Health Consultation

TUTTLE ELEMENTARY SCHOOL

SARASOTA, SARASOTA COUNTY, FLORIDA

SEPTEMBER 8, 2000

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
Department of Health and Human Services
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 the Agency for Toxic Substances and Disease Registry (ATSDR) to review environmental data collected at the Tuttle Elementary School (TES) in Sarasota, Florida. ATSDR reviewed data from the May 31, 2000, draft Site Inspection Report (Tetra Tech 2000) and the February 29, 2000, Response Engineering and Analytical Contract Report (REAC 2000) to decide if a public health hazard existed at the Tuttle Elementary School. In June 2000, ATSDR requested the Florida Department of Health (FDOH) to review the data in these two reports. This health consultation report by FDOH is limited to a review of the methane air concentrations. FDOH will review the remaining environmental data in a future health consultation report.

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

Site Description and History

Tuttle Elementary School is at 925 North Brink Avenue, Sarasota, Sarasota County, Florida. 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 (latitude 27°20'37" north and longitude 82°30'37" west). The campus is bounded by unimproved land to the north and by residential properties to the south, east, and west. Storm water runoff from the school property flows north to a large retention pond.

Before the 1940s, part of the school's property was wetlands. From sometime in the 1950s, 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.

In 1999, the Sarasota County School Board constructed a new school, soccer field, softball field, and playground over the landfill as an addition to an existing school. The school board installed a venting system under the new school building slab to prevent accumulation of methane gas generated by the landfill. The school board also installed seven subsurface gas probes to monitor levels (concentrations) of methane gas. The subsurface gas probes detected low levels of methane in the vents under the school building and in the seven permanent gas probes. The levels were below the lower explosive limit (LEL) for methane and were **not** considered an explosive hazard.

On May 28, 1999, the Florida Department of Environmental Protection (FDEP) notified the Sarasota County School Board of a methane problem (FDEP 1999). In December 1999, EPA began a site investigation.

In December 1999 EPA screened the seven gas wells located on school property using a flame ionization detector (FID). Methane levels were measured above the lower explosive limit (LEL) in six of the subsurface gas probes. Measured methane levels ranged from 0.1% to 38% volume per volume (v/v)(EPA 2000b).

Also, in December 1999, soil gas samples were collected at TES for laboratory analysis. The methane levels detected from the seven gas probes ranged from 4,100 to 200,000 parts per million by volume (ppmv) (or 0.41% to 20% v/v).

In January 2000, on-site screening was conducted for methane, carbon dioxide, and volatile organic compounds. Methane concentrations in gas wells GW-4 and GW-5 were detected at 21% and 28% v/v. These concentrations are above the lower explosive limits (LEL) for methane which is 5% (Merck 1983).

In March 2000, a chemist with EPA's emergency response team evaluated the methane levels at TES and recommended two options: (1) the Sarasota County School Board could continue to monitor the vents and the school for methane for an indeterminate time or (2) the Sarasota County School Board could install a vapor recovery system away from the school at the opposite end of the landfill (EPA 2000a).

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 a former municipal landfill.

Discussion

Landfill Gas Characteristics

Landfill gas is composed of a mixture of different gases. By volume, landfill gas is composed of about 50% carbon dioxide and 50% methane. Landfill gas also contains a smaller percentage of nitrogen, oxygen, ammonia, sulfides, hydrogen, carbon monoxide, and nonmethane organic compounds (NMOCs), such as trichloroethylene, benzene, and vinyl chloride. Landfill gas is 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 in the landfill, moisture content, and temperature.

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. Methane is the constituent of landfill gas that is likely to pose the greatest explosion hazard. Since methane is lighter than air, methane has a natural tendency to move upward, and eventually out of the landfill surface. 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.

Inhalation of Landfill Gas

The severity of adverse health effects associated with exposure to landfill gases depends on the composition of gases, concentration of gases, and duration of inhalation of the gases. As previously indicated, landfill gases are composed of a mixture of gases. Methane and carbon dioxide are generally not considered to be toxic gases in that they would become asphyxiates long before becoming toxic. While methane and carbon dioxide dominate the mixture, the other gases may be significant. As an example, methane and carbon dioxide do not produce the strong, sometimes nauseating, odors associated with landfill 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.

Fires or Explosions

The concentration level at which a gas has the potential to explode is called the explosive limit. The potential for a gas to explode is determined by the lower explosive limit (LEL) and upper explosive limit (UEL). The LEL and UEL are measures of the percent of a gas in the air by volume. At concentrations below its LEL and above its UEL, a gas is not explosive. However, an explosion hazard may exist if a gas is present in the air between the LEL and UEL and an ignition source is present.

Methane can become an explosive hazard if allowed to accumulate to concentrations between 5% and 15% by volume. Methane gas beneath a landfill is not usually explosive because there is insufficient oxygen present to support combustion and there is not usually an ignition source. Methane gas is also not typically explosive when released to the atmosphere because the gas is immediately diluted with ambient air. However, if methane accumulates in confined spaces such as a building crawl space or storage room without ventilation, methane could reach an explosive concentration.

Methane is also flammable. If a post or pole is used to puncture the surface of a landfill, the resultant small voids could act as a vent where methane could collect and discharge out the top of the post or pole. If an ignition source were provided, methane could ignite and burn.

In 1999, a child playing on a slide in a municipal park in Georgia was seriously burnt by inadvertent ignition of landfill gases. The park playground was built over an abandoned and covered dump. The playground equipment in the park included swing sets and slides with frames made of hollow piping material which penetrated the soil covering the waste material.

Environmental investigators theorized that, over time, the pipes filled with landfill gas. When the child slid down one of the slides, she generated static electricity, which ignited the gas and caused an explosion and flare-up. Environmental investigations following the injury revealed flammable levels of methane beneath the playground.

Other closed landfills have had subsurface fires occur and produced noxious gases for many months. Subsurface landfill fires are extremely difficult to extinguish because of the almost inexhaustible supply of flammable gas and lack of direct access by conventional firefighting equipment (ATSDR 2000).

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 children 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 1998). This health consultation addresses issues at the Tuttle school; therefore, children are the primary population of concern.

Conclusions

Methane measurements in the subsurface soil at the Tuttle Elementary School suggest a potential for accumulation of methane gas in school buildings and grounds at levels above the lower explosive limit (LEL). If methane accumulates in enclosed spaces at levels within the explosive limits of methane, an explosion could occur. The possibility of an explosion constitutes a public health hazard at the Tuttle Elementary School.

Recommendations

The following recommendations are offered to the Sarasota County School Board:

1. Prior to the opening of the school and periodically thereafter, monitor to ensure that levels of methane at the surface of the school grounds are well below 10% of the lower explosive limit (LEL). Monitor using a calibrated flame ionization detector. Monitor around the perimeters of the parking lot(s) and hard court(s), immediately above cracks in the parking lot(s), pads, sidewalks and hard court(s), if any exist, at the base of playground equipment, and at least ten random points throughout the playgrounds and ball fields. Early afternoon is usually the best time to conduct outdoor methane monitoring to determine if significant amounts of methane are being emitted through soil cover and cracks in the pavement.

2. Inspect all outside equipment to assess its potential to receive and contain a flammable gas via gas migration (e.g., hollow tubing in bleachers and playground equipment). Remove or modify equipment (by installing venting) that could allow landfill gases to accumulate.

3. Install continuous methane monitors with the appropriate warning alarms in all school buildings including classroom buildings, the administration building, kitchen/multipurpose building, mechanical/custodial building, and arts/music building. Install monitors in locations where gas migration pathways exist (e.g., utility rooms as a result of electrical/phone service penetrations). The fire marshal should be involved in the planning, use, and maintenance (including calibration) of the methane monitoring program.

4. Develop a school contingency plan in the event that indoor methane levels exceed a safe limit. Inform the local fire department of the hazard and involve the fire marshal in the development of the contingency plan.

5. Consider reducing the concentration of landfill gases such as methane in and around the Tuttle Elementary School. If monitoring indicates methane concentrations at dangerous levels, consider installation of a landfill gas collection system.

6. Exclude children, teachers, and other nonconstruction personnel from the school property during any methane monitoring equipment installation and landfill venting construction activities.

Public Health Action Plan

Chemicals other than methane were measured during the EPA sampling events. FDOH will evaluate these chemicals in a separate health consultation.

Preparers of the Report

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References

ATSDR 1998. Guidance on Including Child Health Issues in Division of Health Assessment and Consultation Documents. Agency for Toxic Substances and Disease Registry. Atlanta, GA. July 2, 1998.

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3. EPA 2000a. Memo to EPA Region IV from EPA chemist evaluating methane levels at Tuttle Elementary School. March 15, 2000

4. EPA 2000b. Field Measurements of Landfill Gas Well Monitoring Results. December, 1999.

5. EPA 2000c. Press Release: EPA Conducts Investigation at Tuttle Elementary School in Sarasota, Florida. January 19, 2000.

6. FDEP 1999. Letter from FDEP to Sarasota County School Board regarding Methane monitoring conducted at Tuttle Elementary School. May 28, 1999.

7. Merck 1983. Merck Index, Tenth Edition. Merck and Company, Incorporated. Rahway, New Jersey.

8. REAC 2000. Lockheed Martin Technology Services Group 2000. Trip Report, Tuttle Elementary School. Work Assignment #0122. February 29, 2000.

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

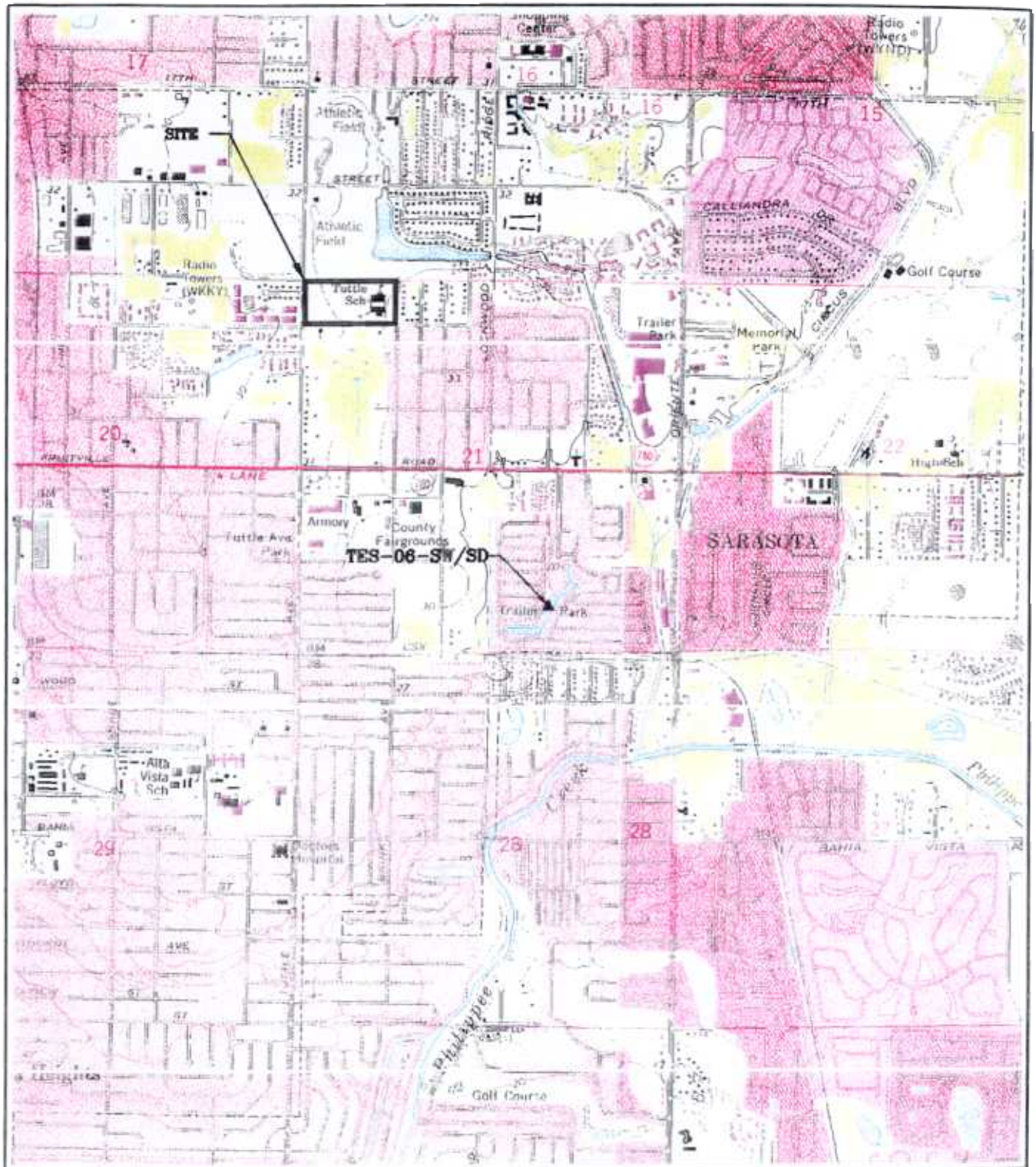
FIGURES

Figure 1: Site Location Map

Figure 2: Magnification of location of Tuttle Elementary School

Figure 3: Layout of Tuttle Elementary School

Figure 4: Sampling Location Map



LEGEND

SW/SD	SURFACE WATER AND SEDIMENT SAMPLING
TES	TUTTLE ELEMENTARY SCHOOL

0 1000 2000

SCALE IN FEET

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

TUTTLE ELEMENTARY SCHOOL
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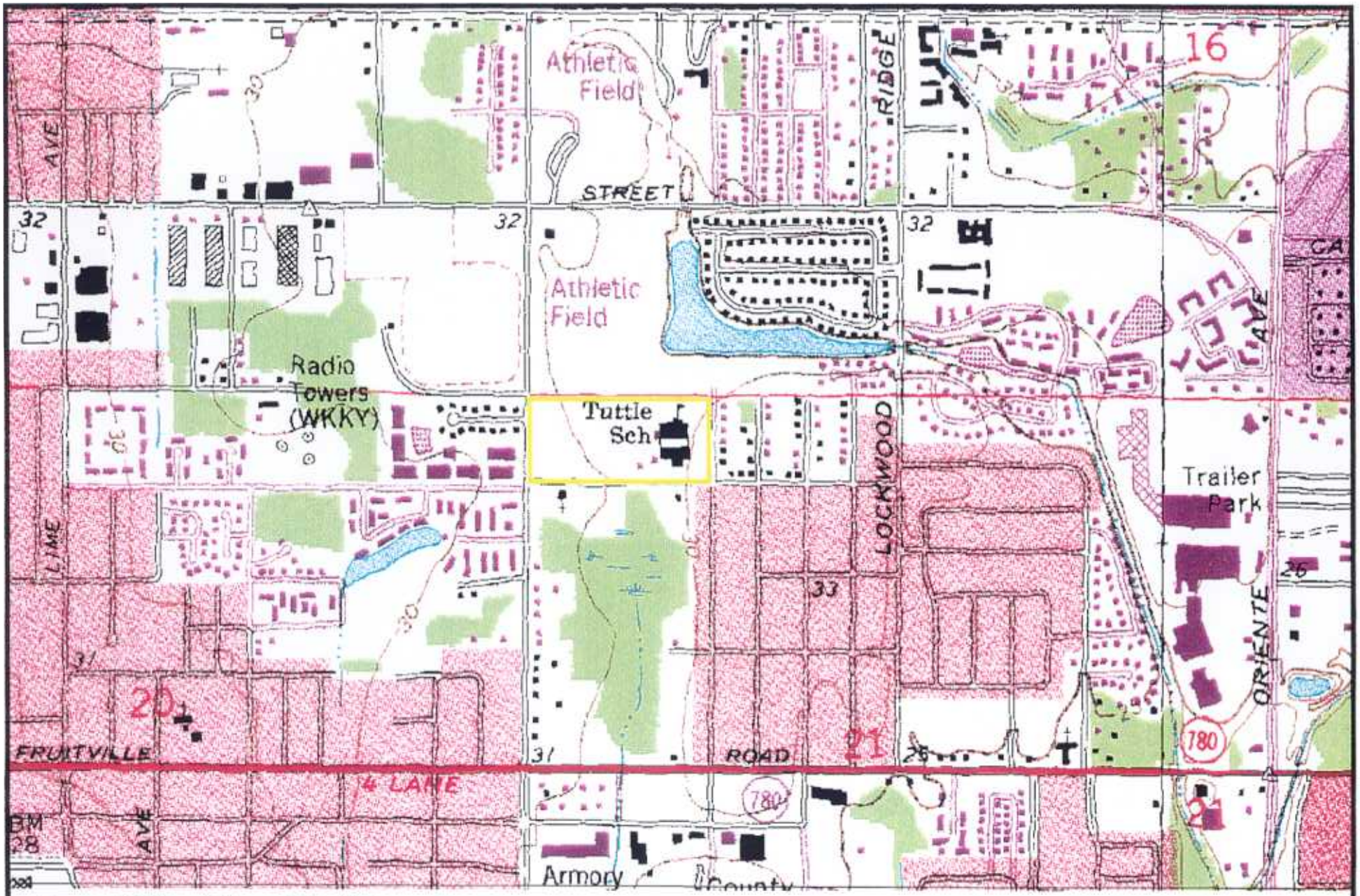
TUTTLE ELEMENTARY SCHOOL

FIGURE 1



Florida Department of Health
Bureau of Environmental Epidemiology

TUTTLE ELEMENTARY SCHOOL

FIGURE 2

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N W E S

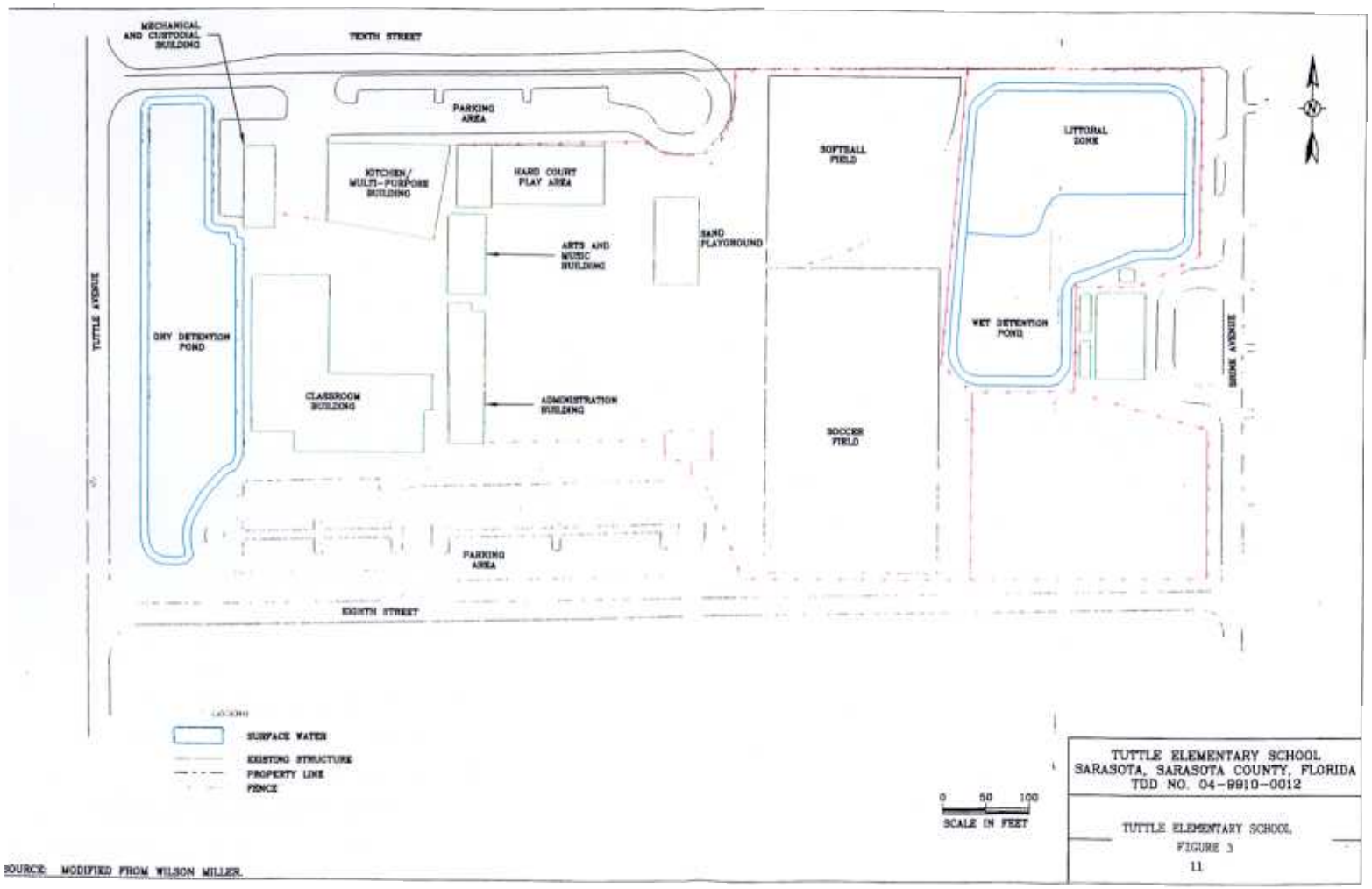

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FIGURE 3

SOURCE: MODIFIED FROM WILSON MILLER.

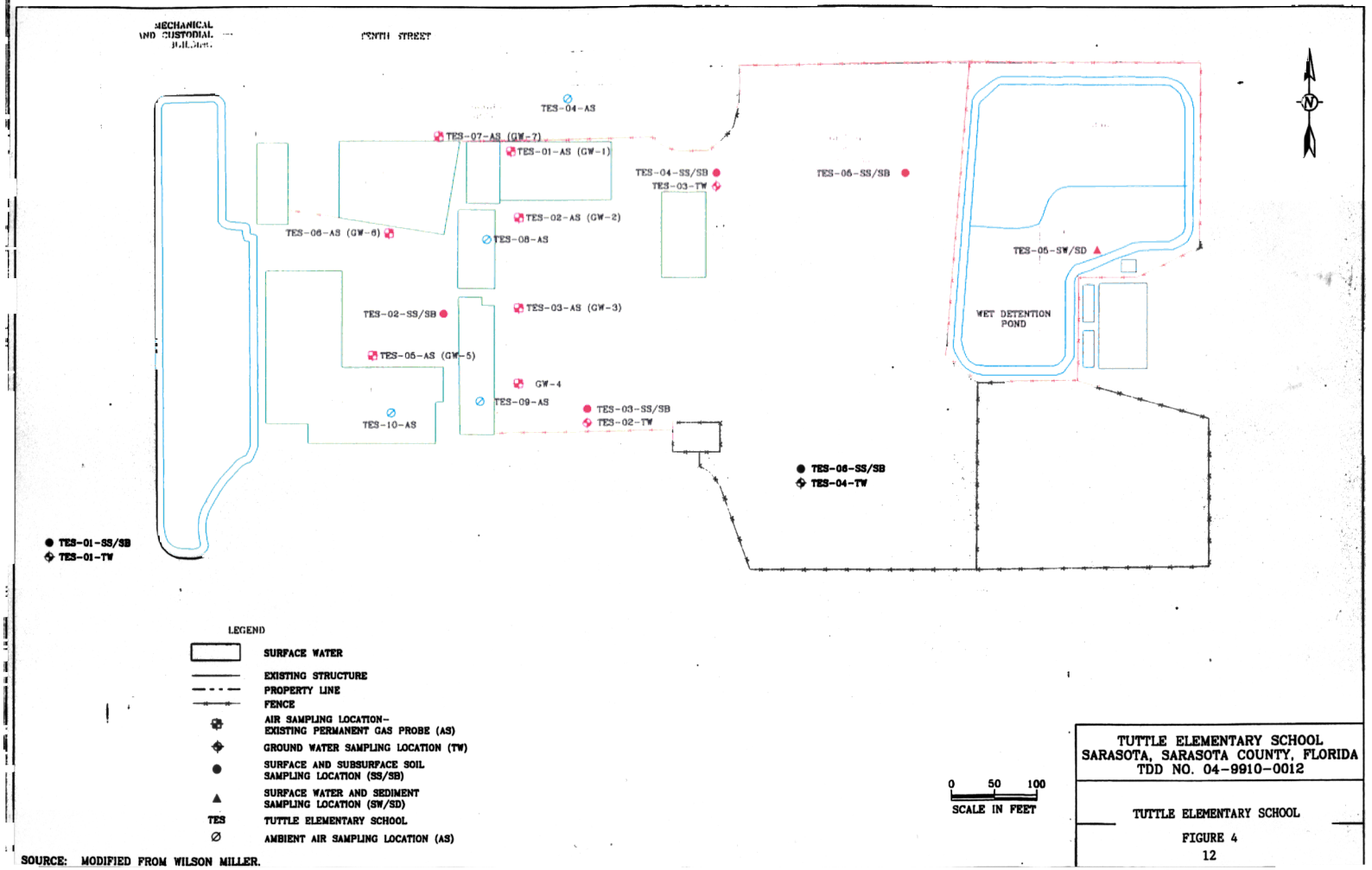

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FIGURE 4
12

ATSDR GLOSSARY OF TERMS

LEL - lower explosive limit - the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25 degrees centigrade and atmospheric pressure

ppm - parts per million

ppmv - parts per million by volume

Public Health Hazard - the health hazard category that is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

UEL - upper explosive limit - the highest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25 degrees centigrade and atmospheric pressure

CERTIFICATION

The Florida Department of Health, Bureau of Environmental Epidemiology prepared the Tuttle Elementary School Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It followed approved methodology and procedures existing at the time it began.

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.

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

APPENDIX

Attachment 1: Press Release dated January 19, 2000- EPA Conducts Investigation at Tuttle Elementary School in Sarasota, Florida

Attachment 2: Newspaper article from Herald Tribune dated January 25, 2000 - EPA to Check Methane Levels at Tuttle Elementary School

EPA United States Environmental Protection Agency

Region4 serving the southeast

Press Release

January 19, 2000

EPA CONDUCTS INVESTIGATION AT TUTTLE ELEMENTARY SCHOOL IN SARASOTA, FLORIDA

The U.S. Environmental Protection Agency is conducting an investigation at Tuttle Elementary School in Sarasota, Florida. The investigation is being conducted under the authority of the Comprehensive Environmental Response and liability Act (CERCLA, also known as Superfund) to determine if the site presents risk to human health and the environment that are sufficient to warrant further investigation and/or remediation.

A Preliminary Assessment of the site concluded that the school did warrant a Site Inspection due to concerns regarding soil exposure and groundwater migration. To date, EPA has collected air, surface and subsurface soil, surface water, sediment and groundwater samples as part of the assessment of the site. Analysis of the samples is ongoing. Also, EPA will undertake further work within the next two weeks to determine rates of methane gas movement and will work to identify the potential exposure in the area.

Tuttle Elementary School is located on the corner of Tuttle Avenue and Eighth Street in Sarasota. The new school occupies the western section of 19 acres owned by Sarasota County, which also includes a former municipal landfill. The landfill was operational from the late 1950s to the late 1960s. Since the landfill was active before existing environmental regulations, complete information is unavailable regarding the types of waste deposited in the landfill.

Recognizing that most landfills generate methane gas, a potentially explosive gas, as well as other gases, measures were

taken to minimize the possibility of methane gas accumulation inside the school buildings. This included placing impermeable material between the landfill material and the building's foundation and the installation of horizontal pipes to allow any gases which might accumulate to passively vent to the outside air. Based on available information, these measures have been effective. In addition, seven gas wells were installed to monitor methane gas concentrations in the vicinity of the buildings. Methane gas concentrations are also being monitored in the passive vent pipes.

-0- January 19, 2000

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Dawn Harris, EPA Press Relations, 404-562-8421


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EPA to check methane levels at Tuttle Elementary School

posted 01/25/00

By Jill Barton
STAFF WRITER

Second-graders, from left, Andrea Hernandez, 7, Flor Dimas, 7, and Cinthia Cohoone, 6, team up on arithmetic homework Monday as they wait for their parents to pick them up at Tuttle Elementary School.(STAFF PHOTO/MICHAEL BARRIENTOS)

The U.S. Environmental Protection Agency will investigate over the next few months whether an old landfill beneath Tuttle Elementary School poses a threat to the school's 800 students and employees.

Methane

• AP Business
• AP Technology
• Quotestream

SPORTS
• AP Sports

ENTERTAINMENT
• Arts
• Attractions
• Calendars
• Comics
• Crossword
• Cuisine
• Et Cetera
• Movies
• Nightlife
• Television
• Summer Camps

SERVICES

Apartments
• Auctions
• Cars
• Classifieds

Dining
E-Town
•
Employment
• New Home Tour
• Online Mall
• Business finder
- Autos
-
Computers
- Health
- Real Estate
-
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been found below the 5-month-old Sarasota school, but the facility was built with that in mind. A special design allows any gases from decomposing debris to vent to the outside air.

Although the safeguard appears effective, the agency plans to check the level and movement of the potentially explosive gas in and around the school, EPA spokeswoman Dawn Harris said.

It also will test the air, soil and water in the area and should determine in two to three months if it needs to conduct further tests or recommend a cleanup or other action, Harris said.

"Naturally, I welcome any and all testing to make sure everything's working properly, and the results seem fine so far," Principal Nancy Dubin said.

Two months before Tuttle Elementary opened last August, the Coalition to Stop Children's Exposure to Pesticides alerted the state Department of Environmental Protection about its concerns relating to the former city dump.

Because of their size, children can be at greater risk from environmental hazards.

DEP officials determined in October that the school's site needed further review, and federal authorities have since taken over the inquiry.

The landfill under the school was active in the 1950s and 1960s, when environmental regulations were not as strict, so the types of waste deposited there and the disposal practices are not fully known.

The original Tuttle Elementary opened in 1962. Sarasota County School District officials decided to replace the dilapidated, tornado-damaged facility 36 years later.

Construction crews began building the new Tuttle Elementary next to its predecessor on Brink Avenue and Eighth Street in May 1998.

Because of its location over the former dump, the $14 million school was specially constructed with a concrete slab beneath its foundation. The layer separates the building from material in the ground.

Horizontal pipes were installed to allow any accumulated gases to vent outside. And seven gas wells were added to monitor methane gas concentrations around the building.

"Methane is odorless and colorless, so we want to make sure if anything does accumulate it's vented," said

Chuck Collins, the district's construction director.

"Methane can be discovered in your backyard, but you have to be cautious with it and make sure you're handling it properly," he said. "We spent in excess of $1 million to make sure what we have is a safe building."

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