Health Consultation

Wingate Road Municipal Incinerator and Landfill

WINGATE ROAD MUNICIPAL INCINERATOR DUMP

FORT LAUDERDALE, BROWARD COUNTY, FLORIDA

CERCLIS NO. FLD981021470

APRIL 14, 1999

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: A Note of Explanation

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In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

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

Summary

Residents near the Wingate Road Superfund site asked the Florida Department of Health (FDOH) if it is safe to eat homegrown vegetables. They are concerned that eating homegrown vegetables might expose them to chemicals found in yard soils or irrigation water used to water the vegetables. In this health consultation, we examined the chemicals which were found in the soil (aluminum, beryllium, cadmium, chromium, copper, mercury, and dioxin) and the chemicals (antimony, and lead) found in water from a private irrigation well. We found that the overall concentrations and distribution of the chemicals in the soil and well water do not present a health hazard. Based on this information, we believe it is safe eat vegetables and fruit grown in gardens near the Wingate site. We recommend, however, that all fruit and vegetables be washed and root vegetables be peeled prior to eating them. At this time, we do not recommend that homegrown vegetables be sampled for chemicals identified in this health consultation.

Background and Statement of Issues

This health consultation evaluates whether eating homegrown vegetables poses a threat to the health of residents living near the Wingate Road Superfund site. In a July 1997 public meeting, residents raised concerns about chemicals in homegrown vegetables. No one has tested homegrown vegetables for chemicals found in local yard soils. FDOH reviewed the most current soil and irrigation well information from residential sampling data. We reviewed the concentrations, toxicity, and characteristics of chemicals that might be of concern.

The Wingate Road Municipal Incinerator and Landfill Superfund site is in Fort Lauderdale, Broward County, Florida (Figure 1). The site operated from 1954 to 1978. A chain-linked fence divides this 60-acre site into two areas (Figure 2). The northern 40 acres is a landfill, 25 feet higher than the surrounding area. In the past, the City of Fort Lauderdale disposed of bottom ash and sludges in the landfill. Today, dense vegetation covers this part of the site. The southern 20-acres was a process area. It has two inactive incinerator buildings, cooling water treatment structures, a vehicle maintenance area, other buildings, and an old percolation pond called Lake Stupid. At one time, a ditch connected Lake Stupid to Rock Pit Lake (Figure 2). Rock Pit Lake is an old borrow pit northeast of the site. Later, the City filled this ditch, stopping water flow between the lakes (1-3). Currently, the city uses the southern area for storing maintenance vehicles (4, 5). The site is in a well-populated area. There is a commercial area immediately west of the site, and a junk yard north of the site. The residential areas are northwest, east and south of the site (1-3).

FDOH has published several documents about the Wingate Road site. The most recent was a July 1996 health consultation on yard soils at homes north and northwest of the site. In that consultation, FDOH determined that residential soils were not a public health concern when accidentally ingested (6).

EPA collected residential soil sample data in September 1994 and March 1998. Soil samples were gathered in residential areas to the northwest, southeast and west of the site (Figure 3). FDOH considered the 1994 and 1998 data in this health consultation (7,8). We also considered the 1998 data from one nearby off-site irrigation well that showed signs of being influenced by contaminated ground water from the Wingate site. All other residential wells tested in 1998 did not appear to be influenced by chemicals from the site (8).

Methodology

This health consultation focuses on nine chemicals of concern. Five of the chemicals were identified in our July 1996 residential soil health consultation (6), and three from the 1998 soil and well water sampling (Table 1). A "contaminant of concern" is a chemical that we need to look at in more detail. It does not necessarily mean that contact with the chemical will cause illness.

To begin, FDOH had to determine if there was a completed exposure pathway. In this case, a completed exposure pathway means that the compounds from the incinerator site can move from the soil or irrigation water into vegetables, and then into people. No one can get sick from eating homegrown vegetables unless there is a completed exposure pathway.

To decide if there was a completed exposure pathway, we looked at what we knew about each contaminant of concern. We asked:

How harmful is the chemical?
What levels of the chemical are normally found in soils and water?
How does the chemical act in soil?
Does the chemical get into plants easily?

Depending on the answers, sometimes a chemical was researched in more detail.

Discussion

FDOH began by looking at the exposure pathway (Table 2). There are two steps in the exposure pathway for homegrown vegetables. First, the chemical compounds have to move from the soil or irrigation water into vegetables. Then people have to eat the vegetables. We assume that residents near the Wingate site are growing and eating their own vegetables. Eating their own homegrown vegetables completes the second step. We focused on whether the compounds could move from yard soil into plants.

Chemicals move into plants as they take in water. This means that chemicals must be dissolved in water to get into plants. Some chemicals are attached to soil particles or solid particles in water and do not dissolve. If a chemical dissolves in water, it can be taken in by plants and the exposure

pathway is complete. If the chemical compounds do not dissolve in water, they will not get inside the vegetables. Sometimes, chemicals will attach to the outside (skin) of vegetables. The exposure pathway will not be complete as long as residents wash their vegetables or peel root vegetables before eating them.

To explore the pathway, FDOH looked at what is known about the Wingate site. We know the Wingate incinerators closed 20 years ago (1-3). We also know Fort Lauderdale has a warm, rainy climate. Given these facts, it is unlikely that any compounds coming from the incinerator, that can dissolve in water are still present in the soil but we do not know for sure.

Chemical Selection Process

FDOH reviewed the concentration of the chemical compounds found in the soil and irrigation water. To decide if there was a completed exposure pathway, we looked at what we knew about each contaminant. We asked:

- How harmful is the chemical?

We found that aluminum, chromium, and copper were not health concerns, even if they did get into plants (11,12,13,14) at the levels found on site.

What levels of the chemical are normally found in soils and water?

We looked at antimony, beryllium, cadmium, inorganic mercury, lead, and dioxin in more detail. We found that exposure to antimony, beryllium, lead, and inorganic mercury was unlikely to be a health problem due to the low concentrations found. We looked at cadmium and dioxin in more detail.

- How does the chemical act in soil?

Some cadmium compounds (cadmium chloride and cadmium oxide) will dissolve in water (15,16). We do not know if these are the cadmium compounds that were found in the soils. It is possible that the cadmium found in the soils can enter the plants but we do not know for sure.

Dioxin does not move very easily in soil. It tends to remain a solid, does not easily dissolve in water, and attaches strongly to soil particles. (17).

Does the chemical get into plants easily?

<u>Cadmium</u>

We do not expect that cadmium, at the levels found in the soil (3.4 mg/kg), will move from the soil to fruits and vegetables. Past studies found that soil cadmium moves into plants (17).

However, recent findings indicate that soil cadmium movement through food to cause human disease as a general case, is limited to rice and tobacco grown in contaminated soil (19,20,21). We believe that rice and tobacco are not likely to be grown in gardens near Wingate.

Dioxin

Since dioxin attaches strongly to soil and does not dissolve in water, not much dioxin moves from soils through roots to stem and leaves. Movement of dioxin into roots is thought to be an insignificant source of vegetative contamination. One study found that the levels of dioxin in leaves were not related to dioxin levels in soils. Another study demonstrated that dioxin movement from roots to shoots did not occur, but shoot contamination was associated with leaf uptake from the air. In general, there is little accumulation of dioxin in plants. Scientists found that dioxin coating or falling on plant leaves in dust or particulates, is the most important mechanism for contamination (17).

Agency for Toxic Substances and Disease Registry's (ATSDR's) Child Health Initiative

ATSDR and FDOH recognize that children are especially vulnerable at hazardous waste sites. Children are more likely to be exposed to hazardous wastes than adults because they play outside. They have more hand-to-mouth behavior than adults, and they may take food into contaminated areas. Children are shorter than adults. They breathe in dust, soil, and vapors close to the ground. Children are also smaller and weigh less than adults. This means their exposure doses of a chemical are larger than those of adults. Childrens' developing bodies can be more sensitive to the harmful effects of chemicals. Finally, children depend on adults to identify dangerous situations, and to keep them safe and healthy.

Because children are vulnerable, we consider the health of children separately from that of adults in this health consultation. We considered dose estimates for a 2 year-old and a 10 year-old child in our exposure calculations (Table 3). We included the childrens' exposure doses when we compared our dose estimates to those found in scientific studies. When deciding whether to collect soil or vegetable samples, we first looked at the exposure dose estimates for children, since they were slightly higher than our estimated adult dose.

Conclusions

Based on the information we reviewed for this health consultation, FDOH concludes the following:

Eating homegrown vegetables and fruit from residential areas near the Wingate site does not pose a threat to public health.

Recommendations

Our recommendation is based on reports, data, and information found in the reference section of this report. The recommendation is specific to the FDOH's review of the September 1994 and the July 1998 residential soil and irrigation well sampling data. If additional data is reviewed in the future, our recommendation may change.

FDOH recommends that:

The Wingate community be informed of the importance of washing (and peeling root vegetables) homegrown vegetables and fruit prior to consumption. FDOH will follow up on this recommendation.

CERTIFICATION

The Florida Department of Health prepared this Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It used approved methodologies and procedures existing at the time the department began this health consultation.

Roberta Erlwein, MPH
Technical Project Officer
Superfund Site Assessment Branch (SSAB)
Division of Health Assessment and Consultation (DHAC)
ATSDR

The Division of Health Assessment and Consultation, ATSDR has reviewed this health consultation, and concurs with its findings.

for Richard Gillig
Section Chief, SPS, SSAB, DHAC, ATSDR

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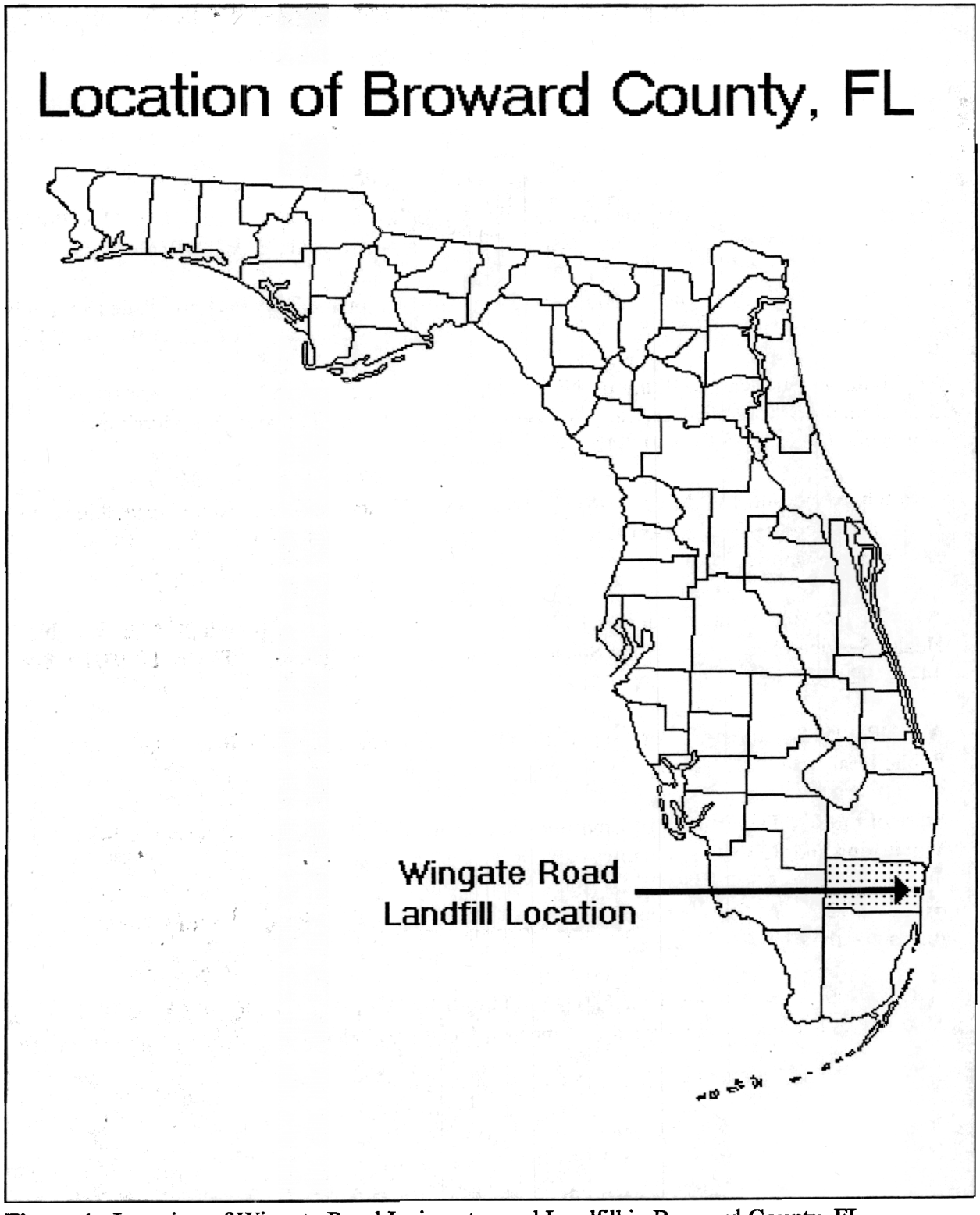

Figure 1. Location of Wingate Road Incinerator and Landfill in Broward County, FL.

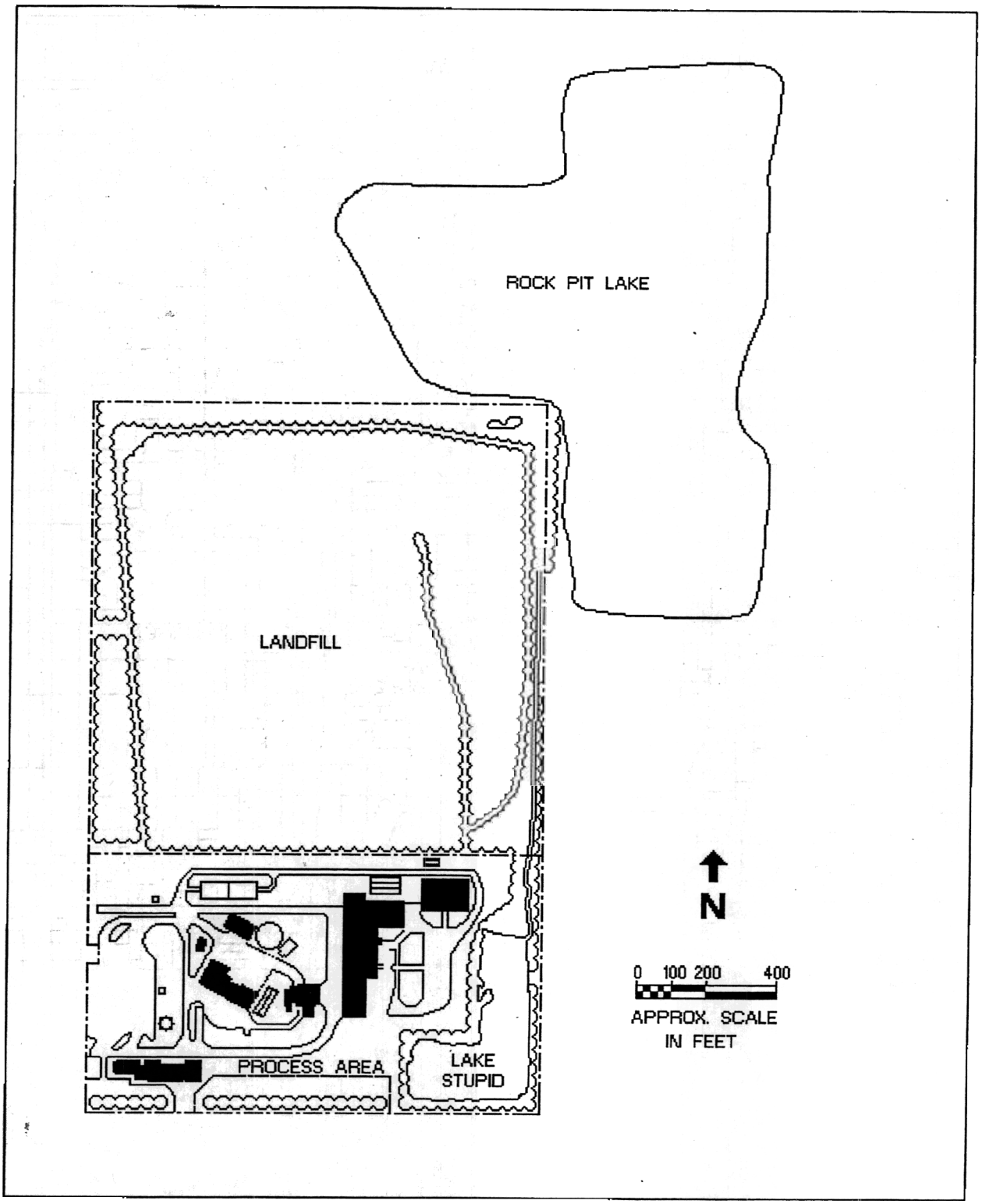

Figure 2. Site Map of Wingate Road Landfill (adapted from the BRA).

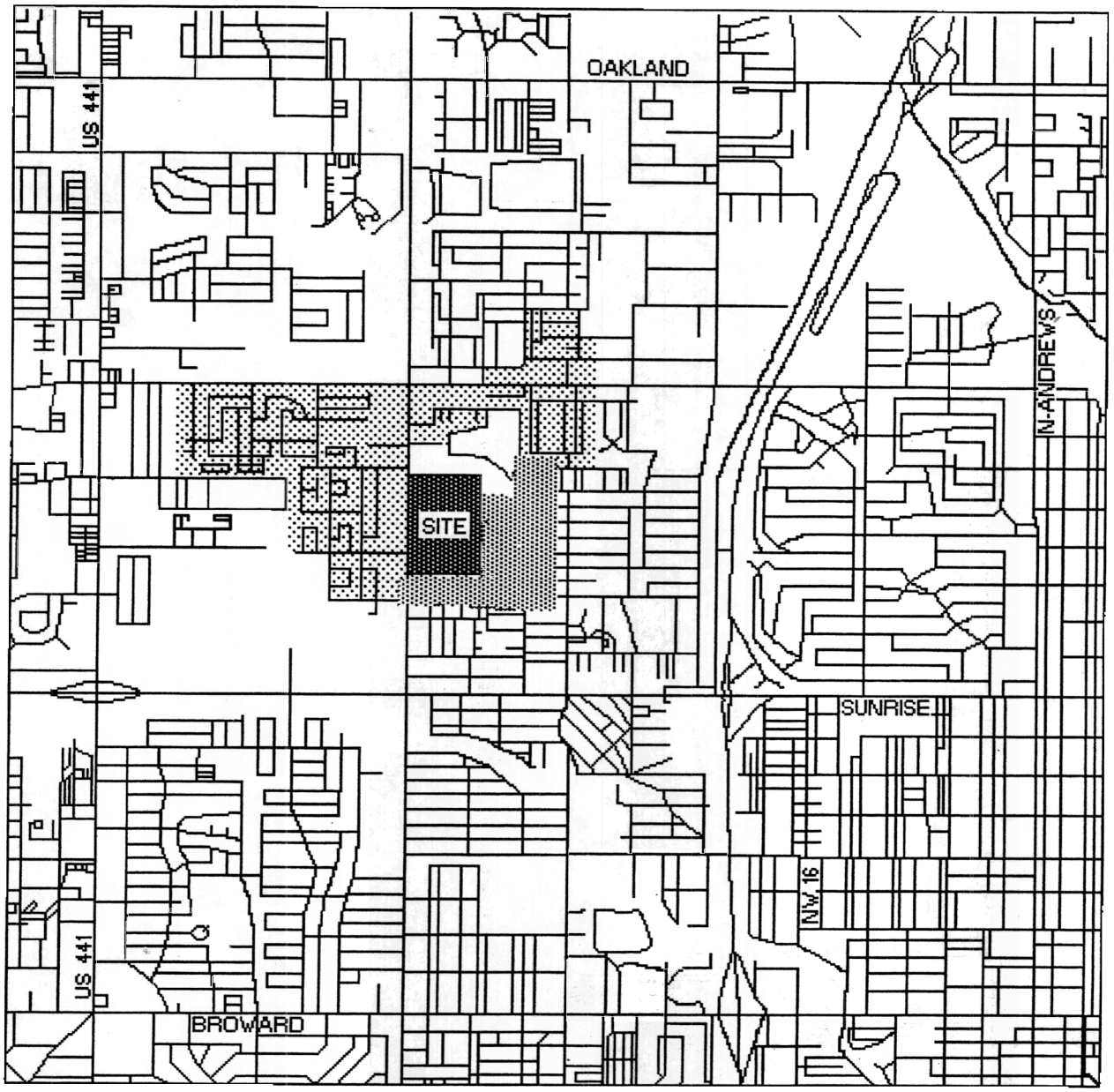

Figure 3. Area Where EPA Collected Residential Soil Samples

Table 1. Chemicals Reviewed

Chemical	Medium	Maximum Concentration
aluminum	soil	2000 mg/kg (ppm)
antimony	irrigation water	16 micrograms/liter (ppb)
beryllium	soil	.24 mg/kg (ppm)
cadmium	soil	3.9 mg/kg (ppm)
chromium	soil	25 mg/kg (ppm)
copper	soil	810 mg/kg (ppm)
mercury	soil	.25 mg/kg (ppm)
lead	irrigation water	29 micrograms/liter (ppb)
dioxins	soil	720 (ppt)

mg/kg = milligrams per kilogram
ppm = parts per million
ppb = parts per billion
ppt = parts per trillion

Table 2 Potential Exposure Pathway (Off Site)

Pathway Name	Source	Medium	Exposure Point	Exposure Route	Receptor Population	Time of Exposure	Exposure Activities	Estimated Number Exposed	Chemicals
Wingate Road Homegrown Vegetables	Wingate Incinerator or Unknown Sources	Plant Tissue	Food	Ingestion	Nearby Residents, Including Children	Present	Eating, Raw, Unwashed Vegetables	0-10,100	Dioxin

Data Source: 36

Table 3. Vegetable Ingestion Dose Calculation Parameters for Hypothetical Residents

Parameter	Hypothetical Resident		
	Adult	Older Child	Young Child
Age	Over 18 y	10 y	2 y
Body Weight	70 kg	35 kg	13 kg
Lifetime Expectancy	70 y	70 y	70 y
Ingestion Frequency	350 d/y	350 d/y	350 d/y
Vegetable Ingestion Rate	0.316 kg/d	0.165 kg/d	0.116 kg/d
Fraction from Contaminated Source	0.40	0.40	0.40
Bioconcentration Factor (BCF)	2	2	2

y - year
kg - kilogram
d/y - days per year
kg/d - kilograms per day
Data Sources: 6, 9-10

Appendix A

Overview of Chemical Contaminants

Aluminum

Aluminum is not harmful to people at most exposure levels (11). The highest amount of aluminum is 2,000 ppm (parts per million) (8) in Wingate yard soils and 50 ppb (parts per billion) in the irrigation well (9). The combined exposure is less than a person would eat in a full daily dose of an aluminum-containing antacid (22). Aluminum does not collect in homegrown vegetables to any significant extent. Several studies show aluminum amounts in farm and nonfarm soils range from 7,000 ppm to more than 100,000 ppm. The average amount of aluminum in underground soils in the eastern US is 33,000 ppm (11). Since aluminum levels at Wingate are smaller than those normally found in most soils, this chemical is unlikely to pose a health threat.

• Antimony

Antimony is a naturally-occurring metal that is silvery white. Antimony is present in small quantities in the earth's crust. It is usually found in very low concentrations (less than 5 ppb) in ground water (23). Antimony was found in the off site irrigation well at a concentration of 16 ppb (8). Most antimony is tightly bound to particles but some may be taken up by plants (23). Antimony has not been classified by the EPA regarding its carcinogenicity (23). The low concentration of antimony found in the water is not a health threat for contaminating homegrown vegetables.

• Beryllium

Beryllium is a mineral that is found in rocks, coal, oil, soil, and volcanic dust. It is a metal that can be harmful when you breathe it but swallowing beryllium has not been reported to cause effects in humans because very little beryllium can move from the stomach and intestines into the bloodstream. Beryllium has been classified by the EPA as a probable human carcinogen when you breathe it (24). In one residential soil sample, beryllium was found at a concentration of 0.24 mg/kg (8), less than the mean concentration of beryllium in U.S. soils (0.6 mg/kg) (24). Since levels at Wingate are less than those normally found in most soils, beryllium is unlikely to pose a health threat.

• Cadmium

Eating too much cadmium can harm a person's health (18). The largest amount of cadmium in Wingate yard soils is 3.9 ppm (8). Average cadmium levels in unpolluted topsoil in the U.S. are about 0.25 ppm. It has been reported that plants take up cadmium easily. It can collect in food crops, especially in plant leaves. However, several studies noted that in an agricultural setting, only rice and tobacco can accumulate cadmium to levels that would cause human illness (19,20,21). EPA

has adopted a level of 19.7 mg/kg cadmium as an acceptable concentration in agricultural soil (25). Since the 3.9 mg/kg soil concentration of cadmium is five times less than EPA's allowable limit for agricultural soil, it is unlikely that the cadmium concentration in the soil is a health threat for homegrown vegetable consumption.

Chromium

Chromium levels vary greatly in soil. One study shows chromium in soil ranges from 5-1,500 ppm. The average amount in Canadian soils is 43 ppm. A study in the mid-Atlantic U.S. found chromium levels ranging between 4.9-71 ppm (12) The highest amount of chromium in Wingate yard soils is 25 ppm (8). Chromium was found in the irrigation well at levels less than the Florida drinking water standards. The chromium levels at Wingate are not higher than background levels.

Chromium's harmfulness depends on its form. Chromium(VI) is much more harmful than chromium(III). Chromium(III) is an essential nutrient. It occurs naturally in food, including many fresh vegetables and fruit (13). People can buy bottles of chromium(III) vitamins in stores (22). In soil, chromium is typically in the chromium(III) form, even under highly oxygen-rich (oxidative) conditions. Chromium(III) in soil usually exists as an undissolvable oxide. Because this compound does not dissolve in water (13, 26), it cannot move from soil into plants. This means chromium in vegetables is unlikely to pose a health threat.

- Copper

Copper is an essential nutrient. People need to eat small amounts of copper in their diet to stay healthy (14). You eat and drink about 1 milligram (1/1000 of a gram) of copper every day. Copper is necessary in your diet for good health. The highest amount of copper in Wingate yard soils is 810 ppm (8). Copper is naturally occurring in soil and ranges from 2 to 250 ppm. Most copper compounds found in the air, water, soil, and rock are so strongly attached to dust and dirt that they cannot easily affect your health (27). Copper found at hazardous waste sites is likely in this form (14). Since copper is known to bind tightly to soil particles, it is unlikely that it will cause a health threat in homegrown vegetables.

- Mercury (inorganic)

Eating too much mercury can harm a person's health (28). The highest amount of mercury in Wingate yard soils is 0.25 ppm (8). Several studies show mercury in soils ranges from 0.020-0.625 ppm. The highest mercury levels usually occur in urban or organic soils (28). Municipal waste incineration can release mercury compounds into the air (15). The compounds likely to get into soil are mercury chlorides and oxides (15, 16). Of these compounds, only mercuric chloride dissolves in water (26, 28).

Because of mercuric chloride's ability to dissolve in water, we estimated exposure doses for an adult, a 10 year-old child and a 2 year-old child (see table 2). We added the doses of mercury from

vegetable consumption to our previously calculated doses for accidentally eating soil. We compared the total mercury intake doses for the three age groups to levels where harmful effects have been seen in people and animals. Our mercury dose estimates were much smaller than doses causing harm to people or animals (28). This means mercury in yard soil is unlikely to pose a health threat.

• Lead

Ingesting lead can be hazardous to human health, especially in young children (29). The concentration of lead found in the irrigation well water exceeded the Florida drinking water standard (30). We estimated the exposure of lead in vegetables using twice the concentration found in the water sample. The estimated exposure doses were far less than those found to be harmful in children or animals even at double the concentration. The low concentration of lead found in the irrigation water is not a health threat for homegrown vegetables.

• Dioxin

Chlorinated dibenzo-p-dioxins (CDDs) are a family of compounds referred to as chlorinated dioxins. These compounds have various harmful effects. In pure form, CDDs are colorless solids or crystals. In the environment they tend to associate with ash, soil, or any surface with high organic content such as plant leaves. Currently, CDDs are primarily released to the environment during combustion of fossil fuel, wood, and during incineration. CDDs have also been detected in cigarette smoke, home-heating systems, and vehicle exhaust. CDDs deposited on land from combustion sources bind strongly to the soil. Plants take up only very small amounts of CDDs by their roots. In general there is little accumulation of dioxin in plants (32). Most CDDs found in plant parts above the ground probably come from air or dust (17).