Agrico Chem
Risk Assess
Public Health Assess

STATE OF FLORIDA
DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

April 20, 1994

Bureau of Waste Cleanup
APR 25 1994
Hazardous Waste
Cleanup Section

Kelsey Helton
Room 368D
Dept. of Environmental Protection
2600 Blair Stone Rd.
Tallahassee, FL 32301

Dear Kelsey:

Enclosed is a copy of the initial release of the public health assessment for the Agrico Chemical Co. Superfund site.

Please review the document for technical accuracy and provide any comments you may have by May 16. You can phone me with your comments, mark and return this draft, or send a more formal reply. This draft is also being sent to other state and local agencies for review. Following incorporation of agency comments, a draft will be released for general public comment before being finalized. This site is being assessed under a cooperative agreement between Florida HRS and the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service.

If you have any questions or need further information, please call me at (904) 488-3385 (SC 278-3385) or write to the address below.

Sincerely,

Bruce J. Tuovila
Environmental Specialist III
Toxicology and Hazard Assessment

Enclosure

Risk Assessment
#74

1317 WINEWOOD BOULEVARD • TALLAHASSEE, FLORIDA 32399-0700

LAWTON CHILES, GOVERNOR

Public Health Assessment for

Bureau of Waste Cleanup
APR 25 1994
Hazardous Waste
Cleanup Section

AGRICO CHEMICAL SITE

PENSACOLA, ESCAMBIA COUNTY, FLORIDA

CERCLIS NO. FLD980221857

MARCH 17, 1994

Initial Release

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

Comments Period Ends.

ARPIL 22, 1994

THE ATSDR HEALTH ASSESSMENT : A NOTE OF EXPLAINATION

Section 104 (i) (6) (F) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, states"...the term 'health assessment' shall include preliminary assessments of potential risks to human health posed by individual sites and facilities, based on such factors as the nature and extent of contamination, the existence of potential pathways of human exposure including ground or surface water contamination, air emissions, and food chain contamination), the size and potential susceptibility of the community within the likely pathways of exposure, the comparison of expected human exposure levels to the short-term and long-term health effects associated with identified hazardous substances and any available recommended exposure or tolerance limits for such hazardous substances, and the comparison of existing morbidity and mortality data on diseases that may be associated with the observed levels of exposure. The Administrator of ATSDR shall use appropriate data, risks assessments, risk evaluations and studies available from the Administrator of EPA."

In accordance with the CERCLA section cited, this Health Assessment has been conducted using available data. Additional Health Assessments may be conducted for this site as more information becomes available.

The conclusions and recommendations presented in this Health Assessment are the result of site specific analyses and are not to be cited or quoted for other evaluations or Health Assessments.

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

PUBLIC HEALTH ASSESSMENT

AGRICO CHEMICAL SITE

PENSACOLA, ESCAMBIA COUNTY, FLORIDA

CERCLIS NO. FLD980221857

Prepared by

The Florida Department of Health and Rehabilitative Services
Under Cooperative Agreement With the
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Initial Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the Agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited timeframe. To the extent possible, it presents an assessment of the potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has been provided to EPA and the affected state, as required by CERCLA section 104 (i)(6)(H) for their information and review. Where necessary, it will be revised in response to comments or additional relevant information provided by them to ATSDR. The revised document will then be released for a 30 day public comment period. Subsequent to the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment 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.

Agency for Toxic Substances and Disease Registry..... David Satcher, M.D., Ph.D., Administrator
Barry L. Johnson, Ph.D., Assistant Administrator

Division of Health Assessment and Disease Registry..... Robert C. Williams, P.E., DEE, Director
Juan J. Reyes, Deputy Director

Federal Programs Branch..... Sally L. Shaver, Chief

Community Health Branch..... Cynthia M. Harris, Ph.D., Chief

Remedial Programs Branch..... Sharon Williams-Fleetwood, Ph.D., Chief

Records & Information Management Branch..... Max M. Howie, Jr., Chief

Emergency Response & Consultation Branch..... C. Harold Emmett, P.E., Chief

Use of trade names is for identification only and does not constitute endorsement by the U.S. Department of Health and Human Services.

Please address comments regarding this report to:

Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Attn: Chief, Records and Information Management Branch, E-56
1600 Clifton Road, N.E., Atlanta, Georgia 30333

ATSDR and its Public Health Assessment

ATSDR is the Agency for Toxic Substances and Disease Registry, a federal public health agency. ATSDR is part of the Public Health Service in the U.S. Department of Health and Human Services. ATSDR is not a regulatory agency. Created by Superfund legislation in 1980, ATSDR's mission is to prevent or mitigate adverse human health effects and diminished quality of life resulting from exposure to hazardous substances in the environment.

The Superfund legislation directs ATSDR to undertake actions related to public health. One of these actions is to prepare public health assessments for all sites on or proposed for the Environmental Protection Agency's National Priorities List, including sites owned or operated by the federal government.

During ATSDR assessment process the author reviews available information on

- the levels (or concentrations) of the contaminants,
- how people are or might be exposed to the contaminants, and
- how exposure to the contaminants might affect people's health

to decide whether working or living nearby might affect peoples' health, and whether there are physical dangers to people, such as abandoned mine shafts, unsafe buildings, or other hazards.

Four types of information are used in an ATSDR assessment.

1) environmental data; information on the contaminants and how people could come in contact with them

2) demographic data; information on the ethnicity, socioeconomic status, age, and gender of people living around the site,

3) community health concerns; reports from the public about how the site affects their health or quality of life

4) health data; information on community-wide rates of illness, disease, and death compared with national and state rates

The sources of this information include the Environmental Protection Agency (EPA) and other federal agencies, state, and local environmental and health agencies, other institutions, organizations, or individuals, and people living around and working at the site and their representatives.

TSDR health assessors visit the site to see what it is like, how it is used, whether people in walk onto the site, and who lives around the site. Throughout the assessment process, TSDR health assessors meet with people working at and living around the site to discuss ith them their health concerns or symptoms.

team of ATSDR staff recommend actions based on the information available that will rotect the health of the people living around the site. When actions are recommended, TSDR works with other federal and state agencies to carry out those actions.

public health action plan is part of the assessment. This plan describes the actions TSDR and others will take at and around the site to prevent or stop exposure to site ontaminants that could harm peoples' health. ATSDR may recommend public health actions hat include these:

- restricting access to the site,
- monitoring,
- surveillance, registries, or health studies,
- environmental health education, and
- applied substance-specific research.

ATSDR shares its initial release of the assessment with EPA, other federal departments and agencies, and the state health department to ensure that it is clear, complete, and accurate. After addressing the comments on that release, ATSDR releases the assessment to the general public. ATSDR notifies the public through the media that the assessment is available at nearby libraries, the city hall, or another convenient place. Based on comments from the public, ATSDR may revise the assessment. ATSDR then releases the final assessment. That release includes in an appendix ATSDR's written response to the public's comments.

If conditions change at the site, or if new information or data become available after the assessment is completed, ATSDR will review the new information and determine what, if any, other public health action is needed.

For more information about ATSDR's assessment process and related programs please write to:

Director
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry
1600 Clifton Road (E-32)
Atlanta, Georgia 30333

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SUMMARY

The Agrico Chemical Co. Superfund site is a former sulfuric acid and phosphate fertilizer production facility in Pensacola, Escambia County, Florida. The site is in a mixed residential/ light industrial/commercial area on the northwest corner of the intersection of Interstate 110 and Fairfield Dr. The plant began operation in 1889 and produced sulfuric acid, superphosphate and monoammonium phosphate. After the plant closed in 1975, all processing equipment and buildings were removed from the site.

Soil and groundwater are contaminated. Contaminants of concern are arsenic, chromium, fluoride, lead, manganese, polycyclic aromatic hydrocarbons (PAHs), sulfate and vanadium. Surface soil on the site is contaminated with arsenic, fluoride and lead at a level of health concern. Groundwater contamination from the site has reached Bayou Texar, an environmentally sensitive estuary about one and one-half miles east-southeast of the site.

Community members are concerned that children who used the now-abandoned on-site baseball field may become ill from their exposure to the contaminants. Residents near the site are concerned that contaminants have migrated from the site to the neighborhood west of the site.

Although groundwater east-southeast of the site is contaminated, there are no public or private drinking water wells in the area. Therefore, contaminated drinking water is not a likely exposure pathway at this site.

Based on the available information, we categorize this site as a public health hazard. Past exposure to arsenic in surface soil, waste sludge, and surface water on the site may cause skin irritation or the appearance of "corns" or "warts". Exposure to fluoride may cause fluorosis of bones and mottling of the teeth. Exposure to lead may cause decreased intelligence scores, slow growth, and hearing impairment in young children.

Children using the on-site baseball field that was abandoned in 1991 have been exposed only to fluoride; however, this exposure is at a level that could cause mottling of the teeth.

Three of the contaminants at this site--arsenic, lead, and the PAHs--are known or suspected human carcinogens. Workers and trespassers on the site have been exposed to arsenic in surface soil at a level that could cause a "low" increase in the risk of skin, bladder, liver, kidney and lung cancer. Exposure to arsenic in surface soil at the on-site baseball field and to lead and PAHs at the levels found on and off of the site would result in no apparent increase in the risk of cancer. Analysis of off-site samples has been limited to fluoride and three analyses for lead. No adverse health effects are likely from exposure to them. However, we have insufficient information about the other contaminants of concern in off-site surface soil and therefore cannot determine if adverse health effects are likely.

We recommend that the Potentially Responsible Parties (PRPs) for the Agrico Chemical Co. site maintain site security and post additional warning signs to reduce the likelihood of trespassing. We also recommend that they collect and analyze additional samples to characterize off-site surface soil and on-site surface water. The PRPs should conduct periodic monitoring of Bayou Texar to ensure timely discovery of any increase in contaminant levels. Finally, they should ensure that remediation workers at this site are provided with appropriate protection from contaminants.

BACKGROUND

The Florida Department of Health and Rehabilitative Services (Florida HRS), in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), will evaluate the public health significance of the Agrico Chemical Company site. Specifically, Florida HRS will determine whether health effects are possible and will recommend actions to reduce or prevent them. ATSDR, located in Atlanta, Georgia, is a federal agency within the U.S. Department of Health and Human Services and is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) to conduct public health assessments at hazardous waste sites.

A. Site Description and History

The Agrico Chemical Co. (Agrico) site occupies about 35 acres at the intersection of Fairfield Dr. and Interstate 110, in Pensacola, Escambia County, Florida (Figures 1-4, Appendix A). The site is bounded by Interstate 110 to the east, Fairfield Dr. to the south, the CSX railroad yard to the west, and CSX property containing two baseball fields to the north.

Production of sulfuric acid from pyrite (iron sulfide) began in 1889 by an unidentified company. From 1920-1963, sulfuric acid and superphosphate fertilizer were produced at the site by the American Agricultural Chemical Company. Continental Oil Company purchased the property and operated the facility from 1963 to 1972. Agrico purchased the facility and operated it until 1975, producing superphosphate and monoammonium phosphate. Fertilizer production ceased in mid-1975 and the facility was purchased by a Florida partnership and a private individual in 1977. In 1979, all buildings and process equipment were removed from the site (Geraghty & Miller 1992b).

In 1983, the EPA conducted a hazardous waste site investigation at the site. They found fluoride, lead, sulfate, and chromium in soil and wastewater pond samples. In 1988 and 1989, the Florida Department of Environmental Regulation (FDER) (now the Florida Department of Environmental Protection (FDEP)) investigated groundwater contamination at the site. They found elevated fluoride and sulfate levels in both shallow and deep groundwater on and downgradient from the site. In 1991 and 1992, contractors for the Potentially Responsible Parties (PRPs) for Agrico conducted remedial investigations of the site. The contractors found that on-site surface and subsurface soil, shallow and deep groundwater, and waste sludge material, as well as off-site surface and subsurface soil, and shallow and deep groundwater were contaminated with arsenic, chromium, fluoride, lead, manganese, sulfate, and vanadium. Surface and subsurface soil both on and off of the site as well as on-site waste sludge were also contaminated with polycyclic aromatic hydrocarbons (PAHs).

In 1978, a baseball field was constructed off of the site to the north. Sometime between 1981 and 1986, a second ballfield was built on the site just south of the first one (Geraghty & Miller 1992c). This on-site ballfield was abandoned in 1991 after soil contamination was found. In 1992, the PRPs built a new ballfield north of the northern ballfield to replace the one that was abandoned (EPA 1992). Both ballfields are now located off of the Agrico site. The abandoned southern-most ballfield has been fenced off to prevent access.

Because of concern over soil and groundwater contamination, EPA included this site in the National Priorities List (NPL) of Superfund sites in 1989. The NPL is maintained by EPA and lists those hazardous waste sites that require cleanup action under the "Superfund" law, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). On September 23, 1992, contractors for the PRPs at this site released a Feasibility Study describing alternative soil cleanup methods (Geraghty & Miller 1992c). On September 29, 1992, EPA issued a Record of Decision (ROD) regarding the selected soil cleanup method (EPA 1992) and on February 18, 1993, EPA concluded a Consent Agreement with the PRPs to implement the cleanup (EPA 1993). A second ROD concerning groundwater contamination is in preparation. This Public Health Assessement is being prepared by Florida HRS for ATSDR as part of this process.

B. Site Visit

Bruce Tuovila, Florida HRS, and the EPA Remedial Project Manager toured the site on February 5, 1992. Mr. Tuovila conducted additional site visits on July 16, 1992 and April 22, 1993. The Agrico site is flat and in a low-lying area with no apparent drainage channels to off-site areas. A large impoundment, formerly used as a wastewater disposal pond, is in the northeast corner of the site and now contains cattails and other marsh plants. Most of the remainder of the site is covered with grass, brush and scattered clumps of small trees. We observed concrete rubble and building foundations over much of the western half of the site. An abandoned building is on the southern border of the site. Just off-site to the west is an active mini-warehouse complex.

In February 1992, only the eastern half of the site, containing the wastewater disposal pond, was fenced. By 1993, EPA had fenced the entire site. Warning signs are posted only at the entrance gate to the dirt access road. The number and location of warning signs is inadequate to warn the public of the hazards on this site and to meet the requirements of sections 403.704 and 403.7255, Florida Statutes, and FDEP Rule 17-736. Additional activities include filling of a concrete holding pond, removal of a brick building on the west side of the site, and construction of a new baseball field north of the site to replace the one abandoned on-site.

During a drive-through tour of the areas around the site, we observed two baseball fields and a company operating a borrow pit to the north of the site, a school and various businesses

south of the site, and the CSX railroad yard west of the site. Immediately west of the rail yard is a small neighborhood consisting of mostly older homes. All homes and businesses in the area are supplied by city water.

C. Demographics, Land Use, and Natural Resource Use

Demographics

According to 1990 census data (BOC 1992), about 150 people live within a one-quarter mile radius of the site and about 6,400 people live within one mile. The population within one-quarter mile is about 96% African-American. The neighborhood west of the site is low to lower-middle income. There are eight daycare centers, six public schools, two hospitals, one private school, and a children's home within one mile of the site.

Land Use

The area within one mile of the site is mixed residential/light industrial/commercial. There are commercial businesses and a school complex south of the site across Fairfield Dr., and the CSX railroad yard and a residential neighborhood west of the site. North of the site is a borrow pit operation and a sand-and-gravel supply business. Interstate 110 borders the site on the east. The Escambia Treating Company hazardous waste site is about two-thirds of a mile northwest of the site.

Natural Resource Use

The main source of drinking water for Pensacola and Escambia County is the Sand-and-Gravel aquifer. This aquifer begins at a depth of 40-50 feet and consists of two water-bearing zones separated by clay or sandy clay layers. The upper zone extends from about 50 to 150 feet below land surface (BLS) and the lower zone from about 150 to 250 feet BLS. The lower zone provides most of the drinking water for the Pensacola area. There is a downward vertical hydraulic gradient between the upper and lower zones of the aquifer, indicating that contamination of the upper zone can migrate into the lower zone. Although regional groundwater flow in this aquifer is southward, groundwater flow near the site is more toward the east-southeast (Watts et al 1988).

A groundwater contamination plume extends east from the Agrico site along the natural hydraulic gradient of the deeper zone and discharges to Bayou Texar, a saltwater estuary. Of the eight public supply wells within three miles of the site, none is within the contamination plume. All households within the area of groundwater contamination use public water for drinking and other domestic purposes. Except for small backyard gardens, there is no agricultural use of the land within one mile of the site.

D. Health Outcome Data

Guided by community health concerns, HRS epidemiologists reviewed information contained in the Florida Cancer Data System (FCDS). FCDS is a program of Florida HRS operated by the University of Miami School of Medicine and covers all cancers reported in Florida between 1981 and 1990. Registry information was available for the 32503 and 32505 zip code areas. These zip codes include neighborhoods around the Agrico Chemical Co. site. We will discuss the results of these reviews in the Public Health Implications, Health Outcome Data Evaluation section.

COMMUNITY HEALTH CONCERNS

We have compiled health concerns expressed by community members during telephone conversations and public meetings, and from newspaper articles and local health officials. These concerns are addressed in the Public Health Implications Community Health Concerns Evaluation section.

Community members whose children used the ballfield on the Agrico site are concerned about the health effects that may result from exposure to contaminants in this area. Residents of the neighborhood west of the site are concerned that contaminants have migrated from the site to their yards and may cause adverse health effects.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

In this section, we review the environmental data collected at this site. We evaluate the adequacy of the sampling that has been conducted, select contaminants of concern, and list the maximum concentration and frequency of detection of the contaminants found in various media. The maximum concentrations found are then compared to background levels and to standard comparison values. The following comparison values are used in the data tables:

1. CREG--Cancer Risk Evaluation Guide--calculated from EPA's cancer slope factors, is the contaminant concentration that is estimated to result in no more than one excess cancer in a million persons exposed over a lifetime.

2. EMEG--Environmental Media Evaluation Guide--derived from ATSDR's Minimal Risk Level (MRL), which provides a measure of the toxicity of a chemical, is the estimate of daily human exposure to a chemical that is likely to be without an appreciable risk of adverse effects, generally for a period of a year or longer.

3. LTHA--Lifetime Health Advisory for Drinking Water--is EPA's estimate of the concentration of a contaminant in drinking water at which adverse health effects would

not be anticipated to occur over a lifetime of exposure. LTHAs provide a safety margin to protect sensitive members of the population.

4. MCL--Maximum Contaminant Level--is the contaminant concentration that EPA considers protective of public health over a 70 year lifetime at an exposure rate of 2 liters of water per day. MCLs are regulatory concentrations.

5. RMEG--Reference Dose Media Evaluation Guide--is calculated from the EPA Reference Dose (RfD)--EPA's estimate of the daily exposure to a contaminant that is unlikely to cause adverse health effects. Similar to EMEGs, RMEGs are estimated contaminant concentrations at which daily exposure would be unlikely to cause a noncarcinogenic health effect.

We have reviewed the environmental sampling data collected at this site and selected the following chemicals as contaminants of concern:

Arsenic	Lead	Sulfate
Chromium	Manganese	Vanadium
Fluoride	Polycyclic Aromatic Hydrocarbons (PAHs)	

We selected these contaminants based on the following factors:

1. Concentrations of contaminants on and off the site.

2. Field data quality, laboratory data quality, and sample design.

3. Comparison of on-site and off-site concentrations with health assessment comparison values for (1) noncarcinogenic endpoints and (2) carcinogenic endpoints.

4. Community health concerns.

The PAHs of concern at the Agrico site are: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benz(a)anthracene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene. All of these chemicals are possible or probable human carcinogens. However, an ATSDR comparison value is available only for benzo(a)pyrene. Consequently, although all of these chemicals are listed in the tables in Appendix B, analysis of the potential health effects from exposure to them will be based primarily on the levels of benzo(a)pyrene found in the various media at this site.

Twenty-nine chemicals were found in various media on the Agrico site at a level below health concern. In addition, 23 other chemicals were detected for which there is insufficient

human health data to determine their public health significance. The chemicals in both these categories are listed in Appendix C. Two possible human carcinogens, 1,1-dichloroethane and 4-methylphenol (*p*-cresol), were detected in groundwater at this site. However, we eliminated them from further consideration because groundwater is not a likely past, present or future human exposure pathway. See the Pathways Analysis section for details.

Identification of a contaminant of concern in this section does not necessarily mean that exposure will cause adverse health effects. Identification serves to narrow the focus of the health assessment to those contaminants most important to public health. When selected as a contaminant of concern in one medium, we have also reported that contaminant in all other media. We will evaluate these contaminants in subsequent sections and determine whether exposure has public health significance.

To identify industrial facilities that could contribute to the contamination near the Agrico Chemical Co. site, we searched the EPA Toxics Release Inventory (TRI) database for 1987-1991. EPA developed TRI from the chemical release information (air, water, and soil) provided by certain industries. The TRI search revealed one industry, Florida Drum Company at 10 Spruce St., within a one mile radius of the site that reported releases of toxic chemicals. Between 1987 and 1991, Florida Drum Co. reported releasing to the air a total of 151,223 pounds of mixed xylenes and 202,564 pounds of methyl ethyl ketone (2-butanone). Florida Drum Co. estimated annual air releases for 1992 and 1993 of 35,300 pounds of mixed xylenes and 41,700 pounds of methyl ethyl ketone.

Both methyl ethyl ketone (2-butanone) and xylene are used as paint thinners, solvents, and cleaning agents. They easily evaporate into the air and can cause irritation of the nose, throat, eyes, and skin. Based on limited information, neither is thought to be carcinogenic (ATSDR 1990c and 1992a). Only xylene was detected at the Agrico site.

In this assessment, the contamination that exists **on** the site will be discussed first, separately from the contamination that occurs **off** the site.

A. On-site Contamination

For the purposes of this evaluation, "on-site" is defined as the Agrico Chemical Co. property within the fenced boundary as shown in Figure 4, Appendix A.

We compiled data in this subsection from the following sources: FDEP groundwater investigation reports (Watts et al 1988, Watts and Wiegand 1989) and EPA reports (EPA 1983, Geraghty & Miller 1992a, 1992b).

Surface Soil

EPA collected a total of 57 surface soil samples (depth 0-6 inches) from various locations on the site between 1983 and 1992 (EPA 1983, Geraghty & Miller 1992a, 1992b) (Figure 5, Appendix A). Fluoride was the only contaminant of concern which was analyzed for in background surface soil samples on-site; its concentration was at a level below the comparison value.

Arsenic, benzo(a)pyrene, chromium, and fluoride levels in on-site surface soil samples exceeded the corresponding comparison values (Table 1, Appendix B). Lead was detected in all 18 samples at a maximum concentration of 46,000 milligrams per kilogram (mg/kg) and sulfate was detected in 3 of 13 samples at a maximum concentration of 1,000 mg/kg. No ATSDR soil comparison values are available for these chemicals. For this assessment, these samples were adequate to characterize the on-site surface soil quality.

Subsurface Soil

EPA collected a total of 157 subsurface soil samples (depth greater than 6 inches) from various locations on the site during 1992 (Geraghty & Miller 1992a, 1992b) (Figure 6, Appendix A). Arsenic, chromium, lead and sulfate were the only contaminants of concern anlayzed for in background subsurface soil samples on-site. Arsenic was found at a level above the comparison value; sulfate was not detected.

Arsenic, benzo(a)pyrene, chromium, fluoride, manganese, and vanadium levels in on-site subsurface soil exceeded the corresponding comparison values (Table 2, Appendix B). Lead was detected in 76 of 80 samples at a maximum concentration of 3,800 mg/kg and sulfate was detected in 11 of 56 samples at a maximum concentration of 9,100 mg/kg. No ATSDR soil comparison values are available for these chemicals. For this assessment, these samples were adequate to characterize the on-site subsurface soil quality.

Surface Water

EPA collected a total of five surface water samples from the wastewater holding ponds on the site during 1983 (EPA 1983) (Figure 7, Appendix A). No background samples were collected.

Fluoride, manganese and vanadium levels in on-site surface water exceeded the corresponding comparison values (Table 3, Appendix B). Arsenic and lead were not detected in any samples. No samples were analyzed for PAHs or chromium. Sulfate was detected in all five samples at a maximum concentration of 2,600,000 micrograms per liter (µg/L). This exceeds the Florida Secondary Drinking Water Standard for sulfate of 250,000 µg/L. No ATSDR comparison value is available for sulfate. Because no recent samples from the wastewater

holding ponds have been analyzed and this water may be impacting on the groundwater quality at the site, we do not consider these samples adequate to characterize the on-site surface water quality.

Shallow Groundwater

FDEP and EPA collected a total of seven shallow groundwater samples (depth less than 150 ft.) from two locations on the site during 1988 and 1992 (Watts et al 1988, Geraghty & Miller 1992a, 1992b) (Figure 8, Appendix A). No background samples were collected.

Arsenic, fluoride and manganese levels in on-site shallow groundwater exceeded the corresponding comparison values (Table 4, Appendix B). PAHs, chromium and vanadium were not detected in any samples. Lead was detected in 4 of 7 samples at a maximum concentration of 6.6 µg/L. This level is below the Florida Maximum Contaminant Level (FLMCL) of 15.0 µg/L. Sulfate was detected in all 7 samples at a maximum concentration of 94,000 µg/L. This is below the Florida Secondary Drinking Water Standard for sulfate of 250,000 µg/L. No ATSDR comparison values are available for these chemicals. For this assessment, these samples were adequate to characterize the on-site shallow groundwater.

Deep Groundwater

FDEP and EPA collected a total of eight deep groundwater samples (depth greater than 150 ft.) from two locations on the site during 1988, 1989 and 1992 (Watts et al 1988, Watts and Wiegand 1989, Geraghty & Miller 1992a, 1992b) (Figure 9, Appendix A). No background samples were collected.

The level of arsenic in on-site deep groundwater exceeded its comparison value (Table 5, Appendix B). PAHs and chromium were not detected in any samples. No samples were analyzed for manganese or vanadium. Lead was detected in 1 of 6 samples at a concentration of 6.7 µg/L. This level is below the FLMCL of 15.0 µg/L. Sulfate was detected in all 8 samples at a maximum concentration of 34,000 µg/L. This is below the Florida Secondary Drinking Water Standard for sulfate of 250,000 µg/L. No ATSDR comparison values are available for these chemicals. For this assessment, these samples were adequate to characterize the on-site deep groundwater.

Waste Sludge

EPA collected a total of 41 waste sludge samples from various locations on the site during 1983 and 1992 (EPA 1983, Geraghty & Miller 1992a, 1992b) (Figure 10, Appendix A). Waste sludge at the Agrico site is the residue from evaporation of wastewater discharged to holding ponds on the site. It has been described as a white or gray, spongy, crystalline or gelatinous material that is very soft and fine-grained with little structural strength. It is

readily distinguished from the native soil which is an orange to brown firm, dense sand (EPA 1983, Watts et al 1988, Geraghty & Miller 1992a).

Arsenic, benzo(a)pyrene, chromium, fluoride, manganese and vanadium levels in on-site waste sludge material exceeded the corresponding comparison values (Table 6, Appendix B). Lead was detected in all six samples at a maximum concentration of 6,900 mg/kg and sulfate was detected in 5 of 12 samples at a maximum concentration of 9,100 mg/kg. No ATSDR comparison values are available for these chemicals. For this assessment, these samples were adequate to characterize the on-site waste sludge material.

B. Off-site Contamination

For the purposes of this evaluation, "off-site is defined as the area outside the boundary fence around the Agrico Chemical Co. property as shown in Figure 4, Appendix A.

We compiled data in this subsection from the following sources: FDEP groundwater investigation reports (Watts et al 1988, Watts and Wiegand 1989) and EPA reports (Geraghty & Miller 1992a, 1992b).

Surface Soil

EPA collected a total of 16 surface soil samples (depth 0-6 inches) from various locations off of the site during 1992. Sample locations were chosen based on aerial photographs indicating the presence of a possible wood treatment facility to the east of the site and a drainage ditch running south of Fairfield Drive along the now present Gulf Power right-of-way. Apartment complexes and residences are now in both of these locations (Geraghty & Miller 1992b) (Figure 11, Appendix A). PAHs, fluoride and lead were not detected in off-site surface soil background samples.

Benzo(a)pyrene and fluoride levels in off-site surface soil samples exceeded the corresponding comparison values (Table 7, Appendix B). No samples were analyzed for arsenic, chromium, manganese, sulfate or vanadium. Lead was detected in the three samples for which it was analyzed at a maximum concentration of 110 mg/kg. No ATSDR soil comparison value is available for lead.

The EPA Remedial Project Manager for the Agrico site has indicated that off-site surface soil sample analysis was limited primarily to fluoride because it was always found in association with other contaminants on the site. Since this site is adjacent to other industrial facilities, it is possible that contaminants found in off-site soil may have originated from a source other than the Agrico site. Fluoride is a contaminant unique to the Agrico site and it was assumed that if fluoride was not present in off-site surface soil samples, no other site-related contaminants would be present (Goldberg pers comm 1994). However, no surface soil samples from the off-site baseball fields were analyzed and many contaminants of concern

have not been analyzed for in off-site surface soil. Without this information, we cannot definitely conclude that no off-site surface soil contamination exists at a level of health concern. Consequently, we do not consider these samples adequate to characterize the off-site surface soil.

Subsurface Soil

EPA collected a total of 24 subsurface soil samples (depth greater than 6 inches) from various locations off of the site during 1992 (Geraghty & Miller 1992b) (Figure 12, Appendix A). PAHs, fluoride and lead were not detected in off-site subsurface soil background samples.

Benzo(a)pyrene and fluoride levels in off-site subsurface soil exceeded the corresponding comparison values (Table 8, Appendix B). No samples were analyzed for arsenic, chromium, manganese, sulfate or vanadium. Lead was detected in all three samples at a maximum concentration of 37 mg/kg. No ATSDR soil comparison value is available for lead. For this assessment, these samples are adequate to characterize the off-site subsurface soil.

Shallow Groundwater

FDEP and EPA collected a total of 26 shallow groundwater samples (depth less than 150 ft.) from various locations off of the site during 1988 and 1992 (Watts et al 1988, Geraghty & Miller 1992a, 1992b) (Figure 13, Appendix A). Arsenic, PAHs, chromium and vanadium were not detected in off-site shallow groundwater background samples.

Arsenic, chromium and fluoride levels in off-site shallow groundwater exceeded the corresponding comparison values (Table 9, Appendix B). Lead was detected in 5 of 26 samples at a maximum concentration of 11 µg/L. This level is below the FLMCL of 15.0 µg/L. Sulfate was detected in 22 of 26 samples at a maximum concentration of 290,000 µg/L. This exceeds the Florida Secondary Drinking Water Standard for sulfate of 250,000 µg/L. No ATSDR comparison values are available for these chemicals.

Fluoride, which indicates the presence of site-related contaminants in the shallow groundwater, extends about one mile southeast of the site. Contaminants of concern, such as arsenic, chromium and lead, are confined to within one-quarter mile southeast of the site. There are no public or private drinking water wells using shallow groundwater in this direction from the site. For this assessment, these samples are adequate to characterize the off-site shallow groundwater.

Deep Groundwater

FDEP and EPA collected a total of 73 deep groundwater samples (depth greater than 150 ft.) from various locations off of the site during 1988, 1989 and 1992 (Watts et al 1988, Watts

and Wiegand 1989, Geraghty & Miller 1992a, 1992b) (Figure 14, Appendix A). Arsenic, PAHs, chromium, and lead were not detected in off-site deep groundwater background samples.

Arsenic, chromium, and fluoride levels in off-site deep groundwater exceeded the corresponding comparison values (Table 10, Appendix B). No samples were analyzed for manganese or vanadium. Lead was detected in 10 of 47 samples at a maximum concentration of 27.2 µg/L. This level exceeds the FLMCL of 15.0 µg/L. Sulfate was detected in 63 of 73 samples at a maximum concentration of 784,000 µg/L. This exceeds the Florida Secondary Drinking Water Standard for sulfate of 250,000 µg/L. No ATSDR comparison values are available for these chemicals.

Fluoride, which indicates the presence of site-related contaminants in the deep groundwater, extends about one and one-quarter miles east southeast of the site and has reached Bayou Texar. Lead and sulfate have migrated off-site along with fluoride and may have also reached the bayou. There are no public or private drinking water wells in this direction from the site. Although fluoride is entering Bayou Texar from the groundwater plume, the maximum concentration is insufficient to exceed the Florida surface water standard for fluoride (Woodward-Clyde 1993). For this assessment, these samples are adequate to characterize the off-site deep groundwater.

C. Quality Assurance and Quality Control

An EPA data review summary is not available for the environmental samples collected at this site. We assume these data are valid, however, since the environmental samples were collected and analyzed by governmental agencies or their contractors. In preparing this public health assessment, we relied on the information provided by these agencies and assumed that the quality assurance and quality control measures described in their reports were followed with regard to chain-of-custody, laboratory procedures, and data reporting. The validity of the analysis and conclusions drawn for this public health assessment are determined by the completeness and reliability of the referenced information.

In each of the preceding On- and Off-Site Contamination subsections, we evaluated the adequacy of the data to estimate exposures. We assumed that estimated data (J) and presumptive data (N) were valid. This second assumption errs on the side of public health by assuming that a contaminant exists when actually it may not exist.

D. Physical and Other Hazards

An abandoned building, concrete foundation rubble, and a wastewater pond are still present on the site and consititute hazards to trespassers. However, because the site is securely fenced we consider the actual risk to trespassers from these physical hazards to be negligible.

PATHWAYS ANALYSES

To determine whether nearby residents are exposed to contaminants migrating from the site, we evaluated the environmental and human components of exposure pathways. Exposure pathways consist of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population.

An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present. We categorize exposure pathways that are not eliminated as either completed or potential. For completed pathways, all five elements exist and exposure to a contaminant has occurred, is occurring, or will occur. For potential pathways, at least one of the five elements is missing, but could exist. For potential pathways, exposure to a contaminant could have occurred, could be occurring, or could occur in the future.

A. Completed Exposure Pathways

For a summary of completed exposure pathways at this site, refer to Table 11, Appendix B.

Surface Soil Pathway

Workers and trespassers on-site, as well as persons using the on-site ballfield, have been exposed in the past to contaminants in the surface soil. Remediation workers may be exposed to these contaminants in the future. Past, present and future exposure to contaminants off of the site is also possible. However, the available information about off-site contamination is insufficient to enable us to evaluate possible health effects from this exposure pathway.

Direct dermal contact and incidental ingestion of surface soil are the primary routes of exposure by this pathway. Workers on the site and persons using the on-site baseball field have been exposed. The number of workers employed at the site is unknown, but estimated to be fewer than 100. About 300 adults and 100 children may have been exposed while playing baseball at the on-site ballfield. This ballfield has been moved to a new location in an area north of the site. Because children and adults using the ballfield are not from the local neighborhood and use the field only for supervised games, it is unlikely that they would be exposed to contaminants on other parts of the site. There are indications that the site has been trespassed by children in the past, most likely from the local neighborhood; however, their number is unknown.

Since access to the entire site is now restricted by fencing, future exposure to on-site surface soil contamination is not likely. Exposure to off-site surface soil contamination is likely; however, we do not have enough information to determine if adverse health effects are possible.

Waste Sludge Pathway

Workers and trespassers on-site, as well as persons using the on-site ballfield, have been exposed in the past to contaminants in waste sludge material. Remediation workers may be exposed to these contaminants in the future.

Direct dermal contact and incidental ingestion of waste sludge are the primary routes of exposure by this pathway. Workers on the site and persons using the on-site baseball field have been exposed. The number of workers employed at the site is unknown, but estimated to be fewer than 100. About 300 adults and 100 children may have been exposed while playing baseball at the on-site ballfield. This ballfield has been moved to a new location in an area north of the site. Because children and adults using the ballfield are not from the local neighborhood and use the field only for supervised games, it is unlikely that they would be exposed to contaminants on other parts of the site. There are indications that the site has been trespassed by children in the past, most likely from the local neighborhood; however, their number is unknown.

Since access to the entire site is now restricted by fencing, future exposure to waste sludge material is not likely.

On-site Surface Water Pathway

Workers and trespassers on-site may have been exposed in the past to contaminants in the wastewater disposal ponds. Remediation workers may be exposed to these contaminants in the future. Direct dermal contact is the primary route of exposure by this pathway.

The number of workers employed at the site is unknown, but estimated to be fewer than 100. There are indications that children have trespassed the site in the past; however, their number is unknown. Since the children who used the on-site baseball field are not from the local neighborhood and use the ballfield only under adult supervision, it is unlikely that they would have an opportunity for exposure to contaminants in the wastewater disposal ponds.

The available environmental data for the on-site disposal ponds consists of a few samples taken more than 10 years ago. We do not consider this information sufficient to evaluate possible health effects from this exposure pathway.

B. Potential Exposure Pathways

For a summary of the potential exposure pathways at this site, refer to Table 12, Appendix B.

Subsurface Soil Pathway

On-site subsurface soil is contaminated. This soil is currently inaccessible and exposure to these contaminants is unlikely. However, if this site is remediated or otherwise developed, workers on the site may be exposed to contaminants in the subsurface soil through direct dermal contact and incidental ingestion.

Off-site subsurface soil is also contaminated. However, it is also inaccessible and exposure to contaminants is unlikely.

Off-site Surface Water Pathway

The groundwater contamination plume has reached Bayou Texar, an environmentally sensitive saltwater aquatic breeding ground. The bayou connects to Escambia Bay and is flushed by tidal action twice per day. Measurements of sediment pore water indicate that contaminants reaching the bayou are currently too low to be of concern (Entrix 1993). However, if the amount of contamination reaching the bayou from groundwater intrusion increases in the future, recreational use of the bayou and fish or shellfish caught for consumption may be affected.

C. Eliminated Pathways

Groundwater on-site and off of the site to the southeast is contaminated. There are no private or public drinking water supply wells in the area of contamination. Several irrigation wells, however, are present in this area. According to the Escambia County Public Health Unit, these wells have been tested and are not currently contaminated. In addition, new wells located in a contaminated area that are permitted by the Northwest Florida Water Management District must be tested. If contamination is found, the well may have to be abandoned. Therefore, groundwater is not a likely exposure pathway.

PUBLIC HEALTH IMPLICATIONS

In this section we discuss the health effects on persons exposed to specific contaminants, evaluate state and local health databases, and address specific community health concerns.

A. Toxicological Evaluation

Introduction

To evaluate health effects, ATSDR has developed Minimal Risk Levels (MRLs) for contaminants commonly found at hazardous waste sites. The MRL is an estimate of daily human exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. ATSDR developed MRLs for each route of exposure, such as ingestion, inhalation, and dermal contact, and for the length of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (greater than 365 days). ATSDR presents these MRLs in Toxicological Profiles. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status. In the following discussion, we used ATSDR Toxicological Profiles for the following chemicals:

Arsenic	Fluoride	PAHs
Benzo(a)pyrene	Lead	Vanadium
Chromium	Manganese	

There is no Toxicological Profile available for sulfate.

In this section, we used standard assumptions to estimate human exposure from direct dermal exposure and incidental ingestion of contaminated soil.

To estimate exposure to children from incidental ingestion of contaminated soil, we made the following assumptions: 1) children between the ages of 1 and 6 ingest an average of 200 milligrams (mg) of soil per day, 2) these children weigh about 10 kilograms (kg), and 3) they ingested soil at the maximum concentration measured for each contaminant. For children exposed at the on-site baseball field, we assumed that they used the field about two days per week throughout the year.

To estimate exposure to adults from incidental ingestion of contaminated soil, we made the following assumptions: 1) adults ingest an average of 100 mg of soil per day, 2) adults weigh about 70 kg, and 3) they ingested soil at the maximum concentration measured for each contaminant. For adults exposed at the on-site baseball field, we assumed that they used the field about two days per week throughout the year.

Arsenic

Workers and trespassers on the site have been exposed to arsenic in surface soil and waste sludge by incidental ingestion and dermal contact. The estimated daily dose of arsenic from incidental ingestion exceeds ATSDR's chronic MRL. Incidental ingestion of arsenic-contaminated soil on the site may lead to darkening of the skin and the appearance of "corns" or "warts". Although skin absorption is minor, contact with arsenic-contaminated soil on the site may cause irritation, swelling and redness of the skin (ATSDR 1993b).

Children who used the on-site baseball field have also been exposed to arsenic in surface soil. However, the estimated daily dose from incidental ingestion is less than ATSDR's chronic oral MRL. Therefore, adverse health effects are unlikely from this exposure.

Arsenic is a known human carcinogen. Long term ingestion of arsenic can increase the risk of skin, bladder, liver, lung and kidney cancer. Incidental ingestion of arsenic-contaminated soil by workers and trespassers on the site could result in a "low" increased risk of cancer. ATSDR defines this level of increase to mean that after 70 years, at most, one or two additional cancers may occur for every 10,000 persons exposed. This exposure would increase the number of expected cancers during the lifetime of these 10,000 persons from 2500 to 2502. However, because of this theoretical increase in the rate of cancer, ATSDR considers this exposure unacceptable.

For persons using the on-site baseball field, lifetime incidental ingestion of surface soil would result in no apparent increase in the risk of cancer.

EPA did not analyze off-site surface soil samples for arsenic. Therefore, we do not know if exposure to arsenic is possible and cannot estimate the likely health effects.

Chromium

Workers and trespassers on-site and children who used the on-site ballfield have been exposed to chromium in surface soil by incidental ingestion and dermal contact. The estimated daily dose of chromium from incidental ingestion is less than EPA's chronic oral RfD. No ATSDR chronic oral MRL is available. Exposure to chromium at the concentrations found in on-site surface soil is unlikely to cause adverse non-carcinogenic health effects. Dermal contact may cause allergic skin reactions in sensitive individuals, but skin absorption is insignificant (ATSDR 1993c).

Since some of the analytical laboratory reports did not specify which form of chromium was detected, we have assumed the presence of chromium(VI), the most toxic form. Chromium(VI) is a known human carcinogen by inhalation, but not by ingestion or dermal contact. Therefore, we do not expect any cancer risk through exposure by ingestion or

dermal contact. Since EPA did not analyze any air samples, we cannot estimate the health effects from inhalation of chromium. However, because this site is in a low-lying area where the soil tends to remain damp, we do not expect enough dust generation on the site or the now-abandoned ballfield to produce an adverse health effect by inhalation.

EPA did not analyze off-site surface soil samples for chromium. Therefore, we do not know if exposure to chromium is possible and cannot estimate the likely health effects.

Fluoride

Workers and trespassers on-site and children who used the on-site ballfield have been exposed to fluoride in surface soil and waste sludge material by incidental ingestion and dermal contact. The estimated daily dose of fluoride from incidental ingestion exceeds the ATSDR chronic MRL. Exposure to fluoride at the concentrations found in surface soil and waste sludge on-site and at the on-site ballfield can cause fluorosis of teeth and bones. Fluorosis of the teeth is characterized by mottling, the appearance of white spots on the teeth. Skeletal fluorosis causes bones to become denser and more brittle, making them more easily broken. Fluoride salts are not absorbed through the skin (ATSDR 1993a).

Individuals off of the site have also been exposed to fluoride in surface soil by incidental ingestion. However, the estimated daily dose of fluoride from incidental ingestion is less than ATSDR's chronic MRL. Therefore, adverse health effects from this exposure are not likely.

Lead

Workers and trespassers on-site have been exposed to lead in surface soil and waste sludge material by incidental ingestion and dermal contact. Individuals off of the site have also been exposed to lead in surface soil. No ATSDR MRL or EPA RfD is available for lead.

The estimated daily dose of lead from incidental ingestion of on-site surface soil and waste sludge exceeds the level at which behavioral impairment has been observed in monkeys (Laughlin et al 1983, Rice 1985, Rice and Karpinski 1988). Several studies have also reported that blood lead levels rise about 3-7 µg/dL for every 1,000 mg/kg increase in soil lead concentration (EPA 1986, Bornschein et al 1986, ATSDR 1988). The level of lead in surface soil at this site is high enough that adverse effects such as decreased intelligence scores, slow growth, and hearing impairment could occur in children.

Children who used the on-site baseball field have also been exposed to lead in surface soil and waste sludge. However, the estimated daily dose from incidental ingestion is less the level at which studies have reported behavioral or neurological impairment. Therefore, adverse health effects are unlikely from this exposure.

Lead is a probable human carcinogen based on animal studies. However, the estimated daily dose of lead is at least 100 times less than the level at which cancer effects have been shown to occur in animals (ATSDR 1993d). Therefore, carcinogenic effects from incidental ingestion are not likely.

Manganese

Workers and trespassers on-site have been exposed to manganese in surface soil and waste sludge material by incidental ingestion and dermal contact. The estimated daily dose of manganese from incidental ingestion is less than EPA's chronic oral RfD. No ATSDR MRL is available. Exposure to manganese at the concentrations found in on-site surface soil is unlikely to cause adverse health effects. Manganese absorption through the skin is negligible (ATSDR 1992b). Therefore, adverse health effects from dermal exposure are not likely.

EPA did not analyze surface soil or waste sludge samples from the on-site baseball field for manganese and did not analyze off-site surface soil samples for manganese. Therefore, we do not know if exposure to manganese is possible for persons off-site or using the ballfield and cannot estimate the likely health effects.

Polycyclic Aromatic Hydrocarbons (PAHs)

Workers and trespassers on-site have been exposed to PAHs in surface soil and waste sludge by incidental ingestion and dermal contact. Individuals off of the site have also been exposed to PAHs in surface soil. The PAHs of concern include: benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. All of these chemicals are possible or probable human carcinogens (ATSDR 1990b). However, an ATSDR comparison value is available only for benzo(a)pyrene (ATSDR 1990a). We do not have enough human health information to determine the health risks from exposure to the other PAHs. Consequently, the evaluation of the health risks from exposure to PAHs will focus on benzo(a)pyrene.

The estimated daily dose of benzo(a)pyrene from incidental ingestion is less than ATSDR's intermediate oral MRL. No chronic oral MRL is available. Exposure to benzo(a)pyrene at the concentrations found in on-site waste sludge and surface soil on and off of the site is unlikely to cause adverse non-carcinogenic health effects. Benzo(a)pyrene may also be absorbed through the skin; however, it is normally metabolized and rapidly excreted (ATSDR 1990a, 1990b).

Benzo(a)pyrene is a probable human carcinogen based on animal studies. However, lifetime incidental ingestion of surface soil and waste sludge at this site would result in no apparent increase in the risk of cancer.

EPA did not analyze surface soil or waste sludge samples from the on-site baseball field for PAHs. Therefore, we do not know if exposure to PAHs is possible for persons using the ballfield and cannot estimate the likely health effects.

Sulfate

Workers and trespassers on-site and children who used the on-site ballfield have been exposed to sulfate in surface soil and waste sludge material by incidental ingestion and dermal contact. No ATSDR MRL or EPA RfD is available for sulfate. The estimated daily dose of sulfate from incidental soil ingestion is at least 100 times less than the dose that would be received by drinking water at the Florida secondary drinking water standard. Therefore, we do not expect any adverse health effects from exposure to sulfate at this site.

EPA did not analyze off-site surface soil samples for sulfate. Therefore, we do not know if exposure to sulfate is possible and cannot estimate the likely health effects.

Vanadium

Workers and trespassers on-site have been exposed to vanadium in on-site surface soil and waste sludge material by incidental ingestion and dermal contact. The estimated daily dose of vanadium from incidental ingestion is less than ATSDR's intermediate MRL. No chronic oral MRL is available. Exposure to vanadium at the concentrations found in on-site soil and waste sludge is unlikely to cause adverse health effects. Absorption of vanadium through the skin is negligible (ATSDR 1992c). Therefore, adverse health effects from dermal exposure are not likely.

EPA did not analyze surface soil or waste sludge samples from the on-site baseball field for vanadium and did not analyze off-site surface soil for vanadium. Therefore, we do not know if exposure to vanadium is possible for persons off-site or using the ballfield and cannot estimate the likely health effects.

B. Health Outcome Data Evaluation

Guided by community health concerns in the population living near the site, Florida HRS epidemiologists conducted an evaluation of cancer incidence in this area. Cancer information was available for the two zip code areas closest to the site. The incidence of cancer in these zip codes was compared with the incidence for the state of Florida.

Based on a comparison of cancer rates corrected for the influence of age and race, three cancer types, liver, kidney and lung, appear to be elevated in the 32503 and 32505 zip code areas. Arsenic is present on the site at a level that could increase the risk of liver, lung and

kidney cancer. However, we do not have any information about the incidence of these cancer types among people who worked at or trespassed on the site.

C. Community Health Concerns Evaluation

We have addressed each community health concern as follows:

1. What health effects could occur in children from exposure to contaminants at the on-site baseball field?

Children playing on the on-site baseball field have been exposed to fluoride at a level of health concern. This exposure could result in mottling of the teeth, that is, the appearance of white spots, could occur. This effect may be permanent. Since this ballfield has been abandoned and access is restricted by fencing, no future exposure is likely.

2. Have contaminants migrated from the site to the yards of residences in the neighborhood west of the site and what health effects may occur from exposure to them?

The Agrico site is in a low-lying area toward which stormwater runoff generally flows. The CSX railroad lines act as an additional barrier to the westward flow of any runoff that may come from the site. Surface soil sampling on the west side of the site, although limited, does not indicate that any site-related contaminants have migrated off of the site. Therefore, it is unlikely that contamination from the site has reached any of the residences west of the site.

CONCLUSIONS

Based on the information currently available, we classify this site as a public health hazard. Specific reasons for this classification are as follows:

1. Arsenic, fluoride and lead are present on the site at levels that could result in chronic health effects such as skin irritation, mottling of teeth, decreased intelligence scores, and hearing impairment. On-site workers and trespassers have been exposed to these contaminants.

2. The number and location of warning signs is inadequate to warn the public and to meet the requirements of sections 403.704 and 403.7255, Florida Statutes, and FDEP Rule 17-736.

3. Future remediation could create contaminated dust and expose remediation workers and nearby residents.

4. Groundwater contamination from the site has reached Bayou Texar, an environmentally sensitive estuary. Although the level of contamination is not currently of health concern, these levels could increase in the future.

5. The number of on-site surface water samples is insufficient to characterize the extent and nature of contamination of this medium.

6. Off-site exposure to site-related contaminants is possible. However, of the contaminants of concern, only PAHs, fluoride and lead have been analyzed for in off-site surface soil; thus, there is insufficient information to characterize the extent and nature of contamination in this medium.

7. Fluoride is present in the soil on the abandoned on-site baseball field at a level that, if ingested, could result in mottling of teeth, especially in young children. Children and adults using the ballfield have been exposed to this contaminant.

RECOMMENDATIONS

Cease/Reduce Exposure Recommendations

1. Maintain site security to reduce the risk of exposure to the community. Provide future remediation workers with appropriate protective equipment while on site.

2. Install additional warning signs as specified in FDEP Rule 17-736 to indicate the area is a hazardous waste site.

3. Conduct air monitoring during remediation for worker protection and to ensure that air-borne contamination generated by remediation operations and machinery is not transported off the site.

4. Conduct periodic surface water sampling of Bayou Texar to ensure that any increases in contaminants entering the bayou are discovered in a timely manner.

Site Characterization Recommendations

1. Analyze a minimum of six samples from the on-site wastewater pond for all contaminants of concern to characterize the current condition of on-site surface water.

2. Analyze a minimum of twelve off-site surface soil (depth 0-3 inches) samples for all contaminants of concern. Areas to sample should include the southernmost off-site baseball field, the field bounded by the mini-warehouse units, the fence on the south side of the site, Interstate 110, and Fairfield Drive, and the areas immediately off of the site to the east and west of the site.

Public Education Recommendations

1. Community members whose children used the now-abandoned on-site baseball field should be informed of the possible health effects from this exposure. Health education information should be provided to community members to assist them in understanding the possible health risks.

Health Activities Recommendation Panel (HARP) Recommendations

The Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), as amended, requires ATSDR to perform follow-up health actions needed at hazardous waste sites. To determine if follow-up health actions are needed, ATSDR's Health Activities Recommendation Panel (HARP) has evaluated the data and information developed in the Agrico Chemical Co. Public Health Assessment.

The Panel has determined that no follow-up health actions are indicated at this time.

If additional information becomes available indicating exposure at levels of concern, ATSDR will evaluate that information to determine what actions, if any, are necessary.

PUBLIC HEALTH ACTIONS

This section describes what ATSDR and/or Florida HRS will do at the Agrico Chemical Co. site after the completion of this public health assessment report. The purpose of a Public Health Action Plan is to ensure that any existing health hazards are reduced and any future health hazards are prevented. ATSDR and/or Florida HRS will do the following:

1. Florida HRS will develop educational materials to inform community members whose children used the now-abandoned on-site baseball field of the possible health effects from their exposure.

2. The Escambia County Parks Department and administration officials of the East Brent Baptist Church in Pensacola will assist Florida HRS in the distribution of these materials.

3. The Escambia County Public Health Unit will provide consultation to those individuals who require additional information or assistance.

4. ATSDR will assist Florida HRS in the development of these educational materials to ensure that the information is accurate and reflects the most recent scientific findings and agency guidelines.

ATSDR and/or Florida HRS will reevaluate the Public Health Action Plan when new environmental, toxicological, or health outcome data are available.

PREPARERS OF REPORT

Bruce J. Tuovila
Environmental Specialist
Office of Toxicology and Hazard Assessment
Florida Department of Health and Rehabilitative Services

E. Randall Merchant
Biological Administrator
Office of Toxicology and Hazard Assessment
Florida Department of Health and Rehabilitative Services

H. Joseph Sekerke, Jr., PhD.
Biological Scientist
Office of Toxicology and Hazard Assessment
Florida Department of Health and Rehabilitative Services

ATSDR Technical Project Officer:

Richard Kauffman
Remedial Programs Branch
Division of Health Assessment and Consultation

ATSDR Regional Representative:

Bob Safay
Regional Services
Office of the Assistant Administrator

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APPENDICES

A. Figures

Figure 1. State Map Showing Location of Escambia County

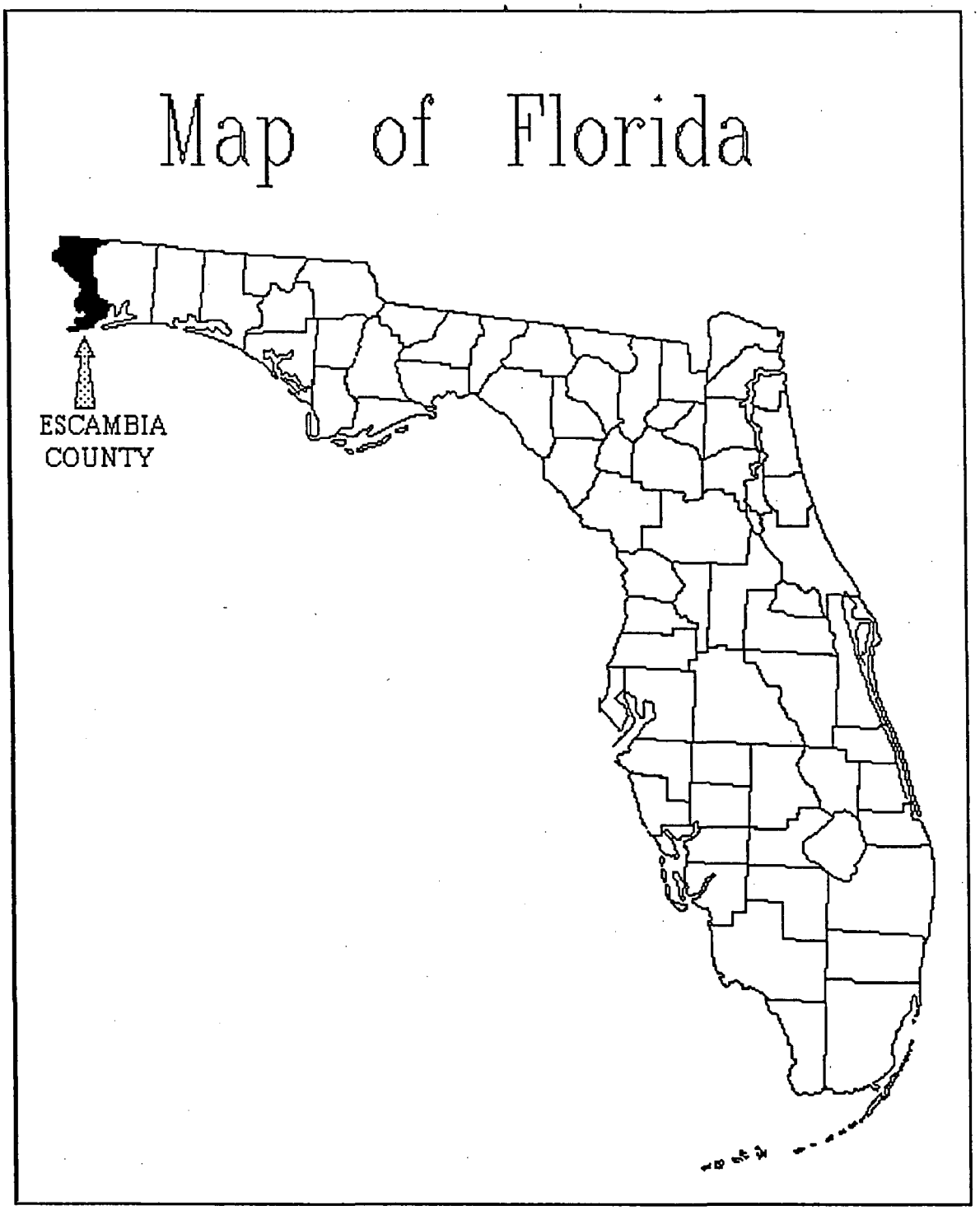


Figure 2. Location of Pensacola in Escambia County

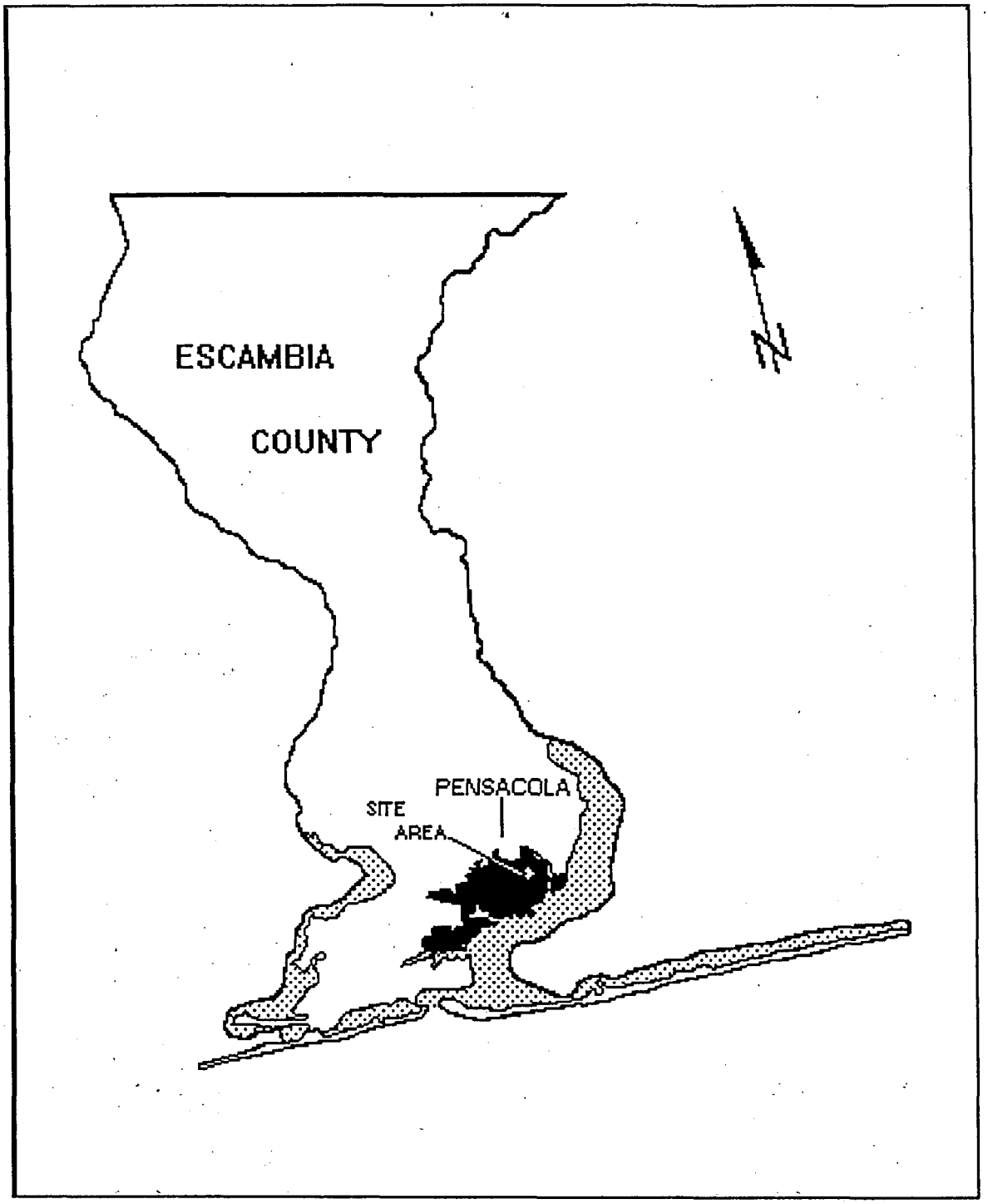


Figure 3. Location of Agrico Chemical Co. in Pensacola

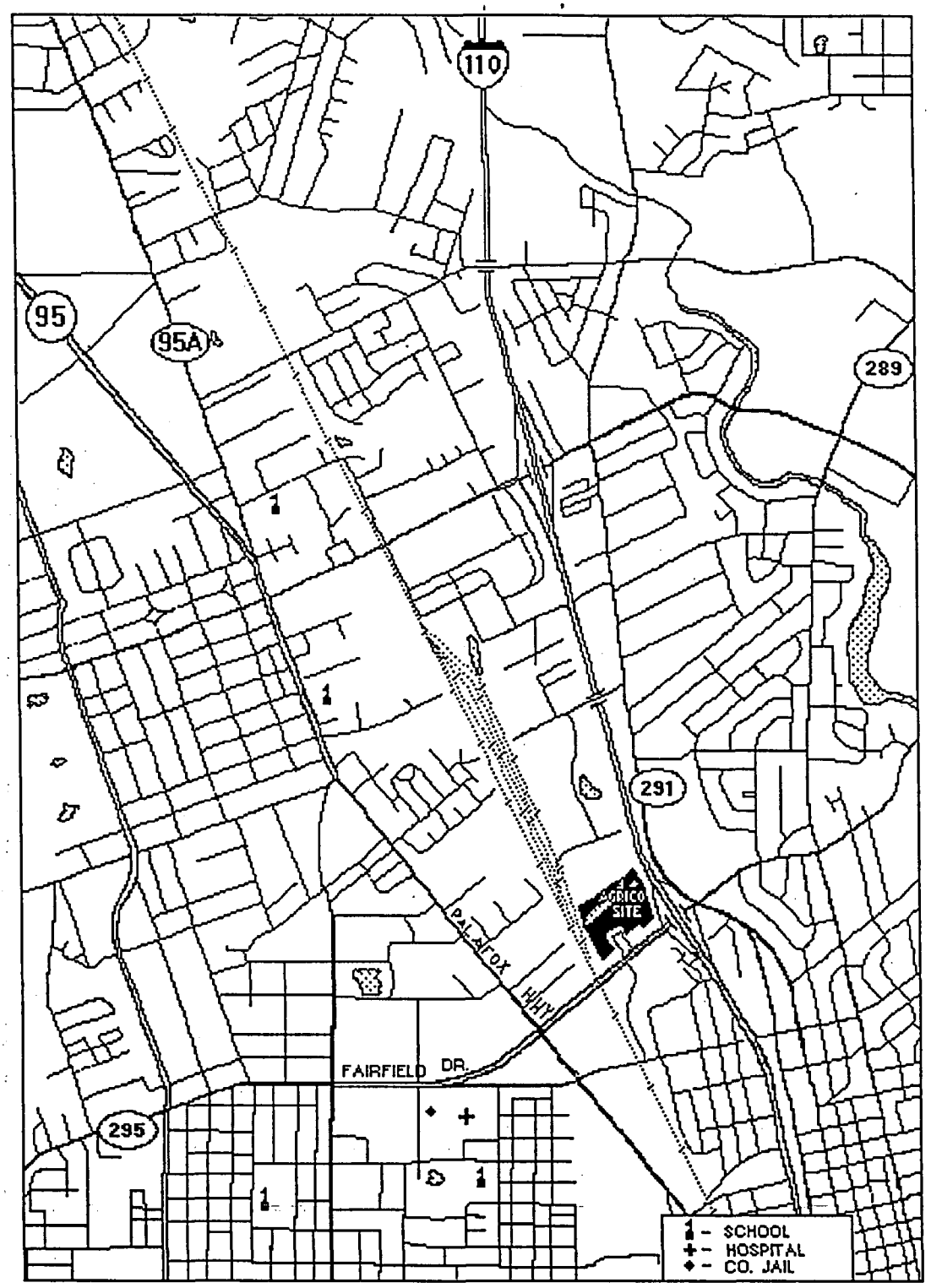


Figure 4. Detail of Agrico Chemical Co. Site

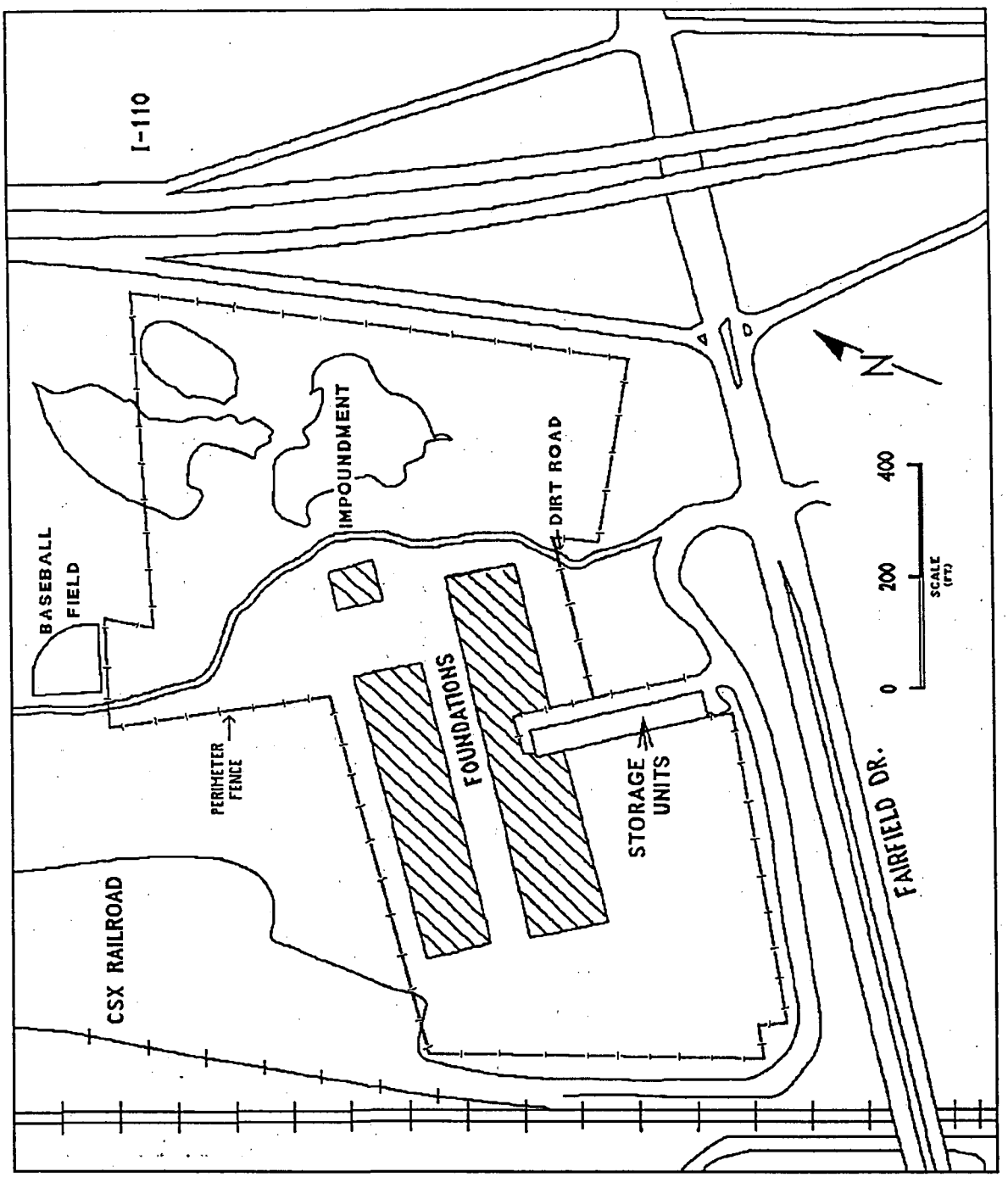


Figure 5. On-site Surface Soil Sample Location

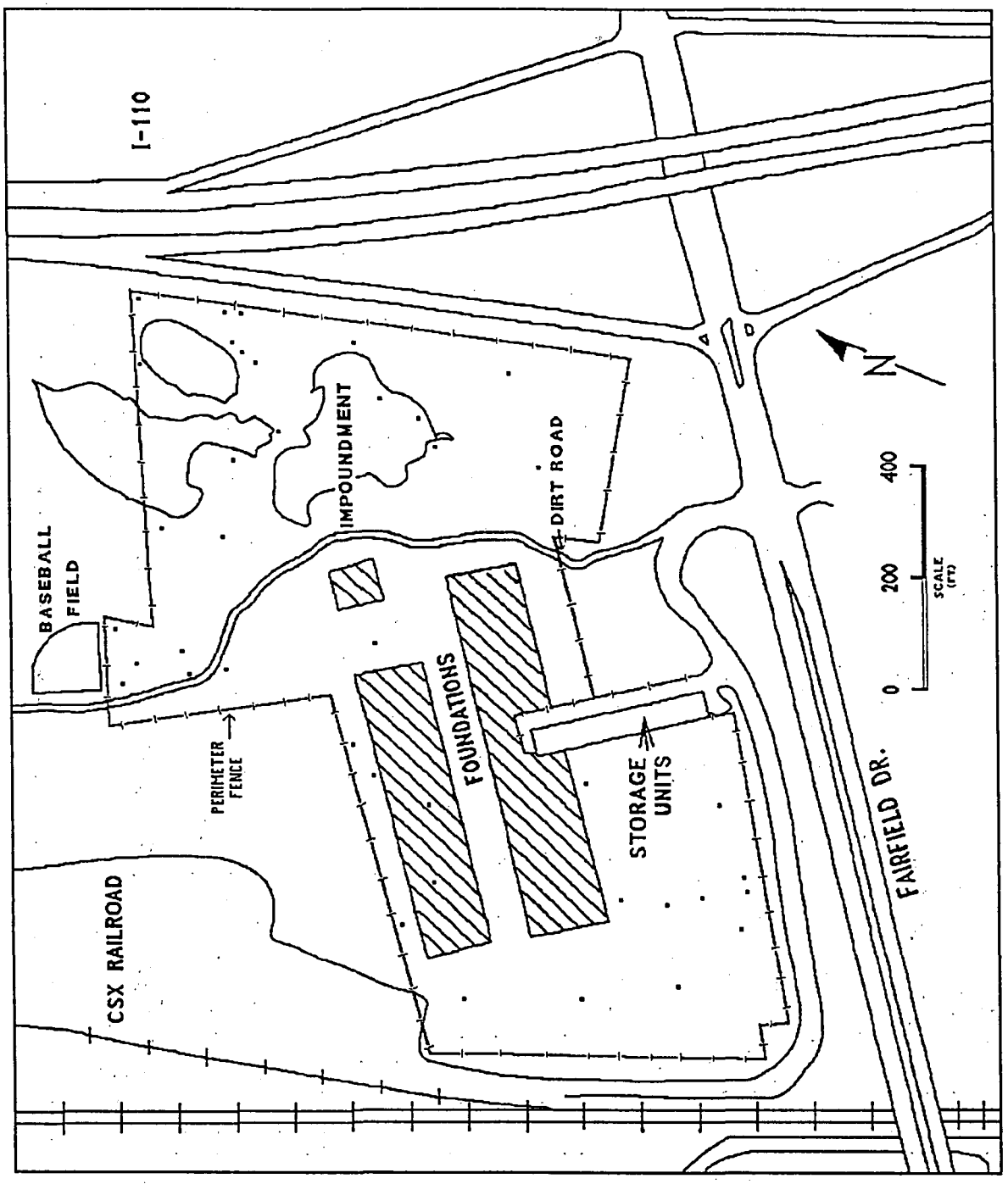


Figure 6. On-site Subsurface Soil Sample Locations

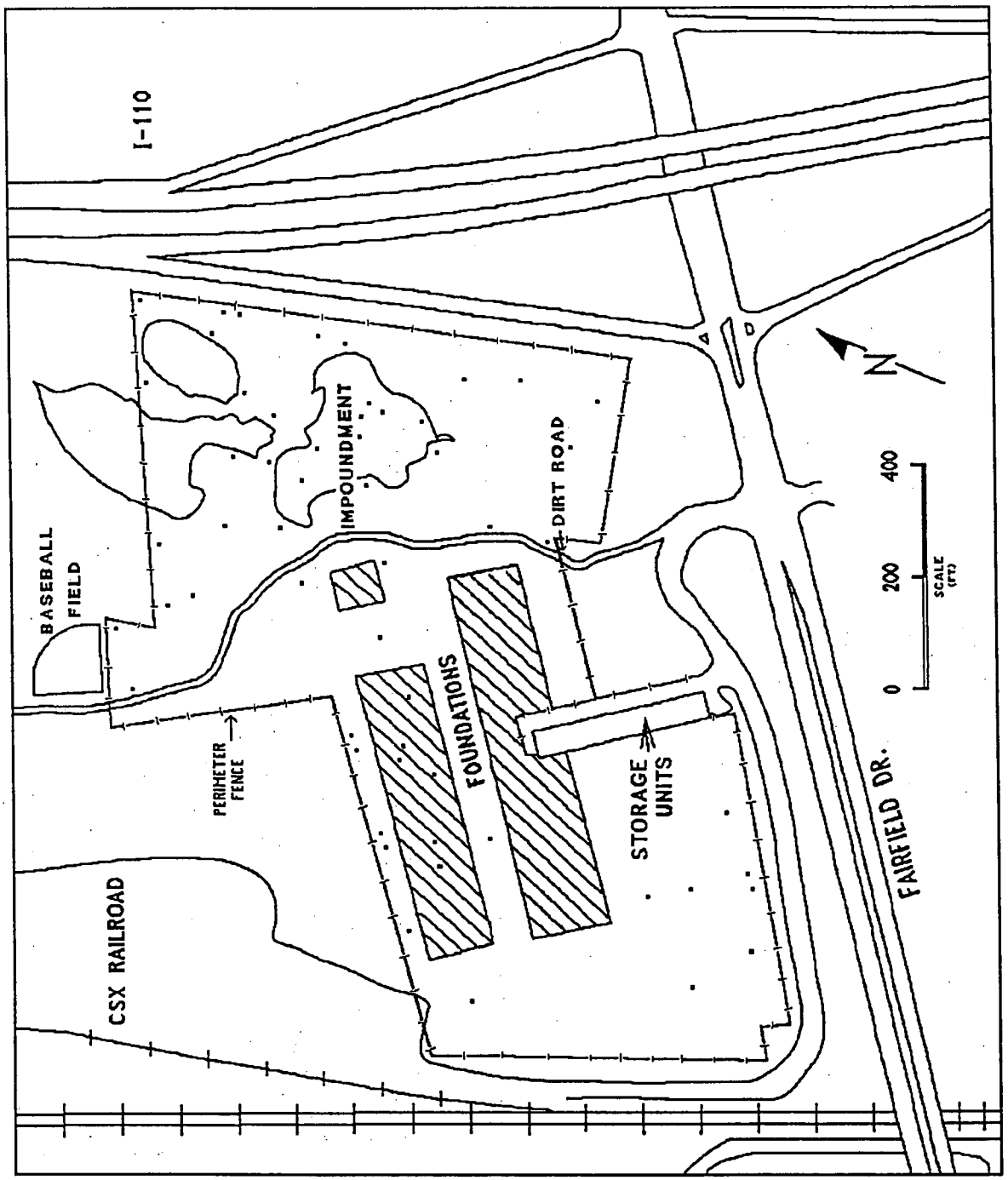


Figure 7. On-site Surface Water Sample Locations

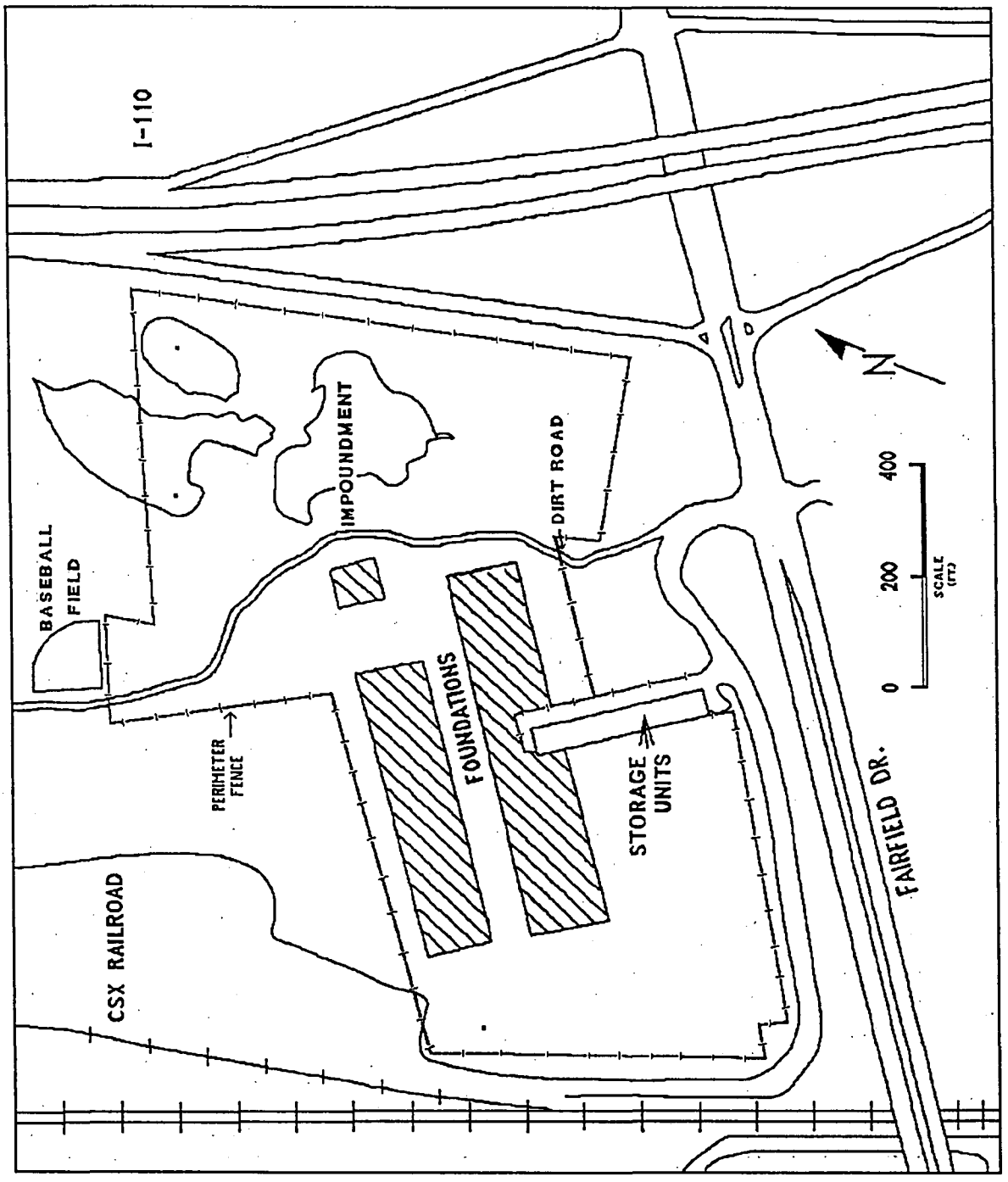


Figure 8. On-site Shallow Groundwater Sample Locations

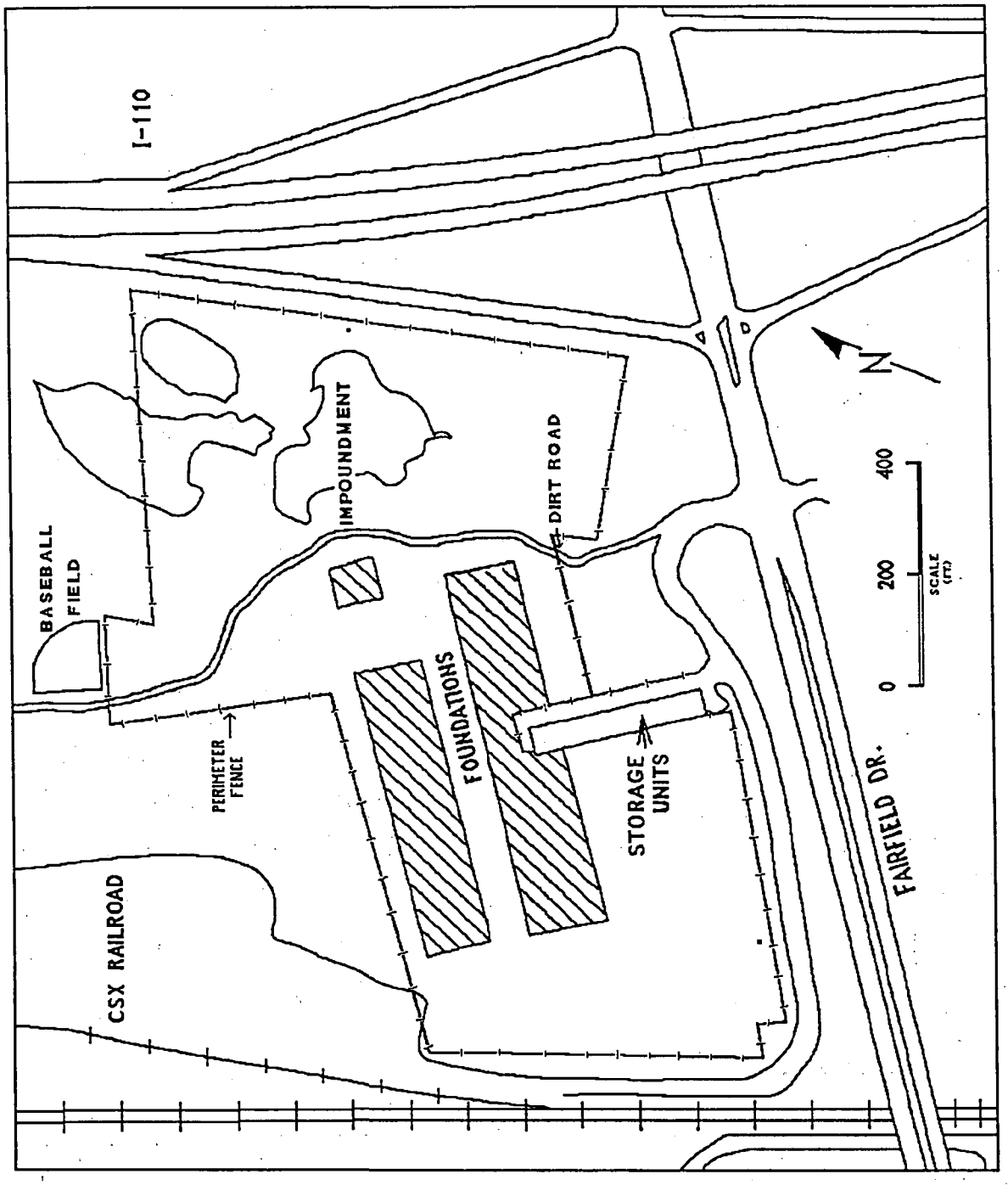


Figure 9. On-site Deep Groundwater Sample Locations

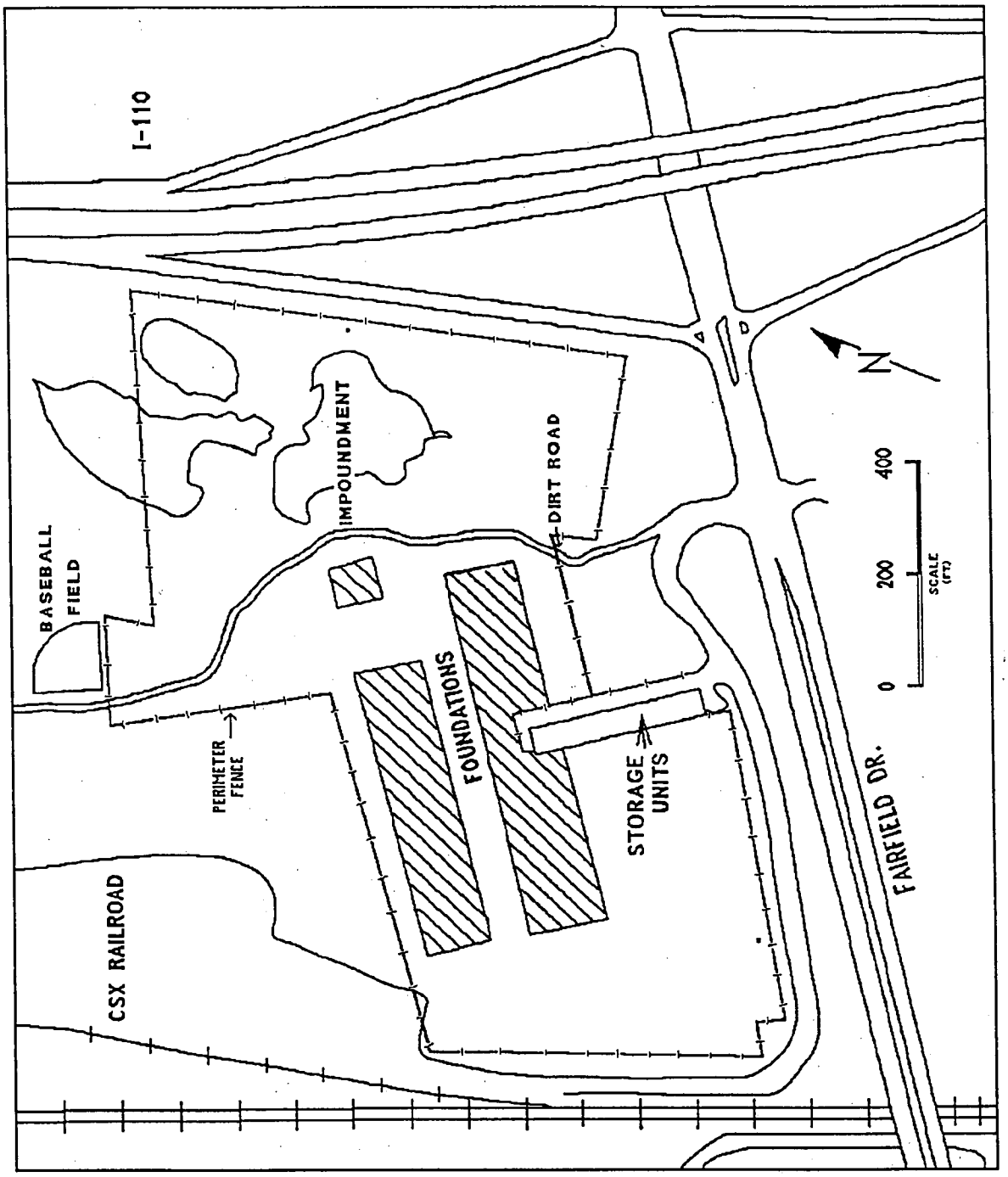


Figure 10. On-site Waste Sludge Sample Locations

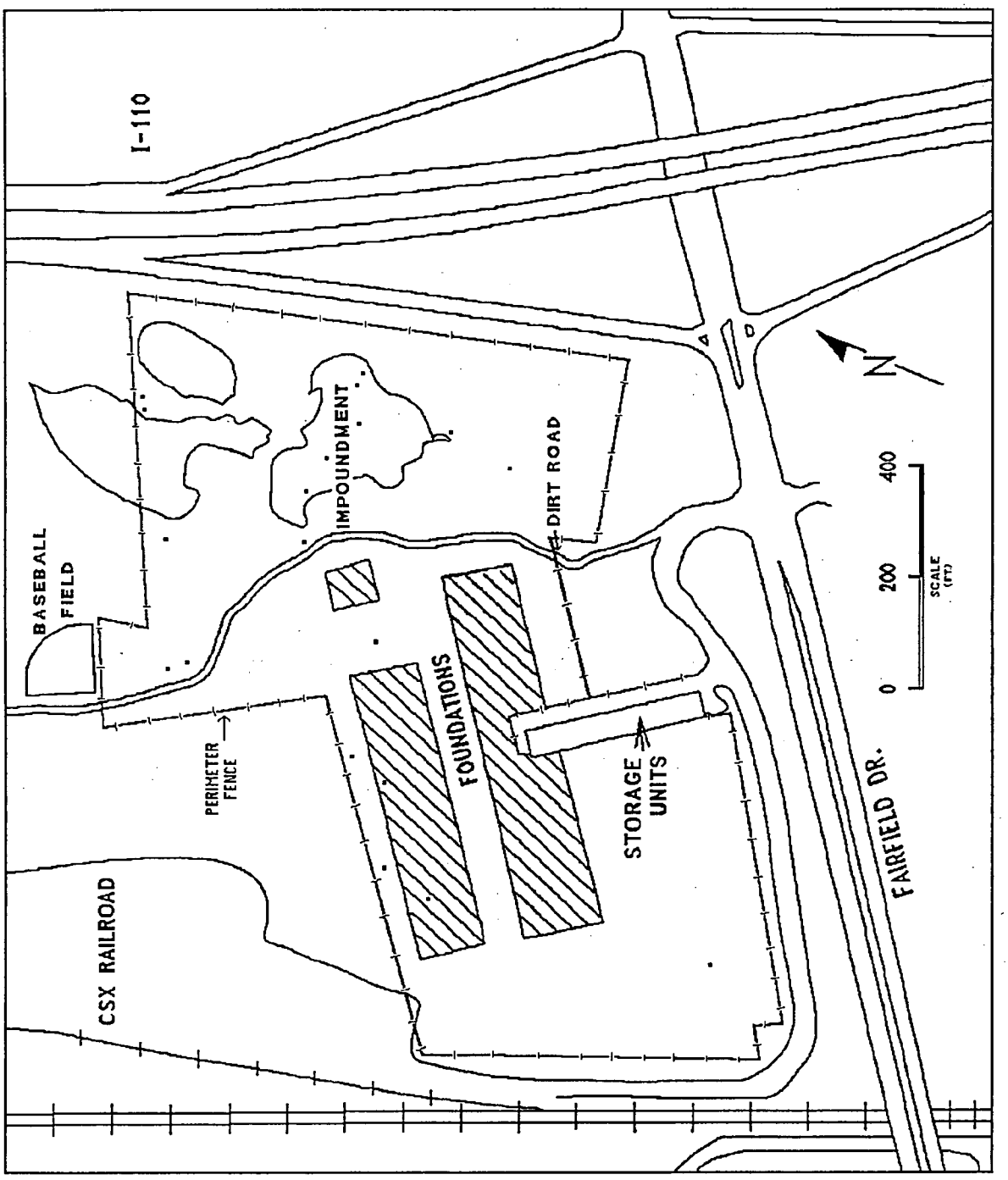


Figure 11. Off-site Surface Soil Sample Locations

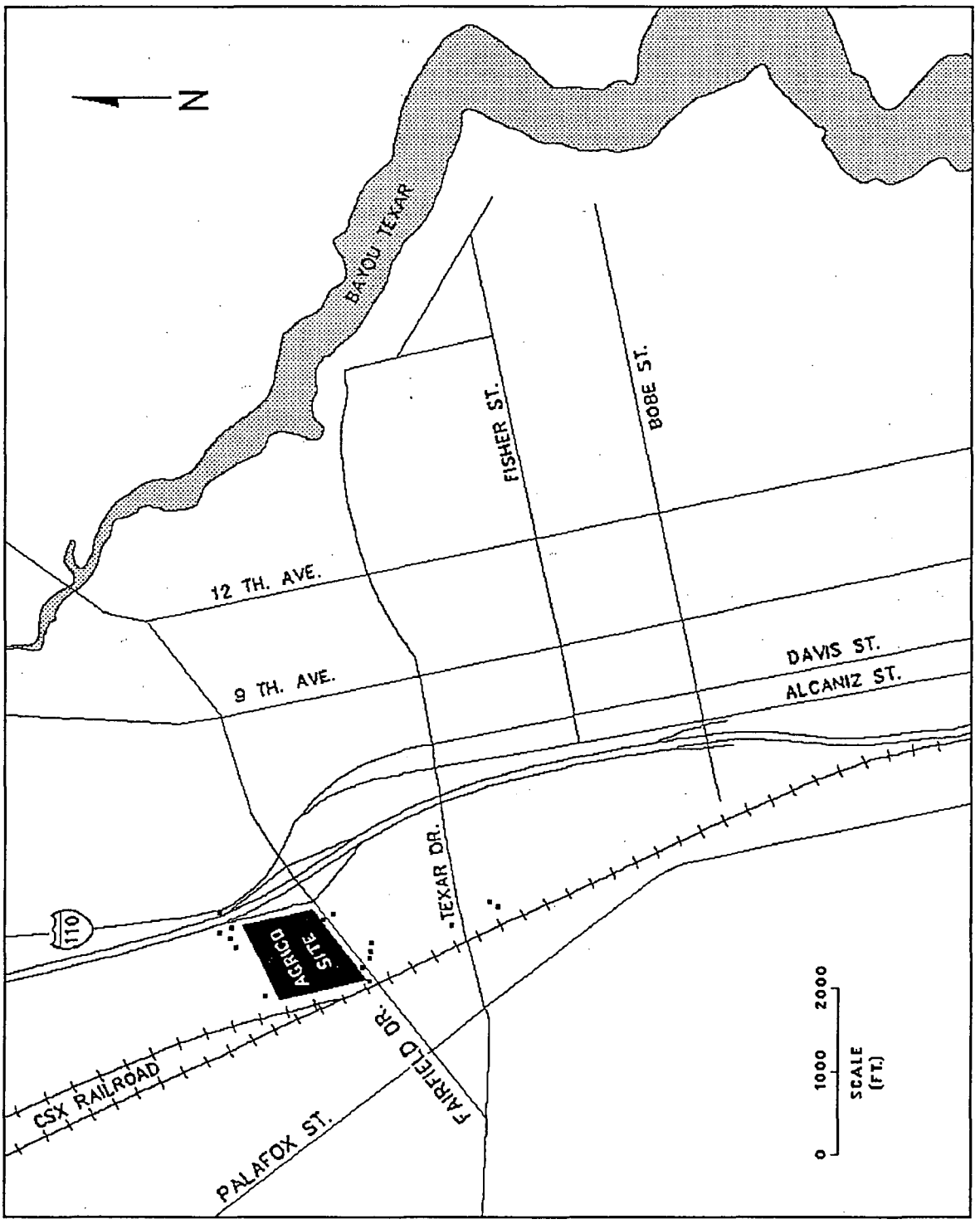


Figure 12. Off-site Subsurface Soil Sample Locations

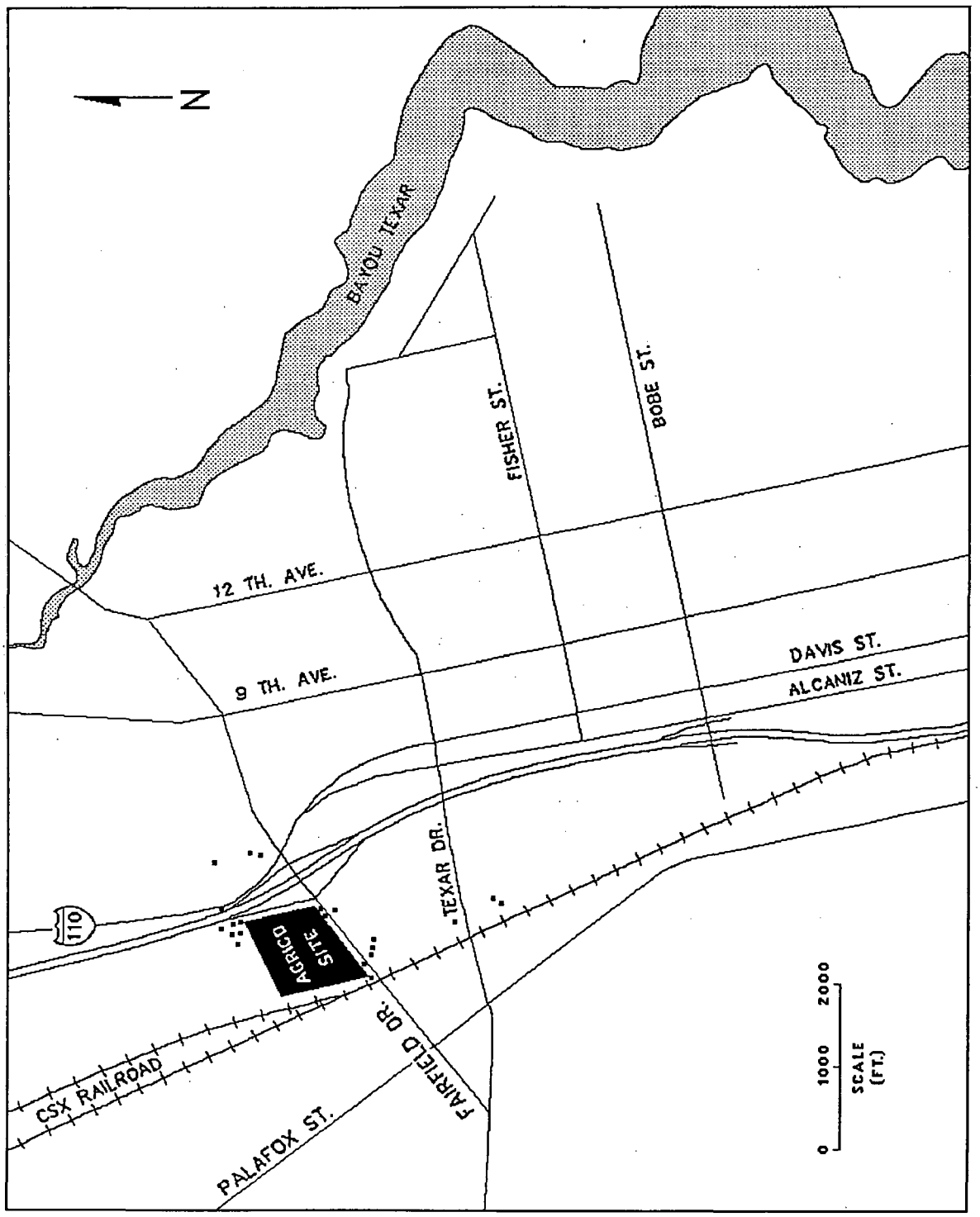


Figure 13. Off-site Shallow Groundwater Sample Locations

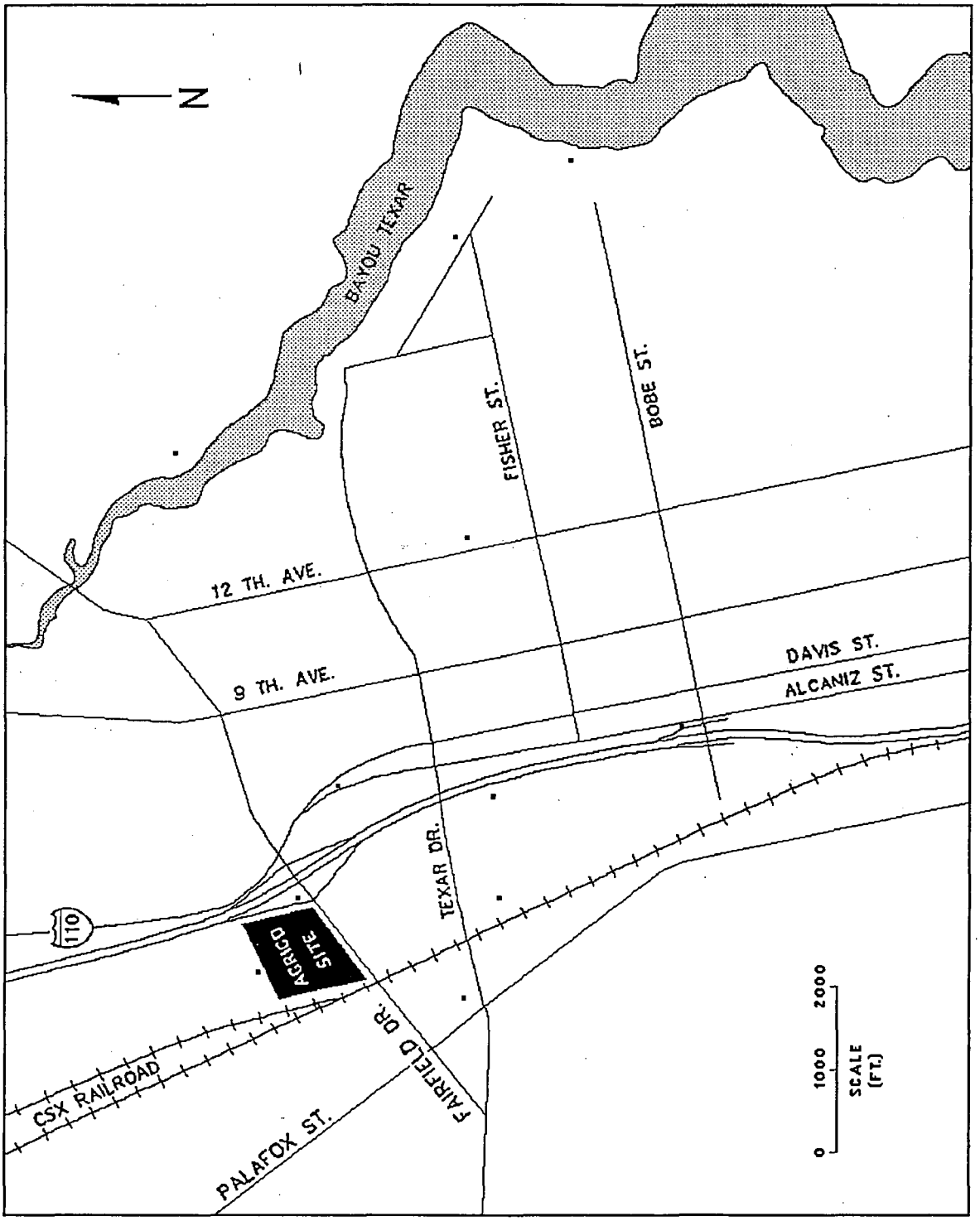
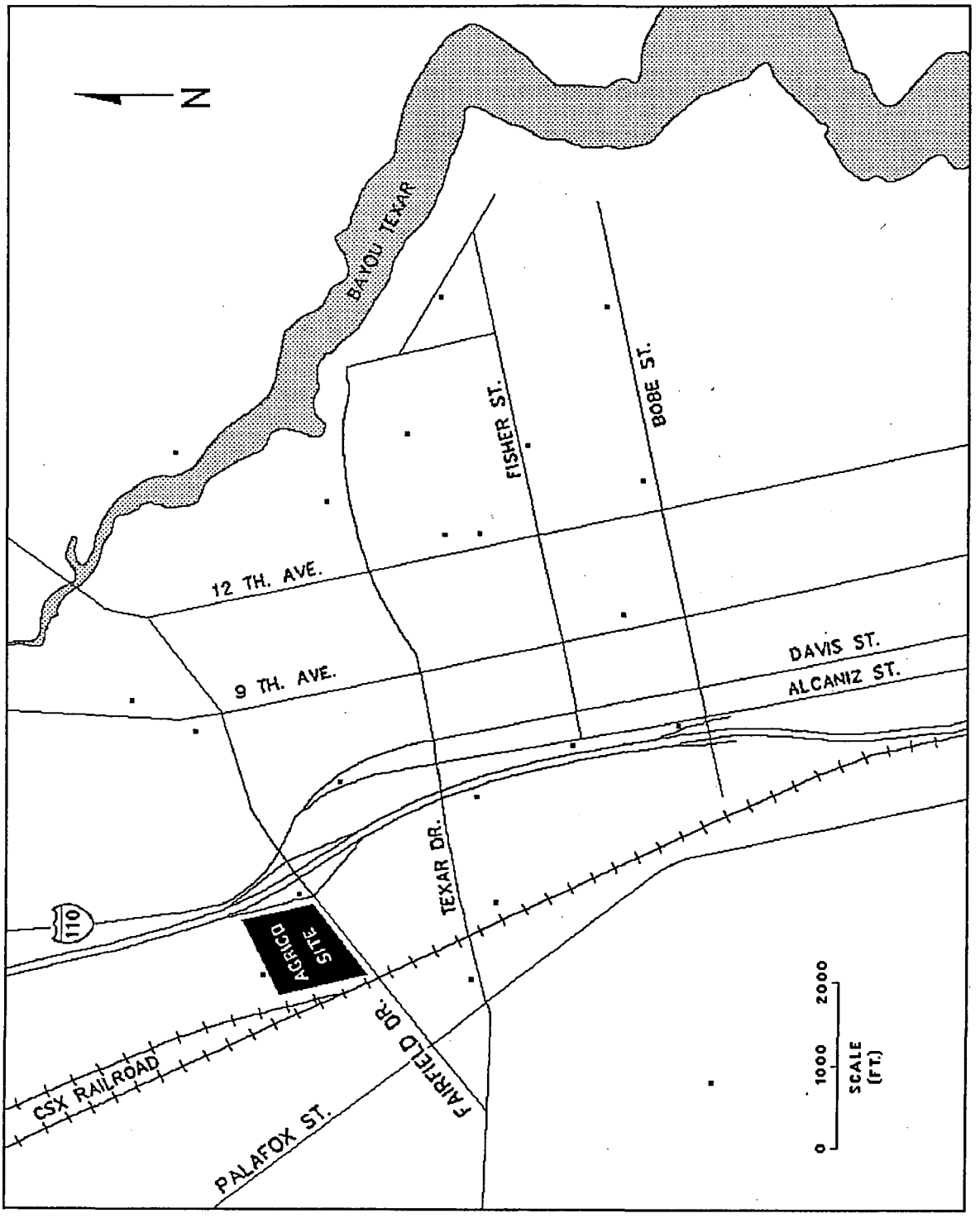


Figure 14. Off-site Deep Groundwater Sample Locations



B. Tables

B. Tables

Table 1. Maximum Concentrations in On-Site Surface Soil

Contaminants of Concern	Maximum Concentration (mg/kg)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (mg/kg)	Comparison Value	
				(mg/kg)	Source
Arsenic	35	13/14	NA	0.4	CREG
Benzo(a)-pyrene	0.98	1/7	NA	0.1	CREG
Benzo(b)-fluoranthene	2.7	-/7	NA	NONE	CARCIN
Benzo(k)-fluoranthene	ND	0/7	NA	NONE	CARCIN
Benz(a)-anthracene	1.4	-/7	NA	NONE	CARCIN
Chromium(VI)	27	5/13	NA	10.0	RMEG
Chrysene	1.7	-/7	NA	NONE	CARCIN
Dibenz(a,h)-anthracene	0.3	-/7	NA	NONE	CARCIN
Fluoride	110,000	34/57	39	100	EMEG
Indeno(1,2,3-c,d) pyrene	1.1	-/7	NA	NONE	CARCIN
Lead	46,000	-/18	NA	NONE	CARCIN
Manganese	7	0/1	NA	10.0	RMEG
Sulfate	1,000	-/13	NA	NONE	NONE
Vanadium	1.3	0/1	NA	6.0	EMEG

NA - not analyzed
ND - not detected
CARCIN - Carcinogen
mg/kg - milligrams per kilogram
Sources: EPA 1983, Geraghty & Miller 1992a, 1992b

Table 2. Maximum Concentration in On-Site Subsurface Soil

Contaminants of Concern	Maximum Concentration (mg/kg)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (mg/kg)	Comparison Value	
				(mg/kg)	Source
Arsenic	56	50/60	1.5	0.4	CREG
Benzo(a)-pyrene	12	1/27	NA	0.1	CREG
Benzo(b)-fluoranthene	12	-/27	NA	NONE	CARCIN
Benzo(k)-fluoranthene	12	-/27	NA	NONE	CARCIN
Benz(a)-anthracene	0.32	-/27	NA	NONE	CARCIN
Chromium(VI)	57	26/60	4.3	10.0	RMEG
Chrysene	16	-/27	NA	NONE	CARCIN
Dibenz(a,h)-anthracene	ND	0/27	NA	NONE	CARCIN
Fluoride	60,000	108/157	NA	100	EMEG
Indeno(1,2,3-c,d) pyrene	10	-/27	NA	NONE	CARCIN
Lead	3,800	-/80	5.5	NONE	CARCIN
Manganese	22	2/4	NA	10.0	RMEG
Sulfate	9,100	-/56	ND	NONE	NONE
Vanadium	27	3/4	NA	6.0	EMEG

NA - not analyzed
ND - not detected
CARCIN - Carcinogen
mg/kg - milligrams per kilogram
Sources: Geraghty & Miller 1992a, 1992b

Table 3. Maximum Concentration in On-Site Surface Water

Contaminants of Concern	Maximum Concentration (µg/L)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (µg/L)	Comparison Value	
				(µg/L)	Source
Arsenic	ND	0/3	NA	0.02	CREG
Benzo(a)-pyrene	NA	NA	NA	0.005	CREG
Benzo(b)-fluoranthene	NA	NA	NA	NONE	CARCIN
Benzo(k)-fluoranthene	NA	NA	NA	NONE	CARCIN
Benz(a)-anthracene	NA	NA	NA	NONE	CARCIN
Chromium(VI)	NA	NA	NA	50.0	RMEG
Chrysene	NA	NA	NA	NONE	CARCIN
Dibenz(a,h)-anthracene	NA	NA	NA	NONE	CARCIN
Fluoride	2680000	4/5	NA	500	EMEG
Indeno(1,2,3-c,d) pyrene	NA	NA	NA	NONE	CARCIN
Lead	ND	0/3	NA	15.0	FLMCL
Manganese	1,000	2/3	NA	50.0	RMEG
Sulfate	2600000	1/5	NA	250000	FLSDW
Vanadium	29	1/3	NA	20.0	LTHA

NA - not analyzed
ND - not detected
FLMCL - Florida MCL
FLSDW - Florida Secondary Drinking Water Standard
µg/L - micrograms per liter
Source: EPA 1983

Table 4. Maximum Concentration in On-Site Shallow Groundwater

Contaminants of Concern	Maximum Concentration (µg/L)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (µg/L)	Comparison Value	
				(µg/L)	Source
Arsenic	300	3/5	NA	0.02	CREG
Benzo(a)-pyrene	ND	0/4	NA	0.005	CREG
Benzo(b)-fluoranthene	ND	0/4	NA	NONE	CARCIN
Benzo(k)-fluoranthene	ND	0/4	NA	NONE	CARCIN
Benz(a)-anthracene	ND	0/4	NA	NONE	CARCIN
Chromium(VI)	ND	0/4	NA	50.0	RMEG
Chrysene	ND	0/4	NA	NONE	CARCIN
Dibenz(a,h)-anthracene	ND	0/4	NA	NONE	CARCIN
Fluoride	27,000	2/7	NA	500	EMEG
Indeno(1,2,3-c,d) pyrene	ND	0/4	NA	NONE	CARCIN
Lead	6.6	0/7	NA	15.0	FLMCL
Manganese	330	2/3	NA	50.0	RMEG
Sulfate	94,000	0/7	NA	250000	FLSDW
Vanadium	ND	0/3	NA	20.0	LTHA

NA - not analyzed
ND - not detected
FLMCL - Florida MCL
FLSDW - Florida Secondary Drinking Water Standard
µg/L - micrograms per liter
Sources: Watts et al 1988, Geraghty & Miller 1992a, 1992b

Table 5. Maximum Concentration in On-Site Deep Groundwater

Contaminants of Concern	Maximum Concentration (µg/L)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (µg/L)	Comparison Value	
				(µg/L)	Source
Arsenic	10	1/4	NA	0.02	CREG
Benzo(a)-pyrene	ND	0/2	NA	0.005	CREG
Benzo(b)-fluoranthene	ND	0/2	NA	NONE	CARCIN
Benzo(k)-fluoranthene	ND	0/2	NA	NONE	CARCIN
Benz(a)-anthracene	ND	0/2	NA	NONE	CARCIN
Chromium(VI)	ND	0/5	NA	50.0	RMEG
Chrysene	ND	0/2	NA	NONE	CARCIN
Dibenz(a,h)-anthracene	ND	0/2	NA	NONE	CARCIN
Fluoride	220	0/8	NA	500	EMEG
Indeno(1,2,3-c,d) pyrene	ND	0/2	NA	NONE	CARCIN
Lead	6.7	0/6	NA	15.0	FLMCL
Manganese	NA	NA	NA	50.0	RMEG
Sulfate	34,000	0/8	NA	250000	FLSDW
Vanadium	NA	NA	NA	20.0	LTHA

NA - not analyzed ND - not detected
FLMCL - Florida MCL
FLSDW - Florida Secondary Drinking Water Standard
µg/L - micrograms per liter
Sources: Watts et al 1988, Watts and Wiegand 1989, Geraghty & Miller 1992a, 1992b

Table 6. Maximum Concentration in On-Site Waste Sludge

Contaminants of Concern	Maximum Concentration (mg/kg)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (mg/kg)	Comparison Value	
				(mg/kg)	Source
Arsenic	58	1/2	NA	0.4	CREG
Benzo(a)-pyrene	1.4	2/10	NA	0.1	CREG
Benzo(b)-fluoranthene	1.0	-/9	NA	NONE	CARCIN
Benzo(k)-fluoranthene	2.4	-/10	NA	NONE	CARCIN
Benz(a)-anthracene	1.3	-/10	NA	NONE	CARCIN
Chromium(VI)	42	2/2	NA	10.0	RMEG
Chrysene	1.7	-/10	NA	NONE	CARCIN
Dibenz(a,h)-anthracene	ND	0/10	NA	NONE	CARCIN
Fluoride	530,000	39/41	NA	100	EMEG
Indeno(1,2,3-c,d) pyrene	1.0	-/10	NA	NONE	CARCIN
Lead	6,900	-/6	NA	NONE	CARCIN
Manganese	46	3/3	NA	10.0	RMEG
Sulfate	9,100	-/12	NA	NONE	NONE
Vanadium	55	3/3	NA	6.0	EMEG

NA - not analyzed
ND - not detected
CARCIN - Carcinogen
mg/kg - milligrams per kilogram
Sources: EPA 1983, Geraghty & Miller 1992a, 1992b

Table 7. Maximum Concentrations in Off-Site Surface Soil

Contaminants of Concern	Maximum Concentration (mg/kg)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (mg/kg)	Comparison Value	
				(mg/kg)	Source
Arsenic	NA	NA	NA	0.4	CREG
Benzo(a)-pyrene	0.58	3/7	ND	0.1	CREG
Benzo(b)-fluoranthene	0.88	-/7	ND	NONE	CARCIN
Benzo(k)-fluoranthene	0.66	-/7	ND	NONE	CARCIN
Benz(a)-anthracene	0.62	-/7	ND	NONE	CARCIN
Chromium(VI)	NA	NA	NA	10.0	RMEG
Chrysene	0.81	-/7	ND	NONE	CARCIN
Dibenz(a,h)-anthracene	ND	0/7	ND	NONE	CARCIN
Fluoride	3,900	4/16	ND	100	EMEG
Indeno(1,2,3-c,d) pyrene	0.48	-/7	ND	NONE	CARCIN
Lead	110	-/3	ND	NONE	CARCIN
Manganese	NA	NA	NA	10.0	RMEG
Sulfate	NA	NA	NA	NONE	NONE
Vanadium	NA	NA	NA	6.0	EMEG

NA - not analyzed
ND - not detected
CARCIN - Carcinogen
mg/kg - milligrams per kilogram
Source: Geraghty & Miller 1992b

Table 8. Maximum Concentrations in Off-Site Subsurface Soil

Contaminants of Concern	Maximum Concentration (mg/kg)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (mg/kg)	Comparison Value	
				(mg/kg)	Source
Arsenic	NA	NA	NA	0.4	CREG
Benzo(a)-pyrene	0.66	2/10	ND	0.1	CREG
Benzo(b)-fluoranthene	2.9	-/10	ND	NONE	CARCIN
Benzo(k)-fluoranthene	2.2	-/10	ND	NONE	CARCIN
Benz(a)-anthracene	2.9	-/10	ND	NONE	CARCIN
Chromium(VI)	NA	NA	NA	10.0	RMEG
Chrysene	3.7	-/10	ND	NONE	CARCIN
Dibenz(a,h)-anthracene	0.69	-/10	ND	NONE	CARCIN
Fluoride	3,300	12/24	ND	100	EMEG
Indeno(1,2,3-c,d) pyrene	2.2	-/10	ND	NONE	CARCIN
Lead	37	-/3	ND	NONE	CARCIN
Manganese	NA	NA	NA	10.0	RMEG
Sulfate	NA	NA	NA	NONE	NONE
Vanadium	NA	NA	NA	6.0	EMEG

NA - not analyzed
ND - not detected
CARCIN - Carcinogen
mg/kg - milligrams per kilogram
Source: Geraghty & Miller 1992b

Table 9. Maximum Concentration in Off-Site Shallow Groundwater

Contaminants of Concern	Maximum Concentration (µg/L)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (µg/L)	Comparison Value	
				(µg/L)	Source
Arsenic	740	2/10	ND	0.02	CREG
Benzo(a)-pyrene	ND	0/11	ND	0.005	CREG
Benzo(b)-fluoranthene	ND	0/11	ND	NONE	CARCIN
Benzo(k)-fluoranthene	ND	0/11	ND	NONE	CARCIN
Benz(a)-anthracene	ND	0/11	ND	NONE	CARCIN
Chromium(VI)	84	1/24	ND	50.0	RMEG
Chrysene	ND	0/11	ND	NONE	CARCIN
Dibenz(a,h)-anthracene	ND	0/11	ND	NONE	CARCIN
Fluoride	94,000	9/24	180	500	EMEG
Indeno(1,2,3-c,d) pyrene	ND	0/11	ND	NONE	CARCIN
Lead	11	0/26	8.6	15.0	FLMCL
Manganese	NA	NA	170	50.0	RMEG
Sulfate	290,000	2/26	68,000	250000	FLSDW
Vanadium	NA	NA	ND	20.0	LTHA

NA - not analyzed
ND - not detected
FLMCL - Florida MCL
FLSDW - Florida Secondary Drinking Water Standard
µg/L - micrograms per liter
Sources: Watts et al 1988, Geraghty & Miller 1992a, 1992b

Table 10. Maximum Concentration in Off-Site Deep Groundwater

Contaminants of Concern	Maximum Concentration (µg/L)	Total # Exceeding Comparison Value/ Total # Samples	Background Concentration (µg/L)	Comparison Value	
				(µg/L)	Source
Arsenic	41.2	3/23	ND	0.02	CREG
Benzo(a)-pyrene	ND	0/17	ND	0.005	CREG
Benzo(b)-fluoranthene	ND	0/17	ND	NONE	CARCIN
Benzo(k)-fluoranthene	ND	0/17	ND	NONE	CARCIN
Benz(a)-anthracene	ND	0/17	ND	NONE	CARCIN
Chromium(VI)	120	2/42	ND	50.0	RMEG
Chrysene	11	-/17	ND	NONE	CARCIN
Dibenz(a,h)-anthracene	ND	0/17	ND	NONE	CARCIN
Fluoride	127,000	32/73	80	500	EMEG
Indeno(1,2,3-c,d) pyrene	ND	0/17	ND	NONE	CARCIN
Lead	27.2	2/47	ND	15.0	FLMCL
Manganese	NA	NA	NA	50.0	RMEG
Sulfate	784,000	8/73	10,000	250000	FLSDW
Vanadium	NA	NA	NA	20.0	LTHA

NA - not analyzed ND - not detected
FLMCL - Florida MCL
FLSDW - Florida Secondary Drinking Water Standard
µg/L - micrograms per liter
Sources: Watts et al 1988, Watts and Wiegand 1989, Geraghty & Miller 1992a, 1992b

Table 11. Completed Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
On-site Surface Soil	Agrico Site	Surface Soil	On-site	Ingestion/Dermal Contact	Workers/ Trespassers/ Individuals using ballfield	Past Future
Off-site Surface Soil	Off Site	Surface Soil	Off-site	Ingestion/Dermal Contact	Residents	Past Present Future
On-site Waste Sludge	Agrico Site	Waste Sludge	On-site	Ingestion/Dermal Contact	Workers/ Trespassers/ Individuals using ballfield	Past Future
On-site Surface Water	Agrico Site	Surface Water	On-Site	Dermal Contact	Workers/ Trespassers	Past Future

Table 12. Potential Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Sub-surface Soil	Agrico Site	Subsurface Soil	On-site	Ingestion/ Dermal Contact	Remediation Workers	Future
Surface Water	Bayou Texar	Surface Water	Off-site	Ingestion/ Dermal Contact/ Fish, Shellfish Consumption	RemediationWorkers	Future

C. Additional Site Contaminants

The following chemicals were detected at this site at levels below human health concern.

1,1-Dichloroethene
1,1,2-Trichloroethane
1,1,2,2-Tetrachlorothane
2,4-Dimethylphenol
2,4-Dinitrotoluene
2,4,6-Trichlorophenol
Aldrin
Benzene
Boron
Bromoform
Carbon Tetrachloride
Chloroform
Chloromethane
Di(2-ethylhexyl)phthalate
Dieldrin
Mercury
Molybdenum
Naphthalene
Nitrate
Pentachlorophenol
p,p'-Dichlorodiphenyldichloroethane (DDD)
p,p'-Dichlorodiphenyldichloroethene (DDE)
p,p'-Dichlorodiphenyltrichloroethane (DDT)
Tetrachloroethene
Trichloroethene
Xylene

The following chemicals were detected at this site. There is insufficient toxicological information available upon which to base an assessment of their public health significance.

1,1-Dichloroethane
2-Chloroethylvinyl Ether
2H-1-Benzopyran-2-one
4-Methylphenol
9H-Carbazole
Acenaphthalene
Acenaphthylene
Aluminum
β-BHC
Benz(a)anthracene
Benzo(b)fluoranthene
Benzo(b)thiophene
Benzo(ghi)perylene
Benzo(k)fluoranthene
Benzyl Alcohol
Chloroethane
Chrysene
Copper
Dibenzofuran
Dibenz(ah)anthracene
Endrin Aldehyde
Ethynyl Methyl Benzene
Indeno(1,2,3-c,d)pyrene
Methyl Naphthalene
Methyl Benzofuran
Methyl Quinoline
Naphthalene Carbonitrile
Phenanthrene
Propenyl Benzene
Propynyl Benzene
Titanium
Trimethylbenzene
Yttrium