS	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
3,3-DICHL'BENZIDINE UG/KG-DRY	34634 GMS	<10000	<5600	<8800	<4500	<7500	<3800	<8300	<5200	<6500	<4300
3-NITROANILINE,SED UG/KG-DRY	98589 GMS	<6000	<3300	<5300	<2700	<4500	<2300	<5000	<3100	<3900	<2600
4-BROMOPHENYL PHENYL ETHER UG/KG-DRY	34639 GMS	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
4-CHLORO-3-METHYL PHENOL UG/KG-DRY	34455 GMS	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
4-CHLOROANILINE UG/KG-DRY	78867 GMS	<6000	<3300	<5300	<2700	<4500	<2300	<5000	<3100	<3900	<2600
4-CHLOROPHENYLPHENYL ETHER UG/KG-DRY	34644 GMS	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
4-METHYLPHENOL UG/KG-DRY	78803 GMS	<6000	<3300	<5300	<2700	<4500	<2300	<5000	<3100	<3900	<2600
4-NITROANILINE UG/KG-DRY	78870 GMS	<3000	<1700	<2600	<1400	<2300	<1100	<2500	<1600	<2000	<1300
4-NITROPHENOL UG/KG-DRY	34649 GMS	<10000	<5600	<8800	<4500	<7500	<3800	<8300	<5200	<6500	<4300
ACENAPHTHENE UG/KG-DRY	34208 GMS	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
ACENAPHTHYLENE UG/KG-DRY	34203 GMS	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
ANTHRACENE UG/KG-DRY	34223 GMS	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
BENZO(A)ANTHRACENE UG/KG-DRY	34529 GMS	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860

PARAMETERS	STORET	B2.0-10	B2.10-20	C7.0-10	C7.10-20	C12.0-10	C12.10-20	D4.0-10	D4.10-20	E9.0-10	E9.10-20
		SAMPLE ID/#									
UNITS	METHOD	APOPKA 1	APOPKA 2	APOPKA 3	APOPKA 4	APOPKA 5	APOPKA 6	APOPKA 7	APOPKA 8	APOPKA 9	APOPKA 10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
BENZO(A)PYRENE	34250	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
UG/KG-DRY	GMS										
BENZO(B)FLUORANTHENE	34233	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
UG/KG-DRY	GMS										
BENZO(GHI)PERYLENE	34524	<3200	<1800	<2800	<1500	<2400	<1200	<2700	<1700	<2100	<1400
UG/KG-DRY	GMS										
BENZO(K)FLUORANTHENE	34245	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
UG/KG-DRY	GMS										
BENZOIC ACID	75315	6200	5100	6500	3900	5100	3700	6800	6300	5700	4900
UG/KG-DRY	GMS										
BENZYL ALCOHOL	75212	<6000	<3300	<5300	<2700	<4500	<2300	<5000	<3100	<3900	<2600
UG/KG-DRY	GMS										
BIS(2-CHL'ISOPROPYL)	34286	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
ETHER UG/KG-DRY	GMS										
BIS(2-CHLOROETHOXY)	34281	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
METHANE UG/KG-DRY	GMS										
BIS(2-CHLOROETHYL)	34276	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
ETHER UG/KG-DRY	GMS										
BIS(2-ETHYLHEXYL)	39102	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
PHTHALATE UG/KG-DRY	GMS										
BUTYLBENZYLPHTHALATE	34295	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
UG/KG-DRY	GMS										
CHRYSENE	34323	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
UG/KG- DRY	GMS										
DI-N-BUTYL PHTHALATE	39112	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
DI-N-OCTYL PHTHALATE	34599	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
UG/KG-DRY	GMS										
DIBEN(A,H)ANTHRACENE	34559	<3200	<1800	<2800	<1500	<2400	<1200	<2700	<1700	<2100	<1400
UG/KG-DRY	GMS										
DIBENZOFURAN	75647	<2400	<1300	<2100	<1100	<1800	<900	<2000	<1200	<1600	<1000
UG/KG-DRY	GMS										
DIETHYL PHTHALATE	34339	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
DIMETHYL PHTHALATE	34344	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
FLUORANTHENE	34379	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
FLUORENE	34384	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG- DRY	GMS										
HEXACHLOROBENZENE	39701	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
UG/KG-DRY	GMS										
HEXACHLOROBUTADIENE	39705	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
UG/KG-DRY	GMS										
HEXACHLOROCYCLOPENTA	34389	<20000	<11000	<18000	<9100	<15000	<7500	<17000	<10000	<13000	<8600
DIENE UG/KG-DRY	GMS										
HEXACHLOROETHANE	34399	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
UG/KG-DRY	GMS										
INDENO(1,2,3-CD)	34406	<3200	<1800	<2800	<1500	<2400	<1200	<2700	<1700	<2100	<1400
PYRENE UG/KG-DRY	GMS										
ISOPHORONE	34411	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
N-NITROSODI-N-PROPYL	34431	<2000	<1100	<1800	<910	<1500	<750	<1700	<1000	<1300	<860
AMINE UG/KG-DRY	GMS										
N-NITROSODIPHE'AMINE	34436	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
NAPHTHALENE	34445	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
NITROBENZENE	34450	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
PENTACHLPHENOL	39061	<10000	<5600	<8800	<4500	<7500	<3800	<8300	<5200	<6500	<4300
UG/KG-DRY	GMS										
PHENANTHRENE	34464	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										
PHENOL	34695	<2800	<1600	<2500	<1300	<2100	<1100	<2300	<1400	<1800	<1200
UG/KG-DRY	GMS										
PYRENE	34472	<1400	<780	<1200	<640	<1100	<530	<1200	<720	<910	<600
UG/KG-DRY	GMS										

PARAMETERS	STORET	B2,0-10 APOPKA	B2,10-20 APOPKA	C7,0-10 APOPKA	C7,10-20 APOPKA	C12,0-10 APOPKA	C12,10-20 APOPKA	D4,0-10 APOPKA	D4,10-20 APOPKA	E9,0-10 APOPKA	E9,10-20 APOPKA
UNITS	METHOD	1	2	3	4	5	6	7	8	9	10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
2,3,7,8-TCDD	34678	<4000	<2200	<3500	<1800	<3000	<1500	<3300	<2100	<2600	<1700
UG/KG-DRY	GMS										
ALDRIN	39333	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
BHC,A	39076	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
BHC,B	34257	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
BHC,D	34262	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
BHC,G(LINDANE)	39783	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
CHLORDANE	39351	<333	<185	<294	<152	<250	<125	<278	<172	<217	<143
UG/KG-DRY	EC										
DDD,PP'	39311	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
DDE,PP'	39321	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
DDT,PP'	39301	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
DIELDRIN	39383	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
ENDOSULFAN SULFATE	34354	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
ENDOSULFAN,A	34364	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
ENDOSULFAN,B	34359	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
ENDRIN	39393	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
ENDRIN KETONE,SED	98591	<333	<185	<294	<152	<250	<125	<278	<172	<217	<143
UG/KG-DRY	EC										
HEPTACHLOR	39413	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
HEPTACHLOR EPOXIDE	39423	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										
METHOXYCHLOR,SED	39481	<333	<185	<294	<152	<250	<125	<278	<172	<217	<143
UG/KG-DRY	EC										
PCB 1016	39514	<1330	<741	<1180	<606	<1000	<500	<1110	<690	<870	<571
UG/KG-DRY	EC										
PCB-1221	39491	<1300	<740	<1200	<610	<1000	<500	<1100	<690	<870	<570
UG/KG-DRY	EC										
PCB-1232	39495	<1300	<740	<1200	<610	<1000	<500	<1100	<690	<870	<570
UG/KG-DRY	EC										
PCB-1242	39499	<1300	<740	<1200	<610	<1000	<500	<1100	<690	<870	<570
UG/KG-DRY	EC										
PCB-1248	39503	<1300	<740	<1200	<610	<1000	<500	<1100	<690	<870	<570
UG/KG-DRY	EC										
PCB-1254	39507	<1300	<740	<1200	<610	<1000	<500	<1100	<690	<870	<570
UG/KG-DRY	EC										
PCB-1260	39511	<1300	<740	<1200	<610	<1000	<500	<1100	<690	<870	<570
UG/KG-DRY	EC										
TOXAPHENE	39403	<6670	<3700	<5880	<3030	<5000	<2500	<5560	<3450	<4350	<2860
UG/KG-DRY	EC										
ALUMINUM,SED	1108	3270	3130	4600	4540	3580	4230	4730	3230	4690	5820
MG/KG-DRY	ICAP										
ANTIMONY,SED	1098	<33	<18	<29	<15	<25	<12	<27	<17	<22	<13
MG/KG-DRY	ICAP										
ARSENIC,SED	1003	10.7	12.7	7.08	10.6	9.94	10.3	9.02	7.31	7.06	9.30
MG/KG-DRY	GFAA										
BARIUM,SED	1008	109	83.2	112	77.1	98.7	64.2	106	92.5	99.3	85.5
MG/KG- DRY	ICAP										
BERYLLIUM,SED	1013	2.54	<0.642	1.09	<0.535	<0.891	<0.436	<0.987	<0.598	<0.775	<0.472
MG/KG-DRY	ICAP										
CADMIUM,SED	1028	<1.89	<1.03	<1.66	<0.862	<1.43	<0.702	<1.59	<0.964	<1.25	<0.760
MG/KG-DRY	ICAP										
CALCIUM,SED	917	45500	42400	65200	50400	58200	54400	63200	53700	57200	63100
MG/KG- DRY	ICAP										

PARAMETERS	STORET	B2,0-10 APOPKA	B2,10-20 APOPKA	C7,0-10 APOPKA	C7,10-20 APOPKA	C12,0-10 APOPKA	C12,10-20 APOPKA	D4,0-10 APOPKA	D4,10-20 APOPKA	E9,0-10 APOPKA	E9,10-20 APOPKA
UNITS	METHOD	1	2	3	4	5	6	7	8	9	10
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89
TIME		14:00	14:00	10:50	10:50	09:45	09:45	13:00	13:00	18:00	18:00
CHROMIUM,SED	1029	7.30	7.46	9.21	9.10	11.6	11.6	21.3	7.51	9.21	10.3
MG/KG-DRY	ICAP										
COBALT,SED	1038	<6.45	<3.53	<5.66	<2.94	<4.90	<2.40	<5.43	<3.29	<4.26	<2.60
MG/KG- DRY	ICAP										
COPPER,SED	1043	18.4	22.1	21.3	17.5	20.1	32.6	18.8	18.1	19.7	19.0
MG/KG-DRY	ICAP										
IRON,SED	1170	2690	2900	3740	4000	3590	3600	3490	2880	3780	4510
MG/KG-DRY	ICAP										
LEAD,SED	1052	<32.6	25.4	<28.6	20.2	26.3	13.5	<27.4	20.8	<21.5	22.9
MG/KG-DRY	ICAP										
MAGNESIUM,SED	924	4530	3870	5740	4210	4830	3260	5540	4380	5120	4510
MG/KG-DRY	ICAP										
MANGANESE,SED	1053	84.9	94.2	106	87.5	100.0	68.8	105	87.4	102	97.1
MG/KG-DRY	ICAP										
MERCURY,SED	71921	<0.133	<0.072	<0.117	<0.061	<0.102	<0.050	<0.110	<0.069	<0.091	<0.057
MG/KG-DRY	CVAA										
NICKEL,SED	1068	<10.4	6.21	<9.15	<4.76	<7.92	<3.87	<8.77	<5.32	<6.89	<4.19
MG/KG-DRY	ICAP										
POTASSIUM,SED	938	890	565	1300	593	807	305	1000	529	660	475
MG/KG-DRY	ICAP										
SELENIUM,SED	1148	1.60	2.24	1.74	1.92	2.34	2.57	1.60	1.84	2.05	2.09
MG/KG-DRY	GFAA										
SILVER,SED	1078	<2.41	<1.32	<2.12	<1.10	<1.83	<0.896	<2.03	<1.23	<1.59	<0.970
MG/KG- DRY	ICAP										
SODIUM,SED	934	1960	1100	1660	911	1410	774	1610	1190	1320	899
MG/KG- DRY	ICAP										
THALLIUM,SED	34480	<97.8	<53.5	<85.8	<44.6	<74.2	<36.3	<82.2	<49.9	<64.6	<39.3
MG/KG- DRY	ICAP										
VANADIUM,SED	1088	5.74	10.1	8.46	8.77	10.7	10.1	5.92	4.42	4.65	7.92
MG/KG-DRY	ICAP										
ZINC,SED	1093	56.3	49.8	62.7	37.6	44.8	32.0	43.3	42.0	41.5	38.5
MG/KG-DRY	ICAP										
MOISTURE	70320	98.5	97.3	98.3	96.7	98.0	96.0	98.2	97.1	97.7	96.5
%WET WT	I										
ENDRIN ALDEHYDE	34369	<66.7	<37.0	<58.8	<30.3	<50.0	<25.0	<55.6	<34.5	<43.5	<28.6
UG/KG-DRY	EC										

PARAMETERS	STORET	F6,0-10 APOPKA	F6,10-20 APOPKA	G3,0-10 APOPKA	G3,10-20 APOPKA	H8,0-10 APOPKA	H8,10-20 APOPKA	I10,0-10 APOPKA	I10,10-20 APOPKA	K6,0-10 APOPKA	K6,10-20 APOPKA
UNITS	METHOD	SAMPLE ID/# 11	12	13	14	15	16	17	18	19	20
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
CYANIDE,SED	721	<7	<4	<6	<3	<5	<3	<6	<3	<6	<4
UG/G- DRY	1										
PHENOLS,SED	61565	15100	9130	18300	5150	96800	97000	115000	17200	67100	34300
UG/G- DRY	1										
1,1,1-TRICHL'ETHANE	34509	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
1,1,2,2-TETRACHLORO ETHANE	34519	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
1,1,2-TRICHL'ETHANE	34514	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
1,1-DICHLOROETHANE	34499	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
1,1-DICHLOROETHYLENE	34504	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
1,2-DICHLOROETHANE	34534	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
1,2-DICHLOROPROPANE	34544	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
2-CHLOROETHYLVINYL ETHER	34579	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
2-HEXANONE	75166	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
UG/KG-DRY	GMS										
ACETONE	75059	1300	<310	720	<260	<450	<270	<560	<280	<590	<380
UG/KG-DRY	GMS										
BENZENE	34237	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
BROMODICHLOROMETHANE	34330	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
BROMOFORM	34290	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
BROMOMETHANE	34416	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
UG/KG-DRY	GMS										
CARBON DISULFIDE	78544	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
CARBON TETRACHLORIDE	34299	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
CHLOROBENZENE	34304	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
CHLOROETHANE	34314	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
UG/KG-DRY	GMS										
CHLOROFORM	34318	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
CHLOROMETHANE	34421	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
UG/KG-DRY	GMS										
CIS-1,3-DICHLORO PROPENE	34702	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
DIBROMOCHLOROMETHANE	34309	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
ETHYLBENZENE	34374	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
METHYL ETHYL KETONE	75078	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
UG/KG-DRY	GMS										
METHYL ISOBUT'KETONE	75169	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
UG/KG-DRY	GMS										
METHYLENE CHLORIDE	34426	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
STYRENE	75192	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
TETRACHLOROETHENE	34478	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
TOLUENE	34483	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
TRANS-1,2-DICHLORO ETHENE	34549	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
TRANS-1,3-DICHLORO PROPENE	34697	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										
TRICHLOROETHENE	34487	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
UG/KG-DRY	GMS										

PARAMETERS	STORET	F6,0-10 APOPKA	F6,10-20 APOPKA	G3,0-10 APOPKA	G3,10-20 APOPKA	H8,0-10 APOPKA	H8,10-20 APOPKA	I10,0-10 APOPKA	I10,10-20 APOPKA	K6,0-10 APOPKA	K6,10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
TRICHLOROFLUOROMETHANE UG/KG-DRY	34491 GMS	<280	<160	<240	<130	<230	<140	<280	<140	<290	<190
VINYL ACETATE UG/KG-DRY	98583 GMS	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
VINYL CHLORIDE UG/KG-DRY	34495 GMS	<560	<310	<480	<260	<450	<270	<560	<280	<590	<380
1,2,4-TRICH'BENZENE UG/KG-DRY	34554 GMS	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
1,2-DICHLOROBENZENE UG/KG-DRY	34539 GMS	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
1,3-DICHLOROBENZENE UG/KG-DRY	34569 GMS	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
1,4-DICHLOROBENZENE UG/KG-DRY	34574 GMS	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
2,4,5-TRICH'PHENOL UG/KG-DRY	98587 GMS	<5000	<2800	<4300	<2300	<4100	<2400	<5000	<2500	<5300	<3500
2,4,6-TRICH'PHENOL UG/KG-DRY	34624 GMS	<5000	<2800	<4300	<2300	<4100	<2400	<5000	<2500	<5300	<3500
2,4-DICHLOROPHENOL UG/KG-DRY	34604 GMS	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
2,4-DIMETHYLPHENOL UG/KG-DRY	34609 GMS	<8300	<4700	<7100	<3800	<6800	<4100	<8300	<4200	<8800	<5800
2,4-DINITROPHENOL UG/KG-DRY	34619 GMS	<22000	<12000	<19000	<10000	<18000	<11000	<22000	<11000	<23000	<15000
2,4-DINITROTOLUENE UG/KG-DRY	34614 GMS	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
2,6-DINITROTOLUENE UG/KG-DRY	34629 GMS	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
2-CHLORONAPHTHALENE UG/KG-DRY	34584 GMS	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
2-CHLOROPHENOL UG/KG-DRY	34589 GMS	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
2-METHYL-4,6-DINITROPHENOL UG/KG-DRY	34660 GMS	<17000	<9400	<14000	<7700	<14000	<8100	<17000	<8300	<18000	<12000
2-METHYLNAPHTHALENE UG/KG-DRY	78868 GMS	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
2-METHYLPHENOL UG/KG-DRY	78872 GMS	<5000	<2800	<4300	<2300	<4100	<2400	<5000	<2500	<5300	<3500
2-NITROANILINE UG/KG-DRY	98588 GMS	<2500	<1400	<2100	<1200	<2000	<1200	<2500	<1300	<2600	<1700
2-NITROPHENOL UG/KG-DRY	34594 GMS	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
3,3-DICHL'BENZIDINE UG/KG-DRY	34634 GMS	<8300	<4700	<7100	<3800	<6800	<4100	<8300	<4200	<8800	<5800
3-NITROANILINE,SED UG/KG-DRY	98589 GMS	<5000	<2800	<4300	<2300	<4100	<2400	<5000	<2500	<5300	<3500
4-BROMOPHENYL PHENYL ETHER UG/KG-DRY	34639 GMS	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
4-CHLORO-3-METHYL PHENOL UG/KG-DRY	34455 GMS	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
4-CHLOROANILINE UG/KG-DRY	78867 GMS	<5000	<2800	<4300	<2300	<4100	<2400	<5000	<2500	<5300	<3500
4-CHLOROPHENYLPHENYL ETHER UG/KG-DRY	34644 GMS	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
4-METHYLPHENOL UG/KG-DRY	78803 GMS	<5000	<2800	<4300	<2300	<4100	<2400	<5000	<2500	<5300	<3500
4-NITROANILINE UG/KG-DRY	78870 GMS	<2500	<1400	<2100	<1200	<2000	<1200	<2500	<1300	<2600	<1700
4-NITROPHENOL UG/KG-DRY	34649 GMS	<8300	<4700	<7100	<3800	<6800	<4100	<8300	<4200	<8800	<5800
ACENAPHTHENE UG/KG-DRY	34208 GMS	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
ACENAPHTHYLENE UG/KG-DRY	34203 GMS	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
ANTHRACENE UG/KG-DRY	34223 GMS	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
BENZO(A)ANTHRACENE UG/KG-DRY	34529 GMS	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200

PARAMETERS	STORET	F6,0-10 APOPKA	F6,10-20 APOPKA	G3,0-10 APOPKA	G3,10-20 APOPKA	H8,0-10 APOPKA	H8,10-20 APOPKA	I10,0-10 APOPKA	I10,10-20 APOPKA	K6,0-10 APOPKA	K6,10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
BENZO(A)PYRENE	34250	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
UG/KG-DRY	GMS										
BENZO(B)FLUORANTHENE	34233	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
UG/KG-DRY	GMS										
BENZO(GHI)PERYLENE	34524	<2700	<1500	<2300	<1200	<2200	<1300	<2700	<1300	<2800	<1800
UG/KG-DRY	GMS										
BENZO(K)FLUORANTHENE	34245	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
UG/KG-DRY	GMS										
BENZOIC ACID	75315	6600	5800	7100	4400	6700	5200	7400	2800	<5300	<3500
UG/KG-DRY	GMS										
BENZYL ALCOHOL	75212	<5000	<2800	<4300	<2300	<4100	<2400	<5000	<2500	<5300	<3500
UG/KG-DRY	GMS										
BIS(2-CHL'ISOPROPYL)	34286	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
ETHER UG/KG-DRY	GMS										
BIS(2-CHLOROETHOXY)	34281	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
METHANE UG/KG-DRY	GMS										
BIS(2-CHLOROETHYL)	34276	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
ETHER UG/KG-DRY	GMS										
BIS(2-ETHYLHEXYL)	39102	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
PHTHALATE UG/KG-DRY	GMS										
BUTYLBENZYLPHTHALATE	34295	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
UG/KG-DRY	GMS										
CHRYSENE	34323	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
UG/KG- DRY	GMS										
DI-N-BUTYL PHTHALATE	39112	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
DI-N-OCTYL PHTHALATE	34599	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
UG/KG-DRY	GMS										
DIBEN(A,H)ANTHRACENE	34559	<2700	<1500	<2300	<1200	<2200	<1300	<2700	<1300	<2800	<1800
UG/KG-DRY	GMS										
DIBENZOFURAN	75647	<2000	<1100	<1700	<920	<1600	<970	<2000	<1000	<2100	<1400
UG/KG-DRY	GMS										
DIETHYL PHTHALATE	34339	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
DIMETHYL PHTHALATE	34344	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
FLUORANTHENE	34379	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
FLUORENE	34384	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG- DRY	GMS										
HEXACHLOROBENZENE	39701	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
UG/KG-DRY	GMS										
HEXACHLOROBUTADIENE	39705	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
UG/KG-DRY	GMS										
HEXACHLOROCYCLOPENTA	34389	<17000	<9400	<14000	<7700	<14000	<8100	<17000	<8300	<18000	<12000
DIENE UG/KG-DRY	GMS										
HEXACHLOROETHANE	34399	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
UG/KG-DRY	GMS										
INDENO(1,2,3-CD)	34406	<2700	<1500	<2300	<1200	<2200	<1300	<2700	<1300	<2800	<1800
PYRENE UG/KG-DRY	GMS										
ISOPHORONE	34411	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
N-NITROSODI-N-PROPYL	34431	<1700	<940	<1400	<770	<1400	<810	<1700	<830	<1800	<1200
AMINE UG/KG-DRY	GMS										
N-NITROSODIPHE'AMINE	34436	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
NAPHTHALENE	34445	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
NITROBENZENE	34450	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
PENTACHLPHENOL	39061	<8300	<4700	<7100	<3800	<6800	<4100	<8300	<4200	<8800	<5800
UG/KG-DRY	GMS										
PHENANTHRENE	34464	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										
PHENOL	34695	<2300	<1300	<2000	<1100	<1900	<1100	<2300	<1200	<2500	<1600
UG/KG-DRY	GMS										
PYRENE	34472	<1200	<660	<1000	<540	<950	<570	<1200	<580	<1200	<810
UG/KG-DRY	GMS										

PARAMETERS	STORET	F6,0-10 APOPKA	F6,10-20 APOPKA	G3,0-10 APOPKA	G3,10-20 APOPKA	H8,0-10 APOPKA	H8,10-20 APOPKA	I10,0-10 APOPKA	I10,10-20 APOPKA	K6,0-10 APOPKA	K6,10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
SAMPLE ID/#											
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
2,3,7,8-TCDD	34678	<3300	<1900	<2900	<1500	<2700	<1600	<3300	<1700	<3500	<2300
UG/KG-DRY	GMS										
ALDRIN	39333	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
BHC,A	39076	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
BHC,B	34257	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
BHC,D	34262	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
BHC,G(LINDANE)	39783	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
CHLORDANE	39351	<278	<156	<238	<128	<227	<135	<278	<139	<294	<192
UG/KG-DRY	EC										
DDD,PP'	39311	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
DDE,PP'	39321	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
DDT,PP'	39301	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
DIELDRIN	39383	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
ENDOSULFAN SULFATE	34354	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
ENDOSULFAN,A	34364	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
ENDOSULFAN,B	34359	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
ENDRIN	39393	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
ENDRIN KETONE,SED	98591	<278	<156	<238	<128	<227	<135	<278	<139	<294	<192
UG/KG-DRY	EC										
HEPTACHLOR	39413	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
HEPTACHLOR EPOXIDE	39423	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										
METHOXYCHLOR,SED	39481	<278	<156	<238	<128	<227	<135	<278	<139	<294	<192
UG/KG-DRY	EC										
PCB 1016	39514	<1110	<625	<952	<513	<909	<541	<1110	<556	<1180	<769
UG/KG-DRY	EC										
PCB-1221	39491	<1100	<630	<950	<510	<910	<540	<1100	<560	<1200	<770
UG/KG-DRY	EC										
PCB-1232	39495	<1100	<630	<950	<510	<910	<540	<1100	<560	<1200	<770
UG/KG-DRY	EC										
PCB-1242	39499	<1100	<630	<950	<510	<910	<540	<1100	<560	<1200	<770
UG/KG-DRY	EC										
PCB-1248	39503	<1100	<630	<950	<510	<910	<540	<1100	<560	<1200	<770
UG/KG-DRY	EC										
PCB-1254	39507	<1100	<630	<950	<510	<910	<540	<1100	<560	<1200	<770
UG/KG-DRY	EC										
PCB-1260	39511	<1100	<630	<950	<510	<910	<540	<1100	<560	<1200	<770
UG/KG-DRY	EC										
TOXAPHENE	39403	<5560	<3130	<4760	<2560	<4550	<2700	<5560	<2780	<5880	<3850
UG/KG-DRY	EC										
ALUMINUM,SED	1108	3420	4230	4730	3350	4050	5180	4660	3740	3660	2590
MG/KG-DRY	ICAP										
ANTIMONY,SED	1098	<26	<15	<23	<13	<21	<13	<28	<14	<28	<18
MG/KG-DRY	ICAP										
ARSENIC,SED	1003	6.82	9.58	8.00	10.2	8.66	10.5	10.9	8.47	9.66	11.9
MG/KG-DRY	GFAA										
BARIUM,SED	1008	122	86.2	122	80.2	95.1	80.6	113	74.6	99.4	80.7
MG/KG- DRY	ICAP										
BERYLLIUM,SED	1013	<0.937	<0.526	<0.835	<0.452	<0.768	<0.473	<0.994	<0.495	<1.00	<0.656
MG/KG-DRY	ICAP										
CADMIUM,SED	1028	<1.51	<0.847	<1.35	<0.728	<1.24	<0.762	<1.60	<0.797	<1.62	<1.06
MG/KG-DRY	ICAP										
CALCIUM,SED	917	65900	55600	69200	55700	62200	57000	63500	62600	55900	51600
MG/KG- DRY	ICAP										

PARAMETERS	STORET	SAMPLE ID/# F6.0-10 APOPKA	F6.10-20 APOPKA	G3.0-10 APOPKA	G3.10-20 APOPKA	H8.0-10 APOPKA	H8.10-20 APOPKA	I10.0-10 APOPKA	I10.10-20 APOPKA	K6.0-10 APOPKA	K6.10-20 APOPKA
UNITS	METHOD	11	12	13	14	15	16	17	18	19	20
DATE		05/18/89	05/18/89	05/18/89	05/18/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89	05/17/89
TIME		12:00	12:00	15:00	15:00	15:50	15:50	17:00	17:00	12:00	12:00
CHROMIUM,SED	1029	7.76	8.73	9.51	7.76	8.32	9.88	13.4	9.45	8.92	6.41
MG/KG-DRY	ICAP										
COBALT,SED	1038	<5.15	<2.89	<4.59	<2.49	<4.22	<2.60	<5.47	<2.72	<5.52	<3.61
MG/KG- DRY	ICAP										
COPPER,SED	1043	20.2	19.1	21.5	20.1	19.3	20.3	37.7	29.0	17.8	16.8
MG/KG-DRY	ICAP										
IRON,SED	1170	3040	3680	3970	4010	3590	4280	4270	3390	3060	2510
MG/KG-DRY	ICAP										
LEAD,SED	1052	<26.0	21.9	<23.2	32.2	<21.3	28.0	40.9	26.3	<27.9	19.7
MG/KG-DRY	ICAP										
MAGNESIUM,SED	924	5400	4460	5800	4220	5250	4450	5440	3260	5250	4100
MG/KG-DRY	ICAP										
MANGANESE,SED	1053	108	94.0	125	103	102	98.9	106	70.5	103	98.6
MG/KG-DRY	ICAP										
MERCURY,SED	71921	<0.111	<0.062	<0.096	<0.049	<0.090	<0.053	<0.112	<0.055	<0.118	<0.076
MG/KG-DRY	CVAA										
NICKEL,SED	1068	<8.33	<4.67	<7.43	<4.02	<6.82	4.23	<8.84	<4.40	<8.92	<5.83
MG/KG-DRY	ICAP										
POTASSIUM,SED	938	924	542	1110	464	836	410	1190	480	1320	730
MG/KG-DRY	ICAP										
SELENIUM,SED	1148	2.03	1.91	1.84	2.08	1.83	1.92	2.24	1.49	1.63	1.75
MG/KG-DRY	GFAA										
SILVER,SED	1078	<1.93	<1.08	<1.72	<0.929	<1.58	<0.972	<2.04	<1.02	<2.06	<1.35
MG/KG- DRY	ICAP										
SODIUM,SED	934	2010	1080	1720	836	1310	837	1520	904	1600	1120
MG/KG- DRY	ICAP										
THALLIUM,SED	34480	<78.1	<43.8	<69.6	<37.7	<64.0	<39.4	<82.9	<41.2	<83.6	<54.6
MG/KG- DRY	ICAP										
VANADIUM,SED	1088	3.96	5.73	6.73	7.78	5.71	7.75	6.30	8.00	7.58	8.56
MG/KG-DRY	ICAP										
ZINC,SED	1093	53.4	38.3	53.8	41.2	39.1	36.1	80.8	63.5	40.4	38.2
MG/KG-DRY	ICAP										
MOISTURE	70320	98.2	96.8	97.9	96.1	97.8	96.3	98.2	96.4	98.3	97.4
%WET WT	1										
ENDRIN ALDEHYDE	34369	<55.6	<31.3	<47.6	<25.6	<45.5	<27.0	<55.6	<27.8	<58.8	<38.5
UG/KG-DRY	EC										

APPENDIX D

RATIOS OF TRACE ELEMENTS TO ALUMINUM

Table D-1. Ratio of Elements to Aluminum for Each Sample Location for Dry Sediment Samples (Page 1 of 3)

Sample[a] Location	Sample Depth (cm)	Arsenic: Aluminum	Barium: Aluminum	Beryllium: Aluminum	Chromium: Aluminum	Copper: Aluminum
B2	0-10	0.003	0.033	0.001	0.002	0.006
B2	10-20	0.004	0.027	0.000	0.002	0.007
C7	0-10	0.002	0.024	0.000	0.002	0.005
C7	10-20	0.002	0.017	0.000	0.002	0.004
C12	0-10	0.003	0.028	0.000	0.003	0.006
C12	10-20	0.002	0.015	0.000	0.003	0.008
D4	0-10	0.002	0.022	0.000	0.004	0.004
D4	10-20	0.002	0.029	0.000	0.002	0.006
E9	0-10	0.002	0.021	0.000	0.002	0.004
E9	10-20	0.002	0.015	0.000	0.002	0.003
F6	0-10	0.002	0.036	0.000	0.002	0.006
F6	10-20	0.002	0.020	0.000	0.002	0.005
G3	0-10	0.000	0.000	0.000	0.002	0.000
G3	10-20	0.003	0.024	0.000	0.002	0.006
H8	0-10	0.002	0.023	0.000	0.002	0.005
H8	10-20	0.002	0.016	0.000	0.002	0.004
I10	0-10	0.002	0.024	0.000	0.003	0.008
I10	10-20	0.002	0.020	0.000	0.003	0.008
K6	0-10	0.003	0.027	0.000	0.002	0.005
K6	10-20	0.005	0.031	0.000	0.002	0.006
MEAN		0.002	0.020	0.000	0.002	0.005

[a]From Figure 2.

Table D-1. Ratio of Elements to Aluminum for Each Sample Location for Dry Sediment Samples (Page 2 of 3)

Sample[a] Location	Sample Depth (cm)	Lead: Aluminum	Mercury: Aluminum	Nickel: Aluminum
B2	0-10	0.010	1.39	0.003
B2	10-20	0.008	1.24	0.002
C7	0-10	0.006	1.25	0.002
C7	10-20	0.004	0.93	0.001
C12	0-10	0.007	1.35	0.002
C12	10-20	0.003	0.78	0.001
D4	0-10	0.006	1.17	0.002
D4	10-20	0.006	1.36	0.002
E9	0-10	0.005	1.09	0.001
E9	10-20	0.004	0.79	0.001
F6	0-10	0.008	1.58	0.002
F6	10-20	0.005	1.06	0.001
G3	0-10	0.000	0.01	0.000
G3	10-20	0.010	1.26	0.001
H8	0-10	0.005	1.30	0.002
H8	10-20	0.005	0.85	0.001
I10	0-10	0.009	1.17	0.002
I10	10-20	0.007	0.87	0.001
K6	0-10	0.008	1.44	0.002
K6	10-20	0.008	1.59	0.002
MEAN		0.005	0.985	0.001

[a]From Figure 2.

Table D-1. Ratio of Elements to Aluminum for Each Sample Location for Dry Sediment Samples (Page 3 of 3)

Sample[a] Location	Sample Depth (cm)	Selenium: Aluminum	Vanadium: Aluminum	Zinc: Aluminum
B2	0-10	0.000	0.002	0.017
B2	10-20	0.001	0.003	0.016
C7	0-10	0.000	0.002	0.014
C7	10-20	0.000	0.002	0.008
C12	0-10	0.001	0.003	0.013
C12	10-20	0.001	0.002	0.008
D4	0-10	0.000	0.001	0.009
D4	10-20	0.001	0.001	0.013
E9	0-10	0.000	0.001	0.009
E9	10-20	0.000	0.001	0.007
F6	0-10	0.001	0.001	0.016
F6	10-20	0.000	0.001	0.009
G3	0-10	0.000	0.000	0.000
G3	10-20	0.001	0.002	0.012
H8	0-10	0.000	0.001	0.010
H8	10-20	0.000	0.001	0.007
I10	0-10	0.000	0.001	0.017
I10	10-20	0.000	0.002	0.017
K6	0-10	0.000	0.002	0.011
K6	10-20	0.001	0.003	0.015
MEAN		0.000	0.002	0.010

[a]From Figure 2.