

Health Consultation

BLOOD AND URINE TEST RESULTS

LIVE OAK, SUWANEE COUNTY, FLORIDA

MAY 11, 2004

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

HEALTH CONSULTATION

BLOOD AND URINE TEST RESULTS

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Prepared by:

Florida Department of Health
Bureau of Community Environmental Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Foreword

This health consultation summarizes findings and public health concerns from a group of residents living near the North Suwannee County site in Live Oak, Florida who submitted blood and urine test results to the Florida DOH for evaluation. A site evaluation prepared by the Florida Department of Health (DOH) provides the background information for report. A site evaluation involves a number of steps:

Evaluating exposure: Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on the site, and how people might be exposed to it. Usually, Florida DOH does not collect its own environmental sampling data. We rely on information provided by the Florida Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (EPA), and other government agencies, businesses, and the public.

Evaluating health effects: If evidence is found that people are being exposed—or could be exposed—to hazardous substances, Florida DOH scientists will take steps to determine whether that exposure could be harmful to human health. Their assessment focuses on public health; that is, the health impact on the community as a whole, and is based on existing scientific information.

Developing recommendations: In an evaluation report—such as this health consultation—Florida DOH outlines its conclusions regarding any potential health threat posed by a site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason the evaluation report will typically recommend actions to be taken by other agencies—including the EPA and Florida DEP. If, however, the health threat is immediate, Florida DOH will issue a public health advisory warning people of the danger and will work to resolve the problem.

Soliciting community input: The evaluation process is interactive. Florida DOH starts by soliciting and evaluating information from various government agencies, the organizations or individuals responsible for cleaning up the site, and from community members who live near the site. Florida DOH shares its conclusions with the organizations and individuals who provided information. Once an evaluation report has been prepared, Florida DOH seeks feedback from the public. *If you have questions or comments about this health consultation, we encourage you to contact us.*

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Purpose

This public health consultation evaluates blood and urine test results of residents who live in north Suwannee County, Florida, north of Live Oak. The Suwannee County Health Department (CHD) requested the Florida Department of Health's (DOH) assistance with this evaluation.

The Florida DOH, in cooperation with the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), assists community residents, local, state, and federal agencies in evaluating the public health implications of exposure to environmental contaminant.

Summary and Statement of Issues

Some North Suwannee County residents feared that something in the environment was making them ill. From March 2002 to December 2002, 36 residents living near the North Suwannee County site visited their personal physicians and requested blood and/or urine testing for various metals. Some residents had one metal tested while others had several tested. Twenty-eight children (ages 2 months to 17 years) and eight adults requested testing from their physicians. These residents and the Suwannee CHD requested Florida DOH review the test results. Florida DOH determined the levels of chemicals in their bodies are unlikely to cause illness.

The conclusions and recommendations of this consultation are only applicable to the 36 residents whose physicians tested the resident's blood and/or urine and submitted the results to the Suwannee CHD/Florida DOH.

Site Description and History

The North Suwannee County site is on 113th Road, approximately four miles north of Live Oak in Suwannee County, Florida (Figures 1 & 2). The neighborhood consists of approximately 35 homes on several unpaved streets. The area is rural with an abundance of animals, trees, and vegetation. The land was formerly agricultural.

In March 2002, at the request of a nearby resident, the Suwannee CHD sampled the resident's private drinking water wells for metals, volatiles, and bacteria. The results of these tests were within acceptable limits. In April 2002, other residents complained about illness/symptoms. In May 2002, Suwannee CHD requested the Florida DOH evaluate health concerns.

In October 2002, more residents reported health complaints to the Suwannee CHD and the Florida DOH. Based on environmental data collected between February 2000 and March 2002, Florida DOH found no indication of exposure likely to cause illness/symptoms reported by nearby residents.

In November 2002, the Suwannee CHD and Florida DOH sampled 11 private drinking water wells for metals, solvents, nitrate, nitrite, chloride, sulfates, pesticides, and bacteria. The Florida DOH notified residents of their test results. The Suwannee CHD and the Florida DOH found no drinking water contamination that would account for the reported symptoms and illnesses.

From January through May 2003, the Florida DOH evaluated levels of hydrogen sulfide and semi-volatile chemicals in 29 drinking water wells and hydrogen sulfide levels in indoor air. The

Florida DOH concluded that hydrogen sulfide in these drinking water wells as well as hydrogen sulfide levels in indoor air would not likely cause illness.

In 2003, the Florida Department of Environmental Protection (DEP) tested soil and ground water. Currently, the Florida DEP plans to conduct further indoor air sampling. After all the soil, water, and air testing is completed, the Florida DOH will prepare a public health assessment evaluating the health threat.

Discussion

From March to December 2002, 36 Suwannee County residents living near the North Suwannee County site visited their personal physicians requesting blood and/or urine testing for various metals. Some had their blood and/or urine tested for a few metals, others had testing for several metals. Metals included aluminum, total arsenic, barium, cadmium, chromium, lead, and mercury.

In October 2002, nearby residents began requesting the Suwannee CHD and the Florida DOH to review their families' blood and/or urine test results. They claimed their physicians were unable to interpret the results.

Since October 2002, the Florida DOH spent numerous hours addressing blood/urine test result questions on the phone. The Florida DOH also prepared and Suwannee CHD distributed 20 education packets to area physicians to help them interpret blood/urine test results.

In November and December 2002, the Florida DOH evaluated blood and urine test results initiated and provided by 36 Suwannee residents (28 children ages 2 months to 17 years and eight adults ages 19 to 46). This evaluation included coordination with the Suwannee CHD, meetings, and numerous phone calls to labs and doctors.

During the week of December 9, the Suwannee CHD mailed letters to each household explaining the blood/urine test results. The letters stated that the blood/urine levels were in the usual range. Some letters included information on aluminum and/or arsenic. Each letter explained that diet, certain medications, cigarette smoke, and other environmental exposures can affect the levels of metals found in blood or urine. Florida DOH included conversion sheets with the letters for those residents who had urinary arsenic testing. The Suwannee CHD mailed copies of each letter and lab results to their physicians.

On December 17 and 18, 2002, Florida DOH went door-to-door distributing soil, water, and blood/urine test results and answering questions.

Blood/Urine Metal Testing Information

There are few guidelines for interpreting blood/urine metal results in residential settings. The Occupational Safety and Health Administration (OSHA) establish standards for metals in the blood/urine of workers. OSHA standards apply to healthy adult workers exposed eight hours per day, five days a week. They are not appropriate for residential settings where adults and children in varying states of health may be exposed twenty-four hours per day, seven days per week.

When a doctor orders a blood or urine test for metals, they give the patient the laboratory results, which include a “normal” range. This laboratory range, however, can be misleading. The laboratory bases its “normal” range on the results gathered for that particular laboratory. The “normal” range does not indicate if the level is a health risk. Seafood, vitamin pills, intravenous (“I.V.”) medications, certain foods, and cigarette smoke all contain metals. These factors can increase the levels of metals in blood and urine.

Rather than comparing blood and urine test results to the laboratory normal/reference range, the Florida DOH first compared the results to national average background levels. If no national average level existed, Florida DOH compared test results to levels cited by ATSDR, the Florida Poisoning Control Center, or the World Health Organization (WHO).

The Florida DOH also researches to see what levels are toxic in the blood or urine and when medical attention is necessary. Aluminum, for example is essentially non-toxic. Other than arsenic, none of the tested metals are carcinogenic and none of the levels found in the residents’ blood or urine are likely to cause illness.

Evaluation of Blood/Urine Metal Testing

Residents had their blood/urine tested for various heavy metals (see Tables I – XII). Residents requested different metal tests from different doctors. Florida DOH did not initiate or coordinate this biological testing; Florida DOH only evaluated the results.

Children ranged in age from 2 months to 18 years old at the time of testing. Some had repeat testing within six months. Adults ranged from 19-46 years old.

Aluminum

Aluminum is essentially non-toxic. It occurs in baking powder, soy-based infant formula, some vegetables, tea, cakes, processed foods (i.e., processed cheeses, baked goods and nondairy cream substitutes). Most of the aluminum you eat or drink is not absorbed into the body (ATSDR 1999a).

Deodorants, antacids, buffered aspirin, intravenous (I.V.) fluids, anti-diarrheal and anti-ulcerative medicines all contain aluminum. Blood and urine normally contains aluminum. Individual variabilities and variabilities in laboratory tests affect the reported aluminum concentration.

Clear guidelines relating aluminum levels to health symptoms are not available. Because aluminum is poorly absorbed, it is not possible to accurately relate aluminum exposure to blood or urine levels. A 24-hour urine sample is the best test for determining if aluminum is present in the body or not. Twenty-four hour urine test are the basis for most studies. Random (single void or “spot”) urine tests are less reliable.

In most people, blood aluminum concentrations are less than 10 micrograms per deciliter ($\mu\text{g}/\text{dL}$). Twenty-four hour urine aluminum concentrations are between three and eight micrograms per liter ($\mu\text{g}/\text{L}$). In aluminum workers, 24-hour urine aluminum concentrations are

between 29 and 55 µg/L. Studies in welding workers showed no adverse health effects with 24-hour urine aluminum levels between 108 and 162 µg/L (ATSDR 1999a).

Range of Aluminum Concentrations in Tested Suwannee County Residents:

Blood/Serum: 12-35 micrograms per deciliter (µg/dL) (4 children)

5-26 µg/dL (4 adults)

Random Urine: 5-55 µg/L (19 children)

5.8-7.7 µg/L (2 adults)

The National Health and Nutrition Examination Survey (NHANES) did not include aluminum. Therefore, we do not have national average background aluminum blood or urine results for comparison.

Arsenic

Arsenic is a naturally occurring element found in soil. Rice/rice cereals, seafood, meats, mushrooms, baked goods, grains, fats/oils, wine, beer, soft drinks, juices, coffee, and cocoa all contain arsenic. Seafood, rice/rice cereals, mushrooms, and poultry usually have the highest arsenic levels.

Blood and urine normally contain arsenic. The amount of arsenic in blood or urine associated with a specific health symptom (e.g., nausea) varies for individuals and varies depending on the arsenic test used.

In children, total urine arsenic levels are usually between 5 and 10 micrograms per liter. Children whose parents smoke have higher urine arsenic levels than children of parents who do not smoke. The World Health Organization recommends intervention for twenty-four hour total urine arsenic levels >100 µg/L. The best specimen is a 24-hour urine collection, although single void or "spot" urine specimens can be helpful in an emergency. Normal total 24-hour urinary arsenic values are <50 µg/L in the absence of consumption of seafood in the past 48 hours. Values in excess of 200 µg/L are unusual and may require treatment.

In most people, blood arsenic levels are normally <70 µg/dL. Blood arsenic levels, however, are less useful than urinary arsenic measurements because the body clears arsenic from the blood within a few hours. Although blood arsenic levels vary, the Florida Poison Control Center considers < 70 µg/dL as normal.

Arsenic occurs in two forms: organic and inorganic. Pesticides used on cotton plants contain organic arsenic. Pressure treated wood contains inorganic arsenic compounds. Organic arsenic is less toxic than inorganic arsenic. Organic arsenic found in fish and other foods is mostly in a non-harmful form. Most physicians order urine and blood tests for total arsenic. They must order a specific test to distinguish between organic and inorganic arsenic. The body rapidly excretes arsenic. Urine tests are only useful for measuring exposure to arsenic in the past two days. Blood tests are only useful for measuring exposure to arsenic in the past three to four hours (ATSDR 2000a).

Range of Arsenic (Total) Concentrations in Tested Suwannee County Residents

| | |
|--------|----------------------------------|
| Blood: | 4.3 – 22.8 µg/dL (nine children) |
| | <10 - 18.5 µg/dL (four adults) |
| Urine: | <5.1- 33.6 µg/L (four adults) |
| | <8.5 – 36.0 µg/L (20 children) |

Two of these children had 24-hour total arsenic urine levels of 5.1 and 8.5 µg/L.

One adult and one child had urinary inorganic arsenic levels below detection limits. To date, the National Health and Nutrition Examination Survey (NHANES) did not include arsenic testing. Therefore, we do not have arsenic blood or urine NHANES results for comparison. Values in excess of 200 µg/L are abnormal and may require treatment.

Cadmium

Cadmium is a natural element in the earth's crust. It combines with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide). All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Production of zinc, lead, and copper also produces cadmium. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics (ATSDR 1999b).

Cadmium stays in the body a very long time and can build up from many years of exposure to low levels. A balanced diet can reduce the amount of cadmium taken into the body from food and drink. Tests are available in some medical laboratories that measure cadmium in blood, urine, hair, or nails. Blood levels show recent exposure to cadmium, and urine levels show both recent and earlier exposure. The reliability of tests for cadmium levels in hair or nails is unknown.

Blood cadmium levels are mainly used for determining recent exposure(s) to cadmium rather than whole body burdens. According to the World Health Organization, blood concentrations <10 µg/dL are considered acceptable in occupational exposures. According to one study, environmental exposure can elevate blood cadmium concentration to above 10 µg/dL.

Range of Cadmium Concentrations in Tested Suwannee County Residents

| | | |
|--------|---------------|-----------------------|
| Blood: | Children (3) | <0.5 µg/dL |
| | Adults (2) | 0.6 & 3.5 µg/dL |
| Urine: | Children (18) | non-detect – 2.3 µg/L |
| | Adults (4) | non-detect – 1.3 µg/L |

National Health and Nutrition Examination Survey Averages for Cadmium (CDC 1999)

| | | |
|--------|---------------------|-------------|
| Blood: | 1-5 years old | 0.4 µg/dL |
| | 6-11 years old | 0.4 µg/dL |
| | 12-19 years old | 1.10 µg/dL |
| | 20 years old and up | 1.50 µg/dL |
| Urine: | 1-5 years old | none tested |
| | 6-11 years old | 0.76 µg/L |
| | 12-19 years old | 0.63 µg/L |
| | 20 years old and up | 1.51 µg/L |

Of the 18 Suwannee County children tested, 11 had cadmium urine levels below detection limits, three had between 0.3 - 0.5 µg/L, and five had levels above 0.5 µg/L.

Single void or random urine tests, the kind reported by most North Suwannee residents, are generally unreliable. Most of the research studies for cadmium include urine results from urine collected over a 24-hour period. Twenty-four hour urine testing provides more accurate results. Single void or random urine test results are not directly comparable to these twenty-four hour urine tests. None-the-less, concentrations of cadmium measured in these north Suwannee County residents' urine are close to or slightly above the NHANES national average. Comparison to the national average, however, can not predict the likelihood of illness.

Chromium

Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms. The most common forms are chromium (0), chromium (III), and chromium (VI). No taste or odor is associated with chromium compounds.

Normal chromium levels for the general population (exposed only via the diet) are 0.01-0.17 µg/dL in blood serum (Sunderman et al. 1989) and 0.24-1.8 µg/L in urine (Iyengar and Woittiez 1988).

Lastly, any biological monitoring (blood, hair or urine) for low-level environmental exposure to chromium should consider confounding variables, including chromium dietary supplements.

Range of Chromium (Total) Concentrations in Tested N. Suwannee County Residents

| | |
|--------|-------------------------------------|
| Blood: | non-detect – 2.4 µg/dL (4 children) |
| | 0.5 & 5.8 µg/dL (2 adults) |
| Urine: | <0.2 – 2.4 µg/L (13 children) |
| | <0.2 & 0.5 µg/L (2 adults) |

The National Health and Nutrition Examination Survey (NHANES) did not include chromium. Therefore, we do not have national average blood or urine chromium concentrations for comparison.

Lead

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. It has no characteristic taste or smell. Metallic lead does not dissolve in water and does not burn. Lead can combine with other chemicals to form lead compounds or lead salts. Some lead salts dissolve in water better than others do. Some natural and manufactured substances contain lead but do not look like lead in its metallic form. Some of these substances can burn—for example, organic lead compounds in gasoline.

Blood lead concentration is the most widely used biomarker of lead exposure. A blood lead concentration greater than 10 micrograms per deciliter ($\mu\text{g}/\text{dL}$) indicates excessive lead exposure. The half-life of lead in blood is 28–36 days (ATSDR 1999c). Blood lead concentrations in all of the north Suwannee County residents tested were below the Centers for Disease Control and Prevention's guideline of 10 $\mu\text{g}/\text{dL}$ and are not likely to cause illness.

Since The Centers for Disease Control and Prevention (CDC) does not have a guideline for lead in urine as urinary levels are generally not useful in estimating lead exposure. Urinary lead levels are not as useful as blood levels because lead levels in urine fluctuate widely. Out of the 20 children whose urine samples were tested, 17 were below detection limits. The other three had urinary lead levels of 1 to 2 $\mu\text{g}/\text{L}$.

Range of Lead Concentrations in Tested Suwannee County Residents

| | | |
|--------|---------------|-------------------------------------|
| Blood: | Children (8) | 0.8 - < 5.0 $\mu\text{g}/\text{dL}$ |
| | Adults (5) | 2.5 - <5 $\mu\text{g}/\text{dL}$ |
| Urine: | Children (20) | non-detect – 1.0 |
| | Adults (4) | non-detect – 2.0 |

National Health and Nutrition Examination Survey Averages for Lead (CDC 1999)

| | | |
|--------|----------------------------|-----------------------------|
| Blood: | Total, ages 6 years and up | 4.9 $\mu\text{g}/\text{dL}$ |
| | 1-5 years old | 7.0 $\mu\text{g}/\text{dL}$ |
| | 6-11 years old | 4.5 $\mu\text{g}/\text{dL}$ |
| | 12-19 years old | 2.8 $\mu\text{g}/\text{dL}$ |
| | 20 years and up | 5.2 $\mu\text{g}/\text{dL}$ |
| Urine: | Total, ages 6 years and up | 2.9 $\mu\text{g}/\text{L}$ |
| | 1-5 years old | none tested |
| | 6-11 years old | 3.4 $\mu\text{g}/\text{L}$ |
| | 12-19 years old | 2.2 $\mu\text{g}/\text{L}$ |
| | 20 years and up | 2.9 $\mu\text{g}/\text{L}$ |

Mercury

Mercury is a naturally occurring metal and exists in several forms. Metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Chlorine gas and caustic soda production uses metallic mercury. Thermometers, dental fillings, and batteries contain metallic mercury.

To assess mercury levels in blood/urine, Florida DOH relies on NHANES national averages and studies cited in ATSDR's toxicological profile. Levels of mercury in north Suwannee County residents blood and urine were all below detection limits and not likely to cause illness.

Range of Mercury Concentrations in Tested Suwannee County Residents

| | |
|--------|--------------------------|
| Blood: | <4 µg/dL (5 children) |
| | <4 µg/dL (2 adults) |
| Urine: | non-detect (18 children) |
| | non-detect (3 adults) |

National Health and Nutrition Examination Survey Averages for Mercury (CDC 1999)

| | | |
|--------|-----------------------------------|-------------|
| Blood: | 1-5 years old (males and females) | 2.3 µg/dL |
| | 16 – 49 years old (females only) | 7.10 µg/dL |
| Urine: | 1-5 years old | none tested |
| | 16-49 years old (females only) | 5.0 µg/L |

Other Chemicals Requested by Suwannee County Residents:

One 15-year-old had blood barium testing. One adult had urinary cobalt and thallium testing. The results for both individuals were less than the laboratory detection limit and within the normal range for these metals. Therefore, the levels are not likely to cause illness.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children may be at greater risk than adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults; this means they breathe dust, soil, and vapors close to the ground (ATSDR 1999).

Because the blood and urine tests provided by the residents are within an acceptable ranges for the measured chemicals evaluated in this consultation, children living near the North Suwannee County site are not expected to experience adverse health effects.

Conclusions

Concentrations of metals in blood and urine of 36 North Suwannee County residents submitted to the Florida DOH for review in October 2002 through December 2002 were all within an acceptable range and therefore are unlikely to cause illness. Based on the information evaluated in this report, the North Suwannee County site is categorized as a no apparent public health hazard.

Recommendations

At this time the Florida DOH does not offer any recommendations with regards to this site.

Public Health Action Plan

In November 2002, the Florida DOH evaluated blood and urine test results provided by 30 Suwannee residents.

In November 2002, the Florida DOH prepared and Suwannee CHD distributed 10 education packets to help area physicians interpret blood/urine test results.

In December 2002, the Florida DOH evaluated blood/urine results provided by six more Suwannee residents. The Suwannee CHD mailed letters to individual residents explaining well and blood/urine test results were within acceptable standards. They also mailed copies of each letter and lab results to their physicians.

In December 2002, the Florida DOH and Suwannee CHD visited the residents' homes to explain the test results.

At this time, Florida DOH does not plan any additional follow up to this evaluation of blood and urine test results.

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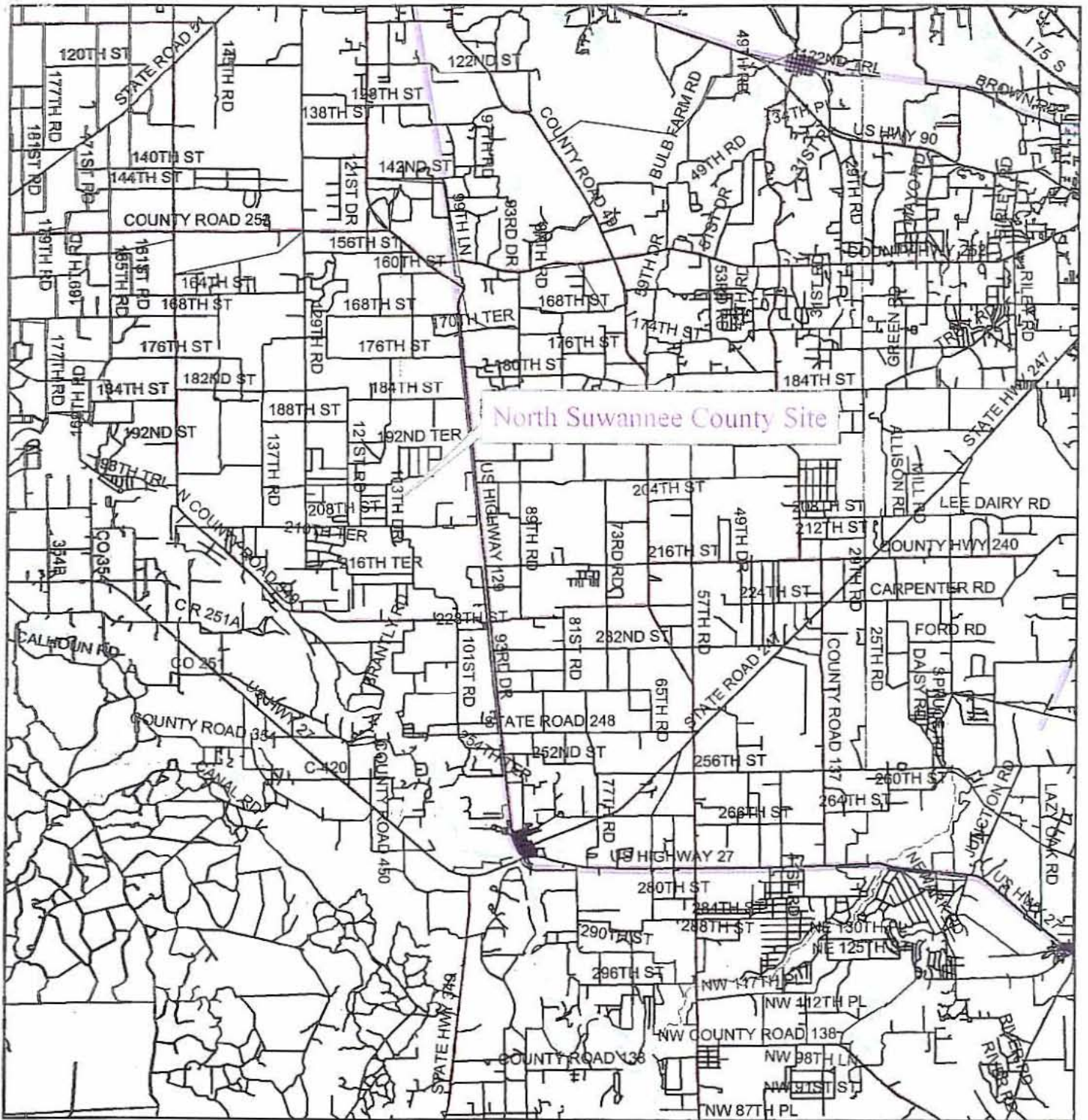
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Map of Florida



SOURCE: FLORIDA DOH FILES

FIGURE 1



North Suwannee County Site

Legend

- All Streets
- Highways
- Water Bodies
- Zipcodes (Year 2000)
- Railroad Lines
- County Boundaries

FIGURE 2
North Suwannee County Site

Table I
Blood/Serum Aluminum Concentrations in
Tested Suwannee Residents

| Blood/Serum Results | Number of Samples | Concentration (µg/dL) | *NHANES blood concentrations |
|----------------------------|--------------------------|------------------------------|-------------------------------------|
| Children | 4 | 12-35 | none |
| Adults | 4 | 5-26 | none |

*NHANES = National Health and Nutrition Examination Survey for Aluminum (CDC, 1999)
 µg/dL = micrograms per liter

Table II
Urinary Aluminum Concentrations in
Tested Suwannee Residents

| Random Urine Results | Number of Samples | Concentration (µg/L) | *NHANES urine concentrations |
|-----------------------------|--------------------------|-----------------------------|-------------------------------------|
| Children | 19 | 5-55 | none |
| Adults | 2 | 5.8-7.7 | none |

*NHANES = National Health Nutritional Exam Survey for Aluminum (CDC, 1999)
 µg/L = micrograms per liter

Table III
Blood/Serum Arsenic Concentrations in
Tested Suwannee Residents

| Blood Results | Number of Samples | Concentration (µg/dL) | *NHANES blood concentrations |
|----------------------|--------------------------|------------------------------|-------------------------------------|
| Children | 9 | 4.3-22.8 | none |
| Adults | 4 | <10 – 18.5 | none |

*NHANES = National Health and Nutrition Examination Survey for Arsenic (CDC, 1999)
 µg/dL = micrograms per liter

Table IV
Urinary Arsenic Concentrations in
Tested Suwannee Residents

| Random Urine Results | Number of Samples | Concentration (µg/L) | *NHANES urine concentrations |
|-----------------------------|--------------------------|-----------------------------|-------------------------------------|
| Children** | 20 | <8.5 – 36.0 | none |
| Adults | 4 | <5.1 – 33.6 | none |

*NHANES = National Health Nutritional Exam Survey for Arsenic (CDC, 1999)
 µg/L = micrograms per liter

**Two of these children had 24-hour total arsenic urine levels of 5.1 and 8.5 µg/L. One adult and one child had urinary inorganic arsenic levels below detection limits.

Table V
Blood/Serum Cadmium Concentrations in
Tested Suwannee Residents

| Blood Results | Number of Samples | Concentration (µg/dL) | *NHANES blood concentrations (µg/L) |
|----------------------|--------------------------|------------------------------|---|
| Children | 3 | <0.5 | 1-5 yrs old 0.4 6-11 yrs old 0.4 12-19 yrs old 1.10 |
| Adults | 2 | 0.6 & 3.5 | 20 yrs old and up 1.5 |

*NHANES = National Health and Nutrition Examination Survey for Cadmium (CDC, 1999)
 µg/dL = micrograms per liter

Table VI
Urinary Cadmium Concentrations in
Tested Suwannee Residents

| Random Urine Results | Number of Samples | Concentration (µg/L) | *NHANES urine concentrations (µg/L) |
|-----------------------------|--------------------------|-----------------------------|--|
| Children | 18 | non-detect – 2.3 | 1-5 yrs old none tested 6-11 yrs old 0.76 12-19 yrs old 0.63 |
| Adults | 4 | non-detect – 1.3 | 20 yrs old and up 1.51 |

*NHANES = National Health Nutritional Exam Survey for Cadmium (CDC, 1999)
 µg/L = micrograms per liter

Table VII
Blood Chromium Concentrations in
Tested Suwannee Residents

| Blood Results | Number of Samples | Concentration ($\mu\text{g}/\text{dL}$) | *NHANES blood concentrations |
|----------------------|--------------------------|---|-------------------------------------|
| Children | 4 | non-detect – 2.4 | none |
| Adults | 2 | 0.5 & 5.8 $\mu\text{g}/\text{L}$ | none |

*NHANES = National Health and Nutrition Examination Survey for Chromium (CDC, 1999)
 $\mu\text{g}/\text{dL}$ = micrograms per liter

Table VIII
Urinary Chromium Concentrations in
Tested Suwannee Residents

| Random Urine Results | Number of Samples | Concentration ($\mu\text{g}/\text{L}$) | *NHANES urine concentrations |
|-----------------------------|--------------------------|--|-------------------------------------|
| Children | 13 | <0.2 – 2.4 | none |
| Adults | 2 | <0.2 & 0.5 | none |

*NHANES = National Health Nutritional Exam Survey for Chromium (CDC, 1999)
 $\mu\text{g}/\text{L}$ = micrograms per liter

**Table IX
Blood Lead Concentrations in
Tested Suwannee Residents**

| Blood Results | Number of Samples | Concentration (µg/dL) | *NHANES blood concentrations (µg/dL) |
|----------------------|--------------------------|------------------------------|--|
| Children | 8 | 0.8 - < 5.0 | 1-5 yrs old 7.0 6-11 yrs old 4.5 12-19 yrs old 2.8 |
| Adults | 5 | 2.5 - <5 | 20 yrs & up 5.2 |

*NHANES = National Health and Nutrition Examination Survey for Lead (CDC, 1999)
µg/dL = micrograms per liter

**Table X
Urinary Lead Concentrations in
Tested Suwannee Residents**

| Random Urine Results | Number of Samples | Concentration (µg/L) | *NHANES urine concentrations (µg/L) |
|-----------------------------|--------------------------|-----------------------------|--|
| Children | 20 | non-detect – 1.0 | 1-5 yrs old none tested 6-11 yrs old 3.4 12-19 yrs old 2.2 |
| Adults | 4 | non-detect – 2.0 | 20 yrs old 2.9 |

*NHANES = National Health Nutritional Exam Survey for Lead (CDC, 1999)
µg/L = micrograms per liter

Table XI
Blood Mercury Concentrations in
Tested Suwannee Residents

| Blood Results | Number of Samples | Concentration ($\mu\text{g}/\text{dL}$) | *NHANES blood concentrations ($\mu\text{g}/\text{L}$) |
|----------------------|--------------------------|---|---|
| Children | 5 | <4 | 1-5 yrs old 2.3 (males and females) |
| Adults | 2 | <4 | 16-49 yrs old 7.10 (females only) |

*NHANES = National Health and Nutrition Examination Survey for Mercury (CDC, 1999)
 $\mu\text{g}/\text{dL}$ = micrograms per liter

Table XII
Urinary Mercury Concentrations in
Tested Suwannee Residents

| Random Urine Results | Number of Samples | Concentration ($\mu\text{g}/\text{L}$) | *NHANES urine concentrations ($\mu\text{g}/\text{L}$) |
|-----------------------------|--------------------------|--|---|
| Children | 18 | Non-detect | 1-5 yrs old none tested |
| Adults | 3 | non-detect | 16-49 yrs old 5.0 (females only) |

*NHANES = National Health Nutritional Exam Survey for Mercury (CDC, 1999)
 $\mu\text{g}/\text{L}$ = micrograms per liter