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GEOLOGICAL SURVEY

The regional influence of an oil-fired power plant on the concentration of elements in native materials in and near south Florida national parks

by

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SUMMARY

In July 1983 the U.S. Geological Survey and the U.S. National Park Service signed an interagency agreement which facilitates joint investigations of suspected biogeochemical problems originating from airborne contaminants in and near selected national park units. Study designs and specific objectives differ from one park region to another and include: (1) the use of lichens (or other epiphytes) or vascular plant species as biomonitors of possible phytotoxic conditions; (2) the use of native materials to determine the region of measurable influence of a suspected point source of sulfur and/or metal contamination; and (3) the establishment of baseline biogeochemical and geochemical levels so that the magnitude of chemical changes with time can be monitored. This report presents results of FY-84 and FY-85 studies in and near Everglades and Biscayne National Parks, Florida.

The following list is a summary of the major conclusions from the study:

1. This study was designed to measure the relative importance of the effect of emissions into the air from the Turkey Point electrical power generation facility on the sulfur and trace-metal levels of nearby vegetation. The region of measurable influence of the power plant could not be precisely defined by utilizing total sulfur, stable suflur isotope ratios, and trace-metal information from samples of plant and soil materials. This area has an extremely complex set of ecosystems and even though the operation of the power plant has had some effect on the chemistry of materials sampled close in (within about 1 km) a major regional influence could not be demonstrated.

2. Plant and soil materials were collected using a study design of three parallel east-west traverses all of which originated on the coast; one also originated at the power plant on the coast. Element regression trends along the power plant traverse were usually dissimilar to trends along the other two traverses. This dissimilarity is interpreted to be the result of a complex set of influences that include (1) dry and wet deposition of substances of marine origin, (2) dry and wet deposition of substances originating from the operation of the power plant (general construction and maintenance activities as well as stack emissions); (3) dry and wet deposition of substances from other complex anthropogenic sources; and (4) uptake and translocation by plants of substances from supporting soils.

3. It is unclear whether or not the activities of the power plant elevate the concentration of certain metals in vegetation samples above some reference level. Levels of aluminum, cobalt, chromium, copper, lead, nickel, vanadium, and zinc in Australian pine and Brazilian pepper leaf samples do not markedly decrease with increasing distance from the power plant (traverse 1). This is due in part because the concentrations in samples from the closest site (0.97 km) are generally low in trace metals. These low values may be due to a "shadow" effect; measurable deposition not found close to the facility. There is a general increase in metal concentrations between 4 and 8 km along traverse 1. Also, there is some evidence, from trace-metal levels in samples collected at the furthest sites (26.5 and 37 km distant from the power plant), that an increase in metal levels occurs here and that long range transport and deposition may be occurring. These trends are confounded by the uncertain influence of a diversity of soil types encountered at the various study sites. Our data suggest that metal deposition may be occurring beyond about 8 km; however, additional studies would be necessary to precisely define this process.

4. The facility burns a mixture of fuel oil and natural gas. The oil contains about 1 percent total sulfur and the natural gas about 9.6 kg of sulfur per 10^6 m^3. The oil/gas consumption ratio, however, is variable over time and therefore the amount of sulfur emitted is also highly variable. Our study should be viewed as an integrated "snapshot" of the influence of the power plant over about a one-year period (the plant material sampled was from the previous growing season) and any extrapolation of these data should be done with appropriate caution.

5. All plant, soil, and oil samples were analyzed for the total concentration of twenty-four elements. Also, all plant and oil samples, and selected soil and seawater samples, were analyzed for stable sulfur isotope abundances.

6. Sodium and total sulfur levels in plant leaves decrease with increasing distance from the coast along all three traverses. These trends are strong evidence that the sea is a source of these elements in vegetation. Total sulfur levels along the power plant traverse are only slightly elevated when compared to samples along the other two traverses.

7. The relative abundance of stable sulfur isotopes in vegetation helps discriminate the sulfur in vegetation that is being contributed by the sea from that which is being contributed by the operations of the power plant. Fuel oil samples possessed δ^{34}sulfur values equal to about zero °/oo and the only similar δ^{34}sulfur values in vegetation were found at a site 0.97 km from the power plant. Marine sulfate has a δ^{34}sulfur of about +20°/oo and samples collected elsewhere near the coast appear to reflect the influence of the addition of sulfate with this large positive value.

8. Vegetation and soil samples collected along a north-south traverse (traverse 4) progressing away from a portland cement manufacturing facility showed no meaningful element concentration versus distance trends.

9. Except for collections along traverse 4 (cement plant/agriculture traverse), the soils encountered in this study were highly variable in their composition and their utility as a sampling medium for the definition of measurable power plant emission effects is limited.

10. No significant difference was found between the element concentration of plant leaf samples collected while wearing rubber gloves to identical samples collected while not wearing gloves.

11. Samples of young and old *Casuarina equisetifolia* wood from trunks of 10-year-old trees showed no historical difference in element concentrations between the sections. Trends of decreasing molybdenum concentration in young and old wood with increasing distance from the coast and power plant could not be explained as being the result of operations at the electrical generation facility.

INTRODUCTION

Background and Purpose

The U.S. National Park Service (NPS) is responsible for protecting the air quality of park regions from significant deterioration. The U.S. Geological Survey (USGS) and the NPS are assessing the effect of known contamination sources on the sulfur and trace-metal concentrations in plants, soils, and other natural materials at selected park units throughout the U.S.A. (Gough and others, 1985). Results of these studies are used in air-quality management decisions for the park units and for areas adjacent to them.

The purpose of this report is to present results from studies of element concentrations in plant leaves and wood, soils, fuel oil, and water collected in and near Everglades and Biscayne National Parks, southern Florida (fig. 1).

This study was designed to measure the relative importance of emissions from the Florida Power and Light (FPL) Turkey Point electrical power generation facility on the sulfur and trace-metal levels of nearby vegetation. Our purposes were to distinguish between anthropogenic and natural sulfur and trace-metal sources and, by sampling principally plant materials, estimate the region of measurable influence of the power plant emissions.

The FPL Turkey Point power plant has been in operation since 1967. The facility consists of two fuel-oil-fired and natural gas-fired generation units (367 MWe each with a daily consumption of about 20,000 barrels of bunker-C-grade oil and 4,000 barrel-equivalents of gas) and two nuclear-powered units (646 MWe each). The power plant cannot now burn oil that contains greater than 1 percent total sulfur; natural gas, however, seldom contains greater than 9.6 kg of total sulfur per 10^6 m^3. Because the oil/gas consumption ratio is variable over time (due to the fluctuating world market prices and fuel availability) the annual sulfur emissions also vary as follows (approximate metric tons of sulfur yr^{-1}): 1980--11,500; 1981--8,000; 1982--5,500; 1983--12,000; 1984--7,000; 1985--4,000.

The power plant is in a mixed urban and agricultural region adjacent to Biscayne National Park and approximately 28 km east of Everglades National Park and 60 km southeast of Big Cypress National Preserve (fig. 1). The area has a subtropical climate and vegetation-type, diverse soils, and is underlain by the Miami Oolitic Limestone and Key Largo Limestone, both of Pleistocene age (Craighead, 1971; Hoffmeister and others, 1967; Puri and Vernon, 1964; and Gallatin and others, 1958). Winds are seasonally variable but are dominated by onshore breezes from the Atlantic Ocean (U.S. Department of Commerce, 1968). The annual prevailing wind direction is from the southeast at a mean annual speed of about 14.5 km hr^{-1} (9 mi hr^{-1}).

Literature Review and Discussion of Contamination-Source Models

The literature is replete with a great diversity of techniques using various sample media in the identification of anthropogenic and natural atmospheric elemental emission sources. Atmospheric gases and particulate matter, precipitation, surface waters, vegetation, and soils have all been analyzed in order to quantify elemental emissions, identify relative source contributions, and assess the region of influence of point and non-point sources. Source-based models, utilizing emission inventories and dispersion predictions, and receptor-based models, using enrichment factors, chemical element balances, factor analysis, element concentration-distance trends, and stable isotope ratios, have all been used. Source-based models suffer from uncertainties or inaccuracies in the emission inventories and dispersion models whereas receptor-based models suffer from the difficulties inherent in identifying contributions from multiple sources at a receptor site.

The determination of element enrichment factors in a sample medium such as atmospheric particulate matter or soil at a sample site is perhaps the simplest receptor-based technique used to identify emission sources (Lee and Daffield, 1979). Enrichment factors are typically calculated by determining the ratio of two elements, such as a volatile trace metal and a major non-volatile element, in atmospheric particles to their ratio in crustal material. The enrichment-factor technique has been used to identify mineral

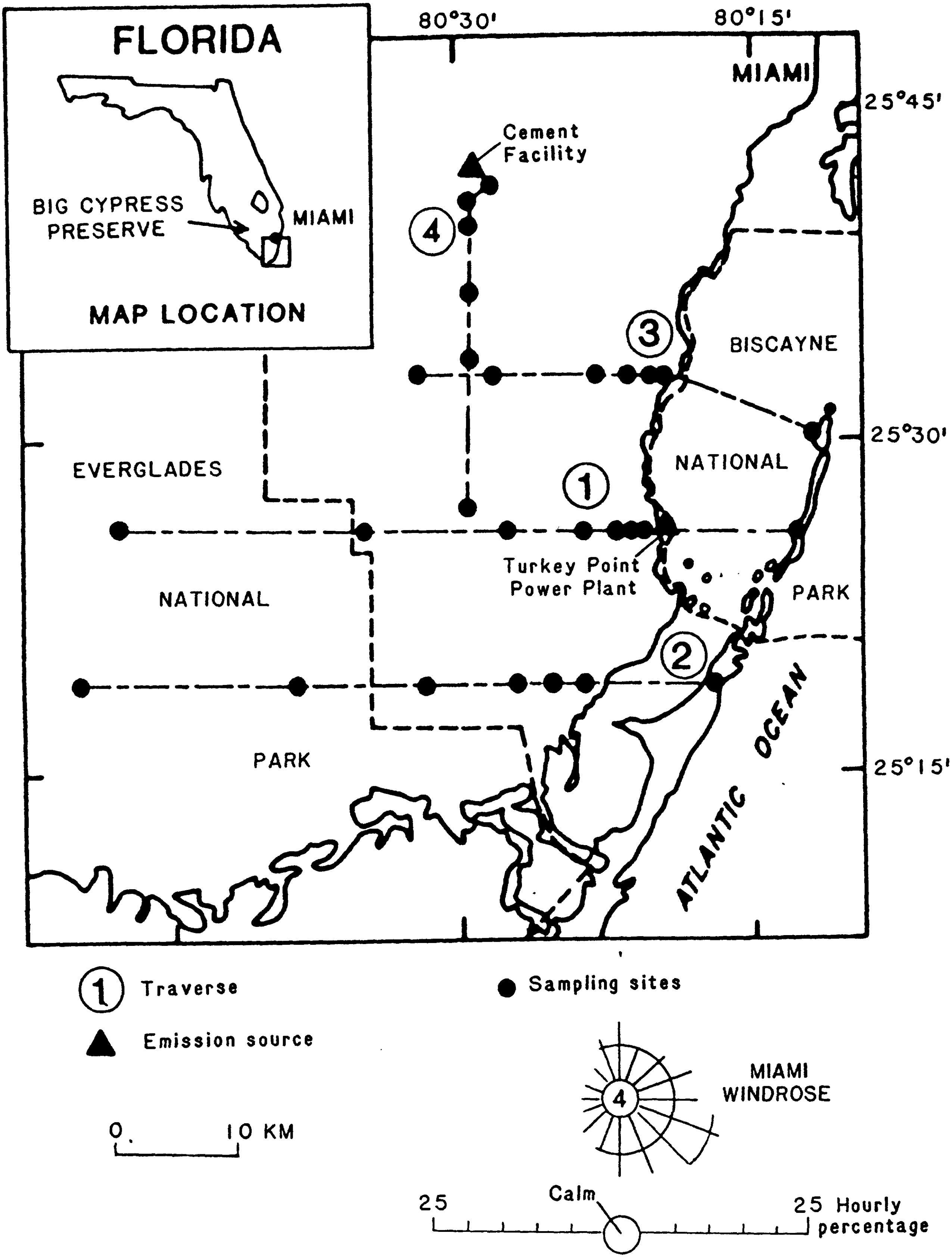


Figure 1. Map of the south Florida study area showing the three east-west and one north-south traverses and the position of the Turkey Point power plant relative to Biscayne and Everglades National Parks. The Miami windrose displays the wind direction along 16 compass points on an hourly percentage basis.

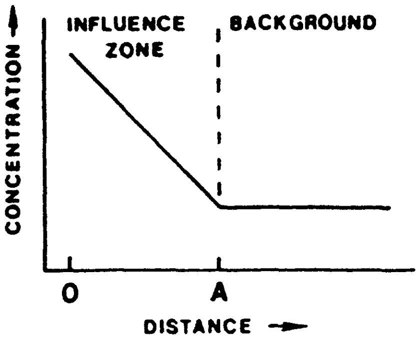
aerosol particles transported to Bermuda from the Saharan Desert (Savoir and Prospero, 1980; Chen and Duce, 1983). It should be noted that the determination of enrichment factors alone may be inconclusive if the emission process or sample media fractionates the elements ratioed.

An extension of the enrichment factor technique is the use of chemical element balances to identify relative strengths of emission sources. This receptor-based model is frequently applied to atmospheric particulate matter where the composition of collected particles is assumed to be a linear function of the chemical composition of particles from all of the emitting sources. In order to identify source strength or contributions from a specific source at the receptor site, a unique elemental pattern or "fingerprint" must be associated with each contributing source. In practice, the elemental pattern at the source is usually related to patterns in the collected material despite possibly significant fractionation in the material between emission and collection at the receptor site. This technique has proved valuable in determining the relative source strengths for different classes of emissions in Pasadena, California (Friedlander, 1973) and in Washington, D.C. (Kowalczyk, Gordon, and Rheingrover, 1982). Marker elements such as Al, Ca, Na, Pb, and V were used to identify soil, cement dust, marine, motor vehicle, and fuel-oil components.

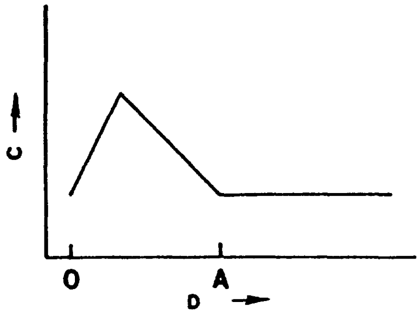
Another technique commonly used to define the minimum region of influence of a point source is the determination of elemental concentration trends in soil and vegetation with respect to distance from an emission source. Typically, a negative correlation between concentration and distance from the source is found for emitted elements. Several hypothetical models are shown in the diagrams below, along with possible explanations, for concentration of an element in a receptor versus distance from a point source.

In model I a point source emits an element m and all receptor sites are sampled at one instant in time and assumed to be equally efficient collectors. As seen in this model there is a negative correlation with the concentration of m versus distance from the source up to the point at which the background concentration is reached. This distance (0 to A) defines a region of influence for the emitting source. Model II illustrates a situation in which chemical conversion of the emitted species occurs during transport away from the source and the receptor only collects the reaction product. An example of this situation might be oxidation of an emitted species during transport. Model III demonstrates a similar situation to model I; however, two point sources, or pseudo-point sources with different regions of influence, emit the same elemental species (as, for example, fine particulates) from the same point. An example of this model would be a point source situated on the ocean coastline. In model IV a less distinct negative correlation between concentration and distance may be found if the background concentration of m varies greatly. Model V demonstrates the influence and importance of the sampling time. If the emissions by the source vary or there are climatic, diurnal, or seasonal influences on dispersion or on the receptors, variations in the regions of influence around a point source can be expected. Differences in the regions of influence might be obtained based on the selection of the receptor used, such as soil versus vegetation sampling or sampling of different plant species. Hence, regions of influence determined by this technique should only be considered as the minimum region of influence and caution should be used in interpreting results where competing emission sources may be involved.

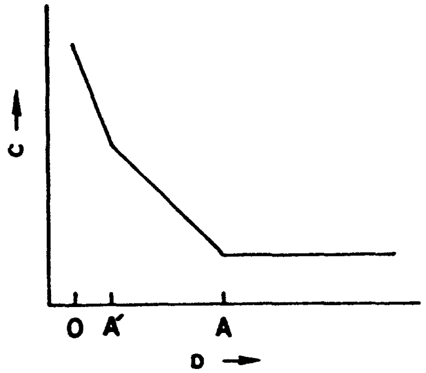
Model I



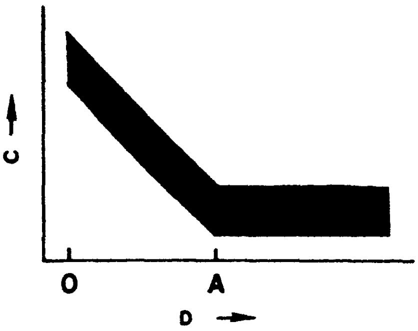
II



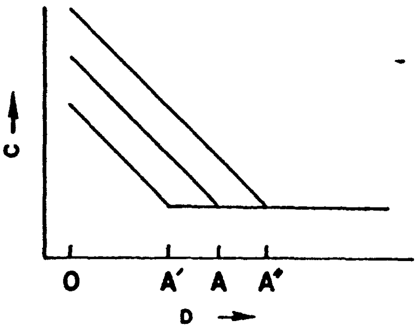
III



Model IV



V



The inverse linear relationship between element concentration in soil and vegetation and distance from an emission source is frequently found near fossil fuel power plants (Connor and others, 1976; Gough and Erdman, 1977; Nygard and Harju, 1983) and refineries (Case and Krouse, 1980) or other types of processing facilities (Severson and Gough, 1976). Typically the concentration trends for selected trace metals such as vanadium from fuel oil (Zoller and others, 1973) or sulfur from coal, are measured in native vegetation. Differences in emission-source-related trace-element concentrations may be found among different plant species due to differences in longevity, absorptive surfaces, metabolism, growth-form, habitat, and microenvironment (Severson and Gough, 1976; Gough and Erdman, 1977).

Importance and Use of Stable Sulfur Isotopes in Emission Studies

Stable isotope ratios can be used to identify relative source contributions. The stable sulfur isotopes $\delta^{32}S$ and $\delta^{34}S$, with natural abundances of 95.02 and 4.21 percent, respectively, have been used to study emissions, particularly from the processing of fossil fuels. The sulfur isotope ratio is usually measured in the sample relative to the isotope ratio in a meteoritic troilite standard. The enrichment-factor determined is expressed as δ^{34}sulfur in parts per thousand (°/••) or per mil.

$$\delta^{34}S°/•• = \frac{[\,^{34}S\ /\ ^{32}S\,]\ \text{sample}}{[\,^{34}S\ /\ ^{32}S\,]\ \text{meteorite}} - 1 \quad \times 1000$$

Due to different reaction rates for each isotope a separation or fractionation of isotopes occurs in many biological processes; the reduction of sulfate by anaerobic bacteria is the predominant fractionation process in nature. In the reduction of sulfate the sulfides produced are enriched in ^{32}sulfur and the residual sulfate is enriched in ^{34}sulfur. Since biological activity and repeated oxidation and reduction of sulfur play a major role in the geochemistry of the near-surface environment, a wide range of sulfur isotope ratios result. For example, coal may have δ^{34}sulfur values as negative as -30°/••, whereas some sulfate minerals may be as positive as +87°/••. Petroleum δ^{34}sulfur values typically range from -8 to +32°/•• (Hoefs, 1980). The open ocean seawater is quite constant at about +20°/•• although it has ranged from +10 to +30°/•• over geologic time.

A variety of environmental studies have been done using the sulfur isotope signature of emission sources to evaluate relative source strengths. Holt and others (1972) examined the variation in sulfur isotopes in surface water, well water, rain, and atmospheric SO_2 and sulfate particulate matter near Chicago. Grey and Jensen (1972) performed a similar study in the Salt Lake City area. They also measured isotopic ratios in surface water, precipitation, and air samples. Grey and Jensen found that the local copper smelters generally had a dominating role in the atmospheric sulfur isotope ratios but during prolonged shutdown of smelters bacteriogenic sulfur became the dominant source of atmospheric sulfur in the area.

Hitchcock and Black (1984) used sulfur isotopes to determine the biogenic contribution to the atmosphere at a rural salt marsh on the Virginia-Atlantic coast. They determined a variety of elements and sulfur isotope ratios in atmospheric particulates. Using chemical element balances and isotopic ratios, they differentiated among the biogenic, oceanic, and anthropogenic sources of sulfur. They determined vanadium and lead, iron, and sodium in the particles in order to identify the anthropogenic, crustal material, and oceanic contributions, respectively, to the ground-level sulfur cycle. They concluded that bacteriogenic $H2_S$ produced in the anoxic marsh sediments dominated this cycle.

Krouse and coworkers have done extensive studies using sulfur isotopes in soils and vegetation to determine the influence of Canadian natural-gas refineries on the chemistry of nearby vegetation. They have found that the sulfur isotope ratios in lichens and mosses are similar to those in atmospheric sulfur oxides, whereas conifer needles exhibit sulfur isotope ratios intermediate between sulfur isotope ratios found in local air and soil (Krouse, 1977; Winner and others, 1978; Case and Krouse, 1980). In a study of the Fox Creek, Alberta area, Krouse and coworkers found that the sulfur concentration in conifer needles and arboreal and terricolous lichens decreased with distance away from a sour-gas processing facility (Case and Krouse, 1980). Because plants do very little fractionating of sulfur isotopes during assimilation, Krouse (1980) confirmed that the increase in sulfur content in the vegetation near the gas facility was due to incorporation of sulfur emitted as SO_2.

In a similar study in the Peace River region of Alberta, baseline data were collected shortly after the beginning of operations of a new gas processing facility (Krouse and Case, 1981). In this region the vegetation and soil sulfur concentrations were isotopically correlated with sub-surface mineralogy and not to the operation of the gas facility. They also showed in an isotopic study near Paige Mountain, N.W.T., Canada, that vegetation and soil sulfur correlated with natural biogenic emissions of H_2S from springs (Krouse and Van Everdingen, 1984). However, in this area where the atmospheric sulfur and groundwater sulfur are isotopically different, although derived from a single evaporite strata, they observed large isotopic variations among sample media over relatively short distances because the vegetation and soil incorporated different proportions of the sulfur from the two sources.

ACKNOWLEDGMENTS

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Co-authors J. P. Bennett and J. R. Wilcox are ecologists with the NPS and FPL, respectively; the other co-authors are botanists, chemists, and soil scientists with the USGS.

STUDY DESIGN AND DATA EVALUATION

The initial field work was conducted between April 20-30, 1984; some study sites were revisited on March 22-24, 1985. The main objective of the study was to distinguish among various south Florida sources (both native and anthropogenic) of sulfur and metals in natural materials. Suspected sources include the following: (1) marine--aerosol and particulate deposition; (2) rocks, soils, and surface and ground water--wind-blown deposition and solute uptake by plants; (3) biogenic--gaseous and solute uptake by plants; (4) urban--gaseous and particulate deposition from populated areas of south Dade County; (5) agriculture--deposition of pesticides, herbicides, and fertilizers; (6) manufacturing--gaseous and particulate deposition from a portland cement factory; and (7) Turkey Point power plant--aerosol, gaseous, and particulate deposition.

The study design was chosen to maximize our ability to segregate the influence of the power plant from other chemical element sources and, at the same time, be as economical in resources as possible (Miesch and Huffman, 1972). Three parallel east-west traverses were positioned about 12 km apart (fig. 1) with sampling sites spaced at intervals that increased geometrically in a westerly direction (essentially downwind, fig. 1). In general, the sites were located well away from obvious local sources of contamination such as major roadways, electrical sub-stations and power transmission lines, and active agricultural areas.

Traverse 1 (called the power plant/agricultural traverse) began 1.0 km west of the Turkey Point power plant on the coast and terminated 40 km west in Everglades park. Traverses 2 (native or undisturbed traverse) and 3 (urban/agricultural traverse) began 0.9 km west of the coast and terminated at distances of 38 km and 20 km, respectively. Like traverse 1, traverse 2 extended into Everglades park. Also, a site several kilometers east of each traverse was located on the outer islands (keys). These eastern sites were within the boundary of Biscayne park for both traverses 1 and 3. One additional traverse (traverse 4) was established; it began 0.5 km southeast of the General Portland Inc. cement plant and extended south for about 25 km (cement factory/agricultural traverse). Except for the sites located nearest the coast and on the keys, all areas were classified vegetationally as pine lands or everglades or man-disturbed equivalents of both.

Along each traverse at the individual sampling sites, leaves, wood, and/or needles from several species (table 1), and the surface horizon of soils (usually to a depth of 10 cm), were collected at paired locations separated by 20 to 50 m; site-replicate samples provided an assessment of chemical variability over small distances. Depending on the availability of the material, as many as seven sample pairs of each type of material were obtained (fig. 1, appendixes I and II).

For each traverse, simple linear regression analysis was used to evaluate the relation between element concentrations in sampled materials and distance. The square of the correlation coefficient (r^2) of this relation is the coefficient of determination. This term, when multiplied by 100, gives the percentage of the total variance in the data that can be attributed to the relation between element concentration and distance. Prediction equations were generated of the form:

$$\log_{10}Y = a + b \log_{10}X$$

where Y is the estimate of the elemental concentration in the sample and X is the distance in km from the coast and power plant. The coefficients a and b were estimated by least-squares methods and are the intercept and slope, respectively.

The analytical data for some elements are missing (usually because of an insufficient amount of sample material) or include values that are below the limits of analytical determination (appendixes I and II). These latter values are expressed as less than (<) a stated value and are said to be "censored." In general, if element concentration data possess missing or censored values it was not included in any of the statistical tests.

Except for the test that evaluated sample handling as a potential source of contamination we do not present mean estimates. A study design that incorporates logarithmic distances from a suspected point source of contamination disporportionately weights the close-in samples and, therefore, mean and deviation estimates are inappropriate statistics.

The term "background concentration" has a very specific meaning and usage in environmental geochemical studies (Tidball and Ebens, 1976) and for purposes of this study we choose to use the term "reference concentration." This distinction, and the application of the reference concentration, is explained in the "Results" section.

SAMPLE COLLECTION, PREPARATION, AND ANALYSIS

Table 1 lists the materials sampled at sites along each of the four traverses. Because much of the study area is in a disturbed condition, introduced (non-native or exotic) plant species (Crowder, 1974) were found to be widely distributed and two of these were chosen for collection: the shrub Brazilian-pepper and the tree Australian-pine (also known as beefwood, an angiosperm and not a true pine) (Small, 1933). Although generally not as broadly distributed along the traverses, buttonwood, slash-pine, and sawgrass, all native species, were collected. Table 1 also lists some materials that were collected only occasionally.

Plant materials were clipped, using stainless-steel shears, or stripped while wearing rubber gloves which were worn as a precaution against contamination from handling. A test was made to measure the relative importance of this source of sampling error and is reported in the "Results" section.

The plant samples consisted of about 50 g of material and were stored in cloth bags and air dried. Leaves judged to be from the previous year (1983) were collected from Brazilian-pepper, Australian-pine, and buttonwood. Needles, also from the previous year, were collected from slash-pine. The Brazilian-pepper and buttonwood samples consisted of a composite of material from numerous individuals at each site; material from Australian-pine and slash-pine were from only one individual per site. The mean leaf area per unit of weight (specific leaf area, Martin and Coughtrey, 1982) that is displayed by a plant species varies with time of year, position of the leaf on the plant, and other physiological and ecological factors; therefore, each sample consisted of numerous leaves collected from several locations around the plant. Sawgrass samples consisted of all material 10 cm above ground (or water level) collected within a 1-m^2 area.

Growth rings identified in the trunk wood of slash-pine may or may not represent annual increments (Tomlinson and Craighead, 1972); the same is presumed to be true for Australian-pine which is even more physiologically aligned with tropical plant species. In order to test historical differences in the metal levels of the wood of these two species over time, therefore, sections were excised and analyzed separately. Logs with outside diameters of between 10 and 15 cm were cut from live, standing trees. The logs were then cut radially into sections several centimeters thick. The bark and phloem were removed using a band saw and the sections were then divided into the outer 1.5-cm material (called young trunk wood) and the remaining inner core (older trunk wood) (table 1). Based upon the size of Australian-pine found growing in dredge material from canals of known age on FPL property, trees with diameters of 10 to 15 cm are estimated to be about 10 years old.

At each collection site a well-homogenized sample of the top 10 cm of soil was taken within about 5 m of the plant samples. This consisted of approximately 1 kg of the less than 1-cm-sized material from an area of about 100 cm^2. All collections were placed in paper bags of known element content (soils) or into cloth bags (plants) and were stored at ambient temperature. In the laboratory the plant material was oven dried at 40°C for 48 hours and ground to pass a 1-mm sieve. Soil samples were dried at ambient temperature and then disaggregated using a ceramic mortar and pestle. The fraction passing a 10-mesh sieve was used for pH determinations. Material ground to pass a 100-mesh sieve was digested and used for total element analysis.

Oil samples were obtained from FPL on a monthly basis from April, 1984 through March, 1985. These samples represent a composite of the "as fired" oil burned in the two electrical generation units over a 1-month period. According to D. Knudson (FPL chemist, personal communication, 1986) the oil is blended by their major wholesale suppliers to contain no more than 1 percent total sulfur. For the past 3 years FPL has obtained mostly "Gulf Coast" oils, which are generally low in vanadium (<50 ppm, as received), rather than oils from South America, which are generally much higher in vanadium (>100 ppm, as received).

All plant, soil, and oil samples were analyzed for the total concentration of 24 elements using inductively coupled plasma emission spectroscopy and combustion-IR analysis. Also, all plant and oil samples and selected soil and seawater sulfate samples were analyzed by mass spectrometry for stable sulfur isotope abundances. The analytical methodology for the plant and soil material, and also the other miscellaneous materials that were collected, is detailed in table 2.

Examination of the plant samples in the laboratory before they were ground revealed very little superficial dust contamination and the material was therefore not washed. The percent ash yield information (appendix I) tends to support this assumption. An examination of all replicate sample pairs for traverses 1, 2, and 3 combined, showed that 45% and 43% of the variability in the ash yield data for Australian-pine and Brazilian-pepper leaves, respectively, was between replicated samples at a location. If the samples had been grossly contaminated, this proportion of the total variability would be expected to be much larger.

RESULTS

Sample Handling as a Potential Source of Contamination

There is some discussion in the literature concerning the handling of samples as a source of heavy-metal contamination (Glooschenko and others, 1981) and as a source of the alkali metal cations potassium and sodium (C. Wetmore, personal communication, 1983). The high ambient temperatures and relative humidities of south Florida, and the resultant tendency to perspire heavily, presented an ideal opportunity to test the null hypothesis that the handling of samples, without gloves, had no effect on the element levels of the plant material sampled. All Australian-pine and Brazilian-pepper leaves along traverse 3 were collected with and without the use of rubber gloves (Playtex). The outside surface of the gloves was not touched when they were put on or removed; they were also rinsed after each use. Table 3 lists the results of a t-test comparison of the level of 14 elements and ash yield, in five pairs of Australian-pine leaf samples and 12 pairs of Brazilian-pepper leaf samples. Elements with censored concentration values were not tested.

These data indicate that we must accept the null hypothesis because none of the differences were significant. Only three element comparisons gave relatively large t-values: barium, potassium, and strontium in Brazilian-pepper. However, except for potassium, higher average concentrations were found with the group that was handled using gloves. Although all of the samples in the study (except those in this comparison test) were handled while we were wearing gloves, the procedure is apparently unnecessary. We could find no conclusive evidence that would contradict this assumption for those elements with censored values that were not compared in this test; however, the smaller the concentration of an element in the material sampled, the more important precautions against introducing contamination becomes.

Laboratory Error

Errors due to laboratory procedures must be small so as not to obscure the natural variation among the samples (Miesch, 1976). Laboratory error for individual elements was determined by analyzing duplicate splits of plant material; elements with censored concentration values were not tested. A one-way, two-level ANOVA was performed that measured the proportion of the variance in the data attributable to duplicate splits, for an individual element, relative to the total amount of variability. Table 4 shows that of the 13 elements (and ash yield) tested, only zinc had an important proportion (>50 percent) of its total observed variation attributable to laboratory error. In this report, therefore, the data for zinc in plant material are interpreted with caution.

Element Concentration Trends Along Traverses

Strong evidence exists that a particular element in sampled material may be associated with some source of emission if the concentration of the element decreases with increasing distance from the suspected source. The element-concentration data in appendixes I and II are ordered relative to increasing distance (top to bottom) from several sources (marine, Turkey Point power plant, and cement plant), and a cursory examination of the data in appendix I (plants) shows several possible trends.

Plant materials

Tables 5-13 list the linear regression intercept and slope estimates for those elements in plant materials that did not possess missing or censored data. Regressions are presented for samples collected along each of the four traverses.

Possible cause-and-effect relations between emission sources and element levels in plant tissue can be suspected if the covariation between logarithms of element concentration in plant or soil material and logarithms of distance along the traverse (the correlation coefficient, r) is negative and greater in absolute value that is judged to be important. In our studies this threshold value has proved to be about 0.60 (an r^2 of about 0.36) (Gough and Erdman, 1977; Severson and Gough, 1979; and Gough and others, 1985). A negative slope indicates an inverse relation between element concentration and distance from the suspected emission source. An r^2 value of 0.36 means that 64 percent of the total variability in the data requires some explanation other than the relation between element concentration and distance. Some of this variance is due to laboratory error. Table 4 lists estimates of the percent of the total error attributed to laboratory procedures; however, these estimates are based on analyses of duplicated samples represented by all of the plant material types and therefore an addition of this error term to the coefficients of determination (multiplied by 100) listed for individual plant species (tables 5-13) has to be done with appropriate caution.

Also given in tables 5-13 are the number of samples used in the calculation of the regression estimates. This number is twice the number of paired (site-replicated) samples collected (see Study Design section). An odd number means either that only one sample at a particular site was collected because of the unavailability of material, or that there was an insufficient quantity of material for all analytical determinations (see appendix I). The observed element concentration ranges are presented as an indication of the spread in the data. These equations are not presented for purposes of predicting element levels in plant material.

Sodium.--Figure 2 gives plots of the linear regressions (see tables 5-13) for sodium versus distance from the ocean coast. Examination of this figure shows that the concentration of sodium decreased in Australian pine leaves with increasing distance along traverse 1 only to about 8 km; beyond 8 km sodium concentrations begin to increase. The positive slope of the regression line for this traverse is dominated by the pair of points at 26.5 km. Concentrations of sodium in the same material but collected at only four sites along traverse 2 show a marked decrease in concentration beyond 8 km but fairly uniform concentrations between about 2 and 6 km. The negative slope of this latter regression is dominated by the pair of points at 12.9 km (appendix I). The plot of sodium in Brazilian-pepper leaves along traverse 3 (fig. 2) is very similar to the traverse 2 plot with concentrations essentially unchanged until about 8 km from the coast. A leveling-off of sodium concentrations appears to occur, therefore, along traverses 2 and 3 between about 4 and 8 km. These data support the general literature (see, for example, Junge, 1972; Gambell and Fisher, 1966) which state that the contribution of sodium from sea-salt aerosols is greatest within several kilometers of the coast. Sodium ascribed to marine sources can be found in rainwater many tens of kilometers inland but is most pronounced within about 10 to 30 km of the coast.

Figure 3 presents the same datum points as are given in figure 2 except that the display is a schematic planar view of the three traverses. The height of each plane (sodium concentration) is the average of site-replicated samples. This type of diagram is perhaps more graphic of the high sodium concentrations near the coast and also of the decrease in concentration, to perhaps background levels, at between 4 and 8 km inland.

Sulfur.--Data from Steudler and Peterson (1984) on the annual gaseous sulfur emissions from natural sources in an area of Massachusetts are given in table 14. They estimate a total of about 4.8 g of sulfur m^{-2} yr^{-1} is generated in a mixed marine-inland-salt marsh environment. Salt marshes emit the greatest amounts of sulfur and the authors show that H_2S and dimethyl sulfide are the two dominant sulfur forms. Using these estimates, an area of $2x10^6$ m^2 (200 km^2, which is the area encircled by a radius of 8 km from the Turkey Point power plant) would generate about $9.6x10^6$ g of sulfur yr^{-1} or 9.6 metric tons of sulfur yr^{-1}. These estimates are three or four orders of magnitude below the estimates for total sulfur emissions by the power plant that we list in the "Introduction."

Certain agricultural practices in the area near Everglades park must also contribute to the overall sulfur levels in native materials. Sulfur is not commonly added as part of general fertilization programs for area crops (R. Champagne, Dade County Agricultural Extension Agent, personal communication, 1984). Most of the fields around Everglades park are alkaline (pH 7.6-8.0), either because of rock-land (limestone) parent material or marl, and micronutrient metals and phosphorus must be added. Sulfur is being contributed to the atmosphere, however, through (1) the use of fuel-oil and natural gas in the drying of some crops (in particular, corn) and (2) the common practice of burning, in place, black-plastic sheeting that covers tomato rows. We sampled both used plastic (material in the fields with soil particles attached) and unused material and found both to contain about 0.35 percent total sulfur. The material has a calculated mass of 0.37g cm^{-2}. Assuming that 50 percent of a tomato field is covered by plastic, then a release of approximately 0.65 kg of sulfur ha^{-1} (or about 0.6 pounds $acre^{-1}$)

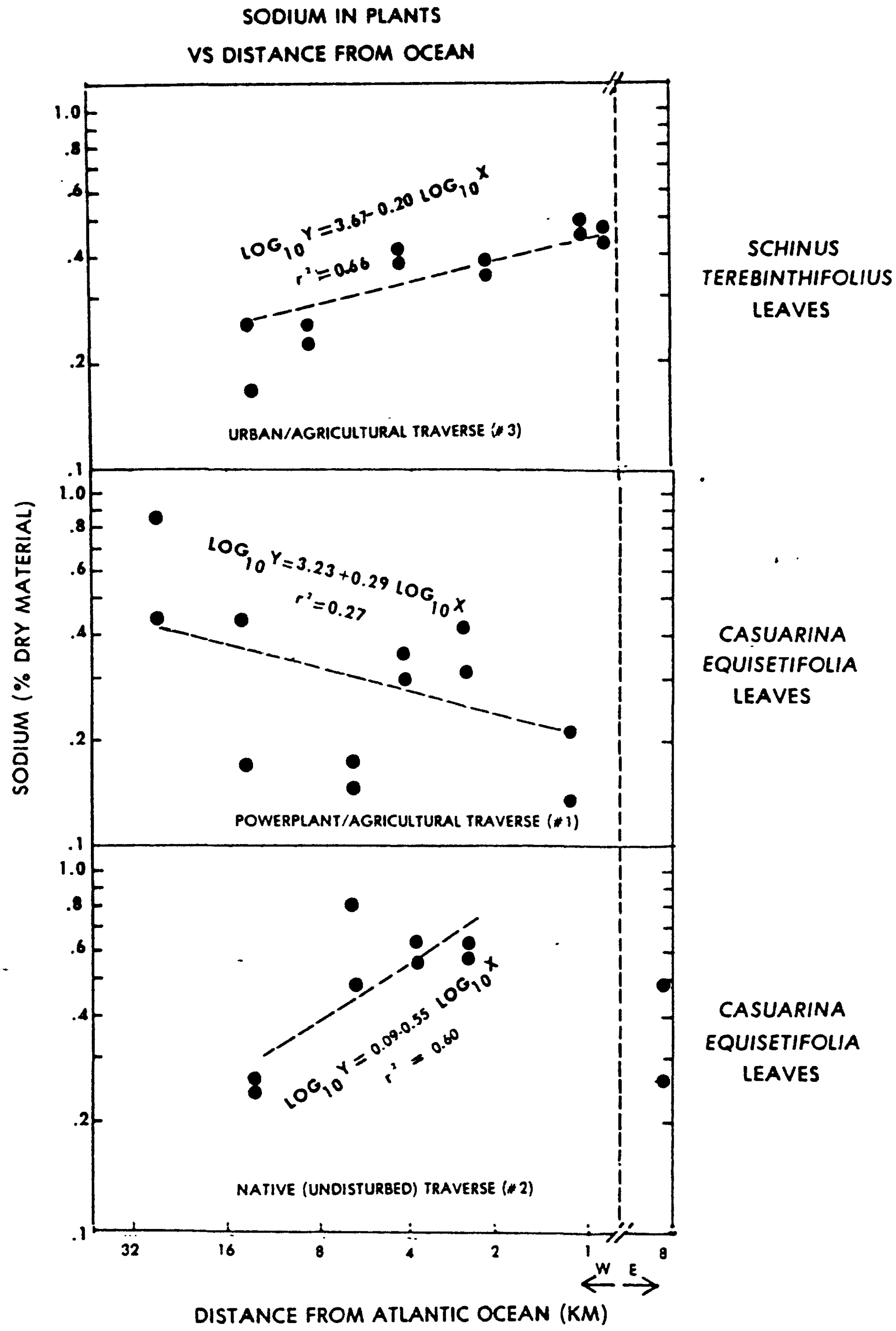

Figure 2. Linear regressions for log sodium concentrations in Casuarina equisetifolia (Australian-pine) and Schinus terebinthifolius (Brazilian-pepper) leaves versus log of the distance from the ocean coast along various traverses (see also fig. 1). Vertical dashed line represents ocean coast.

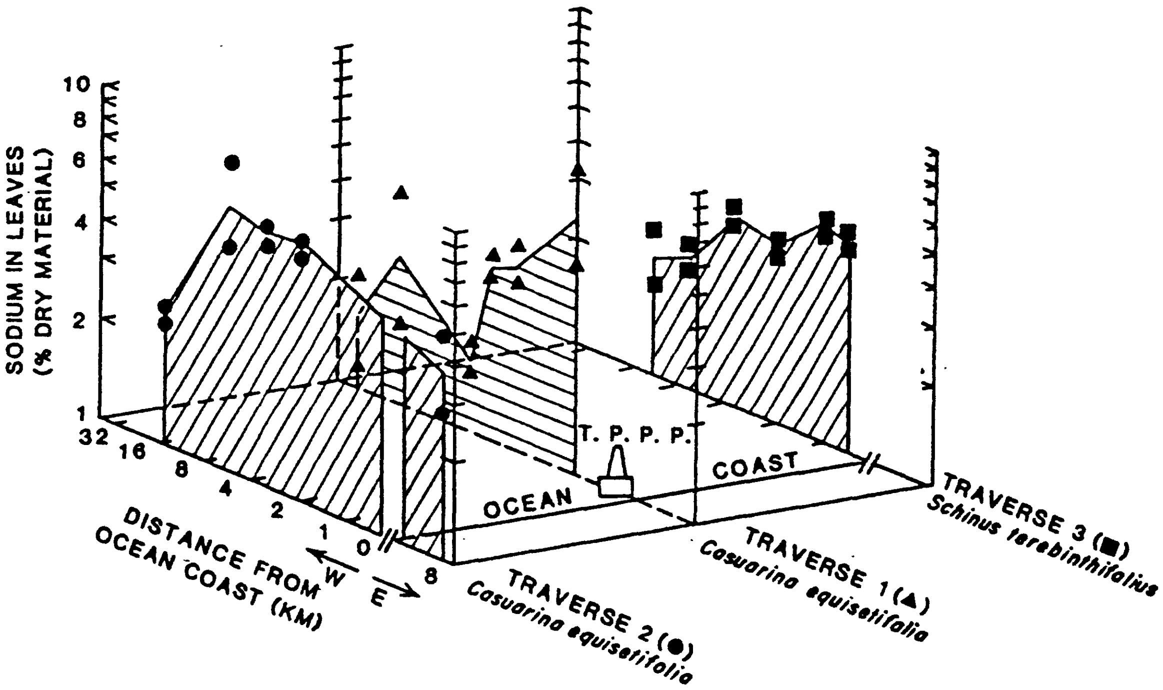

Figure 3. Schematic planar diagrams of sodium in plant leaves versus distance from the coast along the three parallel traverses. The height of the plane (concentration) is the average of replicate samples. T.P.P.P. refers to the Turkey Point power plant and its relative position on traverse 1. These data are the same as are plotted in figure 2.

could be expected. Again, these amounts would be far below the estimated sulfur tonnage released by the power plant. Much of the tomato production in the area, however, does occur adjacent of the eastern boundary of Everglades park.

Table 15 lists the chemical properties and anion concentrations of water samples collected within 3.2 km of the power plant along traverse 1. The relatively high sulfate level of seawater is shown by the sample collected in Biscayne Bay near the power plant. The remaining five are freshwater samples and do not qualify as being brackish (low electrical conductivity and chloride levels); however, they do show a general trend of decreasing sulfate levels with increasing distance from the coast. The source of the increased sulfate at sites 0.08 and 0.94 km could be a function of the operations of the power plant but could also be related to periodic flooding by seawater or the deposition of particulate sulfate aerosols, also of marine origin.

The annual gaseous sulfur emissions from natural sources estimated by Steudler and Peterson (1984) (table 14) do not include sulfur from the atmosphere as gaseous SO_2 or as particulate aerosol sulfate or as ammonium sulfate. We assume that these latter forms of sulfur contribute an important amount to the total natural occurrence of sulfur in south Florida but the power plant would remain the most significant, single localized emission source in the region.

Linear regressions of total sulfur levels in plant leaves with increasing distance from the power plant and the coast gave r^2 values of 0.56 and 0.71 (Brazilian-pepper) and 0.82 (Australian-pine) for traverses 3, 1, and 2, respectively (fig. 4). These trends are strong evidence that the sea is a source of sulfur for samples on these three traverses that originate on the coast. Figure 5 presents the same datum points as are given in figure 4 in a schematic planar view of the three traverses. Total sulfur levels in vegetation along traverse 1 (power plant/agricultural traverse) appear only slightly elevated compared to sulfur levels in samples of identical vegetation collected along traverse 2 or to sulfur levels in leaves of a different species along traverse 3 (fig. 5).

The possible additional influence of the power plant on the sulfur trend in traverse 1 is distinguished from the influence of the sea or biogenic sources by the stable sulfur isotope data (fig. 6). The following is a list of δ^{34}sulfur values for samples of fuel oil from the Turkey Point power plant which are considered by FPL to be composites of oil burned by the facility over a 1-month period.

Sample	Month/Year	δ^{34}sulfur value
P48	April/1984	+ 0.1[1]
P57	May/ 1984	- 0.3
P69	June/ 1984	- 0.7
P84	July/ 1984	- 1.8
P105	Aug./ 1984	- 2.9
P117	Sept./1984	- 0.2
P135	Oct./ 1984	- 0.5
P144	Nov./ 1984	+ 1.3[1]
P149	Dec./ 1984	+ 1.0[1]
P6	Jan./ 1985	- 0.9
P12	Feb./ 1985	+ 0.4
P34	Mar./ 1985	- 1.9

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[1] Average of duplicate analyses of the same sample.

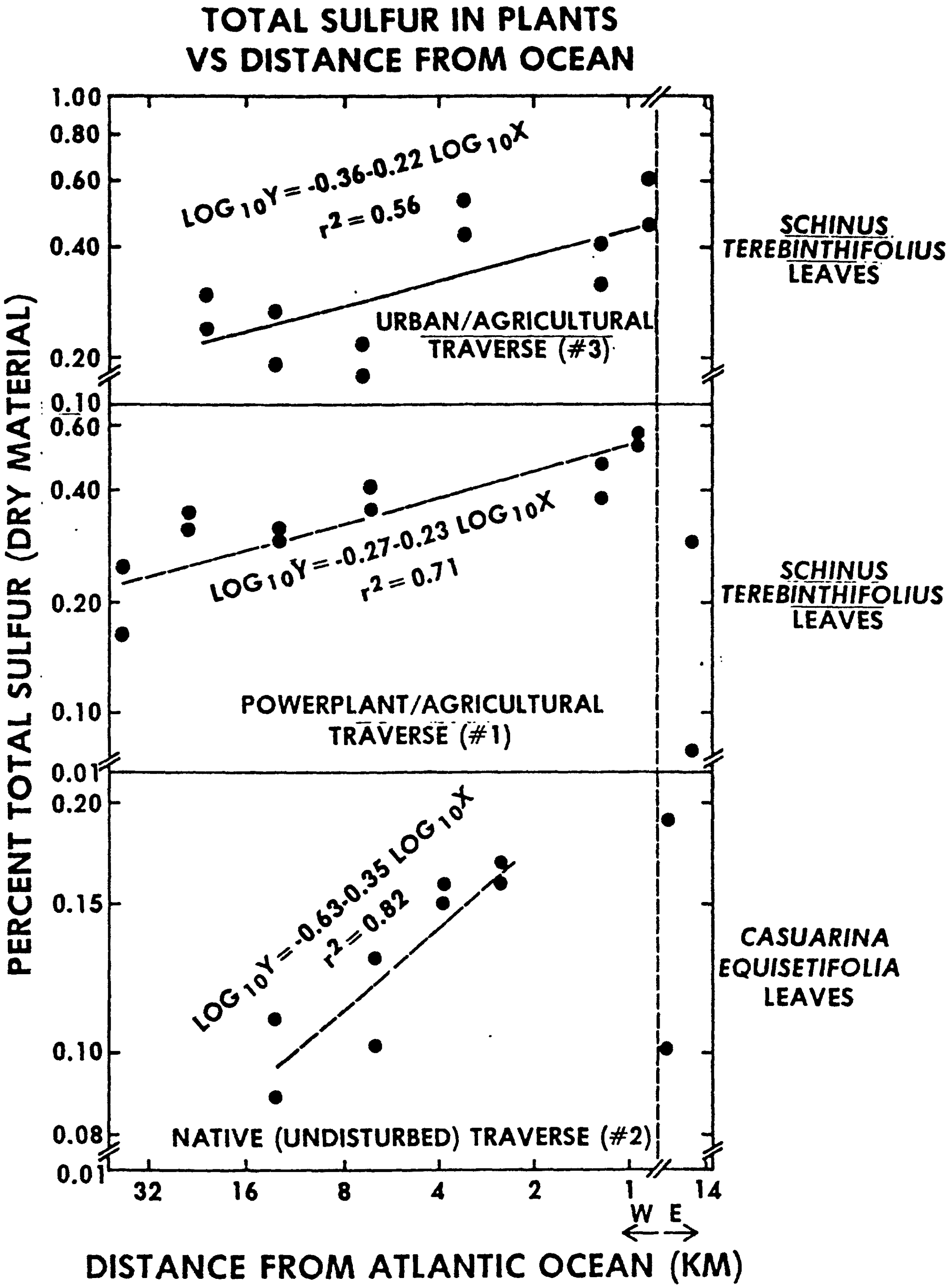


Figure 4. Linear regressions for log total sulfur concentrations in *Schinus Terebinthifolius* (Brazilian-pepper) and *Casuarina equisetifolia* (Australian-pine) leaves versus log of the distance from the ocean coast along various traverses (see also fig 1). Vertical dashed line represents ocean coast.

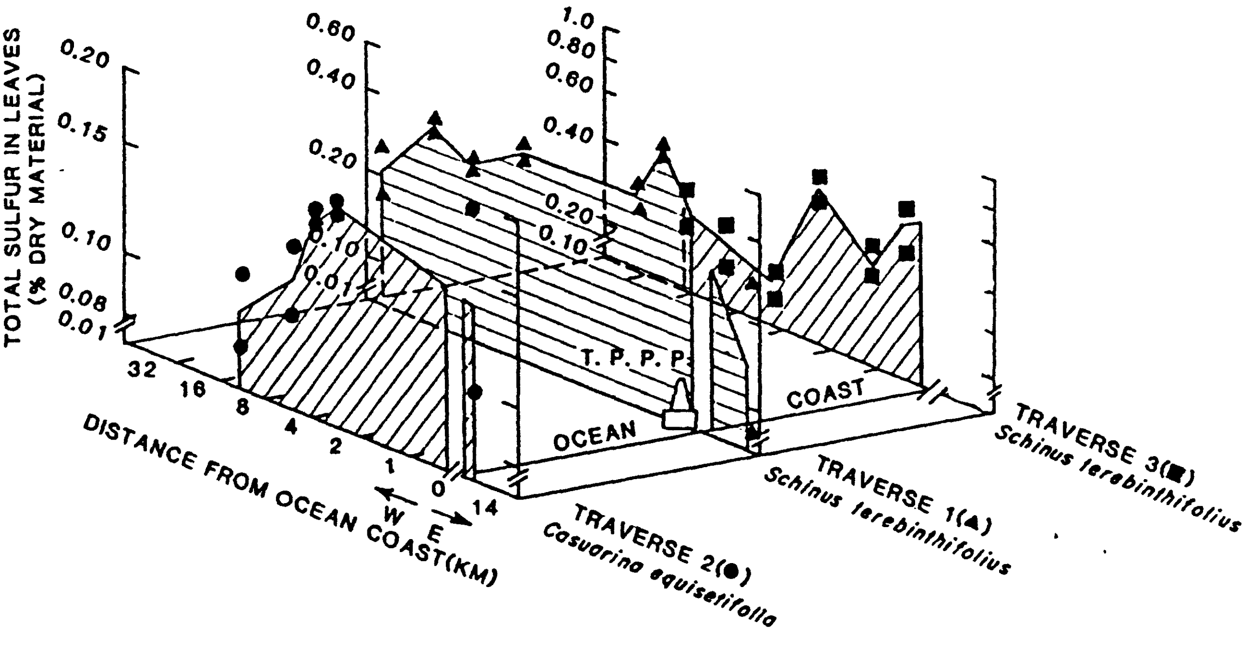


Figure 5. Schematic planar diagrams of total sulfur in plant leaves versus distance from the coast along the three parallel traverses. The height of the plane (concentration) is the of average replicate samples at sites where more than one samples was collected. T.P.P.P. refers to the Turkey Point power plant and its relative position on traverse 1. Note that the scales are different for the three traverses. These data are the same as are plotted in figure 4.

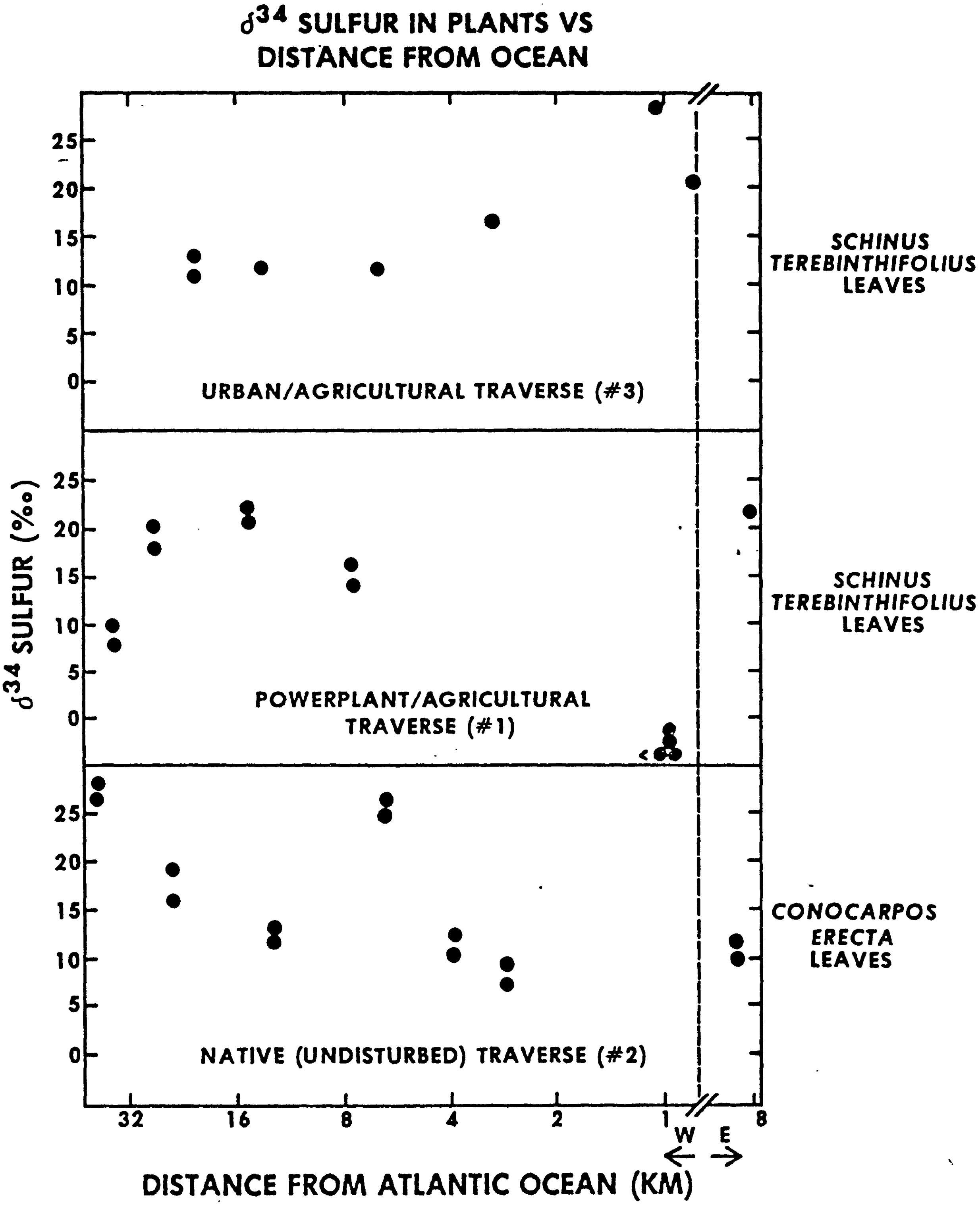


Figure 6. Plot of δ^{34}sulfur values in Schinus terebinthifolius (Brazilian-pepper) and Conocarpus erecta (buttonwood) leaves with distance from the ocean coast along various traverses on a semilog scale (see also fig. 1). Vertical dashed line represents ocean coast.

The $\delta^{34}S$ plot for traverse 1 shows that the sample nearest the power plant contained "light" (near zero) $\delta^{34}S$ values that we conclude originated from sulfate in fuel oil (average of +0.5 ‰ with a range of -2.9 to +1.3) rather than from seawater which has "heavy" $\delta^{34}S$ values (about +20.0 ‰ in the literature; our one sample from Biscayne Bay had a value of +23.8 ‰). Further, microbial processes in anoxic conditions (marsh environments) favor the reduction of $^{32}SO_4^{2-}$ (and its evolution as sulfide gases) relative to $^{34}SO_4^{2-}$, usually resulting in relatively "heavy" $\delta^{34}S$ values for vegetation and soils (Hoefs, 1980). Our traverses show predominantly positive values for plant samples (fig. 6) and for soils (+7.0 to +12 ‰, traverse 1).

Because we did not wash the plant material, the samples were considered receptors for the deposition of atmospheric sulfur. Although we are unsure of the relative influence on our data of absorbed versus adsorbed sulfur by the plants, coastal vegetation (traverses 2 and 3, fig. 4) all had large positive $\delta^{34}S$ values; only the Brazilian-pepper and buttonwood leaf samples collected 0.96 km west of the power plant (traverse 1) had negative ‰ values (Brazilian-pepper: -3.5, -4.4, -7.7, -4.9; buttonwood: -8.2). As with the sodium and total sulfur data above, the $\delta^{34}S$ values have been replotted in a schematic planar diagram (fig. 7). This latter figure is a graphic representation of the major influence that the very low $\delta^{34}S$ values have on the trend along traverse 1.

Trace metals.--At the time of this report, analyses for cobalt, chromium, vanadium, and sulfur concentrations in fuel-oil samples were available. Table 16 lists representative concentration ranges for these four elements in fuel oil as well as various other area materials. Except for the seawater and freshwater data, the values are from samples in this study. The data for soils and plants are not especially unusual (Kabata-Pendias and Pendias, 1984). Because vanadium is known to be concentrated in many bituminous sediments, oils, and coals (Hyden, 1961), we were especially interested in the concentrations of this element in area materials (table 16). The vanadium concentrations for fuel oils were not particularly large (Park and Dunning, 1961); however, a concentration of 46 ppm (table 16) translates to a concentration of 4.6 percent if the ash yield of the oil is 0.001 percent. Typical ash yields from oil are 0.001 to 0.0001 percent (Hyden, 1961).

A very liberal estimate of the amount of oil burned at the Turkey Point power plant in 1984 is approximately 2.0x10^6 metric tons of oil (assuming the combustion of 40,000 barrels of oil/day for 360 days). Nygard and Harju (1983) report from the literature that the combustion of 1,000 metric tons of "heavy fuel oil" emitted into the air, the following estimated metal amounts (kg) during 1984: vanadium (20), nickel (6.0), iron (2.2), lead (0.3), zinc (0.3), cadmium (0.007), and mercury (0.003). Using these estimates, the power plant could have emitted the following amounts of metals (kg): vanadium (28x10^6), nickel (8.4x10^6), iron (3.0x10^6), lead (0.4x10^6), zinc (0.4x10^6), cadmium (1.0x10^4), and mercury (4.2x10^3).

Figure 8 gives concentrations for aluminum, chromium, copper, and vanadium in leaf tissue of Australian-pine collected at sites west of the coast versus distance from the coast along traverses 1 and 2. The data for aluminum and copper do not contain values below the lower limit of analytical determination (LLD) (table 2) and regression lines are also presented.

The trends along traverse 1 of figure 8 are dominated by the values in samples collected at 26.5 km east of the power plant (appendix I). This generality is not quite so pronounced for vanadium because of the large variability between replicate samples at sites with values greater than the LLD. The trends along traverse 2 in figure 8 (the native or undisturbed

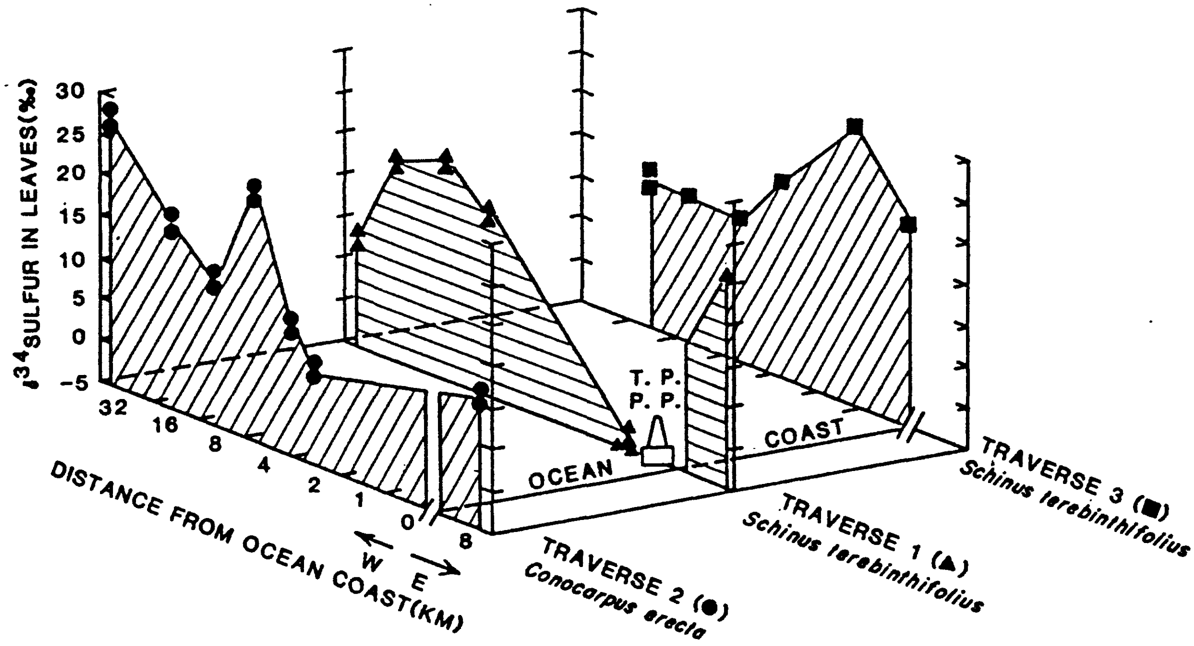
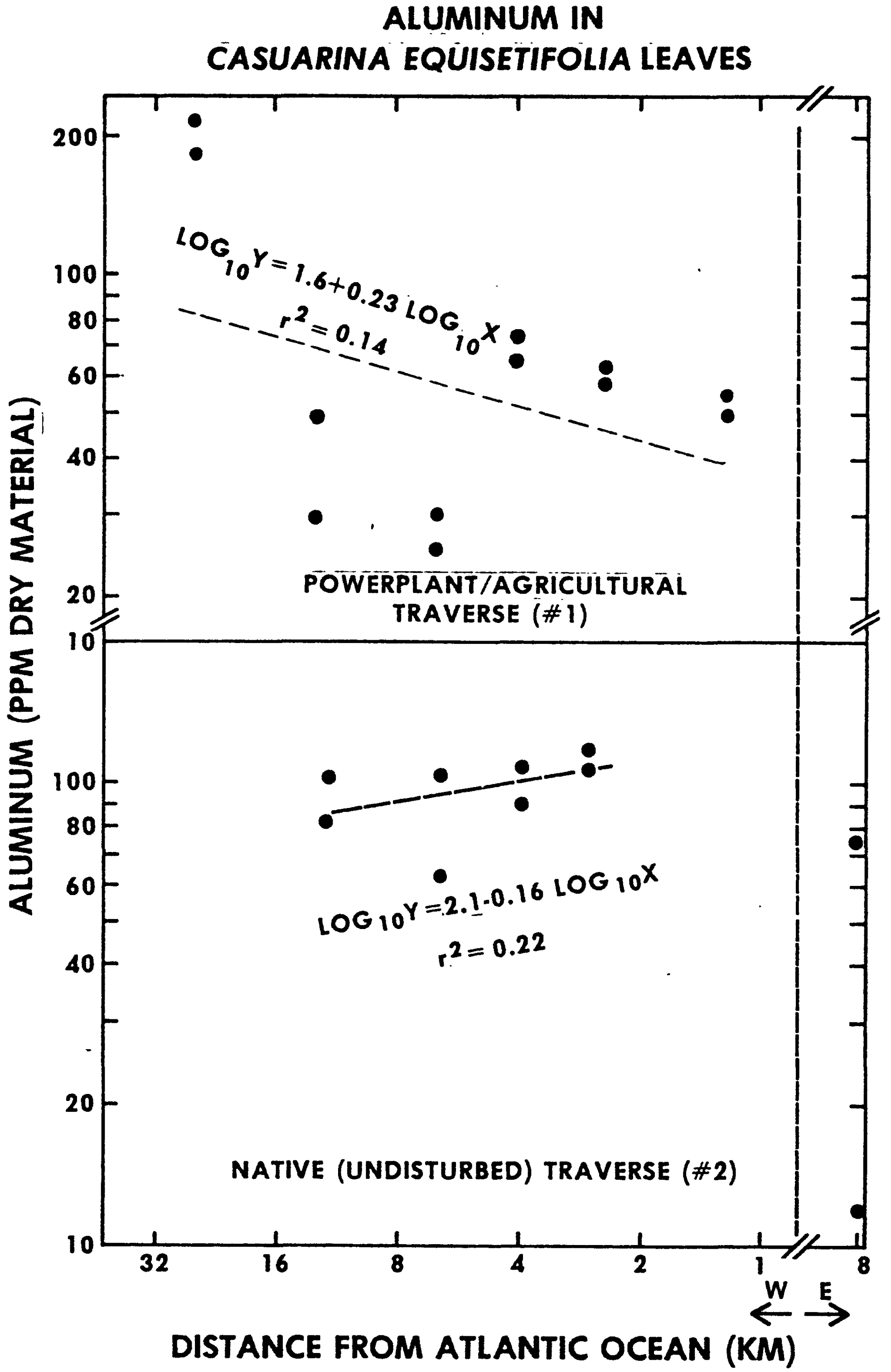
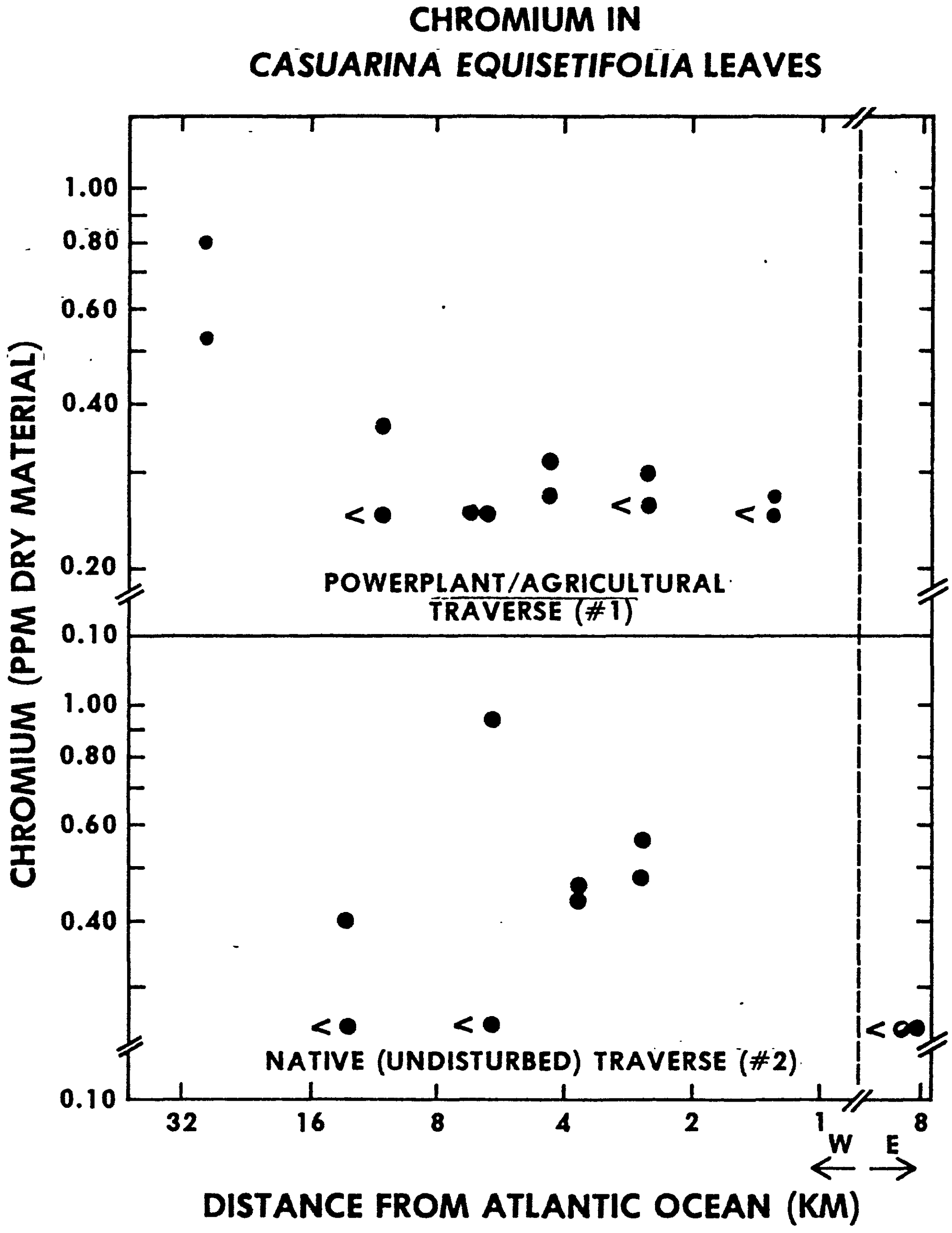


Figure 7. Schematic planar diagrams of δ^{34}sulfur in plant leaves versus distance from the coast along the three parallel traverses. The height of the plane represents the average value of replicate samples at sites where more than one sample was collected. T.P.P.P. refers to the Turkey Point power plant and its relative position on traverse 1. These data are the same as are plotted in figure 6.

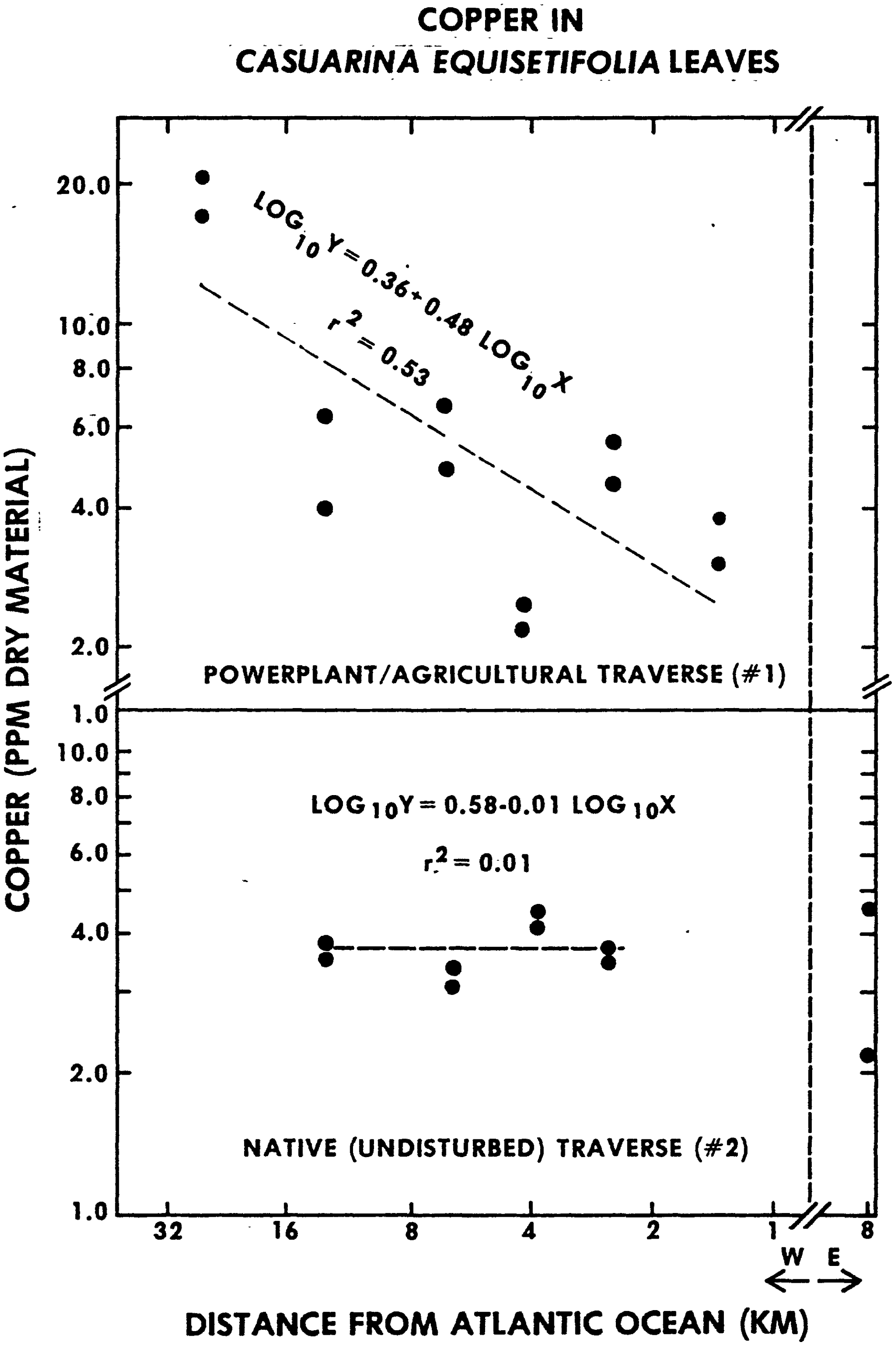


8A. Aluminum.

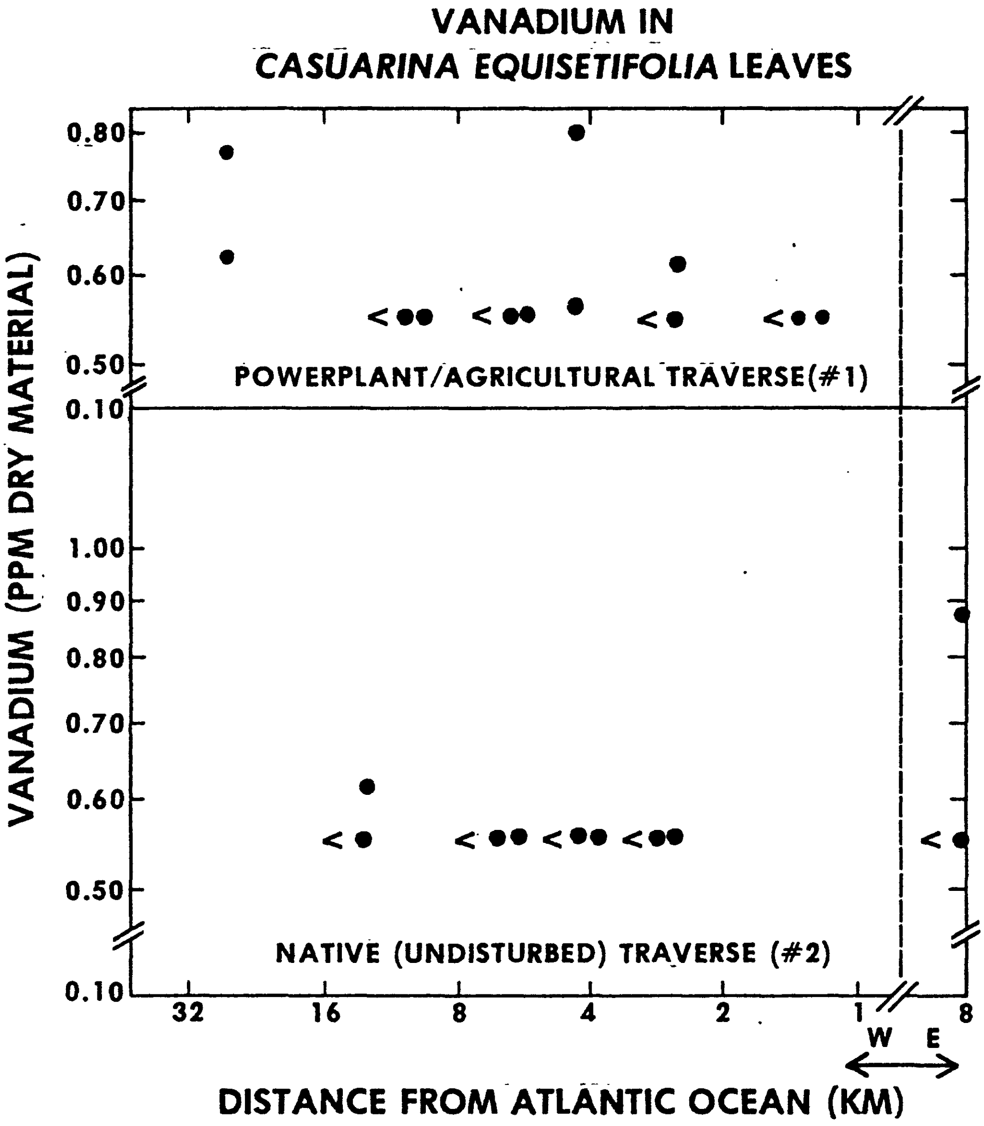
Figure 8. Log element concentrations and, where appropriate, linear regressions for aluminum, chromium, copper, and vanadium in Casuarina equisetifolia (Australian-pine) leaves versus log of the distance from the ocean coast along various traverses (see also fig. 1). Vertical dashed line represents ocean coast.


CHROMIUM IN
CASUARINA EQUISETIFOLIA LEAVES
CHROMIUM (PPM DRY MATERIAL)
1.00
0.80
0.60
0.40
0.20
0.10
POWERPLANT/AGRICULTURAL TRAVERSE (#1)
NATIVE (UNDISTURBED) TRAVERSE (#2)
<
32
16
8
4
2
1
8
W
E
DISTANCE FROM ATLANTIC OCEAN (KM)

8B. Chromium.


COPPER IN
CASUARINA EQUISETIFOLIA LEAVES
COPPER (PPM DRY MATERIAL)
20.0
10.0
8.0
6.0
4.0
2.0
$\log_{10}Y = 0.36 + 0.48 \log_{10}X$
$r^2 = 0.53$
POWERPLANT/AGRICULTURAL TRAVERSE (#1)
1.0
10.0
8.0
6.0
4.0
2.0
1.0
$\log_{10}Y = 0.58 - 0.01 \log_{10}X$
$r^2 = 0.01$
NATIVE (UNDISTURBED) TRAVERSE (#2)
32
16
8
4
2
1
8
W
E
DISTANCE FROM ATLANTIC OCEAN (KM)

8C. Copper.


VANADIUM IN
CASUARINA EQUISETIFOLIA LEAVES
VANADIUM (PPM DRY MATERIAL)
0.80
0.70
0.60
0.50
0.10
POWERPLANT/AGRICULTURAL TRAVERSE(#1)
1.00
0.90
0.80
0.70
0.60
0.50
0.10
NATIVE (UNDISTURBED) TRAVERSE (#2)
32
16
8
4
2
1
8
W
E
DISTANCE FROM ATLANTIC OCEAN (KM)

8D. Vanadium.

traverse) have more moderate slopes and smaller coefficients of determination (r^2).

The metal trends presented in figure 8 are evidence that the activities of the power plant do not materially elevate the concentration of certain trace metals in leaf tissue above some reference level. Even though the power plant has been operating for nearly 20 years, and has been contributing to the overall element burden of the region, a zone of influence is not readily definable using trace-metal analyses of materials we sampled. This conclusion might be expected because not only could trace-element trends be obscured by the complexity of various sources of metals in the area but also because the carbonate-rich substrate would tend to immobilize metals and make them unavailable for uptake through roots. The metal concentration data listed in appendix II for soils show unusually large concentrations for some of these metals--particularly in organic-rich or carbonate-rich soils or both.

The higher-than-normal levels for metals such as aluminum, chromium, copper, nickel, and vanadium at the 26.5-km site (traverse 1) suggests the possibility of long-range transport and deposition. We emphasize, however, that this is one explanation and that this assumption needs further testing.

Wood samples.--Using the technique explained in the "Sample Collection, Preparation, and Analysis" section, samples of young and old wood were collected from the trunks of Australian-pine. Examination of appendix I shows that for samples collected at sites out to a maximum of 8 km from the power plant (traverse 1), only magnesium, molybdenum, sodium, and sulfur showed any observable difference in their concentrations between young and old tissue; the first two having higher concentrations in old tissue, the latter two being higher in young tissue. The samples from the urban/agricultural traverse (traverse 3) showed similar differences for magnesium and molybdenum.

Examination of these data show that only molybdenum and possibly sulfur along traverse 1 and molybdenum along traverse 3 demonstrate trends of decreasing concentration with increasing distance from the coast. The trend for molybdenum in old wood along traverse 1 is particularly dramatic as concentrations decrease by an order of magnitude in a distance of only 1.3 km. Because of similar trends along traverse 3, however, the molybdenum cannot be attributed to the operations of the power plant.

Initial examination of these data would indicate that operations of the power plant are not historically recorded in wood samples with a maximum age of about 10 years. Also, unlike leaf tissue, they apparently do not record the zone of influence of the power plant because there are few element concentration trends. The molybdenum data are interesting and may merit further study. It may be due to some as yet undefined edaphic gradient; for example, molybdenum increases in its availability for uptake by plants as soil pH increases.

Collections along traverse 4.--Unlike traverses 1, 2, and 3, traverse 4 was oriented north-south (see "Study Design" section; fig. 1). Our purpose was to assess whether the activities of a cement manufacturing facility had a measurable effect on the element concentration levels in plants and soils. Tables 12 and 13 give the regression statistics for element concentrations in Australian-pine and Brazilian-pepper leaves versus distance from the facility. These tables show that there were essentially no trends with negative slopes that might be considered important. We emphasize that a more intensive sampling design employing sampling sites spaced at closer intervals and along many radially oriented traverses may define trends. We suspect, however, that the influence of this facility on the biogeochemistry of the area is of minor concern. The raw material for the manufacturing process is, after all, the carbonate rock that underlies the study area.

Soil materials

Despite our efforts to standardize the soil collections in the field the material sampled was highly variable. Extremely diverse soils were encountered, particularly along traverses 1, 2, and 3. These samples varied greatly in organic matter content and in proportions of limestone fragments, silt, and clay; very little sand was encountered except for the samples collected on the keys. Efforts were made to normalize the element concentration data along these three traverses by correcting for the highly variable ash yields that were obtained. Regression statistics, similar to those presented for plant samples in tables 5-13, were calculated. The interpretation of the chemical analyses does not show any readily apparent trends and their utility as a sampling medium for the definition of the region of measurable influence of the power plant appears very limited.

Sulfur and trace-metal trends were looked for also along traverse 4 (the cement factory/agricultural traverse) where the soils were uniformly low in organic matter and composed mostly of weathered and fragmented limestone. As with the plant data, we found no trends that related element concentrations in soil with distance from the cement facility.

A few soil samples were selected for δ^{34}sulfur analysis and these data are reported below; all other soil chemical data are found in appendix II.

Sample	Traverse	Material	δ^{34}sulfur value
1W0.5S	1	mineral soil	+ 7.0
1W4.0S	1	mineral soil	+ 11.1
1W16.0S	1	mineral soil	+ 11.9
2W1.0P	2	organic soil	+ 9.0
2W4.0P	2	organic soil	+ 16.8
2W16.0P	2	organic soil	+ 13.7
4S0.5S	4	mineral soil	+ 12.8
4S2.0S	4	mineral soil	+ 12.6
4S16.0S	4	mineral soil	+ 10.0

CONCLUSIONS AND RECOMMENDATIONS

Information from the analysis of plant material samples for concentrations of total sulfur and stable sulfur isotopes shows that the measurable zone of influence of the Turkey Point oil-fired power plant is within about 3 to 8 km of the facility. This conclusion is based on a study design that relates element concentration levels to distance from an element source. The data for trace metals in leaf tissue do not show pronounced concentrations-to-distance inverse trends and could not be used for determining a close-in zone of influence. The trace-metal data may suggest a "shadow" effect within 1 km of the emission stacks. Additional intensive sampling radially around the power plant will be necessary to precisely define the area of influence.

Although this study was not designed specifically to assess potential phytotoxicity or reduced plant vigor due to contamination from the power plant, several generalizations about trace-element burdens in plant materials can be made. Review of the literature (Gough and others, 1979; Ebens and Shacklette, 1982; and Kabata-Pendias and Pendias, 1984) showed that of the element concentrations measured, only lead and sodium levels in plant materials might be considered large, but not unusually so. Our results show that there is a measurable marine influence which explains the large values for sodium. These values are fairly typical for coastal regions. Lead, on the other hand, is such a ubiquitous, anthropogenic metal that multiple industrial sources are undoubtedly involved in its distribution. The greatest of the lead values from this study (12 ppm in dry Australian-pine leaves) should be considered large (by a factor of about 2 to 3) but not unusual for industrial areas.

The use of vegetation in the biological monitoring of potential contamination from point sources has a number of limitations. Studies have shown that, in general, the use of vegetation for long periods of time may be unsatifactory. Martin and Coughtry (1982, p. 114) state: "Comparisons of concentrations of metal in the same plant species from year to year prove to be so variable that they cannot be used to follow emission rates from specific industrial complexes. Changes in metal concentration in vegetation are due to a large number of variables including emission rates, percentage of winds blowing from source to monitoring site, windspeed, rainfall, condition of the vegetation (seasonal development). Such monitoring is, however, of use if the purpose is to follow the input and burdens of metals within specific ecosystems ..." This study should be viewed as an integrated "snapshot" of the influence of the power plant over about a 1-year period and any extrapolation of these data should be done conservatively.

The relative effectiveness of metal absorption by leaf surfaces has been shown to be dependent on the chemical and physical form of the metal--uptake occurring readily from solutions and minimally from patriculates. The mobility of metals in soils and leaf surfaces varies with the availability of oxygen and moisture and variable element concentration data in native materials can be expected to differ over time. Therefore, a study using a more intensive sampling effort along radially oriented traverses should be repeated at different seasons.

The importance of the presence of sulfur forms on plant surfaces also varies with time. The dry deposition of sulfate can be expected to have a very small direct phytotoxic influence. If, however, fog, drizzle, or high relative humidities follow (all of which are common in south Florida) then the localized formation of both organic and inorganic acids will occur. This lowered foliar pH could increase metal solubilization and absorption. The microanalysis of water droplets on leaf surfaces for concentrations of sulfur (and metals) would help define the magnitude of this potential problem.

Sulfur isotope ratios in materials collected in atmospheric deposition traps could be used to monitor changes in the addition of sulfur to the region. Once a reference δ^{34}sulfur value is determined (over some specific time period), then a change in the ratio would reflect either the addition of new sulfate with a different $^{34}S/^{32}S$ ratio than that of the sulfate already in the reservoir, or would be the result of some isotopically selective removal process (Hitchcock and Black, 1984).

The contribution of sulfur forms from industrial sources to the soils of south Florida probably is of little importance because of the tremendous buffering capacity of the carbonate-rich and marly materials. This property, however, should be quantified.

There are currently several county, state, and federal agencies in south Florida that are examining ambient air quality through the monitoring of a network of fixed samplers. Data from these stations need to be correlated with information being currently obtained from biomonitoring studies. There is an urgent need to determine the applicability of physical and chemical data generated by air samplers with documented biological effects.

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Table 1.--Types of materials sampled and where they were collected

[Leaders (--) mean not applicable]

Material sampled	Description	Traverse
Schinus terebinthifolius Raddi (Brazilian-pepper)	older leaves	1, 3, 4
Casuarina equisetifolia Forst. (Australian-pine)	older leaves young trunk wood old trunk wood	1, 2, 3, 4 1, 3 1, 3
Conocarpus erecta L. (buttonwood)	older leaves	1, 2
Pinus elliottii Engelm. (slash-pine)	second-year needles young trunk wood	3 3
Cladium jamaicense Crantz (sawgrass)	culms and leaves	2
Dry soil	Al horizon	1, 2, 3, 4
Fuel oil	bunker-C-grade	--
Water	sawgrass marsh	1
Miami oolitic limestone	carbonate rock	1

Table 2.--Analytical methodology and references for the analyses of sampled materials

Parameter	Method	Reference
Concentrations of total S	CIR[1] on dry plant material; dry soil; fuel oil; limestone	Jackson and others, 1985.
^{34}S	MS[2] on dry plant material; dry soil; fuel oil; limestone	Hoefs, J., 1980.
Concentrations of Al, Ca, Cd, Ce, Co, Cr, Cu, Ba, Fe, K, Li, Mg, Mn, Mo, Na, Nd, Ni, P, Pb, Sr, Ti, V, and Zn	OES[3] on acid-digested ash of plant material; acid-digested soil	
Ash	Gravimetric on plant dry material; dry soil; fuel oil	Aliquots of sample weighed, burned to ash, and the ash weighed and calculated as percentage of dry weight.
Concentrations of Cl^-, SO_4^{2-}, and F^-	Ion chromatography on water	Fishman and Pyen, 1979.
pH	Glass electrode analysis of water and 1:1 soil (<2-mm fraction) and water solution	Peech, 1965.

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[1] Combustion infrared photometry.

[2] Mass spectrometry.

[3] Inductively coupled argon-plasma-optical emission spectrometry.

Table 3.--Comparison of the element concentration in leaf material of sample pairs of two plant species collected with and without the use of gloves

	Collected with gloves		Collected without gloves		
Element or ash yield	Average (arithmetic mean)	Observed range	Average (arithmetic mean)	Observed range	Calculated t-value[1]
		Australian-pine leaves (n=10)[2]			
Ash, %	5.0	4.8 - 5.2	5.0	4.8 - 5.2	0.59
Al, ppm	68	41 - 100	70	33 - 110	0.43
Ca, %	1.2	1.0 - 1.5	1.2	1.0 - 1.4	1.40
Cu, ppm	4.8	3.6 - 5.5	5.4	3.4 - 7.5	1.08
Ba, ppm	.79	.50 - 1.2	.87	.43 - 1.6	0.38
Fe, ppm	170	80 - 280	160	80 - 300	0.64
K, %	.46	.39 - .60	.43	.22 - .53	0.91
Mg, %	.17	.13 - .19	.16	.13 - .18	0.76
Mn, ppm	13	9.5 - 18	13	9.8 - 16	1.30
Na, %	.34	.24 - .41	.34	.24 - .43	0.41
P, ppm	490	340 - 800	500	340 - 750	0.49
Pb, ppm	2.8	2.5 - 3.2	2.8	2.2 - 3.8	0.37
S(total), %	.12	.083 - .14	.12	.10 - .13	0.66
Sr, ppm	25	15 - 44	24	13 - 46	0.31
Zn, ppm	49	12 - 70	46	12 - 64	1.37
		Brazilian-pepper leaves (n=24)[3]			
Ash, %	10	8.2 - 13	10	8.2 - 13	1.23
Al, ppm	40	22 - 100	40	20 - 99	0.04
Ca, %	2.7	2.2 - 3.9	2.5	2.1 - 3.8	1.51
Cu, ppm	12	4.7 - 45	9.4	5.5 - 15	0.70
Ba, ppm	3.6	1.9 - 6.6	2.9	1.2 - 5.3	1.98
Fe, ppm	60	39 - 90	95	40 - 450	1.05
K, %	1.3	.63 - 2.0	1.4	.43 - 2.2	1.77
Mg, %	.35	.25 - .58	.33	.20 - .47	1.24
Mn, ppm	46	10 - 100	60	8.9 - 16	1.40
Na, %	.37	.18 - .51	.33	.15 - .66	1.13
P, ppm	1200	810 - 2200	1200	760 - 3000	0.36
Pb, ppm	2.2	.90 - 3.6	2.2	1.1 - 4.6	0.19
S(total), %	.35	.19 - .61	.34	.17 - .74	0.14
Sr, ppm	190	100 - 350	150	30 - 310	1.84
Zn, ppm	19	7.9 - 28	28	13 - 97	1.58

[1] For 4 degrees of freedom (5 sample pairs minus 1), $t_{.05}$ = 2.78; Australian pine. For 11 degrees of freedom (12 sample pairs minus 1), $t_{.05}$ = 2.20; Brazilian-pepper.

[2] Five sample pairs.

[3] Twelve sample pairs.

Table 4.--One-way, two level ANOVA comparison of the element concentration in 18 pairs of samples that were split for duplicate analysis.

[Five different plant materials were used: Australian-pine leaves (n=10), Brazilian-pepper leaves (n=10), slash-pine needles (n=4), buttonwood leaves (n=8), and sawgrass leaves and culms (n=4)]

		Percent of total variance	
Element or ash yield	Total log10 variance	Among sample pairs	Between analytical splits
Ash	0.0791	99	1
Aluminum	.2110	88	12
Calcium	.1605	99	1
Copper	.1104	81	19
Barium	.1419	97	3
Iron	.1082	74	26
Magnesium	.1537	99	1
Manganese	.1834	95	5
Phosphorus	.0550	96	4
Potassium	.0891	95	5
Sulfur(total)	.1254	91	9
Sodium	.1614	97	3
Strontium	.2365	78	22
Zinc	.1058	43	57

Table 5.--Regression statistics and observed concentration ranges for elements in Australian pine leaves, traverse 1.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

Element or ash	Regression estimates: Intercept a	Regression estimates: Slope b	Number of samples	Coefficient of determination	Observed element concentration range (ppm)
Ash	0.66	+ 0.11	12	0.39	4.6 - 7.8
Al	1.61	+ .23	12	.19	14 - 210
Ca[1]	.05	+ .10	12	.12	.94 - 2.5
Cd	--	--	12	--	-- - < 7.2
Ce	--	--	12	--	-- - < 1.4
Co	- .88	+ .24	12	.58	.14 - .36
Cr	--	--	12	--	< .26 - .78
Cu	.36	+ .48	12	.53	2.2 - 21
Ba	- .36	+ .53	12	.60	.46 - 3.4
Fe	2.03	+ .21	12	.10	34 - 450
K	3.71	- .01	12	.00	2600 - 7200
Li	--	--	12	--	-- - < .52
Mg	3.22	+ .05	12	.09	1500 - 2400
Mn	1.20	+ .27	12	.27	7.7 - 86
Mo	--	--	12	--	-- - < .72
Na	3.23	+ .29	12	.27	1100 - 8500
Nd	--	--	12	--	-- - < 1.4
Ni	--	--	12	--	< .52 - 1.2
P	2.50	+ .26	12	.60	350 - 1000
Pb	.37	+ .04	12	.01	< .88 - 5.7
S(total)[1]	- .96	+ .11	12	.22	.084- .185
$D^{34}S$[2]	--	--	10	--	8.7 - 19.3
Sr	1.31	+ .22	12	.20	12 - 110
Ti	--	--	12	--	-- - < 18
V	--	--	12	--	< .56 - .81
Zn[3]	1.38	+ .00	12	.00	11 - 39

[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 6.--Regression statistics and observed concentration ranges for elements in Brazilian-pepper leaves, traverse 1.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

Element or ash	Regression estimates		Number of samples	Coefficient of determination	Observed element concentration range (ppm)
	Intercept a	Slope b			
Ash	1.12	- 0.07	9	0.25	9.3 - 15
Al	1.55	+ .02	9	.00	20 - 180
Ca[1]	.53	- .06	9	.09	2.0 - 4.4
Cd	--	--	9	--	-- - < 7.2
Ce	--	--	9	--	-- - < 1.4
Co	--	--	5	--	.28 - .33
Cr	--	--	8	--	< .26 - .88
Cu	.64	+ .22	9	.45	6.6 - 11
Ba	.32	+ .22	9	.11	1.7 - 18
Fe	1.69	+ .15	9	.08	39 - 350
K	4.19	- .06	9	.09	6800 - 20000
Li	--	--	9	--	< .52 - 3.6
Mg	3.55	- .04	9	.04	2000 - 4900
Mn	1.00	+ .32	9	.27	9.8 - 55
Mo	--	--	9	--	< .72 - 1.2
Na	3.69	+ .02	9	.00	870 - 9200
Nd	--	--	9	--	-- - < 1.4
Ni	--	--	8	--	< .52 - 1.4
P	2.88	+ .10	9	.20	790 - 1900
Pb	--	--	9	--	< .88 - 11
S(total)[1]	- .27	- .23	12	.71	.168- .590
$D^{34}S$[2]	.39	+ .59	9	.51	3.5 - 22.4
Sr	2.44	- .18	9	.38	46 - 390
Ti	--	--	9	--	-- - < 18
V	--	--	8	--	< .56 - 2.6
Zn[3]	1.30	+ .06	9	.01	13 - 260

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[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 7.--Regression statistics and observed concentration ranges for elements in Australian pine leaves, traverse 2.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

Element or ash	Regression estimates: Intercept a	Regression estimates: Slope b	Number of samples	Coefficient of determination	Observed element concentration range (ppm)
Ash	0.73	- 0.04	8	0.08	4.5 - 5.8
Al	2.11	- .16	8	.22	12 - 120
Ca[1]	- .07	+ .09	8	.06	.69 - 13
Cd	--	--	8	--	-- - < 7.2
Ce	--	--	8	--	-- - < 1.4
Co	- .88	+ .14	8	.14	.12 - .19
Cr	--	--	8	--	< .26 - .74
Cu	.58	- .01	8	.01	3.1 - 4.5
Ba	.09	- .06	8	.01	.72 - 2.4
Fe	2.42	- .19	8	.09	160 - 420
K	3.42	+ .14	8	.07	2000 - 5300
Li	--	--	8	--	< .52 - .58
Mg	3.24	- .08	8	.41	1300 - 1700
Mn	1.08	+ .19	8	.16	12 - 28
Mo	--	--	8	--	-- - < .72
Na	4.09	- .55	8	.60	2300 - 8100
Nd	--	--	8	--	-- - < 1.4
Ni	--	--	8	--	< .52 - .72
P	2.56	- .03	8	.09	320 - 390
Pb	.74	- .52	8	.47	1.2 - 3.8
S(total)[1]	- .63	- .35	8	.82	.088- .174
$D^{34}S$[2]	--	--	7	--	12.2 - 25.1
Sr	.85	+ .58	8	.46	9.0 - 41
Ti	--	--	8	--	-- - < 18
V	--	--	8	--	< .56 - .62
Zn[3]	1.18	+ .23	8	.61	17 - 25

[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 8.--Regression statistics and observed concentration ranges for elements in buttonwood leaves, traverse 2.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

Element or ash	Regression estimates		Number of samples	Coefficient of determination	Observed element concentration range (ppm)
	Intercept a	Slope b			
Ash	1.16	- 0.20	12	0.66	6.0 - 13
Al	1.31	+ .01	12	.00	10 - 34
Ca[1]	.28	- .03	12	.01	.84 - 2.5
Cd	--	--	12	--	-- - < 7.2
Ce	--	--	12	--	-- - < 1.4
Co	--	--	9	--	.21 - .57
Cr	--	--	11	--	< .26 - .32
Cu	.76	- .23	12	.20	.90 - 6.5
Ba	- .07	+ .39	12	.09	.68 - 4.3
Fe	1.62	+ .10	12	.16	36 - 82
K	3.39	+ .27	12	.40	2500 - 10200
Li	--	--	12	--	< .52 - .96
Mg	3.94	- .15	12	.13	1900 - 9500
Mn	.83	+ .21	12	.20	5.9 - 33
Mo	--	--	12	--	-- - < .72
Na	4.64	- .94	12	.77	1100 - 19500
Nd	--	--	12	--	-- - < 1.4
Ni	--	--	12	--	< .52 - .65
P	2.60	+ .15	12	.31	380 - 1000
Pb	--	--	11	--	< .88 - 1.5
S(total)[1]	- .04	- .46	12	.39	.096- .781
$D^{34}S$[2]	.92	+ .27	12	.42	8.0 - 27
Sr	2.13	+ .02	12	.00	52 - 200
Ti	--	--	12	--	-- - < 18
V	--	--	12	--	-- - < .56
Zn[3]	1.44	- .21	12	.16	5.5 - 50

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[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 9.--Regression statistics and observed concentration ranges for elements in sawgrass culms and leaves, traverse 2.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

	Regression estimates				
Element or ash	Intercept a	Slope b	Number of samples	Coefficient of determination	Observed element concentration range (ppm)
Ash	0.39	+ 0.07	6	0.38	2.6 - 3.5
Al	1.15	+ .11	6	.20	16 - 27
Ca[1]	- .72	+ .19	6	.55	.22 - .42
Cd	--	--	6	--	-- - < 7.2
Ce	--	--	6	--	-- - < 1.4
Co	--	--	3	--	.06 - .07
Cr	--	--	6	--	-- - < .26
Cu	.01	+ .14	6	.12	1.0 - 2.8
Ba	- .27	+ .19	6	.17	.62 - 1.8
Fe	1.59	+ .06	6	.10	36 - 52
K	3.56	+ .14	6	.30	3900 - 7700
Li	--	--	6	--	-- - < .52
Mg	3.09	- .25	6	.61	380 - 840
Mn	1.49	+ .21	6	.31	39 - 88
Mo	--	--	6	--	< .72 - .92
Na	3.19	- .12	6	.06	590 - 1800
Nd	--	--	6	--	-- - < 1.4
Ni	--	--	6	--	-- - < .52
P	2.05	+ .22	6	.62	160 - 300
Pb	--	--	6	--	< .88 - 1.1
S(total)[1]	- .37	- .37	6	.69	.094- .266
$D^{34}S$[2]	--	--	2	--	19.0 - 30.4
Sr	1.15	+ .19	6	.58	18 - 34
Ti	--	--	6	--	-- - < 18
V	--	--	6	--	-- - < .56
Zn[3]	.48	+ .14	6	.21	3.4 - 6.6

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[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 10.--Regression statistics and observed concentration ranges for elements in Brazilian-pepper leaves, traverse 3.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

Element or ash	Regression estimates: Intercept a	Regression estimates: Slope b	Number of samples	Coefficient of determination	Observed element concentration range (ppm)
Ash	1.04	- 0.03	12	0.10	8.2 - 13
Al	1.41	+ .25	12	.62	22 - 100
Ca[1]	.43	- .01	12	.01	2.2 - 3.9
Cd	--	--	12	--	-- - < 7.2
Ce	--	--	12	--	-- - < 1.4
Co	--	--	8	--	.16 - .33
Cr	--	--	12	--	< .26 - .40
Cu	.93	+ .05	12	.01	4.7 - 45
Ba	.45	+ .11	12	.16	2.7 - 18
Fe	1.70	+ .11	12	.44	44 - 90
K	4.08	- .01	12	.00	6100 - 19800
Li	--	--	12	--	< .52 - 1.9
Mg	3.57	- .06	12	.09	2500 - 5800
Mn	1.32	+ .36	12	.36	12 - 100
Mo	--	--	12	--	< .72 - .80
Na	3.67	- .20	12	.66	1800 - 5100
Nd	--	--	12	--	-- - < 1.4
Ni	--	--	12	--	-- - < .52
P	3.13	- .09	12	.15	815 - 2200
Pb	.18	+ .22	12	.42	.90 - 3.6
S(total)[1]	- .36	- .22	12	.56	.186- .607
$D^{34}S$[2]	--	--	7	--	11.2 - 27.8
Sr	2.35	- .19	12	.34	100 - 350
Ti	--	--	12	--	-- - < 18
V	--	--	12	--	-- - < .56
Zn[3]	1.30	- .07	12	.08	7.9 - 28

[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 11.--Regression statistics and observed concentration ranges for elements in slash-pine needles, traverse 3.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

Element or ash	Regression estimates: Intercept a	Regression estimates: Slope b	Number of samples	Coefficient of determination	Observed element concentration range (ppm)
Ash	0.32	- 0.01	6	0.00	1.7 - 2.3
Al	2.03	- .25	6	.36	46 - 76
Ca[1]	- .22	- .24	6	.16	.20 - .42
Cd	--	--	6	--	-- - < 7.2
Ce	--	--	6	--	-- - < 1.4
Co	- 1.56	+ .33	6	.56	.04 - .08
Cr	--	--	6	--	< .26 - .40
Cu	- .02	+ .67	6	.89	3.4 - 7.9
Ba	.19	- .38	6	.79	.44 - .76
Fe	1.69	- .02	6	.01	41 - 56
K	2.37	+ .93	6	.69	1200 - 5200
Li	--	--	6	--	-- - < .52
Mg	3.04	+ .11	6	.06	1100 - 2000
Mn	.11	+ .44	6	.50	11 - 140
Mo	--	--	6	--	-- - < .72
Na	3.89	+ .79	6	.39	480 - 2500
Nd	--	--	6	--	-- - < 1.4
Ni	--	--	6	--	-- - < .52
P	2.69	- .02	6	.00	320 - 560
Pb	1.15	- .74	6	.76	1.4 - 3.8
S(total)[1]	-1.01	- .18	6	.11	.016- .082
$D^{34}S$[2]	--	--	5	--	10.1 - 18.3
Sr	2.26	- .98	6	.63	5.0 - 28
Ti	--	--	6	--	-- - < 18
V	--	--	6	--	-- - < .56
Zn[3]	.65	+ .59	6	.32	12 - 44

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[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 12.--Regression statistics and observed concentration ranges for elements in Australian pine leaves, traverse 4.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

	Regression estimates				
Element or ash	Intercept a	Slope b	Number of samples	Coefficient of determination	Observed element concentration range (ppm)
Ash	0.84	- 0.04	12	0.04	4.5 - 8.7
Al	2.29	- .01	12	.00	85 - 310
Ca[1]	.28	- .07	12	.05	1.2 - 3.0
Cd	--	--	12	--	-- - < 7.2
Ce	--	--	12	--	-- - < 1.4
Co	- .70	- .06	12	.04	.11 - .29
Cr	- .22	+ .10	12	.07	.27 - 1.2
Cu	1.01	- .07	12	.07	6.9 - 18
Ba	.46	- .16	12	.23	1.3 - 4.0
Fe	2.26	+ .02	12	.01	150 - 220
K	3.67	- .01	12	.00	3600 - 6900
Li	--	--	12	--	< .52 - .66
Mg	3.18	+ .13	12	.25	1200 - 2500
Mn	2.04	- .32	12	.12	12 - 240
Mo	--	--	12	--	< .72 - .77
Na	3.55	- .04	12	.01	1300 - 6500
Nd	--	--	12	--	-- - < 1.4
Ni	--	--	12	--	< .52 - .87
P	2.65	+ .15	12	.48	420 - 850
Pb	1.06	- .22	12	.32	4.3 - 12
S(total)[1]	- .85	+ .07	12	.13	.125- .255
D^{34}S[2]	--	--	10	--	7.7 - 13.2
Sr	1.44	+ .05	12	.04	19 - 44
Ti	--	--	12	--	<18 - 20
V	--	--	12	--	< .56 - .92
Zn[3]	1.48	- .22	12	.30	12 - 46

[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 13.--Regression statistics and observed concentration ranges for elements in Brazilian-pepper leaves, traverse 4.

[Regression equations are based on element concentrations expressed in parts per million (dry weight base), except as indicated; a is the intercept and b is the slope of the regression equation; coefficient of determination is equal to the squared correlation coefficient between element concentration and distance (in km) from the power plant; leaders (--) mean not calculated]

	Regression estimates				
Element or ash	Intercept a	Slope b	Number of samples	Coefficient of determination	Observed element concentration range (ppm)
Ash	1.04	+ 0.03	12	0.04	9.2 - 16
Al	2.15	- .15	12	.07	44 - 320
Ca[1]	.40	+ .10	12	.16	2.2 - 5.0
Cd	--	--	12	--	-- - < 7.2
Ce	--	--	12	--	-- - < 1.4
Co	--	--	9	--	.22 - .48
Cr	- .25	- .02	12	.00	.30 - 1.2
Cu	1.17	- .28	12	.40	5.1 - 50
Ba	.97	- .33	12	.46	2.3 - 9.4
Fe	2.10	- .09	12	.06	66 - 230
K	4.24	- .08	12	.08	9400 - 24000
Li	--	--	11	--	< .52 - .55
Mg	3.55	+ .04	12	.03	3000 - 5600
Mn	1.54	+ .20	12	.09	31 - 130
Mo	--	--	12	--	-- - < .72
Na	3.68	- .25	12	.35	1300 - 5500
Nd	--	--	12	--	-- - < 1.4
Ni	--	--	10	--	-- - < .52
P	2.97	+ .31	12	.31	1100 - 6000
Pb	.94	- .43	12	.39	1.4 - 8.7
S(total)[1]	- .51	+ .05	12	.05	.224- .420
$D^{34}S$[2]	--	--	9	--	9.7 - 13.3
Sr	2.08	+ .11	12	.09	86 - 320
Ti	--	--	12	--	< 18 - 26
V	--	--	11	--	-- - < .56
Zn[3]	1.42	- .23	12	.48	8.8 - 25

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[1] Percent.

[2] Per mil.

[3] Large laboratory error term (see Laboratory Error discussion).

Table 14.--Annual gaseous sulfur emissions from natural sources in Massachusetts (after Steudler and Peterson, 1984). [concentrations are expressed as grams of sulfur per square meter per year]

Source	H_2S	DMS[a]	COS[b]	CS[c]	DMDS[d]	Total
Marine	--	0.105	0.001	<0.001	--	0.107
Inland dry lands (non-swamp)	0.097	.007	.016	.023	0.002	.144
Salt marsh	2.190	1.520	0.320	0.180	0.340	4.550

[a] Dimethly sulfide

[b] Carbonyl sulfide

[c] Carbon disulfide

[d] Dimethyl disulfide

Table 15.--Chemistry of water samples at selected study sites.

[pH expressed in standard units; electrical conductivity expressed as millimhos per centimeter; anion concentrations are in milligrams per liter]

Distance west of power plant (km)	pH	Electrical conductivity (mmhos/cm)	Concentration (mg/L)		
			Cl-	F-	SO_4^{2-}
0.0	7.9	50	18,800	1.3	2,700
.80	7.9	1.7	730	1.5	160
.94	7.2	1.8	410	1.6	240
2.4	7.4	2.0	480	.8	30
2.8	7.0	3.0	870	1.2	70
3.2	7.0	1.3	220	.6	80

Table 16.--Representative concentrations of cobalt, chromium, vanadium, and sulfur in power plant fuel oil compared to other area materials. [<, less than the value listed; ∼, approximately the value listed]

	Concentration range (ppm)			
Material	Cobalt	Chromium	Vanadium	Total sulfur
Fuel oil[1]	0.79 - 1.4	0.56 - 0.76	30 - 46	9900 - 10,400
Freshwater[2]	∼ 0.001	<0.001	<0.001	3.7
Seawater[2]	< .001	∼ .006	∼ .05	902
Vegetation[3]	<.02 - 1.1	< .26 - 1.2	< .56 - 2.6	< 50 - 10,100
Mineral Soil[3]	<1 - 6	1 - 180	< 2 - 56	< 50 - 1,740
Peat[3]	<1 - 6	5 - 220	5 - 76	320 - 16,600
Limestone[3]	2 - 3	3 - 9	< 2 - 11	< 50 - 120

[1] As received.

[2] From: Livingstone (1963); Rose and others (1979); Levinson (1980); Stumm and Morgan (1981); Bruland (1983).

[3] Dry-weight base.

EXPLANATION OF APPENDIXES

APPENDIX I

Tables giving the sample identification, location, and chemical composition of plant samples, south Dade County, Florida. The sample identifications are keyed as follows: first position (G)--USGS/NPS study; second position (1, 2, 3, or 4)--traverse number; third position (E, W, N, or S)--direction along a given traverse; fourth and fifth positions (.5 to 32)--site number; sixth position (A, B, C, E, G, M, or W)--plant species or type of plant material; seventh position (1 or 2)--site replicated sample; eighth position (X)--analytical duplicated sample.

APPENDIX II

Tables giving the sample identification, location, and chemical composition of soil samples, south Dade County, Florida. The sample identifications are keyed as follows: first position (1, 2, 3, or 4)--traverse number; second position (E, W, N, or S)--direction along a traverse; third, fourth, and fifth positions (0.5 to 32)--site number; sixth, seventh, and eighth positions--S (mineral soil), P (organic soil), L (limestone-dominated soil), R (site replicated sample); D (analytical duplicated sample).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA

[--, no data available; <, less than the analytical lower limit of determination (adjusted for solution and sample composition effects as well as variable values from conversion to a dry-weight base from an ash-weight base)]

Sample	LATITUDE	LONGITUDE	DIST. KM	DIST. MI	Ash %	Al ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cu ppm	Ba ppm	Fe ppm
CASUARINA EQUISETIFOLIA LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)														
G1W.5A1	25 26 15	80 21 15	1.30	.83	4.60	51	1.15	<.72	<1.44	.10	.20	3.0	.55	64
G1W.5A2	25 26 15	80 21 15	1.30	.83	5.10	56	1.12	<.72	<1.44	.15	<.26	3.8	.46	66
G1W01A1	25 26 15	80 21 15	2.60	1.60	4.80	62	1.15	<.72	<1.44	.14	.29	4.5	.77	235
G1W01A2	25 26 15	80 21 15	2.60	1.60	4.80	62	1.06	<.72	<1.44	.14	<.26	5.8	.86	274
G1W02A1	25 26 15	80 22 15	4.20	2.60	5.20	68	.94	<.72	<1.44	.16	.31	2.5	.83	161
G1W02A2	25 26 15	80 22 15	4.20	2.60	5.40	76	1.35	<.72	<1.44	.16	.27	2.2	1.62	238
G1W04A1	25 26 15	80 23 45	6.90	4.30	4.80	30	1.15	<.72	<1.44	.19	<.26	6.7	.86	192
G1W04A1X	25 26 15	80 23 45	6.90	4.30	4.80	14	1.10	<.72	<1.44	.14	<.26	6.7	1.01	34
G1W04A2	25 26 15	80 23 45	6.90	4.30	7.80	31	2.50	<.72	<1.44	.31	<.26	4.9	.55	187
G1W08A1	25 26 30	80 27 45	13.70	8.50	7.10	50	1.92	<.72	<1.44	.21	<.26	6.3	.78	419
G1W08A1X	25 26 30	80 27 45	13.70	8.50	7.20	50	2.02	<.72	<1.44	.29	<.26	6.6	.79	446
G1W08A2	25 26 30	80 27 45	13.70	8.50	6.10	31	1.71	<.72	<1.44	.10	.37	4.1	3.42	43
G1W16A1	25 26 30	80 35 30	26.50	16.50	5.30	191	1.06	<.72	<1.44	.32	.53	17.0	2.76	217
G1W16A2	25 26 30	80 35 30	26.50	16.50	7.10	206	1.35	<.72	<1.44	.36	.78	21.3	3.34	241
G1W32E1	25 24 0	80 47 30	47.00	29.20	2.40	134	.38	<.72	<1.44	.07	.43	2.9	1.25	108
G1W32E1X	25 24 0	80 47 30	47.00	29.20	2.30	127	.35	<.72	<1.44	.09	.39	2.8	1.15	101
G1W32E2	25 24 0	80 47 30	47.00	29.20	2.70	162	.73	<.72	<1.44	.13	.46	3.5	1.32	113
CASUARINA EQUISETIFOLIA LEAVES; NATIVE/UNDISTURBED TRAVERSE (#2)														
G2E05A1	25 18 0	80 17 45	-7.90	-4.90	4.20	76	.84	<.72	<1.44	.13	<.26	4.6	1.26	109
G2E05A2	25 18 0	80 17 45	-7.90	-4.90	4.00	12	1.20	<.72	<1.44	.12	<.26	2.2	1.16	28
G2W01A1	25 20 15	80 23 15	2.60	1.60	5.60	118	1.23	<.72	<1.44	.17	.45	3.7	1.12	213
G2W01A2	25 20 15	80 23 15	2.60	1.60	5.40	124	1.08	<.72	<1.44	.16	.38	3.5	1.13	211
G2W02A1	25 19 30	80 24 30	3.90	2.40	4.60	110	.69	<.72	<1.44	.14	.37	4.2	2.39	161
G2W02A2	25 19 30	80 24 30	3.90	2.40	4.50	90	.81	<.72	<1.44	.13	.36	4.5	.72	167
G2W04A1	25 19 30	80 26 0	6.60	4.10	4.90	108	.98	<.72	<1.44	.25	.74	3.4	1.13	216
G2W04A2	25 19 30	80 26 0	6.60	4.10	5.80	64	.81	<.72	<1.44	.12	<.26	3.1	.81	423
G2W08A1	25 20 0	80 29 30	12.90	8.00	4.80	82	1.15	<.72	<1.44	.19	<.26	3.9	1.10	163
G2W08A2	25 20 0	80 29 30	12.90	8.00	4.80	106	1.25	<.72	<1.44	.19	.34	3.7	1.15	101
CASUARINA EQUISETIFOLIA LEAVES; URBAN/AGRICULTURAL TRAVERSE (#3)														
G3W.5A1	25 33 30	80 19 0	.53	.33	5.20	104	1.30	<.72	<1.44	.21	.42	5.2	1.25	276
G3W.5A2	25 33 30	80 19 0	.53	.33	4.80	86	1.06	<.72	<1.44	.10	.29	4.8	.72	144
G3W01A1	25 33 30	80 19 45	1.20	.76	5.00	45	1.05	<.72	<1.44	.10	<.26	5.5	.50	210
G3W01A2	25 33 30	80 19 45	1.20	.76	5.10	41	1.48	<.72	<1.44	.15	<.26	5.1	.66	163
G3W02A1	25 33 45	80 20 30	3.40	2.10	5.00	65	1.25	<.72	<1.44	.20	.30	3.6	.80	80
CASUARINA EQUISETIFOLIA LEAVES; CEMENT PLANT/AGRICULTURAL TRAVERSE (#4)														
G4S.5A1	25 41 30	80 28 45	1.90	1.20	7.30	190	2.26	<.72	<1.44	.29	.66	7.3	3.65	161
G4S.5A1X	25 41 30	80 28 45	1.90	1.20	7.30	197	2.26	<.72	<1.44	.29	.66	7.1	2.34	161
G4S.5A2	25 41 30	80 28 45	1.90	1.20	8.70	183	2.96	<.72	<1.44	.26	.61	7.0	2.35	209
G4S01A1	25 41 15	80 29 0	2.60	1.60	4.50	85	1.22	<.72	<1.44	.13	.27	17.1	1.94	162
G4S01A1X	25 41 15	80 29 0	2.60	1.60	4.60	87	1.24	<.72	<1.44	.14	.32	17.5	1.98	170
G4S01A2	25 41 15	80 29 0	2.60	1.60	6.20	223	1.30	<.72	<1.44	.19	.74	12.4	2.73	192
G4S02A1	25 40 0	80 29 0	4.70	2.90	6.60	271	1.45	<.72	<1.44	.20	.92	9.2	2.44	211
G4S02A2	25 40 0	80 29 0	4.70	2.90	5.90	218	1.42	<.72	<1.44	.12	.77	9.4	2.36	171
G4S04A1	25 38 30	80 28 45	7.60	4.70	7.60	274	1.90	<.72	<1.44	.15	1.06	8.4	1.75	213
G4S04A2	25 38 30	80 28 45	7.60	4.70	6.80	313	1.70	<.72	<1.44	.14	1.22	7.5	2.24	224
G4S08A1	25 34 45	80 29 30	14.80	9.20	7.10	156	2.34	<.72	<1.44	.21	.57	9.2	3.98	149
G4S08A2	25 34 45	80 29 30	14.80	9.20	5.60	185	1.68	<.72	<1.44	.11	.78	7.8	1.29	162
G4S16A1	25 28 15	80 30 30	26.90	16.70	5.30	191	1.17	<.72	<1.44	.21	.80	7.4	1.48	164
G4S16A1X	25 28 15	80 30 30	26.90	16.70	5.30	186	1.17	<.72	<1.44	.21	.74	6.9	1.48	164
G4S16A2	25 28 15	80 30 30	26.90	16.70	6.60	139	1.65	<.72	<1.44	.20	.66	9.2	1.58	271

Appendix I.

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA--Continued

Sample	K ppm	Li ppm	Mg ppm	Mn ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	P ppm	Pb ppm	Tot S %	$\lvert\delta^{34}S\rvert$	Sr ppm	Ti ppm	V ppm	Zn ppm
CASUARINA EQUISETIFOLIA LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)--Continued																
G1W.5A1	6,440	<.52	1,610	12.9	<.72	2,070	<1.44	.74	400	1.75	.092	--	15	<18	<.56	25.0
G1W.5A2	4,437	<.52	1,734	13.3	<.72	1,122	<1.44	.66	485	1.94	.136	15.0	19	<18	<.56	31.6
G1W01A1	4,416	<.52	1,488	32.2	<.72	3,168	<1.44	<.52	370	1.58	.084	--	28	<18	<.56	25.4
G1W01A2	4,176	<.52	1,488	29.8	<.72	4,176	<1.44	<.52	403	3.50	.119	18.3	25	<18	.62	26.9
G1W02A1	6,760	<.52	2,288	20.3	<.72	3,640	<1.44	.52	348	5.72	.171	18.6	21	<18	.57	18.2
G1W02A2	4,428	<.52	2,268	20.0	<.72	2,970	<1.44	<.52	437	4.81	.173	19.3	27	<18	.81	12.4
G1W04A1	7,200	<.52	1,728	19.7	<.72	1,344	<1.44	.62	480	1.97	.136	9.9	12	<18	<.56	39.4
G1W04A1X	6,240	<.52	1,632	7.7	<.72	2,160	<1.44	<.52	466	<.88	.113	--	106	<18	<.56	11.5
G1W04A2	5,140	<.52	2,184	43.7	<.72	1,482	<1.44	.62	413	2.81	.148	8.7	38	<18	<.56	31.2
G1W08A1	2,556	<.52	2,272	78.1	<.72	4,402	<1.44	.64	476	1.99	.185	17.2	48	<18	<.56	27.7
G1W08A1X	2,664	<.52	2,448	86.4	<.72	4,680	<1.44	.58	497	2.38	.176	16.8	50	<18	<.56	28.8
G1W08A2	6,100	<.52	1,830	32.3	<.72	1,708	<1.44	<.52	610	2.62	.115	14.2	91	<18	<.56	15.9
G1W16A1	5,035	<.52	1,537	23.3	<.72	4,505	<1.44	.90	1,007	2.49	.169	15.4	18	<18	.64	24.4
G1W16A2	5,093	<.52	2,059	32.7	<.72	8,520	<1.44	1.21	994	2.84	.137	17.3	28	<18	.78	34.0
G1W32E1	2,136	<.52	1,800	17.0	<.72	2,304	<1.44	<.52	552	1.42	.077	--	24	<18	<.56	5.8
G1W32E1X	1,955	<.52	1,702	15.9	<.72	2,162	<1.44	<.52	506	1.31	.065	--	22	<18	<.56	5.5
G1W32E2	1,566	<.52	1,728	10.6	<.72	2,376	<1.44	<.52	675	1.81	.078	--	46	<18	.57	8.6
CASUARINA EQUISETIFOLIA LEAVES; NATIVE/UNDISTURBED TRAVERSE (#2)--Continued																
G2E05A1	4,074	<.52	1,344	18.1	<.72	3,780	<1.44	.80	349	3.70	.119	17.7	15	<18	.88	63.0
G2E05A2	2,080	<.52	1,320	16.8	<.72	1,520	<1.44	<.52	248	<.88	.096	--	120	<18	<.56	4.0
G2W01A1	2,464	<.52	1,568	17.9	<.72	6,160	<1.44	<.52	342	4.59	.174	14.2	19	<18	<.56	17.9
G2W01A2	2,970	<.52	1,674	20.5	<.72	5,940	<1.44	.59	346	2.27	.155	13.7	18	<18	<.56	19.4
G2W02A1	3,404	.55	1,610	11.5	<.72	6,440	<1.44	<.52	363	3.36	.161	12.2	9	<18	<.56	17.5
G2W02A2	2,970	.58	1,485	11.7	<.72	5,850	<1.44	<.52	387	3.82	.148	12.7	11	<18	<.56	18.4
G2W04A1	4,263	<.52	1,470	15.2	<.72	4,900	<1.44	<.52	323	1.67	.128	25.1	22	<18	<.56	18.1
G2W04A2	5,162	<.52	1,682	13.3	<.72	8,120	<1.44	<.52	371	1.16	.104	--	13	<18	<.56	19.7
G2W08A1	5,200	<.52	1,344	28.3	<.72	2,352	<1.44	.58	331	1.44	.108	12.2	41	<18	<.56	25.4
G2W08A2	1,968	<.52	1,488	19.2	<.72	2,448	<1.44	.72	346	2.02	.088	13.1	38	<18	.62	22.1
CASUARINA EQUISETIFOLIA LEAVES; URBAN/AGRICULTURAL TRAVERSE (#3)--Continued																
G3W.5A1	4,472	.52	1,768	16.1	<.72	3,848	<1.44	.73	468	2.76	.140	15.0	17	<18	.88	38.0
G3W.5A2	3,984	.62	1,680	10.1	<.72	4,080	<1.44	<.52	336	2.54	.126	20.2	15	<18	.67	67.2
G3W01A1	6,000	<.52	1,800	12.5	<.72	3,700	<1.44	<.52	475	2.70	.099	--	16	<18	<.56	70.0
G3W01A2	3,876	<.52	1,887	18.4	<.72	3,009	<1.44	<.52	357	2.96	.003	--	32	<18	<.56	56.1
G3W02A1	5,000	<.52	1,300	9.5	<.72	2,400	<1.44	<.52	800	3.25	.127	12.8	44	<18	<.56	12.5
CASUARINA EQUISETIFOLIA LEAVES; CEMENT PLANT/AGRICULTURAL TRAVERSE (#4)--Continued																
G4S.5A1	4,380	<.52	1,168	30.7	<.72	3,285	<1.44	.58	504	10.95	.149	7.9	31	<18	.80	23.4
G4S.5A1X	4,526	<.52	1,168	30.7	<.72	3,285	<1.44	<.52	518	10.95	.125	--	32	<18	.80	24.1
G4S.5A2	4,350	<.52	1,305	55.7	<.72	2,523	<1.44	<.52	418	12.18	.144	8.9	43	<18	<.56	22.6
G4S01A1	3,645	<.52	2,115	85.5	<.72	1,935	<1.44	<.52	495	4.95	.145	12.1	27	<18	<.56	13.5
G4S01A1X	3,588	<.52	2,162	87.4	<.72	1,932	<1.44	<.52	506	5.06	.149	11.9	28	<18	<.56	14.3
G4S01A2	5,952	.56	2,480	235.6	<.72	4,960	<1.44	.87	620	12.40	.207	11.3	19	19	.68	45.9
G4S02A1	4,620	.66	1,584	118.8	<.72	6,534	<1.44	.66	508	9.90	.156	13.2	28	20	.92	25.1
G4S02A2	4,484	.59	2,301	212.4	.77	4,720	<1.44	<.52	525	7.67	.132	--	27	<18	.88	21.8
G4S04A1	6,916	<.52	1,900	57.8	<.72	4,332	<1.44	.76	631	7.37	.171	9.8	33	<18	.68	26.6
G4S04A2	6,520	<.52	2,108	61.2	<.72	3,944	<1.44	.54	660	9.52	.177	11.9	27	20	.75	21.1
G4S08A1	3,692	<.52	2,130	14.9	<.72	1,349	<1.44	<.52	852	4.47	.144	7.7	31	<18	.57	15.6
G4S08A2	3,696	<.52	1,680	11.8	<.72	1,792	<1.44	<.52	840	4.31	.132	--	26	<18	<.56	11.8
G4S16A1	3,657	<.52	2,385	63.6	<.72	4,505	<1.44	<.52	583	8.48	.172	10.5	29	<18	.58	12.2
G4S16A1X	3,922	<.52	2,305	63.6	<.72	4,505	<1.44	<.52	583	8.48	.166	--	29	<18	.58	12.2
G4S16A2	5,874	<.52	2,310	79.2	<.72	3,828	<1.44	.59	660	5.74	.255	10.0	44	<18	.59	19.1

Appendix I (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA--Continued

Sample	LATITUDE	LONGITUDE	DIST. KM	DIST. MI	Ash %	Al ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cu ppm	Ba ppm	Fe ppm
SCHINUS TEREBINTHIFOLIUS LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)														
G1E08B1	25 26 0	80 12 15	-12.90	-8.00	11.00	11	.91	<.72	<1.44	.33	<.26	10.8	.99	55
G1E08B2	25 26 0	80 12 15	-12.90	-8.00	10.00	20	.72	<.72	<1.44	.40	<.26	13.0	.60	60
G1W.5B1	25 26 15	80 21 15	.97	.60	15.00	30	4.35	<.72	<1.44	.30	--	3.1	3.60	45
G1W04B1	25 26 15	80 23 45	6.90	4.30	9.30	28	2.05	<.72	<1.44	.28	<.26	11.2	2.14	47
G1W04B2	25 26 15	80 23 45	6.90	4.30	9.40	28	2.26	<.72	<1.44	--	<.26	7.0	1.88	47
G1W08B1	25 26 30	80 27 45	13.70	8.50	13.00	39	3.90	<.72	<1.44	.26	<.26	6.6	3.77	91
G1W08B1X	25 26 30	80 27 45	13.70	8.50	13.00	182	2.73	<.72	<1.44	.52	.65	15.6	2.60	351
G1W08B2	25 26 30	80 27 45	13.70	8.50	11.00	55	2.53	<.72	<1.44	--	<.26	7.9	2.31	77
G1W16B1	25 26 0	80 35 30	26.00	16.50	11.00	33	3.19	<.72	<1.44	.33	<.26	8.7	7.26	88
G1W16B2	25 26 0	80 35 30	26.00	16.50	11.00	44	3.19	<.72	<1.44	.33	<.26	7.3	5.28	176
G1W32B1	25 24 0	80 47 30	37.00	22.90	9.80	20	2.25	<.72	<1.44	--	<.26	10.8	1.67	39
G1W32B2	25 24 0	80 47 30	37.00	22.90	11.00	33	3.30	<.72	<1.44	--	.88	6.6	17.60	55
SCHINUS TEREBINTHIFOLIUS LEAVES; URBAN/AGRICULTURAL TRAVERSE (#3)														
G3W.5B1	25 33 30	80 19 0	.53	.33	11.00	22	2.53	<.72	<1.44	.33	<.26	12.1	1.87	44
G3W.5B2	25 33 30	80 19 0	.53	.33	10.00	30	2.90	<.72	<1.44	.20	.40	5.8	3.60	50
G3W01B1	25 33 30	80 19 45	1.20	.76	11.00	33	2.53	<.72	<1.44	--	<.26	17.6	2.42	66
G3W01B2	25 33 30	80 19 45	1.20	.76	11.00	22	2.20	<.72	<1.44	.33	<.26	9.7	2.53	55
G3W02B1	25 33 45	80 20 30	3.40	2.10	13.00	26	3.77	<.72	<1.44	--	<.26	6.4	3.90	52
G3W02B2	25 33 45	80 20 30	3.40	2.10	13.00	26	3.90	<.72	<1.44	.26	<.26	6.9	6.63	39
G3W04B1	25 33 15	80 22 45	7.20	4.50	8.20	41	2.21	<.72	<1.44	.16	<.26	5.9	3.28	57
G3W04B2	25 33 15	80 22 45	7.20	4.50	8.40	42	2.27	<.72	<1.44	--	<.26	4.7	3.36	59
G3W08B1	25 34 45	80 26 15	12.90	8.00	10.00	50	2.60	<.72	<1.44	.20	.40	10.0	2.90	70
G3W08B2	25 34 45	80 26 15	12.90	8.00	9.20	46	2.21	<.72	<1.44	.28	<.26	9.2	2.21	74
G3W16B1	25 32 15	80 30 45	20.70	12.90	11.00	44	2.97	<.72	<1.44	.22	<.26	6.2	4.62	66
G3W16B2	25 32 15	80 30 45	20.70	12.90	10.00	100	2.60	<.72	<1.44	--	<.26	45.0	5.30	90
SCHINUS TEREBINTHIFOLIUS LEAVES; CEMENT PLANT/AGRICULTURAL TRAVERSE (#4)														
G4S.5B1	25 41 30	80 28 45	1.90	1.20	13.00	130	2.60	<.72	<1.44	.26	.65	9.4	7.93	117
G4S.5B1X	25 41 30	80 28 45	1.90	1.20	12.00	120	2.40	<.72	<1.44	.24	.36	8.0	7.44	120
G4S.5B2	25 41 30	80 28 45	1.90	1.20	11.00	99	2.31	<.72	<1.44	--	.44	8.3	6.82	88
G4S01B1	25 41 15	80 29 0	2.60	1.60	11.00	110	2.86	<.72	<1.44	.33	.44	49.5	5.83	99
G4S01B1X	25 41 15	80 29 0	2.60	1.60	11.00	44	2.75	<.72	<1.44	--	.33	9.5	3.52	88
G4S01B2	25 41 15	80 29 0	2.60	1.60	10.00	60	2.80	<.72	<1.44	.30	.30	10.0	6.70	80
G4S02B1	25 40 0	80 29 0	4.70	2.90	13.00	182	3.51	<.72	<1.44	.26	.78	8.7	6.50	143
G4S02B2	25 40 0	80 29 0	4.70	2.90	11.00	165	2.75	<.72	<1.44	.22	.88	9.5	5.83	132
G4S04B1	25 38 30	80 28 45	7.60	4.70	13.00	325	4.03	<.72	<1.44	.39	1.17	8.4	9.23	221
G4S04B1X	25 38 30	80 28 45	7.60	4.70	13.00	325	4.03	<.72	<1.44	.39	1.17	8.1	9.49	234
G4S04B2	25 38 30	80 28 45	7.60	4.70	14.00	210	3.78	<.72	<1.44	.28	.84	9.2	6.58	154
G4S08B1	25 34 45	80 29 30	14.80	9.20	11.00	66	2.53	<.72	<1.44	--	.66	5.7	2.64	66
G4S08B2	25 34 45	80 29 30	14.80	9.20	9.20	83	2.21	<.72	<1.44	--	.55	7.4	2.30	92
G4S16B1	25 28 15	80 30 30	26.90	16.70	16.00	64	4.96	<.72	<1.44	.48	.32	5.4	4.48	96
G4S16B1X	25 28 15	80 30 30	26.90	16.70	16.00	64	4.96	<.72	<1.44	.48	.32	4.8	4.48	80
G4S16B2	25 28 15	80 30 30	26.90	16.70	11.00	55	2.97	<.72	<1.44	.22	.33	6.1	2.53	66
CONOCARPUS ERECTA AND MYRICA CERIFERA LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)														
G1E08C1	25 26 0	80 12 15	-12.90	-8.00	11.00	22	2.53	<.72	<1.44	.88	<.26	3.3	.66	44
G1E08C2	25 26 0	80 12 15	-12.90	-8.00	12.00	24	1.92	<.72	<1.44	1.08	<.26	2.4	.72	60
G1W.5C1	25 26 30	80 20 30	1.30	.83	7.20	14	1.51	<.72	<1.44	.36	<.26	4.8	.79	36
G1W.5C1X	25 26 30	80 20 30	1.30	.83	7.20	14	1.51	<.72	<1.44	.36	<.26	3.2	.65	43
G1W.5C2	25 26 30	80 20 30	1.30	.83	8.60	9	1.98	<.72	<1.44	.95	<.26	5.8	.77	52

Appendix I (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA--Continued

SCHINUS TEREBINTHIFOLIUS LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)--Continued

Sample	K ppm	Li ppm	Mg ppm	Mn ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	P ppm	Pb ppm	Tot S %	D-34 S	Sr ppm	Ti ppm	V ppm	Zn ppm
G1E08B1	12,100	.88	2,310	22.0	<.72	19,800	<1.44	1.10	1,650	<.88	.299	20.2	56	<18	<.56	50.6
G1E08B2	17,000	<.52	2,800	23.0	<.72	16,000	<1.44	.70	1,700	<.88	.067	--	39	<18	<.56	59.0
G1W.5B1	13,350	3.60	4,350	10.4	.75	4,050	<1.44	--	930	3.00	.586	-3.5	360	<18	--	22.5
G1W04B1	20,460	<.52	2,046	13.0	<.72	874	<1.44	<.52	735	1.95	.359	14.6	149	<18	<.56	13.0
G1W04B2	15,840	<.52	2,538	12.2	<.72	2,632	<1.44	<.52	799	1.50	.407	13.3	141	<18	<.56	13.2
G1W08B1	6,760	<.52	4,290	54.6	<.72	4,940	<1.44	<.52	793	2.08	.327	22.3	390	<18	<.56	13.0
G1W08B1X	15,600	1.17	4,940	48.1	<.72	9,230	<1.44	1.43	1,196	10.66	.324	22.4	46	<18	2.60	260.0
G1W08B2	12,100	<.52	3,410	31.9	<.72	6,710	<1.44	<.52	858	2.42	.300	19.8	176	<18	<.56	18.7
G1W16B1	11,000	<.52	3,080	27.5	<.72	2,970	<1.44	<.52	1,100	<.88	.317	19.3	121	<18	<.56	22.0
G1W16B2	13,200	<.52	3,080	52.8	<.72	2,420	<1.44	<.52	968	1.54	.353	18.0	121	<18	<.56	18.7
G1W32B1	15,680	1.57	2,842	9.8	<.72	4,018	<1.44	<.52	911	<.88	.250	8.0	186	<18	<.56	23.5
G1W32B2	10,230	<.52	3,410	47.3	1.21	2,750	<1.44	<.52	1,870	.99	.168	10.3	198	<18	<.56	20.9

SCHINUS TEREBINTHIFOLIUS LEAVES; URBAN/AGRICULTURAL TRAVERSE (#3)--Continued

Sample	K ppm	Li ppm	Mg ppm	Mn ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	P ppm	Pb ppm	Tot S %	D-34 S	Sr ppm	Ti ppm	V ppm	Zn ppm
G3E08C1	10,080	.90	9,720	70.2	<.72	36,000	<1.44	--	2,340	1.62	.910	--	101	<18	--	55.8
G3E08C2	14,400	--	7,920	79.2	<.72	34,200	<1.44	--	2,520	--	.688	--	86	<18	--	43.2
G3W.5B1	16,500	1.87	3,300	11.0	<.72	4,620	<1.44	<.52	1,012	1.21	.470	21.1	220	<18	<.56	24.2
G3W.5B2	7,800	<.52	3,200	69.0	.80	4,700	<1.44	<.52	2,100	.90	.607	--	160	<18	<.56	24.0
G3W01B1	15,400	1.10	3,740	17.6	<.72	5,060	<1.44	<.52	1,056	2.20	.408	27.8	242	<18	<.56	27.5
G3W01B2	19,800	.77	4,070	10.4	<.72	4,950	<1.44	<.52	1,210	2.64	.329	--	220	<18	<.56	18.7
G3W02B1	12,610	<.52	4,680	12.2	<.72	3,380	<1.44	<.52	1,300	1.69	.531	--	351	<18	<.56	14.3
G3W02B2	6,110	<.52	5,850	35.1	<.72	3,900	<1.44	<.52	2,210	1.17	.427	16.1	351	<18	<.56	7.9
G3W04B1	7,298	<.52	3,116	58.2	<.72	3,936	<1.44	<.52	984	2.95	.188	11.9	115	<18	<.56	13.9
G3W04B2	8,064	<.52	2,604	48.7	<.72	4,452	<1.44	<.52	815	3.44	.217	--	134	<18	<.56	20.2
G3W08B1	13,000	<.52	2,800	100.0	<.72	2,500	<1.44	<.52	950	2.90	.271	11.9	110	<18	<.56	22.0
G3W08B2	15,640	<.52	2,484	82.8	<.72	2,392	<1.44	<.52	1,012	2.39	.186	--	101	<18	<.56	22.1
G3W16B1	15,400	<.52	2,750	63.8	<.72	1,760	<1.44	<.52	880	1.87	.299	13.0	121	<18	<.56	19.8
G3W16B2	14,000	<.52	4,000	38.0	<.72	2,900	<1.44	<.52	1,400	3.60	.245	11.2	130	<18	<.56	14.0

SCHINUS TEREBINTHIFOLIUS LEAVES; CEMENT PLANT/AGRICULTURAL TRAVERSE (#4)--Continued

Sample	K ppm	Li ppm	Mg ppm	Mn ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	P ppm	Pb ppm	Tot S %	D-34 S	Sr ppm	Ti ppm	V ppm	Zn ppm
G4S.5B1	24,700	.65	3,640	24.7	<.72	5,720	<1.44	<.52	1,240	9.23	.329	--	169	<18	<.56	26.0
G4S.5B1X	22,800	<.52	3,360	22.8	<.72	5,280	<1.44	<.52	1,188	8.04	.371	--	156	<18	<.56	24.0
G4S.5B2	19,800	<.52	3,080	15.4	<.72	3,630	<1.44	<.52	1,012	6.93	.332	9.7	121	<18	<.56	25.3
G4S01B1	15,400	<.52	4,400	42.9	<.72	3,300	<1.44	<.52	1,650	4.18	.295	--	143	<18	<.56	15.4
G4S01B1X	18,700	<.52	3,080	96.8	<.72	2,310	<1.44	<.52	1,012	2.64	.268	--	97	<18	<.56	27.5
G4S01B2	11,000	<.52	3,700	110.0	<.72	3,000	<1.44	<.52	1,100	2.50	.229	--	150	<18	<.56	22.0
G4S02B1	16,900	<.52	3,900	31.2	<.72	3,380	<1.44	<.52	1,690	6.50	.402	8.9	143	<18	<.56	15.6
G4S02B2	11,000	.55	3,300	33.0	<.72	4,730	<1.44	<.52	1,320	6.16	.420	8.8	110	<18	<.56	17.6
G4S04B1	9,490	<.52	4,680	123.5	<.72	3,510	<1.44	<.52	1,183	8.84	.351	11.8	234	<18	<.56	22.1
G4S04B1X	9,360	.65	4,810	126.1	<.72	3,510	<1.44	<.52	1,300	8.71	.311	13.8	234	26	<.56	20.8
G4S04B2	13,860	.56	5,600	81.2	<.72	3,780	<1.44	--	1,400	6.30	.416	13.3	154	<18	<.56	12.7
G4S08B1	18,700	<.52	2,970	84.7	<.72	1,540	<1.44	<.52	6,050	2.20	.350	9.8	95	<18	<.56	14.3
G4S08B2	16,560	<.52	3,312	44.2	<.72	1,288	<1.44	<.52	4,048	1.47	.224	10.6	86	<18	<.56	8.8
G4S16B1	14,240	--	4,960	57.6	<.72	2,400	<1.44	--	1,488	2.72	.403	11.8	320	<18	--	19.2
G4S16B1X	12,960	--	4,800	59.2	<.72	2,400	<1.44	--	1,472	2.72	.406	12.5	320	<18	--	19.2
G4S16B2	13,200	<.52	3,300	40.7	<.72	2,970	<1.44	<.52	1,650	1.43	.386	11.6	198	<18	<.56	12.1

CONOCARPUS ERECTA AND MYRICA CERIFERA LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)--Continued

Sample	K ppm	Li ppm	Mg ppm	Mn ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	P ppm	Pb ppm	Tot S %	D-34 S	Sr ppm	Ti ppm	V ppm	Zn ppm
G1E08C1	3,630	.88	13,200	16.5	<.72	6,160	<1.44	<.52	1,210	<.88	1.010	--	143	<18	<.56	58.3
G1E08C2	4,080	.84	13,200	13.2	<.72	12,000	<1.44	<.52	876	1.44	.757	19.4	132	<18	<.56	34.8
G1W.5C1	7,200	<.52	9,360	6.0	<.72	1,008	<1.44	<.52	540	<.80	.434	19.3	86	<18	<.56	28.8
G1W.5C1X	7,200	<.52	9,360	6.0	<.72	936	<1.44	<.52	554	<.88	.440	--	86	<18	<.56	28.1
G1W.5C2	9,460	<.52	8,600	5.9	<.72	817	<1.44	.69	559	<.80	.641	18.0	120	<18	<.56	18.1

Appendix I (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA--Continued

Sample	LATITUDE	LONGITUDE	DIST. KM	DIST. MI	Ash %	Al ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cu ppm	Ba ppm	Fe ppm
CONOCARPUS ERECTA AND MYRICA CERIFERA LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)														
G1W01C1	25 26 15	80 21 15	2.60	1.60	11.00	11	3.30	<.72	<1.44	.22	<.26	8.1	1.43	55
G1W01C2	25 26 15	80 21 15	2.60	1.60	11.00	22	3.30	<.72	<1.44	.22	<.26	6.8	1.43	55
G1W02C1	25 26 15	80 22 15	4.20	2.60	8.30	17	2.07	<.72	<1.44	.25	<.26	6.5	1.08	42
G1W02C1X	25 26 15	80 22 15	4.20	2.60	8.20	16	2.13	<.72	<1.44	.16	<.26	5.2	1.07	49
G1W02C2	25 26 15	80 22 15	4.20	2.60	6.30	13	1.70	<.72	<1.44	.13	<.26	5.0	1.51	38
G1W32M1	25 24 0	80 47 30	47.00	29.20	4.10	29	1.07	<.72	<1.44	.12	<.26	2.0	1.60	82
G1W32M2	25 24 0	80 47 30	47.00	29.20	3.90	23	.90	<.72	<1.44	--	<.26	2.3	1.40	70
CONOCARPUS ERECTA LEAVES; NATIVE/UNDISTURBED TRAVERSE (#2)														
G2E05C1	25 18 0	80 17 45	-7.90	-4.90	11.00	22	1.87	<.72	<1.44	.66	<.26	15.4	1.21	44
G2E05C2	25 18 0	80 17 45	-7.90	-4.90	14.00	14	2.38	<.72	<1.44	1.12	--	32.2	1.40	42
G2W01C1	25 20 15	80 23 15	2.60	1.60	13.00	26	1.82	<.72	<1.44	.52	<.26	3.3	1.30	52
G2W01C1X	25 20 15	80 23 15	2.60	1.60	13.00	13	1.82	<.72	<1.44	.39	<.26	3.4	1.17	52
G2W01C2	25 20 15	80 23 15	2.60	1.60	12.00	24	2.16	<.72	<1.44	.36	<.26	5.8	1.32	36
G2W02C1	25 19 30	80 24 30	3.90	2.40	12.00	12	1.80	<.72	<1.44	.36	<.26	3.8	.72	36
G2W02C1X	25 19 30	80 24 30	3.90	2.40	12.00	12	1.80	<.72	<1.44	.24	<.26	4.2	.84	48
G2W02C2	25 19 30	80 24 30	3.90	2.40	11.00	22	1.54	<.72	<1.44	—	<.26	3.9	.77	44
G2W04C1	25 19 30	80 26 0	6.60	4.10	9.00	18	2.05	<.72	<1.44	.29	<.25	4.4	1.27	53
G2W04C2	25 19 30	80 26 0	6.60	4.10	11.00	33	2.53	<.72	<1.44	.22	<.26	3.5	2.20	66
G2W08C1	25 20 0	80 29 30	12.90	8.00	6.80	34	1.70	<.72	<1.44	--	<.26	2.5	23.80	41
G2W08C2	25 20 0	80 29 30	12.90	8.00	6.00	30	.84	<.72	<1.44	--	<.26	5.3	.78	54
G2W16C1	25 19 30	80 37 0	25.60	15.90	7.00	28	2.03	<.72	<1.44	.21	<.26	1.8	43.40	56
G2W16C2	25 19 30	80 37 0	25.60	15.90	8.30	25	2.32	<.72	<1.44	.42	<.26	6.5	3.07	66
G2W32C1	25 19 30	80 49 45	46.50	28.90	6.80	14	1.22	<.72	<1.44	.48	<.26	4.0	.68	82
G2W32C2	25 19 30	80 49 45	46.50	28.90	8.10	16	2.35	<.72	<1.44	.57	.32	.9	1.62	41
PINUS ELLIOTTII NEEDLES; URBAN/AGRICULTURAL TRAVERSE (#3)														
G3W04E1	25 33 15	80 22 45	7.20	4.50	2.00	60	.36	<.72	<1.44	.06	.40	3.4	.76	56
G3W04E2	25 33 15	80 22 45	7.20	4.50	2.30	76	.39	<.72	<1.44	.05	.37	3.4	.76	44
G3W08E1	25 34 45	80 26 15	12.90	8.00	2.30	51	.39	<.72	<1.44	.07	<.26	5.0	.53	39
G3W08E2	25 34 45	80 26 15	12.90	8.00	1.70	46	.25	<.72	<1.44	.07	<.26	5.8	.56	41
G3W16E1	25 32 15	80 30 45	20.80	12.90	2.10	53	.20	<.72	<1.44	.04	<.26	5.9	.48	48
G3W16E1X	25 32 15	80 30 45	20.80	12.90	2.10	50	.20	<.72	<1.44	.08	<.26	6.1	.44	46
G3W16E2	25 32 15	80 30 45	20.80	12.90	2.20	62	.42	<.72	<1.44	.09	<.26	7.9	.57	51
CLADIUM JAMAICENSIS CULMS AND LEAVES; NATIVE/UNDISTURBED TRAVERSE (#2)														
G2W04G1	25 19 30	80 26 0	6.60	4.10	3.10	22	.31	<.72	<1.44	--	<.26	1.6	.62	50
G2W04G2	25 19 30	80 26 0	6.60	4.10	2.60	16	.22	<.72	<1.44	--	<.26	1.0	.73	36
G2W16G1	25 19 30	80 37 0	25.60	15.90	2.90	17	.35	<.72	<1.44	.06	<.26	1.2	1.36	38
G2W16G1X	25 19 30	80 37 0	25.60	15.90	2.90	15	.35	<.72	<1.44	--	<.26	1.2	1.39	35
G2W16G2	25 19 30	80 37 0	25.60	15.90	3.50	18	.42	<.72	<1.44	.07	<.26	2.8	1.70	42
G2W32G1	25 19 30	80 49 45	46.50	28.90	3.20	22	.35	<.72	<1.44	--	<.26	1.6	1.06	54
G2W32G1X	25 19 30	80 49 45	46.50	28.90	3.10	22	.34	<.72	<1.44	--	<.26	1.4	.84	50
G2W32G2	25 19 30	80 49 45	46.50	28.90	3.40	27	.37	<.72	<1.44	.07	<.26	1.6	.71	48
YOUNG CASUARINA EQUISETIFOLIA TRUNK WOOD; POWER PLANT/AGRICULTURAL TRAVERSE (#1)														
1W.5AW1	25 26 30	80 20 30	1.30	.83	.59	3	.18	<.72	<1.44	<.02	<.26	.6	.06	11
1W01AW1	25 26 15	80 21 15	2.60	1.60	.99	<1	.35	<.72	<1.44	<.02	<.26	.3	.07	4
1W02AW1	25 26 15	80 22 15	4.20	2.60	1.30	<1	.40	<.72	<1.44	.03	<.26	.2	.06	4
1W04AW1	25 26 15	80 23 45	6.90	4.30	.98	<1	.33	<.72	<1.44	.03	<.26	.4	.06	4
1W08AW1	25 26 30	80 27 45	13.70	8.50	.76	<1	.25	<.72	<1.44	.02	<.26	.7	.05	2
1W08AW1X	25 26 30	80 27 45	13.70	8.50	.76	<1	.25	<.72	<1.44	.02	<.26	.7	.05	2

Appendix I (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA--Continued

Sample	K ppm	Li ppm	Mg ppm	Mn ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	P ppm	Pb ppm	Tot S %	D-34 S	Sr ppm	Ti ppm	V ppm	Zn ppm
CONOCARPUS ERECTA AND MYRICA CERIFERA LEAVES; POWER PLANT/AGRICULTURAL TRAVERSE (#1)--Continued																
G1W01C1	6,020	<.52	6,710	9.8	<.72	1,070	<1.44	<.52	484	1.10	.217	17.3	143	<18	<.56	13.2
G1W01C2	6,160	<.52	7,590	9.8	<.72	2,090	<1.44	<.52	451	<.88	.290	18.0	154	<18	<.56	15.4
G1W02C1	6,806	<.52	5,810	7.2	<.72	3,237	<1.44	<.52	614	<.88	.350	14.5	125	<18	<.56	12.4
G1W02C1X	6,888	<.52	5,822	7.2	<.72	3,280	<1.44	<.52	607	<.88	.351	--	123	<18	<.56	12.3
G1W02C2	4,851	<.52	4,725	5.7	<.72	2,142	<1.44	<.52	498	<.88	.220	17.2	88	<18	<.56	10.7
G1W32M1	4,510	<.52	1,722	69.7	<.72	1,640	<1.44	<.52	451	.90	.029	--	49	<18	<.56	11.9
G1W32M2	5,070	<.52	1,677	66.3	<.72	1,911	<1.44	<.52	507	<.88	.147	--	43	<18	<.56	12.9
CONOCARPUS ERECTA LEAVES; NATIVE/UNDISTURBED TRAVERSE (#2)--Continued																
G2E05C1	2,090	.88	7,810	6.8	<.72	14,300	<1.44	<.52	440	.88	.302	9.8	105	<18	<.56	52.8
G2E05C2	4,900	1.26	9,100	8.5	<.72	16,800	<1.44	1.26	602	1.40	.710	13.1	140	<18	<.56	99.4
G2W01C1	2,730	.65	7,670	10.3	<.72	19,500	<1.44	<.52	429	1.04	.717	8.2	143	<18	<.56	20.8
G2W01C1X	2,600	.65	7,410	10.1	<.72	19,500	<1.44	<.52	429	1.43	.644	8.0	143	<18	<.56	20.8
G2W01C2	2,520	.72	8,640	9.6	<.72	14,400	<1.44	<.52	492	--	.781	9.9	156	<18	<.56	22.8
G2W02C1	2,800	.96	8,040	7.7	<.72	16,800	<1.44	<.52	456	--	.687	10.6	144	<18	<.56	22.8
G2W02C1X	2,880	.84	8,160	7.8	<.72	16,800	<1.44	<.52	456	.96	.631	11.1	144	<18	<.56	21.6
G2W02C2	3,850	.66	8,470	7.9	<.72	15,400	<1.44	<.52	385	1.54	.469	12.6	121	<18	<.56	22.0
G2W04C1	6,370	<.52	5,800	5.9	<.72	8,232	<1.44	<.52	598	<.88	.483	26.4	147	<18	<.56	9.3
G2W04C2	3,960	<.52	9,460	10.0	<.72	7,260	<1.44	<.52	616	<.88	.461	24.9	176	<18	<.56	13.2
G2W08C1	6,052	<.52	6,052	20.4	<.72	1,632	<1.44	<.52	524	<.88	.096	12.0	184	<18	<.56	49.6
G2W08C2	6,600	<.52	1,860	7.8	<.72	8,400	<1.44	<.52	780	<.88	.127	11.3	52	<18	<.56	16.8
G2W16C1	5,950	<.52	4,830	32.9	<.72	1,120	<1.44	<.52	630	<.88	.002	15.9	252	<18	<.56	24.5
G2W16C2	6,640	<.52	6,474	11.6	<.72	1,079	<1.44	<.52	639	<.88	.410	18.1	149	<18	<.56	14.9
G2W32C1	10,200	<.52	5,236	17.7	<.72	2,856	<1.44	<.52	1,020	<.88	.296	27.1	95	<18	<.56	12.2
G2W32C2	2,916	<.52	7,776	7.9	<.72	1,458	<1.44	.65	429	<.88	.247	27.3	203	<18	<.56	5.5
PINUS ELLIOTTII NEEDLES; URBAN/AGRICULTURAL TRAVERSE (#3)--Continued																
G3W04E1	1,540	<.52	1,260	10.8	<.72	1,640	<1.44	<.52	560	3.80	.068	13.5	24	<18	<.56	12.6
G3W04E2	1,173	<.52	1,426	23.0	<.72	2,530	<1.44	<.52	483	3.22	.066	11.4	28	<18	<.56	13.1
G3W08E1	2,990	<.52	2,024	142.6	<.72	483	<1.44	<.52	414	1.52	.082	10.1	18	<18	<.56	43.7
G3W08E2	3,060	<.52	1,105	79.9	<.72	850	<1.44	<.52	323	2.21	.055	15.7	13	<18	<.56	14.4
G3W16E1	5,250	<.52	1,302	48.3	<.72	693	<1.44	<.52	546	1.36	.016	--	5	<18	<.56	19.3
G3W16E1X	5,040	<.52	1,302	48.3	<.72	693	<1.44	<.52	525	1.43	.065	18.3	5	<18	<.56	19.1
G3W16E2	2,420	<.52	1,738	94.6	<.72	1,232	<1.44	<.52	506	1.87	.075	--	15	<18	<.56	28.6
CLADIUM JAMAICENSIS CULMS AND LEAVES; NATIVE/UNDISTURBED TRAVERSE (#2)--Continued																
G2W04G1	5,270	<.52	837	65.1	<.72	1,302	<1.44	<.52	174	1.09	.188	--	24	<18	<.56	3.4
G2W04G2	3,900	<.52	754	39.0	<.72	1,560	<1.44	<.52	164	<.88	.266	--	18	<18	<.56	4.4
G2W16G1	4,930	<.52	377	43.5	<.72	696	<1.44	<.52	200	<.88	.094	--	22	<18	<.56	4.1
G2W16G1X	4,930	<.52	377	43.5	<.72	696	<1.44	<.52	197	<.88	.096	--	22	<18	<.56	4.1
G2W16G2	7,700	<.52	560	49.0	<.72	595	<1.44	<.52	305	<.88	.126	19.0	24	<18	<.56	5.9
G2W32G1	6,080	<.52	544	83.2	<.72	1,760	<1.44	<.52	285	<.88	.136	--	29	<18	<.56	6.7
G2W32G1X	5,890	<.52	496	80.6	<.72	1,674	<1.44	<.52	273	<.88	.139	--	28	<18	<.56	6.5
G2W32G2	5,440	<.52	510	88.4	.92	1,088	<1.44	<.52	231	.88	.098	30.4	34	<18	<.56	3.7
YOUNG CASUARINA EQUISETIFOLIA TRUNK WOOD; POWER PLANT/AGRICULTURAL TRAVERSE (#1)--Continued																
1W.5AW1	572	<.52	207	2.2	2.06	142	<1.44	<.52	57	<.88	.022	--	4	<18	<.56	2.5
1W01AW1	871	<.52	139	4.7	1.19	109	<1.44	<.52	24	<.88	.021	14.2	13	<18	<.56	1.3
1W02AW1	1,430	<.52	182	1.8	<.72	234	<1.44	<.52	35	<.88	.014	18.0	11	<18	<.56	.9
1W04AW1	1,078	<.52	127	4.1	.91	30	<1.44	<.52	27	<.88	.018	--	12	<18	<.56	1.9
1W08AW1	380	<.52	84	4.3	<.72	334	<1.44	<.52	23	<.88	.013	--	9	<18	<.56	1.5
1W08AW1X	372	<.52	84	4.3	<.72	327	<1.44	<.52	23	<.88	<.005	--	9	<18	<.56	1.5

Appendix I (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA--Continued

Sample	LATITUDE	LONGITUDE	DIST. KM	DIST. MI	Ash %	Al ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cu ppm	Ba ppm	Fe ppm
OLD CASUARINA EQUISETIFOLIA TRUNK WOOD; POWER PLANT/AGRICULTURAL TRAVERSE (#1)														
1W.5AW2	22 26 30	80 20 30	1.30	.83	.57	<1	.19	<.72	<1.44	<.02	<.26	.4	.03	13
1W01AW2	25 26 15	80 21 15	2.60	1.60	.90	3	.31	<.72	<1.44	<.02	<.26	.2	1.35	3
1W02AW2	25 26 15	80 22 15	4.20	2.60	.55	<1	.12	<.72	<1.44	<.02	<.26	.2	.03	2
1W04AW2	25 26 15	80 23 45	6.90	4.30	.91	<1	.25	<.72	<1.44	.03	<.26	.3	.05	5
1W08AW2	25 26 30	80 27 45	13.70	8.50	.72	<1	.24	<.72	<1.44	<.02	<.26	.5	.06	1
YOUNG CASUARINA EQUISETIFOLIA TRUNK WOOD; URBAN/AGRICULTURAL TRAVERSE (#3)														
3W.5AW1	25 33 30	80 19 0	.53	.33	1.20	<1	.37	<.72	<1.44	.02	<.26	.9	.02	5
3W01AW1	25 33 30	80 19 45	1.20	.76	.80	<1	.18	<.72	<1.44	<.02	<.26	1.4	.04	3
3W02AW1	25 33 45	80 20 30	3.40	2.10	.68	<1	.15	<.72	<1.44	.02	<.26	.7	.04	3
3W02AW1X	25 33 45	80 20 30	3.40	2.10	.67	<1	.15	<.72	<1.44	.02	<.26	.7	.04	3
OLD CASUARINA EQUISETIFOLIA TRUNK WOOD; URBAN/AGRICULTURAL TRAVERSE (#3)														
3W.5AW2	25 33 30	80 19 0	.53	.33	.94	<1	.28	<.72	<1.44	<.02	<.26	.5	.03	3
3W01AW2	25 33 30	80 19 45	1.20	.76	.72	<1	.22	<.72	<1.44	<.02	<.26	.6	.04	1
3W02AW2	25 33 45	80 20 30	3.40	2.10	.61	<1	.16	<.72	<1.44	<.02	<.26	.3	.04	3
YOUNG PINUS ELLIOTTII TRUNK WOOD; URBAN/AGRICULTURAL TRAVERSE (#3)														
3W04EW1	25 33 15	80 22 45	7.20	4.50	.22	4	.05	<.72	<1.44	<.02	<.26	.8	.46	20
3W04EW2	25 33 15	80 22 45	7.20	4.50	.27	2	.08	<.72	<1.44	<.02	<.26	.9	.12	22
3W32EW1	25 23 0	80 38 15	32.10	20.00	.23	2	.07	<.72	<1.44	<.02	<.26	.5	.09	3
3W32EW2	25 23 0	80 38 15	32.10	20.00	.32	2	.11	<.72	<1.44	<.02	<.26	.4	.13	6

Appendix I (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF PLANT SAMPLES, FLORIDA--Continued

Sample	K ppm	Li ppm	Mg ppm	Mn ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	P ppm	Pb ppm	Tot S %	D-34 S	Sr ppm	Ti ppm	V ppm	Zn ppm
OLD CASUARINA EQUISETIFOLIA TRUNK WOOD; POWER PLANT/AGRICULTURAL TRAVERSE (#1)--Continued																
1W.5AW2	359	<.52	251	1.1	10.26	68	<1.44	<.52	22	<.88	.010	--	6	<18	<.56	1.1
1W01AW2	639	<.52	270	3.4	2.79	77	<1.44	<.52	23	<.88	<.005	--	12	<18	<.56	1.2
1W02AW2	1,210	<.52	143	1.8	<.72	99	<1.44	<.52	37	<.88	.021	--	4	<18	<.56	.9
1W04AW2	1,092	<.52	237	4.6	<.72	51	<1.44	<.52	18	<.88	.018	--	8	<18	<.56	.8
1W08AW2	266	<.52	137	6.6	<.72	360	<1.44	<.52	20	<.88	.015	--	9	<18	<.56	1.2
YOUNG CASUARINA EQUISETIFOLIA TRUNK WOOD; URBAN/AGRICULTURAL TRAVERSE (#3)--Continued																
3W.5AW1	1,800	<.52	156	.9	1.44	101	<1.44	<.52	85	<.88	.021	8.1	7	<18	<.56	1.7
3W01AW1	1,840	<.52	144	1.0	<.72	104	<1.44	<.52	51	<.88	.016	--	6	<18	<.56	2.2
3W02AW1	1,632	<.52	95	.6	<.72	68	<1.44	<.52	66	<.88	.017	--	7	<18	<.56	1.0
3W02AW1X	1,608	<.52	94	.6	<.72	74	<1.44	<.52	66	<.88	.023	--	7	<18	<.56	.9
OLD CASUARINA EQUISETIFOLIA TRUNK WOOD; URBAN/AGRICULTURAL TRAVERSE (#3)--Continued																
3W.5AW2	1,316	<.52	226	1.2	2.16	92	<1.44	<.52	42	<.88	.012	--	6	<18	<.56	.9
3W01AW2	936	<.52	302	.9	.79	69	<1.44	<.52	30	<.88	.017	--	8	<18	<.56	1.5
3W02AW2	915	<.52	342	.5	.92	79	<1.44	<.52	41	<.88	.008	--	8	<18	<.56	.7
YOUNG PINUS ELLIOTTII TRUNK WOOD; URBAN/AGRICULTURAL TRAVERSE (#3)--Continued																
3W04EW1	172	<.52	110	1.9	<.72	51	<1.44	<.52	51	<.88	.011	--	5	<18	<.56	2.2
3W04EW2	143	<.52	146	2.7	<.72	38	<1.44	<.52	38	<.88	<.005	--	7	<18	<.56	2.5
3W32EW1	202	<.52	163	2.5	<.72	23	<1.44	<.52	23	<.88	<.005	--	7	<18	<.56	3.4
3W32EW2	160	<.52	214	3.0	<.72	28	<1.44	<.52	29	<.88	.014	--	11	<18	<.56	3.5

Appendix I (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF SOIL SAMPLES, FLORIDA

[--, no data available; <, less than the analytical lower limit of determination (adjusted for solution and sample composition effects)]

Sample	LATITUDE	LONGITUDE	DIST. KM	AL %	BA PPM	BE PPM	CA %	CE PPM	CO PPM	CR PPM	CU PPM	FE %	GA PPM	K%	LA PPM
POWER PLANT/AGRICULTURE TRAVERSE (#1)															
1E8.0RS	25 26 0	80 12 15	-12.90	.66	21	<1	29.0	6	2	18	3	.31	<4	.07	3
1E8.0S	25 26 0	80 12 15	-12.90	1.00	32	<1	24.0	9	2	19	1	.38	<4	.16	4
1W0.5RS	25 26 30	80 20 30	1.30	.40	16	<1	30.0	5	2	10	2	.20	<4	<.05	<2
1W0.5S	25 26 30	80 20 30	1.30	.40	17	<1	34.0	<4	<1	8	4	.17	<4	<.05	<2
1W1.0P	25 26 15	80 21 15	2.60	.09	9	<1	3.7	<4	1	5	4	.13	<4	<.05	<2
1W1.0RP	25 26 15	80 21 15	2.60	.54	14	<1	9.5	8	1	13	8	.32	<4	.06	2
1W2.0P	25 26 15	80 22 15	4.20	.49	14	<1	3.5	6	2	14	13	.37	<4	.06	<2
1W2.0RP	25 26 15	80 22 15	4.20	.35	15	<1	4.0	<4	2	17	6	.32	<4	<.05	<2
1W4.0RS	25 26 15	80 23 45	6.90	.27	15	<1	32.0	<4	1	5	6	.17	<4	<.05	<2
1W4.0S	25 26 15	80 23 45	6.90	.11	13	<1	35.0	<4	1	2	6	.11	<4	<.05	<2
1W8.0RS	25 26 30	80 27 45	13.70	.08	15	<1	34.0	<4	2	2	4	.13	<4	<.05	<2
1W8.0S	25 26 30	80 27 45	13.70	.07	15	<1	35.0	<4	1	4	<1	.12	<4	<.05	<2
1W16.0L	25 26 15	80 23 45	26.00	.05	7	<1	39.0	<4	2	4	<1	.02	<4	<.05	<2
1W16.0RS	25 26 0	80 35 30	26.00	1.10	33	<1	32.0	12	2	34	19	1.20	<4	<.05	5
1W16.0S	25 26 0	80 35 30	26.00	1.20	32	<1	31.0	14	2	31	10	1.40	<4	<.05	5
1W16.0SD	25 26 0	80 35 30	26.00	1.20	32	<1	31.0	13	2	30	7	1.40	<4	<.05	5
1W32.0L	25 24 0	80 47 30	37.00	.17	7	<1	38.0	<4	2	8	<1	.09	<4	<.05	<2
1W32.0LD	25 24 0	80 47 30	37.00	.19	8	<1	38.0	<4	3	8	1	.10	<4	<.05	<2
1W32.0P	25 24 0	80 47 30	37.00	9.40	98	2	3.5	82	6	220	3	3.90	16	.06	40
1W32.0RP	25 24 0	80 47 30	37.00	7.80	86	2	2.4	65	6	190	6	3.80	13	.07	42
NATIVE/UNDISTURBED TRAVERSE (#2)															
2E5.0L	25 18 0	80 17 45	-7.90	.06	6	<1	38.0	<4	2	3	1	.03	<4	<.05	<2
2E5.0RS	25 18 0	80 17 45	-7.90	.60	19	<1	31.0	9	2	16	8	.36	<4	<.05	2
2E5.0S	25 18 0	80 17 45	-7.90	.20	12	<1	35.0	<4	2	8	4	.25	<4	<.05	<2
2W1.0P	25 20 15	80 23 15	2.60	.28	11	<1	2.0	<4	<1	7	2	.31	<4	.21	<2
2W1.0RP	25 20 15	80 23 15	2.60	.40	18	<1	2.0	4	<1	23	6	.21	<4	.27	3
2W1.0RPD	25 20 15	80 23 15	2.60	.50	14	<1	2.1	7	1	11	4	.22	<4	.26	3
2W2.0P	25 19 30	80 24 30	3.90	.60	13	<1	2.3	8	1	12	4	.26	<4	.23	3
2W2.0RP	25 19 30	80 24 30	3.90	.36	9	<1	2.4	<4	<1	7	4	.12	<4	.22	<2
2W2.0RPD	25 19 30	80 24 30	3.90	.36	9	<1	2.4	5	1	15	5	.12	<4	.23	<2
2W4.0P	25 19 30	80 26 0	6.60	.31	15	<1	3.8	<4	2	12	4	.33	<4	.09	<2
2W4.0RP	25 19 30	80 26 0	6.60	.21	23	<1	17.0	<4	1	9	4	.49	<4	.13	<2
2W4.0RPD	25 19 30	80 26 0	6.60	.19	22	<1	16.0	<4	1	8	4	.44	<4	.09	<2
2W8.0RS	25 20 0	80 29 30	12.90	.54	17	<1	35.0	5	1	13	1	.52	<4	<.05	<2
2W8.0S	25 20 0	80 29 30	12.90	.51	18	<1	34.0	4	2	14	<1	.45	<4	<.05	<2
2W8.0SD	25 20 0	80 29 30	12.90	.53	18	<1	34.0	<4	2	13	3	.46	<4	<.05	<2
2W16.0P	25 19 30	80 37 0	25.60	7.60	77	2	3.1	73	5	190	6	2.80	12	.10	44
2W16.0RP	25 19 30	80 37 0	25.60	8.30	120	2	4.5	85	6	210	8	2.70	12	.11	51
2W32.0RS	25 19 30	80 49 45	46.50	.15	13	<1	33.0	<4	1	2	2	.13	<4	<.05	<2
2W32.0S	25 19 30	80 49 45	46.50	.69	18	<1	28.0	5	2	12	5	.36	<4	<.05	<2
URBAN/AGRICULTURE TRAVERSE (#3)															
3E8.0RS	25 30 0	80 10 45	-14.50	.04	11	<1	21.0	<4	1	2	2	.04	<4	<.05	<2
3E8.0S	25 30 0	80 10 45	-14.50	.04	12	<1	20.0	<4	<1	1	1	.02	<4	<.05	<2
3W0.5RS	25 33 30	80 19 0	.53	.51	16	<1	32.0	4	2	14	7	.43	<4	.06	<2
3W0.5S	25 33 30	80 19 0	.53	.45	16	<1	31.0	<4	2	12	11	.35	<4	.05	<2
3W1.0RS	25 33 30	80 19 45	1.20	.91	31	<1	29.0	9	2	31	19	.47	<4	.05	3
3W1.0S	25 33 30	80 19 45	1.20	.32	20	<1	31.0	<4	2	26	22	.23	<4	<.05	<2
3W2.0RS	25 33 45	80 20 30	3.40	.21	23	<1	35.0	<4	1	27	34	.23	<4	<.05	<2
3W2.0S	25 33 45	80 20 30	3.40	.25	26	<1	33.0	<4	2	25	39	.22	<4	<.05	<2
3W2.0SD	25 33 45	80 20 30	3.40	.25	25	<1	34.0	<4	2	26	42	.21	<4	<.05	<2
3W4.0L	25 33 15	00 22 45	7.20	.17	7	<1	38.0	4	2	8	1	.11	<4	<.05	<2
3W4.0LD	25 33 15	80 22 45	7.20	.21	7	<1	37.0	<4	3	8	1	.12	<4	<.05	<2

Appendix II.

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF SOIL SAMPLES, FLORIDA--Continued

Sample	LI PPM	MG%	MN PPM	MO PPM	NA%	NB PPM	ND PPM	NI PPM	P%	PB PPM	TOTAL S%	SC PPM	SR PPM	TH PPM	TI%
POWER PLANT/AGRICULTURE TRAVERSE (#1)--Continued															
1E8.0RS	0	.45	60	<2	.26	5	<4	4	.070	6	.034	<2	2,000	<4	.040
1E8.0S	15	.76	68	<2	.99	<4	5	6	.070	<4	.017	<2	1,700	<4	.050
1W0.5RS	7	.29	73	<2	.07	<4	<4	5	.010	5	.174	<2	1,200	<4	.020
1W0.5S	7	.34	80	<2	.08	<4	<4	4	.010	4	.054	<2	1,300	<4	.020
1W1.0P	4	.36	6	<2	.27	<4	<4	7	.040	8	.584	<2	340	<4	.006
1W1.0RP	9	.34	16	<2	.33	<4	<4	8	.080	13	.918	<2	510	<4	.030
1W2.0P	23	.30	11	<2	.21	<4	<4	10	.070	25	1.660	<2	320	<4	.030
1W2.0RP	8	.30	8	2	.19	<4	<4	7	.060	9	1.380	<2	420	<4	.020
1W4.0RS	3	.26	43	<2	.03	<4	<4	3	.020	11	.014	<2	1,200	<4	.010
1W4.0S	<2	.22	37	<2	.02	<4	<4	3	.010	7	.007	<2	1,200	<4	<.005
1W8.0RS	<2	.15	51	<2	.15	<4	<4	2	.030	6	.016	<2	860	<4	<.005
1W8.0S	<2	.15	63	<2	.16	<4	<4	<2	.020	5	.014	<2	900	<4	<.005
1W16.0L	<2	.12	5	<2	.05	<4	<4	<2	.009	<4	.008	<2	2,700	<4	<.005
1W16.0RS	13	.30	190	<2	.03	<4	5	8	.120	6	.020	<2	700	<4	.050
1W16.0S	14	.29	150	<2	.03	<4	8	8	.060	4	.015	<2	710	<4	.060
1W16.0SD	14	.29	150	<2	.03	<4	5	9	.060	6	.020	<2	690	<4	.060
1W32.0L	3	.11	24	<2	.03	<4	<4	2	<.005	<4	.008	<2	2,200	<4	.009
1W32.0LD	3	.12	27	<2	.04	<4	<4	3	<.005	<4	.010	<2	2,200	<4	.009
1W32.0P	110	.36	87	<2	.10	15	40	53	.060	34	.032	15	280	15	.540
1W32.0RP	99	.27	66	<2	.09	11	36	48	.090	30	.189	12	260	12	.450
NATIVE/UNDISTURBED TRAVERSE (#2)--Continued															
2E5.0L	<2	.33	27	<2	.03	<4	<4	<2	.020	<4	<.005	<2	1,400	<4	<.005
2E5.0RS	7	.29	180	<2	.05	<4	4	5	.040	19	.015	<2	1,400	<4	.030
2E5.0S	3	.31	140	<2	.04	<4	<4	3	.030	28	.012	<2	1,400	<4	.010
2W1.0P	9	1.20	8	<2	4.20	<4	<4	4	.050	9	1.300	<2	270	<4	.020
2W1.0RP	50	1.20	10	2	3.90	<4	<4	10	.070	<4	1.630	<2	250	<4	.030
2W1.0RPD	35	1.20	9	2	4.10	<4	<4	6	.070	<4	1.620	<2	260	<4	.030
2W2.0P	14	1.30	10	2	3.10	<4	<4	6	.090	7	1.220	<2	290	<4	.040
2W2.0RP	26	1.40	6	3	3.70	<4	4	4	.050	<4	1.390	<2	290	<4	.020
2W2.0RPD	17	1.40	7	4	3.70	<4	<4	6	.050	<4	1.290	<2	300	<4	.020
2W4.0P	12	.82	10	3	1.10	<4	<4	8	.060	7	1.140	<2	440	<4	.020
2W4.0RP	13	1.10	20	<2	1.60	<4	<4	5	.000	<4	.368	<2	810	<4	.010
2W4.0RPD	15	1.00	18	<2	1.60	<4	<4	4	.080	<4	.344	<2	740	<4	.010
2W8.0RS	7	.29	63	<2	.04	<4	<4	4	.006	<4	<.005	<2	1,200	<4	.030
2W8.0S	6	.30	67	<2	.06	<4	<4	4	.008	<4	.015	<2	1,200	<4	.030
2W8.0SD	7	.30	67	<2	.06	<4	<4	4	.008	<4	.011	<2	1,200	<4	.030
2W16.0P	95	.40	91	<2	.06	12	38	49	.070	24	.253	14	250	13	.430
2W16.0RP	90	.47	98	<2	.10	11	43	55	.110	37	.205	15	400	13	.470
2W32.0RS	<2	.18	100	<2	.13	<4	<4	<2	.010	<4	.042	<2	880	<4	.007
2W32.0S	6	.20	110	<2	.24	<4	<4	4	.020	6	.107	<2	830	<4	.040
URBAN/AGRICULTURE TRAVERSE (#3)--Continued															
3E8.0RS	2	.51	9	<2	.10	<4	<4	<2	.380	<4	.018	<2	2,700	<4	.006
3E8.0S	2	.45	8	<2	.20	<4	<4	<2	.380	<4	.029	<2	2,500	<4	.006
3W0.5RS	10	.50	50	<2	1.10	<4	<4	3	.020	96	.064	<2	3,100	<4	.030
3W0.5S	9	.46	52	<2	1.00	<4	<4	3	.020	15	.020	<2	2,600	<4	.020
3W1.0RS	13	.44	77	<2	.71	<4	<4	6	.060	35	.025	<2	1,700	<4	.040
3W1.0S	5	.50	70	<2	.68	<4	<4	2	.080	29	.040	<2	1,600	<4	.020
3W2.0RS	3	.17	200	<2	.05	<4	<4	3	.150	35	.020	<2	1,300	<4	.010
3W2.0S	4	.17	180	<2	.05	<4	<4	4	.160	47	.033	<2	1,600	<4	.010
3W2.0SD	3	.17	180	<2	.04	<4	<4	4	.160	50	.019	<2	1,600	<4	.010
3W4.0L	3	.12	33	<2	.03	<4	<4	3	.008	<4	.000	<2	1,800	<4	.009
3W4.0LD	3	.12	35	<2	.03	<4	<4	2	.008	<4	.012	<2	1,800	<4	.009

Appendix II (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF SOIL SAMPLES, FLORIDA--Continued

Sample	V PPM	Y PPM	YB PPM	ZN PPM	TOTAL C%	ORGNC C%	CRBNT C%
					POWER PLANT/AGRICULTURE TRAVERSE (#1)--Continued		
1E8.0RS	6	5	<1	5	12.9	4.3	8.6
1E8.0S	8	5	<1	4	10.9	3.5	7.4
1W0.5RS	12	<2	<1	8	15.9	6.4	9.6
1W0.5S	8	<2	<1	5	13.6	3.1	10.5
1W1.0P	17	<2	<1	6	43.5	43.4	.1
1W1.0RP	27	3	<1	12	37.2	36.0	1.2
1W2.0P	46	3	<1	17	42.5	42.4	.1
1W2.0RP	22	<2	<1	7	41.8	41.7	.1
1W4.0RS	6	<2	<1	7	16.9	7.3	9.6
1W4.0S	4	<2	<1	5	14.9	4.5	10.4
1W8.0RS	6	<2	<1	8	15.1	4.9	10.2
1W8.0S	3	<2	<1	<4	15.2	4.8	10.4
1W16.0L	3	<2	<1	<4	11.6	<.1	11.7
1W16.0RS	21	7	<1	20	14.2	4.6	9.6
1W16.0S	22	7	<1	12	14.1	4.6	9.5
1W16.0SD	22	7	<1	11	14.1	4.6	9.5
1W32.0L	5	<2	<1	<4	11.9	.3	11.6
1W32.0LD	6	<2	<1	<4	12.1	.6	11.5
1W32.0P	74	44	4	14	18.3	17.8	.5
1W32.0RP	71	39	3	19	23.4	23.3	.1
					NATIVE/UNDISTURBED TRAVERSE (#2)--Continued		
2E5.0L	<2	<2	<1	<4	11.9	.3	11.6
2E5.0RS	6	6	<1	15	14.2	4.8	9.4
2E5.0S	3	3	<1	12	13.6	3.3	10.3
2W1.0P	8	<2	<1	<4	37.1	37.0	.1
2W1.0RP	11	3	<1	<4	36.2	36.2	.1
2W1.0RPD	12	3	<1	<4	35.7	35.6	.1
2W2.0P	12	3	<1	5	35.1	35.0	.1
2W2.0RP	8	<2	<1	<4	37.3	37.2	.1
2W2.0RPD	8	<2	<1	<4	37.7	37.6	.1
2W4.0P	8	<2	<1	7	39.2	39.1	.1
2W4.0RP	5	<2	<1	<4	28.0	23.9	4.1
2W4.0RPD	5	<2	<1	<4	20.3	24.3	4.0
2W8.0RS	7	2	<1	<4	13.4	2.8	10.6
2W8.0S	6	2	<1	4	13.8	3.5	10.3
2W8.0SD	6	2	<1	<4	13.9	3.6	10.3
2W16.0P	65	49	4	15	23.5	23.4	.1
2W16.0RP	76	57	4	22	21.1	20.6	.5
2W32.0RS	<2	<2	<1	5	16.1	6.2	9.9
2W32.0S	7	2	<1	10	18.8	10.5	8.3
					URBAN/AGRICULTURE TRAVERSE (#3)--Continued		
3E8.0RS	<2	<2	<1	5	6.5	.4	6.1
3E8.0S	<2	<2	<1	5	6.4	.6	5.8
3W0.5RS	8	2	<1	<4	12.1	2.5	9.6
3W0.5S	5	<2	<1	5	12.1	2.6	9.5
3W1.0RS	11	4	<1	10	12.4	3.7	8.7
3W1.0S	5	<2	<1	18	14.2	5.0	9.2
3W2.0RS	6	<2	<1	28	13.6	3.3	10.3
3W2.0S	6	<2	<1	38	13.2	3.3	9.9
3W2.0SD	6	<2	<1	39	13.4	3.2	10.2
3W4.0L	5	<2	<1	<4	11.5	<.1	11.5
3W4.0LD	5	<2	<1	<4	11.6	.3	11.3

Appendix II (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF SOIL SAMPLES, FLORIDA--Continued

Sample	LATITUDE	LONGITUDE	DIST. KM	AL%	BA PPM	BE PPM	CA%	CE PPM	CO PPM	CR PPM	CU PPM	FE %	GA PPM	K%	LA PPM
URBAN/AGRICULTURE TRAVERSE (#3)--Continued															
3W4.0RS	25 33 15	80 22 45	7.20	4.90	33	1	.3	61	3	130	5	2.50	6	.06	34
3W4.0S	25 33 15	80 22 45	7.20	4.60	34	1	1.1	56	3	130	6	2.40	6	.06	30
3W4.0SD	25 33 15	80 22 45	7.20	3.90	30	1	1.2	48	2	110	6	2.00	5	.05	26
3W8.0L	25 34 45	80 26 15	12.90	.13	6	<1	30.0	<4	2	5	1	.07	<4	<.05	<2
3W8.0RS	25 34 45	80 26 15	12.90	5.30	39	1	2.2	63	6	120	13	2.90	6	.06	34
3W8.0S	25 34 45	80 26 15	12.90	5.50	34	1	1.1	71	4	120	8	2.90	7	.06	37
3W16.0L	25 32 15	80 30 45	20.70	.12	5	<1	38.0	<4	2	6	1	.06	<4	<.05	<2
3W16.0RS	25 32 15	80 30 45	20.70	6.10	32	2	2.3	76	5	150	6	3.10	8	.08	40
3W16.0S	25 32 15	80 30 45	20.70	4.90	30	1	5.5	61	4	120	6	2.40	6	.08	33
CEMENT PLANT/AGRICULTURE TRAVERSE (#4)															
4S0.5L	25 41 30	80 28 45	1.90	.17	8	<1	38.0	<4	2	8	2	.28	<4	<.05	<2
4S0.5RS	25 41 30	80 28 45	1.90	2.10	33	<1	21.0	19	3	84	23	.62	<4	.08	9
4S0.5S	25 41 30	80 28 45	1.90	2.00	32	<1	21.0	19	2	97	13	.64	<4	.08	9
4S1.0L	25 41 15	80 29 0	2.60	.21	9	<1	37.0	5	2	8	1	.31	<4	<.05	<2
4S1.0RS	25 41 15	80 29 0	2.60	2.40	49	<1	17.0	24	3	67	13	.94	4	.09	11
4S1.0S	25 41 15	80 29 0	2.60	3.20	54	<1	19.0	28	2	87	14	1.10	<4	.10	16
4S2.0L	25 40 0	80 29 0	4.70	.22	7	<1	38.0	<4	2	8	1	.33	<4	<.05	<2
4S2.0RS	25 40 0	80 29 0	4.70	1.60	27	<1	24.0	24	2	63	23	.94	<4	.06	12
4S2.0S	25 40 0	80 29 0	4.70	1.40	28	<1	23.0	15	2	55	23	.89	<4	.06	8
4S4.0L	25 38 30	80 28 45	7.60	.15	8	<1	38.0	<4	2	8	<1	.23	<4	<.05	<2
4S4.0LD	25 38 30	80 28 45	7.60	.15	6	<1	38.0	<4	2	7	<1	.24	<4	<.05	<2
4S4.0RS	25 38 30	80 28 45	7.60	1.50	20	<1	17.0	16	2	39	8	.86	<4	<.05	8
4S4.0S	25 38 30	80 28 45	7.60	1.00	17	<1	18.0	10	2	30	8	.70	<4	<.05	5
4S4.0SD	25 38 30	80 28 45	7.60	1.00	17	<1	18.0	10	2	30	8	.71	<4	<.05	5
4S8.0L	25 34 45	80 29 30	14.80	.28	7	<1	37.0	<4	2	9	3	.18	<4	<.05	<2
4S8.0RS	25 34 45	80 29 30	14.80	1.50	23	<1	7.0	14	2	67	25	.76	<4	<.05	8
4S8.0S	25 34 45	80 29 30	14.80	1.90	21	<1	6.3	21	2	76	31	.97	<4	<.05	11
4S16.0L	25 28 15	80 30 30	26.90	.19	7	<1	39.0	<4	2	8	1	.10	<4	<.05	<2
4S16.0RS	25 28 15	80 30 30	26.90	5.70	61	1	18.0	61	5	170	57	2.80	8	.19	34
4S16.0S	25 28 15	80 30 30	26.90	5.10	59	1	19.0	56	5	180	57	2.50	6	.13	31

Appendix II (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF SOIL SAMPLES, FLORIDA--Continued

Sample	LI PPM	MG%	MN PPM	MO PPM	NA%	NB PPM	ND PPM	NI PPM	P%	PB PPM	TOTAL S%	SC PPM	SR PPM	TH PPM	TI%
URBAN/AGRICULTURE TRAVERSE (#3)--Continued															
3W4.0RS	54	.17	90	<2	.03	7	26	33	.010	26	.005	9	33	8	.300
3W4.0S	50	.17	99	<2	.03	5	24	31	.020	24	.011	8	64	7	.300
3W4.0SD	43	.14	87	<2	.03	6	21	27	.020	21	<.005	7	64	6	.250
3W8.0L	<2	.11	86	<2	.03	<4	<4	3	.008	<4	.006	<2	2,500	<4	<.005
3W8.0RS	56	.21	550	<2	.03	9	29	36	.010	24	.008	10	180	7	.320
3W8.0S	57	.32	810	<2	.03	8	31	38	.010	25	.007	11	83	8	.330
3W16.0L	<2	.10	49	<2	.02	<4	<4	2	.007	<4	.007	<2	1,800	<4	<.005
3W16.0RS	55	.29	560	<2	.03	8	33	41	.020	24	<.005	12	96	8	.360
3W16.0S	46	.29	650	<2	.03	6	28	32	.020	21	<.005	9	220	5	.280
CEMENT PLANT/AGRICULTURE TRAVERSE (#4)--Continued															
4S0.5L	3	.09	44	<2	.02	<4	<4	3	.010	<4	<.005	<2	1,900	<4	.009
4S0.5RS	34	.16	190	<2	.03	<4	7	14	.100	14	.027	4	1,400	<4	.110
4S0.5S	33	.16	180	<2	.03	5	7	14	.130	15	.030	4	1,300	<4	.110
4S1.0L	4	.09	80	<2	.02	<4	<4	3	.010	<4	.005	<2	1,800	<4	.009
4S1.0RS	40	.18	110	<2	.03	<4	8	17	.060	130	.033	4	980	<4	.130
4S1.0S	55	.20	160	<2	.04	5	13	21	.090	90	.034	3	1,100	<4	.160
4S2.0L	3	.10	67	<2	.02	<4	<4	2	.010	<4	.011	<2	1,600	<4	.010
4S2.0RS	23	.15	210	<2	.03	<4	10	11	.140	18	.005	<2	1,200	<4	.080
4S2.0S	20	.13	230	<2	.03	<4	5	9	.120	14	.009	<2	1,100	<4	.080
4S4.0L	2	.11	27	<2	.02	<4	<4	3	.008	<4	<.005	<2	1,700	<4	.007
4S4.0LD	2	.11	28	<2	.02	<4	<4	<2	.007	<4	.008	<2	1,700	<4	.006
4S4.0RS	17	.13	98	<2	.03	<4	6	10	.030	21	.031	3	690	<4	.090
4S4.0S	13	.11	120	<2	.03	<4	<4	7	.030	31	.016	<2	740	<4	.060
4S4.0SD	13	.12	130	<2	.03	<4	4	7	.030	31	.020	<2	770	<4	.050
4S8.0L	3	.09	53	<2	.02	<4	<4	3	.020	<4	<.005	<2	1,700	<4	.010
4S8.0RS	16	.08	330	<2	.02	<4	5	11	.160	13	.006	2	270	<4	.090
4S8.0S	21	.09	360	<2	.02	<4	8	14	.160	13	<.005	3	230	<4	.110
4S16.0L	2	.09	29	<2	.03	<4	<4	3	.020	<4	.007	<2	2,000	<4	.009
4S16.0RS	52	.40	560	<2	.09	9	29	39	.170	69	.038	11	860	9	.320
4S16.0S	47	.36	590	<2	.11	8	28	34	.190	80	.040	7	900	7	.270

Appendix II (continued).

IDENTIFICATION, LOCATION, AND CHEMICAL COMPOSITION OF SOIL SAMPLES, FLORIDA--Continued

Sample	V PPM	Y PPM	YB PPM	ZN PPM	TOTAL C%	ORGNC C%	CRBNT C%
URBAN/AGRICULTURE TRAVERSE (#3)--Continued							
3W4.0RS	50	33	3	6	2.8	2.8	.0
3W4.0S	47	30	2	6	3.6	3.4	.2
3W4.0SD	41	26	2	8	3.7	3.5	.2
3W8.0L	4	<2	<1	<4	11.6	<.1	11.6
3W8.0RS	56	33	3	15	7.2	6.8	.4
3W8.0S	57	36	3	8	6.1	6.0	.1
3W16.0L	5	<2	<1	<4	11.8	.3	11.5
3W16.0RS	75	37	3	10	4.7	4.2	.5
3W16.0S	54	31	3	9	5.8	4.4	1.4
CEMENT PLANT/AGRICULTURE TRAVERSE (#4)--Continued							
4S0.5L	7	<2	<1	<4	11.2	<.1	11.4
4S0.5RS	15	8	<1	28	9.6	3.5	6.2
4S0.5S	15	8	<1	30	9.2	3.5	5.8
4S1.0L	10	<2	<1	<4	11.4	<.1	11.4
4S1.0RS	22	10	<1	49	8.8	4.0	4.8
4S1.0S	27	13	1	46	9.8	4.2	5.6
4S2.0L	8	<2	<1	<4	11.3	<.1	11.4
4S2.0RS	23	8	<1	22	9.1	2.3	6.8
4S2.0S	21	7	<1	20	8.7	2.1	6.6
4S4.0L	9	<2	<1	<4	11.5	.2	11.3
4S4.0LD	9	<2	<1	<4	11.7	.4	11.3
4S4.0RS	18	6	<1	16	9.0	4.3	4.7
4S4.0S	18	4	<1	13	9.2	4.2	5.0
4S4.0SD	10	4	<1	14	9.8	4.6	5.2
4S8.0L	11	<2	<1	5	11.4	.2	11.2
4S8.0RS	16	7	<1	34	4.1	2.3	1.8
4S8.0S	20	10	1	34	3.5	1.8	1.6
4S16.0L	3	<2	<1	<4	11.7	.1	11.6
4S16.0RS	49	38	3	26	11.8	6.7	5.1
4S16.0S	52	33	3	64	13.0	7.7	5.3

Appendix II (continued).