Health Consultation

TUTTLE ELEMENTARY SCHOOL

SARASOTA, SARASOTA COUNTY, FLORIDA

FEBRUARY 27, 2001

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

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

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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HEALTH CONSULTATION

TUTTLE ELEMENTARY SCHOOL

SARASOTA, SARASOTA COUNTY, FLORIDA

Prepared by:

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

Purpose

In May 2000 the United States Environmental Protection Agency (EPA) asked for assistance from the Agency for Toxic Substances and Disease Registry (ATSDR). EPA asked ATSDR to review environmental data collected at the Tuttle Elementary School (TES) in Sarasota, Florida. Specifically, EPA asked ATSDR to review data from the May 31, 2000, draft Site Inspection Report and the February 29, 2000, Response Engineering and Analytical Contract (REAC) report. EPA asked ATSDR to determine if a public health hazard exists at this school. In June 2000, ATSDR requested the Florida Department of Health (FDOH) to review the data in these two reports. This health consultation will determine if there is a public health concern based on air, soil, sediment, and surface water data. This health consultation does not evaluate the public health concern from methane at this site. The public health concern from methane was evaluated in a previous FDOH health consultation dated September 8, 2000.

The ATSDR provides the financial support for this health consultation report.

Rationale

This health consultation determines if there is a public health concern due to exposure to indoor air, surface soil (0-6" deep), sediment, and surface water. This health consultation does not evaluate soil deeper than 6" because children are unlikely to be exposed to soil deeper than 6". Since the school is supplied with municipal water from an uncontaminated source, we did not consider ingestion of on-site groundwater. We also did not evaluate soil gas data because ambient air data were available and are more relevant to public health.

Site Description and History

Tuttle Elementary School is at 925 North Brink Avenue, Sarasota, Sarasota County, Florida (Figure 1 and 2). The school has 74 faculty members and 954 students. The campus consists of about 17 acres bordered by Tuttle Avenue, Eighth Street, North Brink Avenue, and Tenth Street . It is bounded by unimproved land to the north and by residential properties to the south, east, and west (Figure 3). Storm water runoff from the school property flows north to a large retention pond (Figure 4).

Before the 1940s, part of the school's property was wetlands. In the1950s, this wetland was used as a municipal landfill. No information is available regarding the nature of materials deposited in the landfill. The landfill was covered with an unspecified thickness of soil and Sarasota County purchased the property.

Prior to the construction of the new Tuttle School in 1999, Sarasota County School Board's consultants conducted several investigations of the Tuttle property. They found the following:

- The approximate area of the main landfill was determined to be about 7 acres. A smaller area, about 0.5 acres, of landfill debris was encountered in the northeastern corner of the site.

- Landfill debris extended from about 4 to 9 feet below ground surface (bgs).

- Bis(2-ethylhexyl)phthalate, barium, cadmium, chromium, and lead were detected in two surface soil composite samples at levels below the Florida residential cleanup standard.

- Low levels of hydrogen sulfide, ranging from 0 to 4 parts per million (ppm), were detected in off-site and on-site sewer manholes. In addition, hydrogen sulfide levels in the interior of the buildings ranged from 0 to 1 ppm. School Board consultants concluded that these gas levels could be attributed to a nearby sewer lift station.

In 1999, the Sarasota County School Board constructed a new school, soccer field, softball field, and playground over the landfill as an addition to the existing school (Figure 4). The school board installed a venting system under the new school building slab to prevent accumulation of methane gas generated by the landfill.

In September 1999, the Florida Department of Environmental Protection (FDEP) recommended further investigation under CERCLA because students come in direct contact with the soil on the playground.

During the week of December 19, 1999, EPA consultants conducted a Site Inspection (SI). Based on the data previously collected by the County's consultants, EPA consultants identified an old municipal landfill as a potential source of contamination. The potential source area, based on previous investigations, is approximately 6.5 acres of the property used as a landfill in the 1950s (Tetra Tech 2000).

During the week of December 19, 1999, EPA's consultants collected 6 surface soil samples, 6 subsurface soil samples, 4 groundwater samples, 6 surface water samples, 8 sediment samples, and 10 air samples at the TES. These sampling locations are shown in Figure 5. Sampling results are included in Tables I, II, and III.

EPA consultants designed the December 1999 air sampling program to determine the concentrations and nature of gases generated by the landfill. In January 2000, EPA consultants made flux measurements of the gases that may have been migrating through the landfill cover. They also made portable classroom measurements in January 2000.

In January 2000, EPA consultants collected over 30 air samples for volatile organic compounds (VOC) analysis using various sampling methods, including Flux sampling, Tedlar bag sampling, and SUMMA® grab sampling. They collected samples from portable classrooms, gas vents, gas wells, the courtyard, and the northern parking lot. Sampling locations are shown in Figure 6. Sampling results from the portable classrooms are included in Table IV.

In May 2000, a teacher at the school contacted EPA and expressed concerns about possible illnesses related to the new elementary school which had been constructed, in part, over the same landfill.

Discussion

To select contaminants for further evaluation, FDOH compared the maximum level of each chemical detected during air, soil, sediment, and surface water data sampling with ATSDR screening values. Screening values include EMEGs (environmental media evaluation guidelines), RMEGs (reference dose media evaluation guidelines), and CREGs (Cancer risk evaluation guide for a one-in-one-million excess cancer risk). Screening values are not predictive of health effects. Screening values are only used to select contaminants for further evaluation. Each screening value is based on levels that are low enough so that concentrations below those levels are unlikely to cause illness. The screening values are derived to protect the most sensitive members of the population. Contaminant concentrations below screening values are unlikely to pose a public health concern and, therefore, are not evaluated further. Contaminants detected above the screening value are evaluated further by estimating a dose and comparing the dose to health guidelines. Contaminants without ATSDR screening values were compared with the Florida Department of Environmental Protection screening guidelines. Maximum contaminant concentrations and appropriate screening values are listed in Tables I through V.

Land Disposal/Soil Contamination

Land disposal has been the method of choice for centuries, mainly due to economic reasons, for most of our municipal waste and much of our industrial waste. Land disposal units include pits, ponds, lagoons, landfills, septic lines, land treatment facilities, and open dumps. While these disposal practices differ greatly, each procedure may result in the placement of hazardous constituents in direct contact with the soil. The presence of hazardous chemicals in the soil represents a potential source of a continuing release to other environmental media including air, surface water, and groundwater (Donnelly 1994). For example, organic vapors are capable of moving considerable distances both vertically and horizontally in the soil. Organic chemicals may be released from soils into surface waters by dissolution into runoff water or by adsorption onto soil particles (Donnelly 1994).

Landfill Gas Characteristics

Landfill gas is composed of a mixture of different gases. Typically, landfill gases are composed of about 50% carbon dioxide and 50% methane, by volume. Landfill gases also contain a smaller percentage of nitrogen, oxygen, ammonia, sulfides, hydrogen, carbon monoxide, and nonmethane organic compounds (NMOCs) such as trichloroethylene, benzene, and vinyl chloride. Landfill gases are produced by three processes–bacterial decomposition, volatilization, and chemical reactions. The rate and volume of landfill gas produced at a specific site depend on the composition and age of the refuse, and the presence of oxygen, moisture content, and temperature in the landfill.

Landfill gas expands to fill whatever space is available. Once gas is produced in a landfill, the gas begins to move or "migrate." The movement of landfill gas creates health and safety concerns when the gas enters buildings and other confined areas such as utility corridors.

Densely compacted waste or a landfill cap can inhibit upward movement of landfill gas. When upward movement is inhibited, the gas tends to migrate horizontally to other areas within the landfill or to areas outside the landfill where it can resume its upward path. Other gases, such as carbon dioxide, are denser than air and can collect in subsurface areas such as utility corridors.

Age and disposal history of landfill waste generate significant differences in landfill gas generation and movement of gas within the landfill. Sanitary and vegetative wastes disposed in the oldest portion of a landfill may be past peak landfill gas production while wastes disposed immediately before closure may not have reached peak production rates. The concentration and movement of landfill gas can change rapidly (in a matter of hours) in response to changes in atmospheric and subsurface conditions. Higher atmospheric pressures can inhibit upward movement of landfill gases. Rainfall can saturate pore spaces in surface soils, thereby reducing vertical movement and increasing horizontal movement. Rising flood waters in adjacent rivers or daily tidal fluctuations in adjacent estuaries may cause a temporary rise in water table levels, displacing landfill gases upward and outward. Infrequent monitoring of landfill gases may miss such rapid changes or lead to misinterpretations of site-specific conditions (ATSDR 2000b).

Inhalation of Landfill Gas

The severity of adverse health effects associated with exposure to landfill gases depends on the composition, concentration, and duration of inhalation of gases. Landfill gas odors are produced by the mixtures of sulfides, ammonia, and other gases. Odors can cause symptoms such as headaches or nausea. Typically, these effects are reversed when the odor is eliminated.

Evaluation of indoor and outdoor air data:

Air data are presented in Tables I and II. EPA consultants collected air samples using flux sampling, Tedlar® bag sampling, and SUMMA® grab sampling. FDOH did not evaluate the Tedlar® bag sampling because the bags were defective. EPA consultants collected the air data in Table I using SUMMA® canisters over an 8-hour time period. Air data from Table II were from SUMMA® grab samples collected within a 5-minute time frame. EPA consultants analyzed all collected air samples for volatile organic compounds.

The air samples collected in portable classroom #7 and the administration building contained benzene at concentrations above the ATSDR comparison value (ATSDR 2000). Carbon tetrachloride samples collected in the mechanical room were also above the ATSDR comparison value. All other air contaminant concentrations were below ATSDR comparison values. Our estimate of a child's maximum exposure to benzene for acute inhalation exposure ($\leq$ 14 days) is 100 times less than the Minimal Risk Level (MRL). An MRL is an estimate of daily exposure (by a specified route and length of time) to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. For intermediate inhalation exposure (15-364 days), our estimate is 10 times less than the MRL. For chronic inhalation exposure ($\geq$365 days), our estimate is 500 times less than the cancer effect level (CEL) for humans (ATSDR 1997).

Our estimate of a child's maximum exposure to carbon tetrachloride for acute inhalation exposure ($\leq$ 14 days) is 1,000 times less than the MRL. For intermediate inhalation exposure, our estimate is 400 times less than the MRL. For chronic inhalation exposure (≥365 days), our estimate is 100,000 times less than the NOAEL (ATSDR 1994).

Therefore, using these estimates, the measured concentrations of air contaminants are not considered to be a public health concern for children or teachers at the Tuttle Elementary School.

Evaluation of surface soil data:

Surface soil data are presented in Table III. Of all the soil samples taken from the elementary school, only arsenic and dieldrin results were greater than ATSDR's screening values. For soil ingestion exposure doses, we used a body weight of 16 kilograms for a child, ingesting 200 milligrams of soil per day.

Our estimate of a child's exposure to arsenic for acute oral ingestion (≤14 days) is 100 times less than the LOAEL. For intermediate exposure (15-364 days), our estimate is 90 times less than the NOAEL. For chronic exposure (≥365 days), our estimate is seven times less than the MRL (ATSDR 1998). Therefore, oral ingestion of arsenic at this calculated dose is not likely to be a public health concern.

Our estimate of a child's exposure to dieldrin for acute oral ingestion (≤14 days) is five times less than the MRL. For intermediate exposure (15-364 days), our estimate is 100 times less than the NOAEL. For chronic exposure (≥365 days), our estimate is two times less than the MRL (ATSDR 1993). Therefore, oral ingestion of dieldrin at this estimated dose is not likely to cause a health hazard, and the detected soil contaminants are not considered to be a public health concern to children or teachers at the Tuttle Elementary School.

Many of the VOCs found in the soil do not have ATSDR comparison values. In addition, many of the miscellaneous extractables are unknown compounds for which there is insufficient toxicological information.

Evaluation of sediment data:

Sediment data are presented in Table IV. Of all the sediment samples taken from the elementary school the week of December 19, 1999, none of the laboratory results exceeded ATSDR's screening values. Therefore, measured concentrations of contaminants in sediments are not considered to be at levels of public health concern for children or teachers at Tuttle Elementary School.

Evaluation of surface water data:

Surface water sample data are presented in Table V. Although it is unlikely that a child will ingest water from the wet retention pond on the school grounds, we took the conservative approach and evaluated ingestion of water from this pond. EPA consultants detected dieldrin and selenium in the wet retention pond above ATSDR's CREG screening value. All other contaminant concentrations were below ATSDR comparison values. Our estimate of a child's maximum exposure to dieldrin for acute oral ingestion (≤14 days) is seven times less than the MRL. For intermediate exposure (15-364 days), our estimate is 700 times less than the NOAEL. For chronic exposure (≥365 days), our estimate is seven times less than the MRL (ATSDR 1993).

Our estimate of a child's maximum exposure to selenium for acute oral ingestion (≤14 days) is 900 times less than the LOAEL. For intermediate exposure (15-364 days), our estimate is 90 times less than the LOAEL. For chronic exposure (≥365 days), our estimate is nine times less than the MRL (ATSDR 1996). Therefore, based on these estimates, the detected concentration of contaminants in surface water are not at levels of public health concerns to children and teachers at Tuttle Elementary School.

Child Health Initiative

Small children may have greater exposures to environmental contaminants than adults. Pound for pound, children drink more water, eat more food, and breathe more air than adults. For example, children in the first six months of life drink seven times as much water per pound as the average adult. Children's exposure to contaminants in the environment is also greater because they play close to the ground and exhibit hand to mouth behaviors. The obvious implication for environmental health is that children can have much greater "doses" than adults to contaminants that are present in soil, water, and air (ATSDR 1998b). For these reasons, we gave special consideration to children's health in this health consultation.

Based on the evaluated air, soil, and water data from EPA, excluding methane, this site poses a **no** apparent public health hazard to the children attending the Tuttle Elementary School.

Conclusions

Based on the 1999/2000 air, soil, and water environmental data from EPA, this site poses a no apparent public health hazard to the children and teachers at the Tuttle Elementary School. FDOH/ATSDR previously assessed the public health concern from methane at this school in a September 8, 2000, health consultation report.

Recommendations/Public Health Action Plan

If additional environmental information becomes available, the FDOH will, if requested, re-evaluate the implications of environmental contamination at the Tuttle Elementary School..

Preparers of the Report

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Bureau of Environmental Epidemiology

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12. Tetra Tech 2000. Draft Site Inspection, Tuttle Elementary School. TDD No. 04-9910-0012. May 31, 2000.

CERTIFICATION

The Tuttle Elementary School Health Consultation was prepared by the Florida Department of Health, Bureau of Environmental Epidemiology, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

Debra Gable
Technical Project Officer, SPS, SSAB, DHAC

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

for RG

Richard Gillig
Branch Chief, SPS, SSAB, DHAC, ATSDR

TABLE I:

Maximum Contaminant Concentrations in Indoor and Outdoor Air Samples Taken at Tuttle Elementary School During the Week of 12/19/99

Contaminant	Maximum Air Concentration	Location of Maximum Air Concentration*	ATSDR Screening Value**	Source of Screening Value
Acetone	32 µg/m³ (13.5 ppb)	Administration Building	30,880 µg/m³ (13,000 ppb)	Chronic EMEG/child ATSDR 2000
Benzene	0.98 J µg/m³ (0.31 ppb)	Administration Building	0.10 µg/m³ (0.03 ppb)	CREG ATSDR 2000
Carbon Tetrachloride	0.75 J µg/m³ (0.12 ppb)	Mechanical Room	0.07 µg/m³ (0.01 ppb)	CREG ATSDR 2000
Chloromethane	2.5 µg/m³ (1.2 ppb)	Mechanical Room	103.30 µg/m³ (50.0 ppb)	Chronic EMEG/child ATSDR 2000

Source: Tetra Tech 2000
µg/m³ = micrograms per cubic meter
ppb = parts per billion
J = estimated concentration
*Air samples were also taken in the music room and the northern parking lot for these contaminants. Only the maximum concentrations are included in the table. All the samples were collected using SUMMA ® canisters during an 8-hour period, except for the grab sample from the parking lot.
**ATSDR EMEGs, RMEGs and CREGs are not predictive of health effects. They are only used to select contamination for further evaluation. Also, ATSDR's MRLs, EMEGs and EPA's RfCs may not protect hypersensitive (allergic) individuals.
EMEG - Environmental Media Evaluation Guide--is derived from the ATSDR's Minimal Risk Level (MRL) using standard exposure assumptions, such as ingestion of two liters of water per day and body weight of 70 kg for adults. MRL's are estimates of daily human exposure to a chemical likely to be without an appreciable risk of noncancerous illnesses, generally for a year or longer.
RMEG - Reference Dose Media Evaluation Guide--is derived from the EPA's Reference Dose (RfD) using standard exposure assumptions. RfDs are estimates of daily human exposure to a chemical likely to be without an appreciable risk of noncancerous illness, generally for a year or longer.
CREG - Cancer Risk Evaluation Guide--is calculated from the EPA's cancer slope factor and is the contaminant concentration estimated to result in no more than one excess cancer per one million persons exposed over a lifetime.
MRL - Minimal Risk Level - an estimate of daily exposure of a human being to a chemical (in mg/kg/day) that is likely to be without an appreciable risk of deleterious effects (noncarcinogenic) over a specified duration of exposure. MRLs are based on human and animal studies and are reported for acute (≤ 14 days), intermediate (15-364 days), and chronic (≥365 days). MRLs are published in ATSDR Toxicological Profiles for specific chemicals.

TABLE II:

Maximum Contaminant Concentrations in Indoor and Outdoor Air Samples Taken at Tuttle Elementary School During January, 2000

Contaminant	Maximum Air Concentration	Location of Maximum Air Concentration*	ATSDR Screening Value**	Source of Screening Value
Benzene	1.60 µg/m³ (0.5 J ppb)	Portable Classroom #7	0.10 µg/m³ (0.03 ppb)	CREG ATSDR 2000
Chloromethane	2.07 µg/m³ (1.0 J ppb)	Portable Classroom #7, 12 & 13	103.25 µg/m³ (50.0 ppb)	Chronic EMEG ATSDR 2000
Ethylbenzene	1.74 µg/m³ (0.4 J ppb)	Portable Classroom # 2	4342 µg/m³ (1000 ppb)	Intermediate EMEG ATSDR 2000
Toluene	7.54 µg/m³ (2.0 J ppb)	Portable Classroom #7	1507.60 µg/m³ (400 ppb)	Chronic EMEG ATSDR 2000
Trichlorofluoro methane	4.50 µg/m³ (0.8 J ppb)	Portable Classroom #2 & 7	NA	______
Total Xylenes	6.08 µg/m³ (1.4 J ppb)	Portable Classroom #2	434.20 µg/m³ (100 ppb)	Chronic EMEG

Source: Lockheed Martin 2000a
µg/m³= micrograms per cubic meter
ppb = parts per billion
J = Estimated concentration since the air level was below 1.00 nanoliter quantitation limit
NA = Not available
*Air samples were collected from 15 portable classrooms and sampled for VOCs. Only the maximum VOC concentrations are shown in the table. Samples were grab samples collected within a five minute period.
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TABLE III:

Maximum Concentrations of
Soil Samples (0-6 inches) Taken at Tuttle Elementary School During the Week of 12/19/99

Contaminant	Maximum Surface Soil Concentration (ppm)	Location of Maximum Soil Concentration	ATSDR Screening Value* (ppm)	Source of Screening Value
Aldrin	0.034	In a low area of the soccer field	0.04	CREG ATSDR 2000
Alpha-chlordane *Gamma-chlordane*	0.007 0.009	East of the administrative building	2.0 (total chlordane)	CREG ATSDR 2000
Arsenic	8.8	Courtyard between the classroom bldg, kitchen & adm bldg	0.5	CREG ATSDR 2000
Chromium	13 J	East of the administrative building	200	RMEG/child for CrVI ATSDR 2000
Cobalt	0.82 J	East of the administrative building	NA	______
Dieldrin	0.130	In a low area of the soccer field	0.04	CREG ATSDR 2000
4,4-DDT	0.0047	East of the Administrative Building	2.0	CREG ATSDR 2000
Heptachlor Epoxide	0.002 N	East of the administrative building	0.08	CREG ATSDR 2000

Source: Tetra Tech 2000
ppm = parts per million
N = presumptive evidence of presence of material
*ATSDR EMEGs, RMEGs and CREGs are not site specific and are not predictive of health effects. They are only used to select contamination for further evaluation. They are only based on levels unlikely to cause illness. Also, ATSDR's MRLs, EMEGs and EPA's RfCs may not protect hypersensitive (allergic) individuals.

TABLE IV:

Maximum Concentrations of Sediment Samples Taken at Tuttle Elementary School During the Week of 12/19/99

Contaminant	Maximum Sediment Concentration (ppm)	Location of Maximum Sediment Concentration	ATSDR Screening Value* (ppm)	Source of Screening Value
Chromium	9.1 J	Unnamed lake	200	RMEG/child CrVI ATSDR 2000
Dieldrin	0.025	Wet retention pond	0.04	CREG ATSDR 2000

Source: Tetra Tech 2000

ppm = parts per million

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TABLE V:

Maximum Concentrations of Surface Water Samples Taken at Tuttle Elementary School During the Week of 12/19/99

Contaminant	Maximum Surface Water Concentration (ppb)	Location of Maximum Surface Water Concentration	ATSDR Screening Value* (ppb)	Source of Screening Value
Dieldrin	0.12	Wet retention pond	0.002	CREG ATSDR 2000
Selenium	3.0	Unnamed lake	0.50	Chronic EMEG ATSDR 2000

Source: Tetra Tech 2000

ppb = parts per billion

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ATSDR GLOSSARY OF TERMS

Acute Exposure - Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Adverse Health Effect - A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR - The **A**gency for **T**oxic **S**ubstances and **D**isease **R**egistry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

CEL - Cancer Effect Level - The lowest dose of chemical in a study, or group of studies, that produces significant increases in the incidence of cancer (or tumors).

Chronic Exposure - A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be chronic.

Concern - A belief or worry that chemicals in the environment might cause harm to people.

Concentration - How much or the amount of a substance present in a certain amount of soil, water, air, or food.

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

EMEG - Environmental Media Evaluation Guide--is derived from the ATSDR's Minimal Risk Level (MRL) using standard exposure assumptions, such as ingestion of two liters of water per day and body weight of 70 kg for adults. MRL's are estimates of daily human exposure to a chemical likely to be without an appreciable risk of noncancerous illnesses, generally for a year or longer.

U.S. Environmental Protection Agency (EPA) - The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

Exposure - Coming into contact with a chemical substance.

Ingestion - Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See **Route of Exposure**).

Inhalation - Breathing. It is a way a chemical can enter your body (See **Route of Exposure**).

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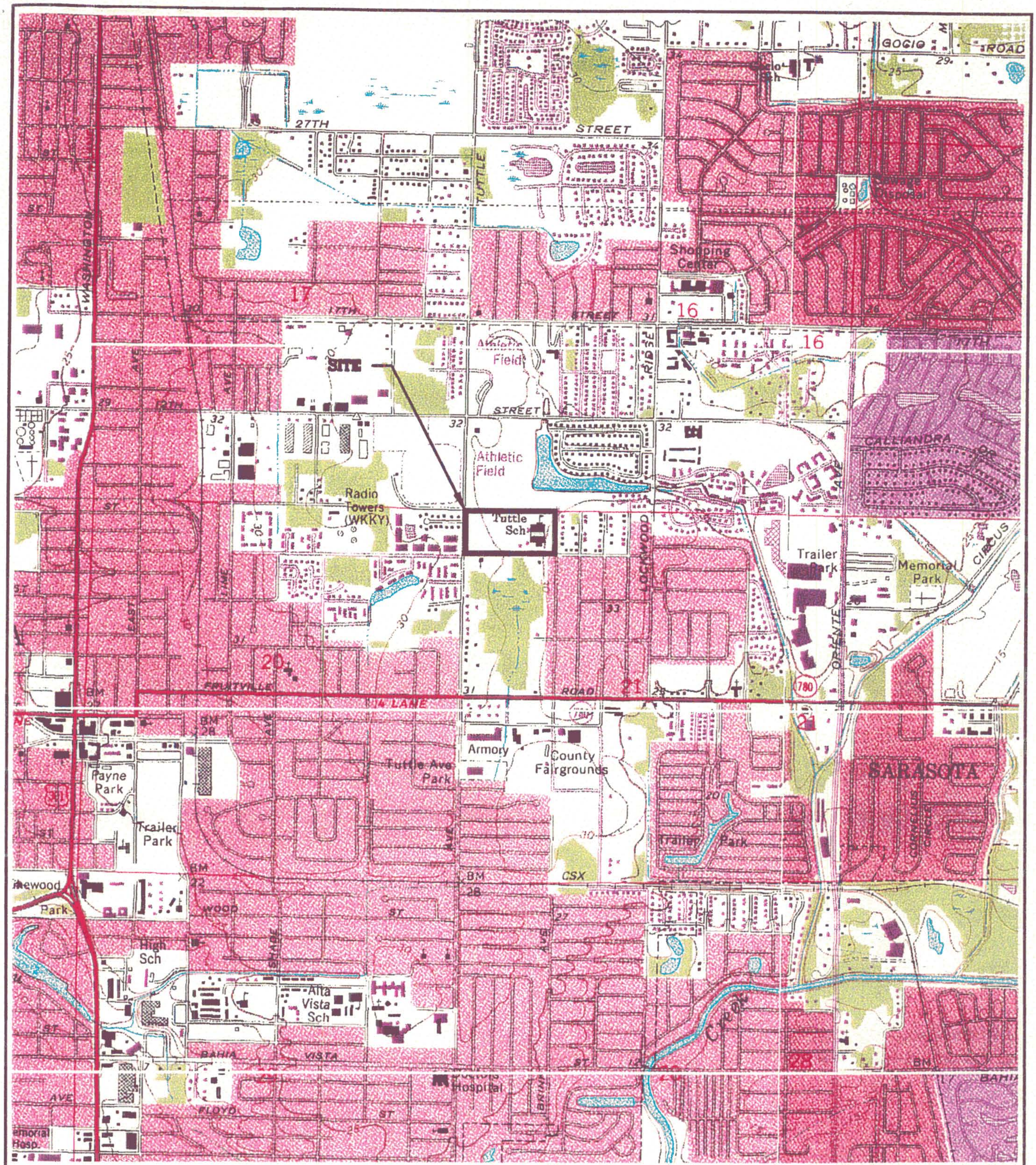
Inhalation - Breathing. It is a way a chemical can enter your body (See **Route of Exposure**).

FIGURES



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SCALE IN FEET

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SOURCE: MODIFIED FROM USGS, SARASOTA, AND BEE RIDGE, FLORIDA QUADRANGLES, 1973, PHOTOREVISED 1987.

TUTTLE ELEMENTARY SCHOOL
SARASOTA, SARASOTA COUNTY, FLORIDA
TDD NO. 04-9910-0012

FIGURE 1
SITE LOCATION MAP

Tetra Tech EM Inc.

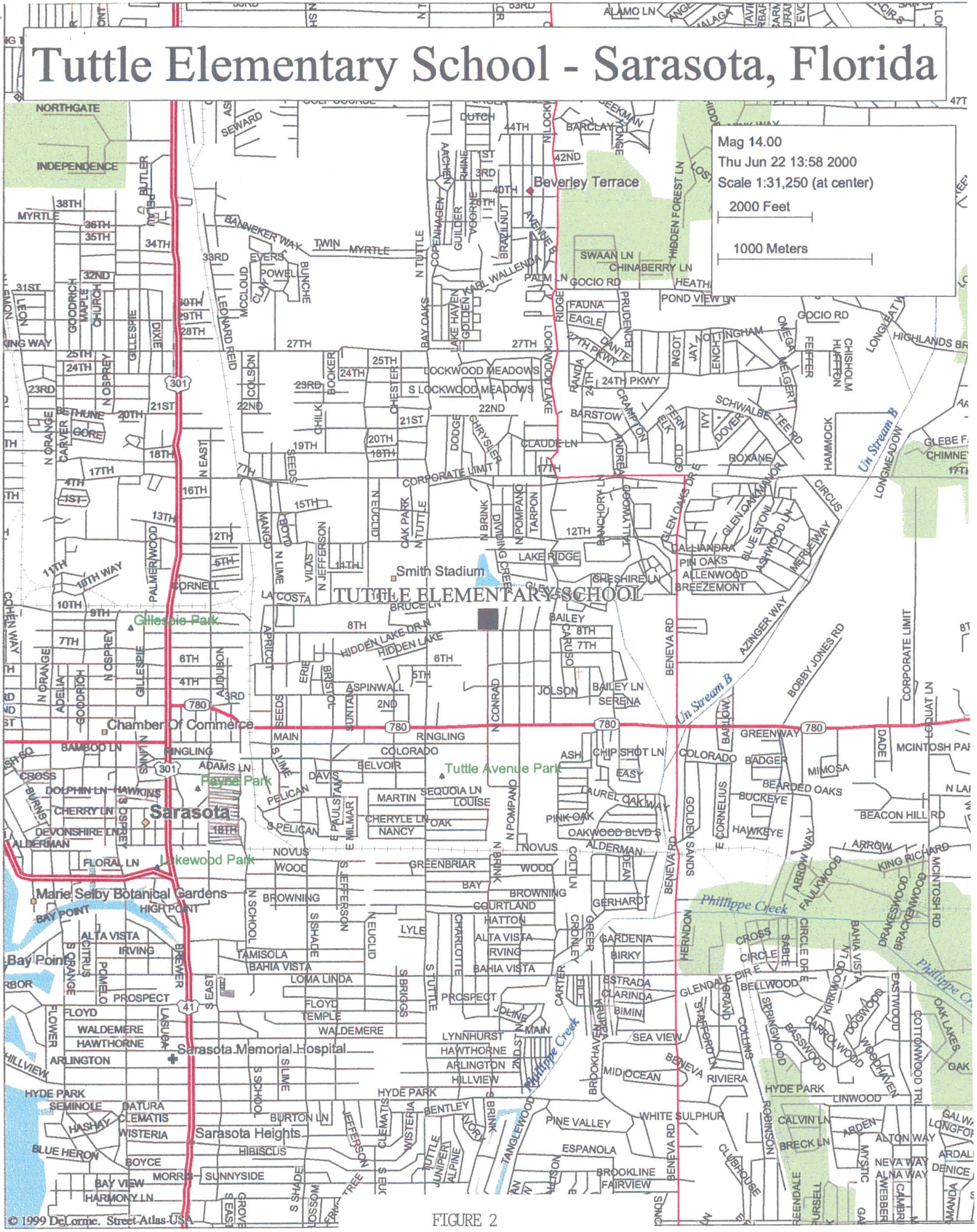


FIGURE 2

Tuttle Elementary School

City Map

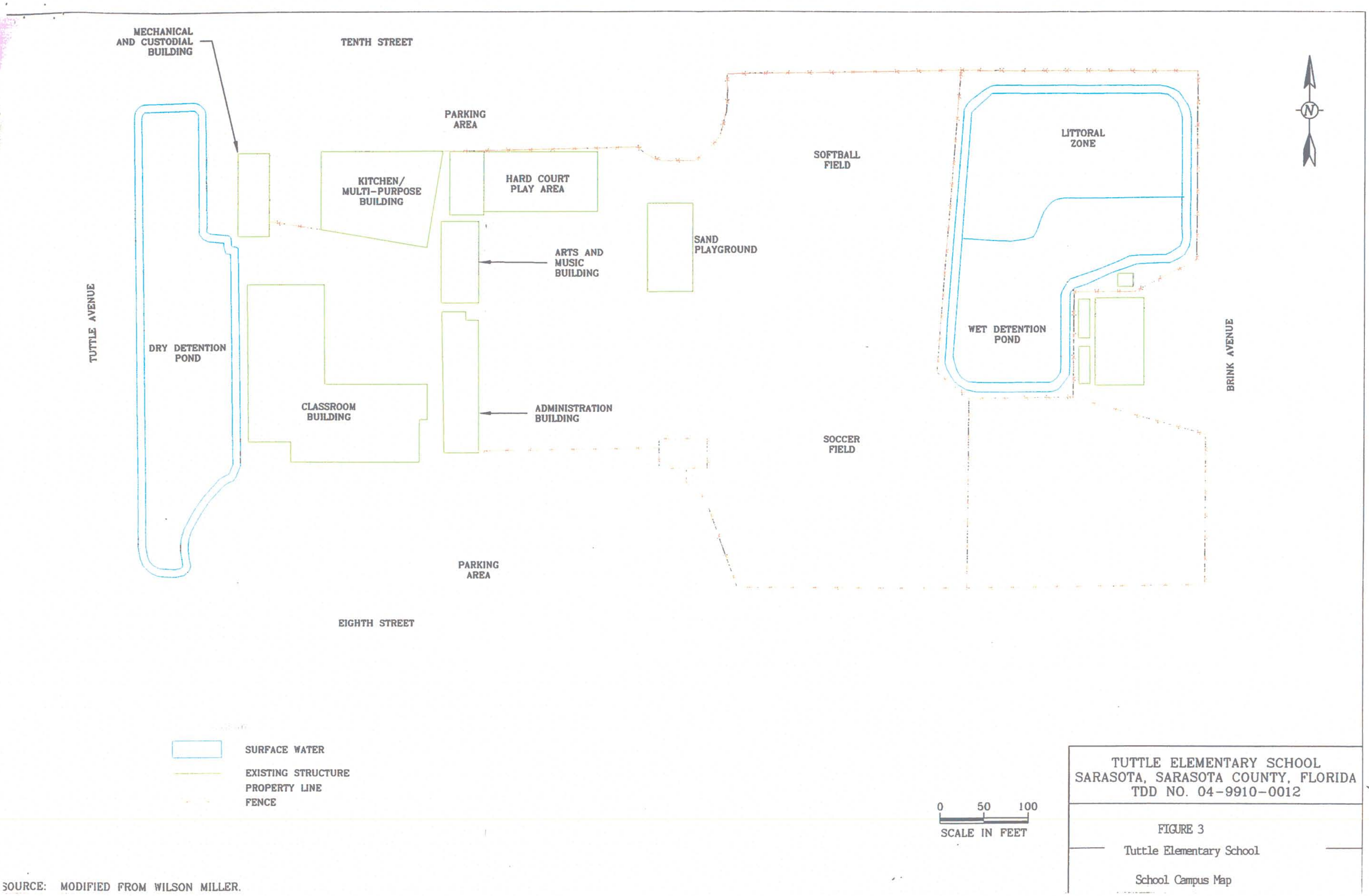


FIGURE 3
Tuttle Elementary School
School Campus Map

SOURCE: MODIFIED FROM WILSON MILLER.

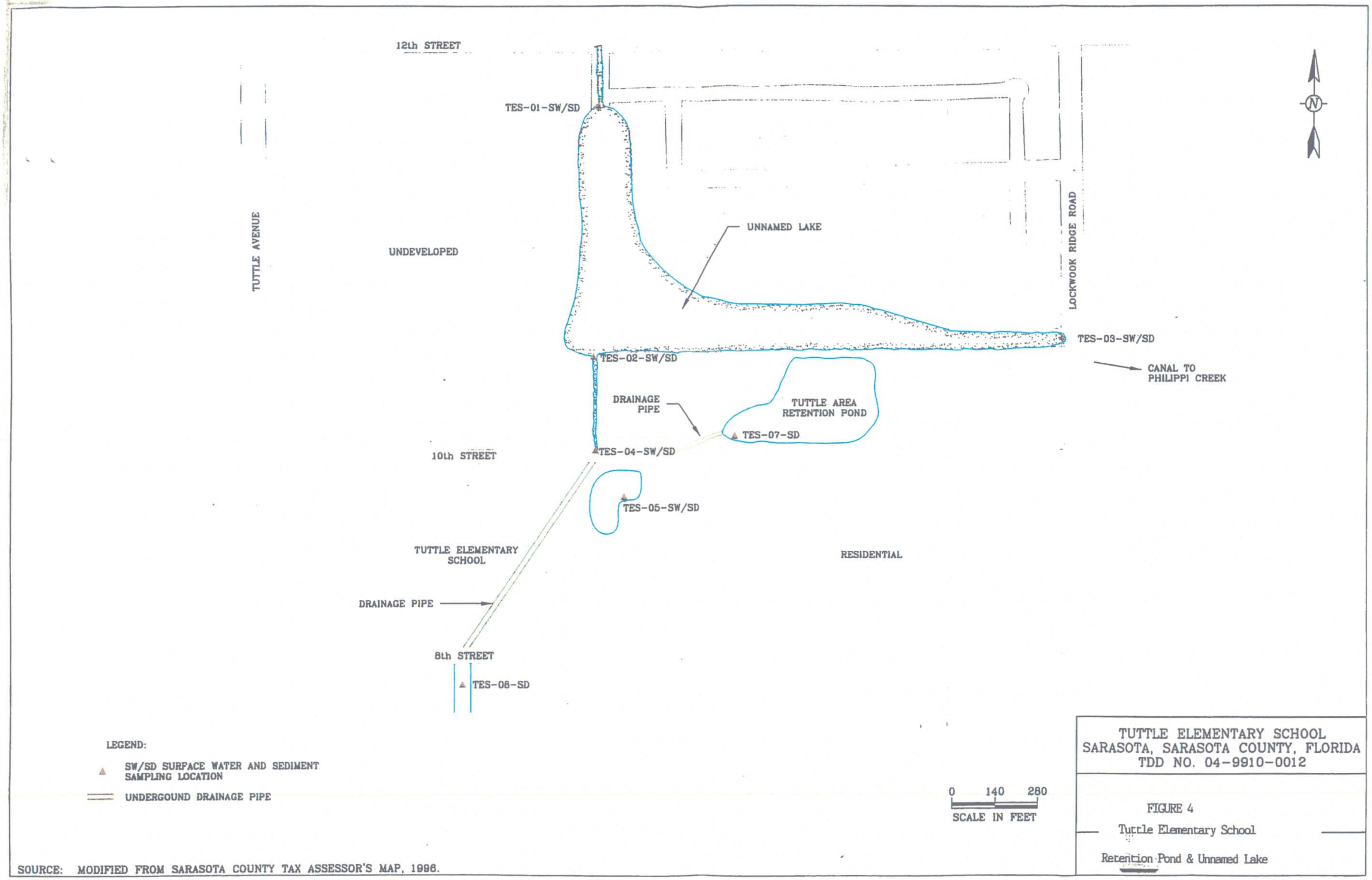
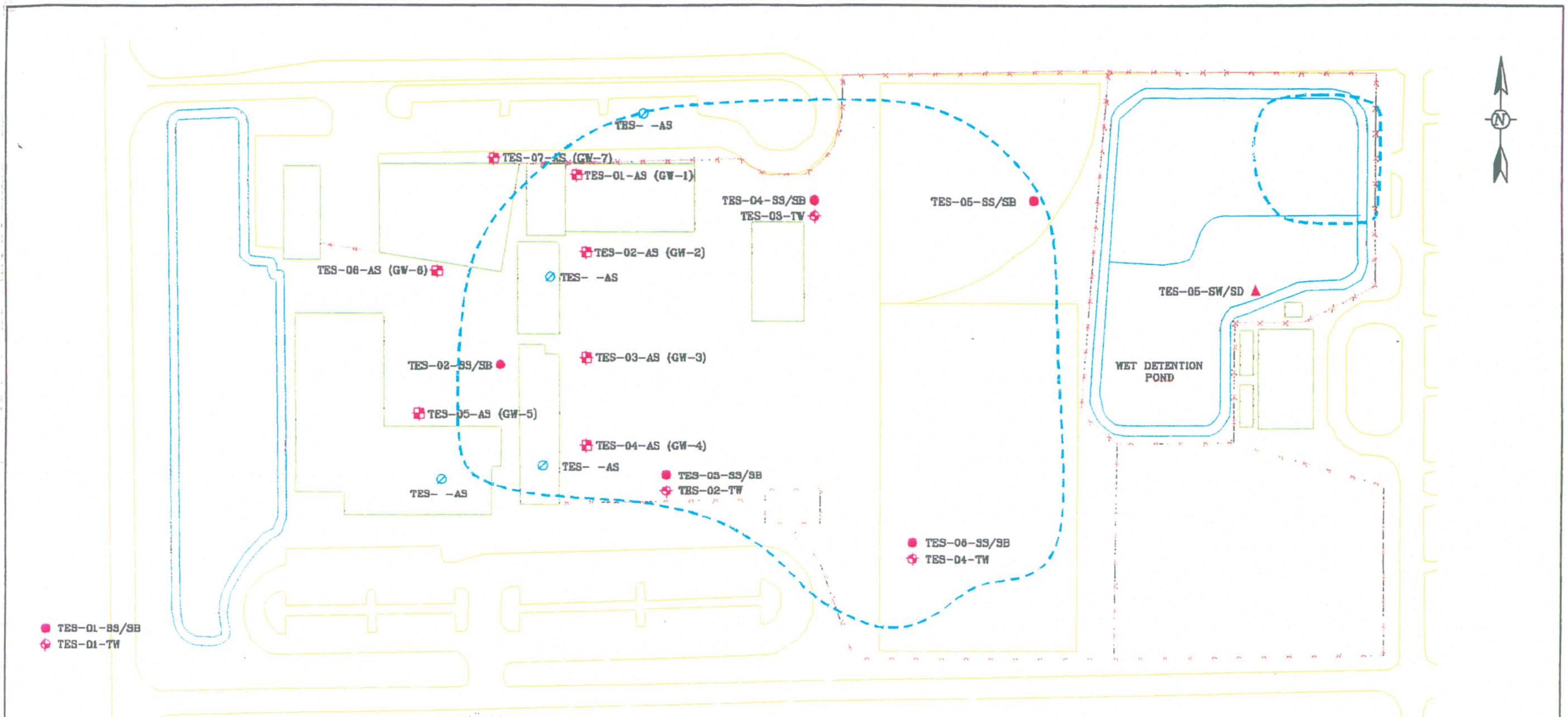


FIGURE 4
Tuttle Elementary School
Retention Pond & Unnamed Lake



SURFACE WATER
EXISTING STRUCTURE
PROPERTY LINE
FENCE
AIR SAMPLING LOCATION- EXISTING PERMANENT GAS PROBE (AS)
GROUND WATER SAMPLING LOCATION (TW)
SURFACE AND SUBSURFACE SOIL SAMPLING LOCATION (SS/SB)
SURFACE WATER AND SEDIMENT SAMPLING LOCATION (SW/SD)
TES TUTTLE ELEMENTARY SCHOOL
AMBIENT AIR SAMPLING LOCATION
APPROXIMATE BOUNDARY FOR FORMER LANDFILL

0 50 100
SCALE IN FEET

SOURCE: MODIFIED FROM WILSON MILLER.

TUTTLE ELEMENTARY SCHOOL
SARASOTA, SARASOTA COUNTY, FLORIDA
TDD NO. 04-9910-0012

FIGURE 5
Tuttle Elementary School
Boundaries of Former Landfill & Sampling Location Map

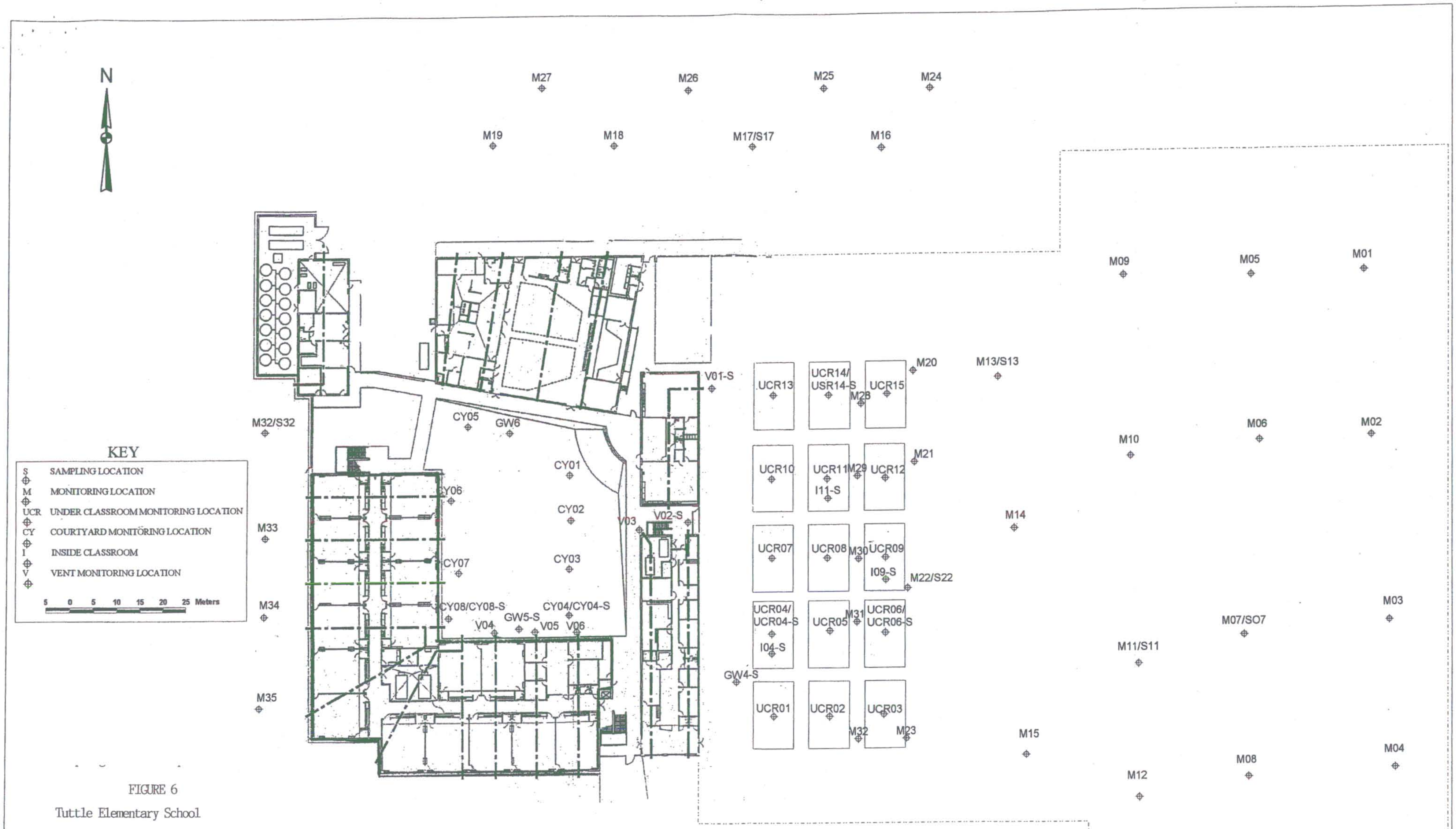


FIGURE 6

Tuttle Elementary School

Additional Air Sampling Locations

TUTTLE ELEMENTARY SCHOOL SITE
FLUX MONITORING & SAMPLING
LOCATIONS
SARASOTA, FL
FEBRUARY 2000

U.S. EPA ENVIRONMENTAL RESPONSE TEAM
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT
68-C99-223
W.O.# R1A00122