HEALTH CONSULTATION

Brown Barge Middle School
Pensacola,
Escambia County, Florida

Prepared by:
Florida Department of Health,
Bureau of Community Environmental Health
Under Cooperative Agreement with
U. S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Contents

Foreword

This document summarizes the Florida Department of Health's evaluation of soil data for Brown Barge Middle School in Pensacola. Florida Department of Health evaluates site-related public health issues through the following processes:

- Evaluating exposure: Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is found on the site, and how people might be exposed to it. Usually, Florida DOH does not collect its own environmental sampling data. Florida Department of Environmental Protection (DEP) provided the information for this Health Consultation.
- Evaluating health effects: If there is evidence that people are being exposed, or could be exposed, to hazardous substances, Florida DOH scientists will determine whether that exposure could be harmful to human health. This report focuses on public health; that is, the health impact on the community as a whole, and is based on existing scientific information.
- Developing recommendations: In this evaluation report, Florida DOH outlines its conclusions regarding any potential health threat posed by the Brown Barge Middle School site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions to be taken by other agencies, including the US Environmental Protection Agency (EPA) and Florida DEP. If, however, an immediate health threat exists or is imminent, Florida DOH will issue a public health advisory warning people of the danger, and will work to resolve the problem.
- Soliciting community input: The evaluation process is interactive. Florida DOH starts by soliciting and evaluating information from various government agencies, individuals or organizations responsible for cleaning up the site, and those living in communities near the site. Any conclusions about the site are shared with the groups and organizations providing the information. Once an evaluation report has been prepared, Florida DOH seeks feedback from the public. *If you have questions or comments about this report, we encourage you to contact us*.

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Summary and Statement of Issues

The Brown Barge Middle School is on a roughly triangular-shaped property at 151 East Fairfield Drive. This property is west of Interstate 110 South, in the eastern part of the City of Pensacola. School buildings include four interconnected main buildings, several storage and project buildings, and portable classrooms. A running track, basketball court, and the mobile home residence of the property maintenance person are on the southern part of the property. A chain-link fence borders the school.

The northern tip of the school property lies across East Fairfield Drive from a former fertilizer manufacturing facility. Agrico Chemical Company and other companies manufactured fertilizer on this property from 1889 to1975 using sulfuric acid produced on the site. Some of these companies (Appendix A) made sulfuric acid by heating the mineral pyrite in lead-lined vats. They pumped wastes from sulfuric acid and fertilizer production into ponds and spilled some on the ground. In the past, some of these wastes remained on the site as hardened “sludge” that looked like spilled cement. The Florida Department of Health (Florida DOH) has evaluated available data from samples of groundwater, soil and surface water on and near the Agrico site in seven reports since 1990 (Appendix A). Florida DOH found some elevated levels of chemicals on the site, which in the past could have presented a health hazard to people accidentally ingesting soil or groundwater at the highest levels measured.

The US Environmental Protection Agency (EPA) contractors buried solidified and stabilized soil and sediment in an on-site landfill with a slurry wall and a geo-synthetic cap, designed to minimize movement of the buried contaminants. The soil and sediment remediation process was completed in 1997. The EPA and Florida Department of Environmental Protection (DEP) required long-term groundwater monitoring to track the movement of groundwater contamination, which is on-going.

In October 2003, Florida DEP and their contractor, Ecology and Environment (E&E), took 19 surface and 9 subsurface soil samples as a follow-up to earlier limited sampling at the school (Appendix A). They screened all samples for radioactive decay during the sample collection process using a survey rate-meter. They designed their soil-sampling network to focus on the potential for exposures associated with school activities, construction of the new media center building, and construction of the Florida Department of Transportation entrance ramp extension. They also considered area-wide coverage of the school property. They analyzed these soil samples for target analyte list metals, fluoride, pesticides, polychlorinated biphenyls (PCBs), high-resolution dioxins and furans, and base, neutral and extractable compounds. They also analyzed 9 surface soil and 3 subsurface soil samples for radiochemicals. Florida DOH Bureau of Radiation Control personnel evaluated these radiochemical results and found that the radiation levels measured were typical of undisturbed, unenhanced soil and are unlikely to cause health effects.

Florida DOH determined that none of the detected chemicals were measured at levels likely to cause noncancer illness. Only arsenic and PAHs were measured above their screening values. The highest arsenic levels were measured near the drive at the front of the school, and the highest PAHs were measured near the school buildings. In areas where children or teachers are more likely to contact soil, such as the playgrounds, measured chemical levels are lower.

The screening values for arsenic and PAHs low because both are regulated as carcinogens. Florida DOH calculated the following theoretical increased cancer risks using assumptions that are unlikely to be met by schoolchildren. We assumed daily, long-term incidental ingestion of soil or inhalation of dust containing the highest measured arsenic and PAH levels:

- for PAHs by the incidental soil ingestion exposure route – an increase of 6 theoretical cases in 100,000 – this falls between increased theoretical risks described as "low" and "no apparent,"
- for PAHs by the dust inhalation exposure route – an increase of about 2 theoretical cases in 100,000 – this falls between increased theoretical risks described as "low" and "no apparent",
- for arsenic by the incidental soil ingestion exposure route – an increase of 1 theoretical case in 100,000 – described as "no apparent" increased theoretical risk, and
- for arsenic by the dust inhalation exposure route – an increase of less than 1 theoretical case in 1,000,000 – described as "no significant" increased theoretical risk.

If Florida DEP takes additional samples on the Brown Barge Middle School property, Florida DOH, Bureau of Community Environmental Health staff will evaluate any additional test results. If additional chemicals are found, Florida DOH will reevaluate exposure pathways. Florida DOH will also inform and educate nearby residents about the public health threats associated with this site.

Purpose

Florida DEP asked Florida DOH to review 2003 sampling results and participate in a public meeting to address possible health-related questions associated with the Florida DEP's site screening evaluation of the Brown Barge Middle School in Pensacola. Florida DOH agreed.

Background

Florida DEP sampled and analyzed soil from Brown Barge Middle School to determine if a release of hazardous substances had occurred and/or if a contaminant source is present on the school property. They also wanted to determine if the property has been impacted by contamination that may have migrated from the former Agrico Chemical Company (ACC) and/or the former Escambia Treating Company National Priorities List site. DEP initiated this evaluation in response to requests from citizens to conduct follow-up sampling at the school to further evaluate the possible soil contamination that was reported in the EPA's April 1996 Field Investigations for the Escambia Treating Company Relocation Evaluations Pilot. Based on the chemical levels measured in these October 2003 soil samples, Florida DEP decided that their contractors should take additional samples to determine the extent of soil contaminant levels above state soil cleanup target levels (Ecology and Environment [E & E] 2004).

Site Description and History

The Brown Barge Middle School is on a 7.25-acre property at 151 East Fairfield Drive in Pensacola, Florida. Figure 1 shows the site location and a one-mile radius around the site. Figure 2 shows a footprint of buildings and other site features. There are four interconnected main buildings, storage and project buildings, and portable classrooms in the center of the property. A parking lot is located north of the school, and a running track, basketball court, and the mobile home residence of the school maintenance person are located on the southern part of the property. In 2004, the Escambia County School board plans to build a Media Center on the grassy area north of the track. The Florida Department of Transportation (FDOT) purchased the northernmost 40 to 50 feet of the property to expand the Interstate 110 entrance ramp.

Brown Barge Middle School was built in 1955 on what 1941 aerial photos show to be vacant property. Although these photos show dirt roads on the property, no industrial or commercial activities were evident (E&E 2004). The smaller buildings and parking areas were added in later years.

Demographics

In 2000, about 8,013 people lived within a 1-mile radius of a point in the center of the site. Approximately 76% were black or African American and 21% percent were white. All other racial/ethnic groups made up less than 1%, with about 1% being two or more races (Bureau of the Census, U.S. Department of Commerce 2000). The neighborhood west of the site is low to lower-middle income. There are 5 other schools (Booker T. Washington, Pickens, Jehovah Lutheran, Petree and Semmes), and University Hospital and Clinic hospital, within 1 mile of Brown Barge Middle School.

Land Use

Brown Barge Middle School is in downtown Pensacola. The area within one mile of the site is mixed residential, light industrial, and commercial. East Fairfield Drive borders the north school boundary. North of the site, across Fairfield Drive, are the Agrico Chemical Company, a borrow pit operation, and a sand-and-gravel supply business. The Escambia Treating Company is about $^{2}/_{3}$ mile northwest of the school. Northeast of the site are the CSX railroad yard and a residential neighborhood. Immediately east of the property are Roosevelt Drive and Interstate 110 (I-110). Land use east of I-110 is mixed-use commercial and residential. Commercial and residential properties are west of the school's western boundary. The property to the south is owned by the Escambia County School Board and is used as a school bus depot, for storage and maintenance, and includes the J.E. Hall Center (which formerly was a high school). A residential neighborhood is south, across Texar Drive.

Natural Resource Use

Potable water for this area comes from the Sand and Gravel aquifer. Locally, this aquifer is about 300 feet thick and is made up of poorly sorted, coarse-grained, quartz sand. The interconnected spaces between the aquifer sediments allow rapid groundwater movement, making the aquifer vulnerable to groundwater contamination.

Community Health Concerns

Because of the school's proximity to nearby hazardous waste sites, a student and the student's parents wanted to know if chemicals had gotten on to the property soil from movement of airborne particles or surface water runoff. To address these concerns, Florida DEP developed the school soil-sampling plan, which they call the "Scope of Work" in 2003. They based the work plan on their September 8, 2003, site visit findings, and the results of their meetings with representatives from Escambia County, the City of Pensacola, the Brown Barge Middle School, and their contractor Ecology and Environment (E&E).

Florida DEP and their consultant E&E designed the Brown Barge Middle School (BBS) site evaluation to address the potential for chemical releases on the school property. Their listed data quality objectives were:

- "determine if a release of hazardous substances has occurred and/or if a contaminant source is present at the BBS (Brown Barge Middle School) property;
- review historical records and aerial photography to determine if past operations or activities at the site(s) have impacted the property;
- collect surface soil samples (0-3 inches) and conduct laboratory analyses to evaluate the potential for soil contamination to obtain sufficient information for FDOH to evaluate the potential for exposure to soil contamination;
- collect soil samples (0-2 feet) and conduct laboratory analyses to determine the potential for soil contamination as it relates to potential exposure associated with future construction activities or disturbance of soils;
- evaluate the potential impact to soils within the BBS property that may have occurred as a result of potential airborne and stormwater contaminant migration from the Agrico Chemical Company and Escambia Treating Company sites; *(and)*

- evaluate data generated during this Expanded Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Screening to determine if the EPA or the Florida DEP requires further action at the BBS. The sampling data will be evaluated as it relates to EPA's Hazard Ranking System criteria and compared to Florida DEP's Soil Cleanup Target Levels."

On April 19, 2004, DEP held a public meeting with their contractor E&E at the Brown Barge Middle School, from 6:00 to 8:30 pm, to discuss the October 2003 sampling results. Connie Garrett, Health Assessor with the Florida DOH, attended the meeting. During the meeting, Ms. Garrett discussed her public health evaluation of these sampling results. Ms. Garrett also listened and noted those health concerns she had not addressed.

Addressing Community Health Concerns

In a brief presentation during the meeting, Ms. Garrett noted total equivalency (TEQ, for an explanation see Appendix B) PAHs and arsenic were the chemicals measured at or above Florida DOH's health-based screening values. She explained that when calculating exposure levels, she assumes a child will eat 200 milligrams of soil (about the weight of 2 postage stamps) contaminated with the highest levels of chemical measured, daily, for three years. She assumes the child weighs about 30 pounds. She noted that the chemical exposure amounts that she calculated per weight (also known as the dose) would be unlikely to cause noncancer health effects. She said she based this evaluation on arsenic and PAH doses linked with illnesses in medical and animal studies. She gave the theoretical risks of increased cancer from inhalation and ingestion (accidentally eating contaminated soil or breathing contaminated dust) and explained that the risks varied for arsenic and PAHs. With daily, long-term ingestion and inhalation of <u>the highest measured chemical levels on the site those theoretical risks might be</u>:

- ☑ an increase of 6 theoretical cases in 100,000 for incidental ingestion of PAHs in soil — this falls between increased theoretical risks described as "low" and "no apparent,"
- ☑ an increase of about 2 theoretical cases in 100,000 for inhalation of PAHs in dust – this falls between increased theoretical risks described as "low" and "no apparent",
- ☑ an increase of 1 theoretical case in 100,000 for incidental ingestion of arsenic in soil — described as "no apparent" increased theoretical risk, and
- ☑ an increase of less than 1 theoretical case in 1,000,000 for inhalation of arsenic in dust — described as below the "no significant" increased theoretical risk level.

She also explained that it would be unlikely for all the exposure assumptions to be met, making the theoretical risks of increased cancer due to ingestion of contaminated soil or inhalation of contaminated dust even less. The highest arsenic levels were measured near the circular drive at the front of the school, and the highest PAHs were measured near the school buildings. In areas where children or teachers are more likely to contact soil, such as the playgrounds, measured chemical levels are lower.

An audience member **asked** Ms. Garrett **about dermal exposure to soil contaminants.** The relatively low concentrations of arsenic and PAHs and their ability to bind with soil make them less likely to be a dermal exposure hazard. Often the clay and organic (plant and animal) material in soil bind with the chemical contaminants. This makes the contaminants less likely to let go of the soil and enter through the skin. Medical reports show workers having direct skin contact with high levels of inorganic arsenic dust developed skin redness and swelling with papules (pimples) and vesicles (blisters) in severe cases. However, the arsenic levels that might cause contact dermatitis are very much higher than arsenic levels measured on the site (ATSDR 2000). These dermal exposure studies indicate that although direct contact may be of concern at high exposure levels, they do not suggest that lower levels are likely to cause significant irritation.

Worker exposures to high levels of PAHs show cancers (skin, bladder, lung and gastrointestinal) are the most significant endpoint of PAH toxicity. Long-term worker PAH exposures have been linked with skin and eye irritation, photosensitivity, respiratory irritation (with cough and bronchitis), leukoplakia[1], precancerous skin growths enhanced by exposure to sunlight, erythema[2], skin burns, acneiform lesions, mild hepatoxicity, and haematuria[3]. Also several PAH compounds are immunotoxic, and some suppress selective compounds of the immune system. As with arsenic, workers' dermal exposure studies indicate that although direct contact may be of concern at high exposure levels, they do not suggest that lower levels are likely to cause significant irritation (Goodfellow et al. 2001).

An audience member asked if there were areas where children should not be allowed to play, based on these data. Mr. Sharp of the Escambia County school board called and emailed Ms. Garrett in January when the testing results came back from the laboratory, asking the same question. After Ms. Garrett screened the data, she plotted the occurrences of soil with chemicals above their screening values on a map of the school. As previously mentioned, the elevated arsenic values were mainly near Fairfield Drive and the elevated PAH TEQs were near the brick school buildings. Elevated chemical levels were not measured on or near fields and other areas where children are likely to play.

At the meeting DEP pointed out that, one of the locations of elevated arsenic (inside the running track) on Ms. Garrett's preliminary map was incorrect, probably due to her error in matching the sample number to the sample location. She corrected that map for this report. Generally, with incidental soil ingestion, Florida DOH is concerned with activities where soil can get on the hands and then accidentally into the mouth. Ms. Garret suggested to Mr. Sharp that students should not plant butterfly or vegetable gardens near the circular drive at the front of the school until DEP and the school board had decided on corrective measures to prevent exposure to contaminated soil. Landscaping personnel will carry out most dust generating activities, and they should wear dust masks when the weather is dry to prevent excessive exposure to silica (sand) dust, a naturally occurring carcinogen, as well as the chemicals that have been measured on the site.

An audience member asked **if there are child sensitive standards used for determining increased cancer risks**. The cancer slopes we use to calculate increased cancer risks are the same for adults and children for a given chemical, but this is not the reason the doses we calculate for exposure and cancer risks are about the same as for both children and adults. We

[1] Leukoplakia is a common, is a common, potentially pre-cancerous disease of the mouth that involves the formation of white spots on the mucous membranes of the tongue and inside of the mouth. Despite the increased risk associated with having leukoplakia, many people with this condition never get oral cancer

[2] Erythema nodosum is an inflammation of subcutaneous fat tissue.

[3] Haematuria is passage of blood in the urine.

assume adults will ingest less soil and weigh more, which makes the amount of chemical per body weight (the dose) about ten times less for adults than for children. However, we also assume adults' exposure durations could be about ten times as long. We use 30 years instead of 3, so adults' lower exposure levels are negated by their long assumed exposure duration.

Another community member **asked if the health consultation considered the synergistic effects of chemical exposure.** Epidemiologic studies have shown that individuals exposed to both metals and PAHs have increased incidences of cancer, especially lung cancer[4]. Several National Institute of Environmental Health Sciences (NIEHS) researchers are looking at the synergistic effects of arsenic and PAHs under the Superfund Basic Research Program[5]. The long-term goal of this research is to develop a means to predict the health risks arising from exposure to metals and PAHs chemical mixtures[6]. While synergistic effects may be seen for high levels of exposure in research studies, it may still be difficult to link low level exposures with the same results, even in a controlled study.

An audience member also **asked about what would occur at the school to clean up the soil and what cleanup levels would be required**. It is Florida DOH's understanding that DEP will work with the school board to determine the soil remediation necessary.

After the meeting, an audience member handed written questions to one of the DEP staff. She made a copy of the following questions for Florida DOH:

- **What symptoms can we expect in case of contamination with these toxics?**
- **Are the kids going to be tested?**
- **When is the cleanup going to start?** (This is an issue between DEP and the Escambia County School Board).

Symptoms from on-site exposure are not likely. Florida DOH evaluated the available data for possible public health implications. We calculated theoretical exposure amounts for children and adults using assumptions that may not be met on this school property. We used a smaller child (30 pounds), ingesting 200 milligrams (equivalent to the weight of 2 postages stamps) of soil every day (school does not meet every day) for three years. We also assumed the child would ingest only soil with the highest measured level of contamination, even though the areas of contamination are not in play areas or other areas where the child might accidentally eat soil. **The doses we calculated using these conservative assumptions were below levels linked with non-cancer symptoms in medical reports and animal studies. It might also be unlikely to see any cancer increases given the numbers of students relative to the theoretical statistical increase (the greatest theoretical increase we calculated was 6 in 100,000), and because**

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[4] http://niem.med.nyu.edu/superfund/project1.html

[5] The NIEH is one of 27 Institutes and Centers of the National Institutes of Health (NIH),which is a component of the Department of Health and Human Services (DHHS). The Superfund Basic Research Program is a federally funded basic research program at NIEH that operates in cooperation with the EPA.

[6] http://www.eh.uc.edu/superfund/scientists/Project1.asp Their research will test the hypothesis that metals exposure enhances cell DNA methylation. The research group believes this change may act like a switch in the control of gene activity, increasing the susceptibility of DNA to PAH-induced damage.

children this age might be less likely to accidentally eat soil from the school grounds, especially in non-play areas.

Again emphasizing that it is unlikely that the cancer increases we calculated would be predictive because ***actual exposure levels will not be (or were not in the past) this high***, we give the following information on cancers to answer the community member's question. Cancers associated with workers exposed to elevated levels of **PAHs** occur at the points of contact, on the skin through dermal contact and in the lungs via inhalation, as well as bladder and gastrointestinal from swallowed amounts. In animal studies, tumors have also formed at locations other than contact, for example lung tumors after dermal exposure. From lowest to highest dose cancer effect levels, chronic **arsenic** exposures have been linked to lung, basal and squamous cell skin cancers, liver cancer (haemangioendothelioma), urinary tract cancers (bladder, kidney, prostate, ureter, and all urethral cancers), and intra-epidermal cancers (ATSDR 2000 and Dr. Selene Chou, personal communication).

Florida DOH is not recommending testing children for arsenic or PAHs because the levels of chemicals measured were relatively low, and those samples that contained PAHs and arsenic above the screening values did not come from areas where children are likely to play. Results from animal studies show that PAHs do not tend to be stored in the body for long periods of time and tissues in the body change PAHs to many other substances. While PAHs may be stored temporarily in the kidneys, liver, fat, spleen, adrenal glands and ovaries, most PAHs that enter the body leave within a few days, primarily in the feces and urine (ATSDR 1995). PAHs or their metabolites measured in urine, blood or body tissues can show exposure to PAHs, but cannot be used to predict whether any health effects will occur or to determine the extent or sources of PAH exposure. Arsenic also does not stay in most body tissues for very long, so measurement of arsenic in urine is reliable only for detecting arsenic exposure within the last week or so. Many urine tests do not measure the different forms of arsenic, and this can be misleading because nonharmful forms of arsenic in fish and shellfish can give high readings, although someone has not been exposed to a toxic form of arsenic. Tests of hair and fingernails can tell about exposure to high levels of arsenic over the past 6 to 12 months, but these tests are not useful in detecting low-levels of arsenic exposure. If high levels of arsenic are detected in hair and fingernails, unless more is known about the exposure, it is usually not possible to predict whether a person will have harmful health effects (ATSDR 2000).

Following the meeting, DEP sent Florida DOH data collected by the Florida Department of Transportation in preparation for road construction north of the school. Florida DOH will evaluate this information for public health concerns in another Health Consultation.

Discussion

In this section, Florida DOH reviews the soil data to identify current levels of chemicals present on the school grounds. Next, Florida DOH reviews possible ways people might come into contact with those chemicals. Finally, Florida DOH evaluates whether the measured levels of chemicals might cause adverse health effects if people are exposed to them.

Public health consultations attempt to moderate the uncertainties inherent in the health consultation process by using conservative assumptions when estimating or interpreting health risks. Also, the health-based values (established by the ATSDR, EPA and DEP) Florida DOH uses to screen the data include wide margins of safety. The assumptions, interpretations, and recommendations made in this public health consultation are intended to protect public health.

Environmental Contamination

In this section, Florida DOH reviews soil data collected in October 2003. Florida DOH evaluated the sampling adequacy and identified arsenic and PAHs as the contaminants of concern. Florida DOH selected contaminants of concern by considering the following factors:

1. Comparisons of the maximum concentrations of contaminants identified at the site to ATSDR- and Florida DEP published standard comparison values for contaminated environmental media for which a completed exposure pathway, or potential exposure pathway, is found to exist at the site. Standard comparison values are specific to the type of environmental media (water, soil, sediment) that is contaminated. These standard comparison values are used to select site contaminants for further evaluation. These values are not used to predict health effects or to establish clean-up levels. When site contaminants are found to have media concentrations that are above ATSDR's chemical-specific standard comparison values, the contaminant is selected for further evaluation. This does not necessarily mean that a contaminant represents a health risk. Site contaminants that fall below an ATSDR chemical-specific standard comparison value are unlikely to be associated with illness, and consequently are not evaluated further, unless the community has expressed a specific concern about the contaminant.
2. Community health concerns. These are concerns expressed by members of the nearby community about possible adverse health effects from exposure to site contaminants.
3. Comparisons of maximum site concentrations found in completed and potential exposure pathways to toxicological information published in ATSDR's chemical-specific Toxicological Profiles (available on the Internet at http://www.atsdr.cdc.gov/toxpro2.html - %20A). These chemical-specific profiles summarize information about the toxicity of chemicals from the scientific literature.

Florida DOH used the following standard comparison values, in order of priority, to select the contaminants of concern:

1. Cancer Risk Evaluation Guide (CREG). A CREG is the contaminant concentration estimated to result in no more than 1 excess cancer per 1 million persons exposed during a lifetime (i.e., 70 years). CREGs are calculated from the EPA-established cancer slope factor (ATSDR 1992).
2. Environmental Media Evaluation Guide (EMEG). An EMEG is derived from the ATSDR-established Minimal Risk Level (MRL), using standard exposure assumptions (e.g., ingestion of 200 milligrams of soil per day and body weight of 30 kilograms (kg) for children). MRLs are estimated levels of daily human exposure to a chemical for a period of 1 year or longer which is likely to be without any appreciable risk of noncancerous illnesses.
3. Soil Target Cleanup Levels (SCTLs). In addition to the other criteria, we used Florida DEP soil cleanup target levels (SCTLs).

Identification of a contaminant of concern in this section of the report does not necessarily mean that exposure to the contaminant will cause illness. Identification of contaminants of concern helps narrow the focus of the public health consultation to those contaminants that pose a potential public health risk to area residents.

DEP and E&E collected 19 surface soil samples from ground surface to 3 inches below the level of ground surface to evaluate risks associated with school activities. They determined 9 subsurface soil samples were adequate to evaluate exposure scenarios during on-site construction activities. They selected areas of proposed construction of the new media center and the FDOT East Fairfield Drive widening/entrance ramp. They co-located 4 subsurface soil samples with the surface samples (BBSSB-1, 2, 3 and 4) and composited soil for the sample from 3-24 inches deep. They composited soil from soil 0-24 inches below land surface for the other 5 subsurface samples. DEP and E&E collected BBSSB-1 for background comparison.

Quality Assurance and Quality Control - Florida DOH used EPA Region IV Laboratory data to prepare this public health consultation. Florida DOH assumed that these data are valid. The completeness and reliability of the referenced environmental data determine the validity of the analyses and conclusions drawn for this public health consultation.

Exposure Pathways

Most chemical contaminants in the environment will only harm people through direct exposure. It is essential to determine or estimate the frequency of contact people could have with hazardous substances in their environment in order to assess the public health significance of the contaminants.

Accidental ingestion of soil could occur if teachers or children got soil on their hands and then put their hands into their mouths. Teachers or children could inhale dust in windy conditions, or maintenance people could inhale dust if they were operating power machinery when soil conditions were dry. Remediation, construction, or landscaping workers could be exposed through incidental ingestion or skin contact with on-site surface soil or through inhalation of dusts, currently or in the future. Cleanup work, construction, or other activities such as mowing might result in incidental exposure to contaminants in surface soil or dusts.

Public Health Implications

Florida DOH evaluates exposures by estimating daily doses for children and adults. Kamrin (1988) explains the concept of dose in the following manner:

> . . .all chemicals, no matter what their characteristics, are toxic in large enough quantities. Thus, the amount of a chemical a person is exposed to is crucial in deciding the extent of toxicity that will occur. In attempting to place an exact number on the amount of a particular compound that is harmful, scientists recognize they must consider the size of an organism. It is unlikely, for example, that the same amount of a particular chemical that will cause toxic effects in a 1-pound rat will also cause toxicity in a 1-ton elephant.
>
> Thus instead of using the amount that is administered or to which an organism is exposed, it is more realistic to use the amount per weight of the organism. Thus, 1 ounce administered to a 1-pound rat is equivalent to 2,000 ounces to a 2,000-pound (1-ton)

elephant. In each case, the amount per weight is the same; i.e., 1 ounce for each pound of animal.

This amount per weight is the *dose*. Dose is used in toxicology to compare the toxicity of different chemicals in different animals. The units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day) are used to express doses in this public health consultation. A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds.

To calculate the daily dose of each contaminant, Florida DOH uses standard assumptions about body weight, ingestion and inhalation rates, duration of exposure (period of time), and other factors needed for dose calculation (ATSDR 1992, EPA 1997). We assume that people are exposed daily to the maximum concentration measured at the site. ATSDR's toxicological profiles on contaminants discuss toxicity from three exposure routes - inhalation, ingestion, and dermal (skin) exposure. For each of these exposure routes, ATSDR also groups health effects by duration (time period) of exposure. Acute exposures are those with a duration of 14 days or less; intermediate exposures are those with a duration of 15 - 364 days; and chronic exposures are those that occur for 365 days or more (or an equivalent period of time for animal exposures). ATSDR Toxicological Profiles also provide information on the environmental transport and regulatory status of contaminants.

To estimate exposure from incidental ingestion of contaminated soil, Florida DOH used the following assumptions (EPA 1997):

1) children 1 - 4 years of age ingest an average of 200 mg of soil per day,
2) adults ingest an average of 100 mg of soil per day,
3) children 1 - 4 years of age weigh an average of 15 kg,
4) adults weigh an average of 70 kg,
5) children and adults ingest contaminated soil at the maximum concentration measured for each contaminant.

Florida DOH determined that none of the chemicals measured in soil for this site evaluation were at levels likely to cause non-cancer health effects. Arsenic and total equivalency polycyclic aromatic hydrocarbons (TEQ PAHs ***Table 9 Appendix*** *B*) have low health-based screening levels because they are regulated as carcinogens and both were measured on the site above the cancer-screening values. ***We discuss the theoretical increases in cancer that might result with daily ingestion of soil containing the highest measured levels of arsenic and PAHs in the following section***. The highest arsenic levels were measured near the circular drive at the front of the school, and the highest PAHs were measured near the school buildings. However, in areas where children or teachers are more likely to contact soil, such as the playgrounds, measured chemical levels are lower. Before site remediation, high levels of fluoride were measured in Agrico soil. The source of these chemicals is not known at this time. Because fluoride levels were not elevated in school soils and soil fluoride levels were very high on the Agrico site, it seems less likely that the source of the arsenic and PAHs measured above their screening levels was movement of soil off the Agrico site.

Florida DOH calculated the theoretical increased statistical risk for cancer for children and adults for the highest level of **TEQ PAHs** measured:

- for the incidental soil ingestion exposure route – an increase of 6 theoretical cases in 100,000 – this falls between increased theoretical risks described as “low” and “no apparent,”
- for dust inhalation exposure route – an increase of about 2 theoretical cases in 100,000 – this falls between increased theoretical risks described as “low” and “no apparent.”

Cancer increases associated with workers exposed to elevated levels of PAHs occur at the points of contact, on the skin through dermal contact and in the lungs via inhalation. In animal studies, tumors have also formed at locations other than contact, for example lung tumors after dermal exposure.

Florida DOH calculated the theoretical increased statistical risk for cancer for children and adults for the highest level of **arsenic** measured:

- for the incidental soil ingestion exposure route – an increase of 1 theoretical case in 100,000 – described as “no apparent” increased risk, and
- for the dust inhalation exposure route – an increase of less than 1 theoretical case in 1,000,000 – described as “no significant” increased risk.

From lowest to highest dose cancer effect levels, chronic arsenic exposures have been linked to lung, basal and squamous cell skin cancers, liver cancer (haemangioendothelioma), urinary tract cancers (bladder, kidney, prostate, ureter, and all urethral cancers), and intra-epidermal cancers (ATSDR 2000 and Dr. Selene Chou, personal communications).

Figure 3 shows all the locations where TEQ PAHs were measured above the 0.1 milligrams per kilogram (mg/kg) screening value. The highest values were measured near the buildings. PAHs are created when organic materials like plants are burned. PAHs are also present in asphalt and tar-roofing material and could have been deposited from roofing runoff at these site locations. PAHs did not occur above screening levels at the sample points away from the buildings.

Figure 4 shows all the locations where arsenic was measured at or above the 0.5 mg/kg screening value. The background soil location contained 0.9 mg/kg. Florida DEP’s draft arsenic value for residential land use is 2.1 mg/kg. This new value has been proposed because animal studies have shown that only about 1/3 of the arsenic ingested in soil is available for uptake by the body. Only two surface soil values on the site are above 2.1 mg/kg both were from the landscaped area in front of the school.

Child Health Considerations

ATSDR and Florida DOH recognize the unique vulnerabilities of infants and children demand special attention. Children are at a greater risk than are adults to certain kinds of exposure to hazardous substances. Because they play outdoors and because they often carry food into contaminated areas, children are more likely to be exposed to contaminants in the environment. Children are shorter than adults, which mean they breathe dust, soil, and heavy vapors closer to the ground. They are also smaller, resulting in higher doses of chemical exposure per body weight. If toxic exposures occur during critical growth stages, the developing body systems of children can sustain permanent damage. Probably most important, however, is that children depend on adults for risk identification and risk management, housing, and access to medical care. Thus, adults should be aware of public health risks in their community, so they can guide their children accordingly.

In recognition of these concerns, ATSDR developed the chemical screening values for children's exposures that were used in preparing this report. These screening values are specific to children younger than the middle school-aged children attending the Brown Barge Middle School. Therefore, these screening values would be protective of any children that might live in the mobile home on the site.

Other susceptible populations may have different or enhanced responses to toxic chemicals than will most persons exposed to the same levels of that chemical in the environment. Reasons may include genetic makeup, age, health, nutritional status, and exposure to other toxic substances (like cigarette smoke or alcohol). These factors may limit that persons' ability to detoxify or excrete harmful chemicals or may increase the effects of damage to their organs or systems.

Conclusions

Florida DOH categorizes the soil on the Brown Barge Middle School as "No Apparent Public Health Hazard." Florida DOH evaluated analyses for 19 surface soil samples and for 9 subsurface soil samples. Florida DOH determined that while arsenic and PAHs were measured at levels slightly above their screening values, these levels are unlikely to cause non-cancer health effects.

The highest arsenic levels were measured in the landscaping at the front of the school and the highest PAHs were measured near the school buildings. In areas where children or teachers are more likely to contact soil, such as the playgrounds and the running track, measured chemical levels are lower. While the source of these chemicals has not been determined, arsenic may be present in fertilizers, pesticides, mulch, and pressure–treated wood. PAHs may be present in asphalt and roofing tar. Before site remediation, high levels of fluoride were measured in Agrico soil. Because fluoride levels were not elevated in school soils and soil fluoride levels were very high on the Agrico site, it is less likely that the source of the arsenic and PAHs measured above their screening levels was movement of soil off the Agrico site.

Florida DOH calculated theoretical statistical increased cancer risks assuming **daily, long-term exposure to the highest measured levels of arsenic and PAHs measured**. For incidental soil ingestion (accidentally eating soil), the increased theoretical risk could be described as between "low" and "no apparent": we calculated an increase of 6 theoretical cases in 100,000 for PAHs and an increase of 1 theoretical case in 100,000 for arsenic. For dust inhalation, the increased theoretical risk is not likely to be significant: we calculated an increase of less than 1 theoretical case in 1,000,000 for arsenic and about 2 theoretical cases 100,000 for PAHs.

Florida DOH Bureau of Radiation Control personnel evaluated the results of 9 surface soil and 3 subsurface soil sampled for radiochemicals. They determined that the radiation levels measured were typical of undisturbed, unenhanced soil and are unlikely to cause health effects.

If Florida DEP takes additional samples on the Brown Barge Middle School property, Florida DOH, Bureau of Community Environmental Health staff will evaluate any additional test results.

If additional chemicals are found, Florida DOH will reevaluate exposure pathways. Florida DOH will also inform and educate nearby residents about the public health threats associated with this site.

Recommendations

Florida DOH recommends children and adults should avoid hand-to-mouth contact with the areas of the school property that contain slightly contaminated surface soil. The Escambia County School board should work with the Florida DEP to limit possible exposure to soils containing contaminants above DEP's Soil Target Cleanup Levels. Controls may include the following:

- ☑ providing sidewalks instead of any dirt paths the children may have worn near the buildings,
- ☑ not involving children in gardening activities near the buildings or in the landscaping near the circular drive, and
- ☑ the use of mulch to prevent soil exposure in the circular drive area.

Public Health Action Plan

If Florida DEP takes additional samples on the Brown Barge Middle School property, Florida DOH, Bureau of Community Environmental Health staff will evaluate any additional test results. If additional chemicals are found, Florida DOH will reevaluate exposure pathways.

Florida DOH will also inform and educate nearby residents about the limited public health threats identified at this site. Florida DOH will attend (attended) a public meeting with DEP at the Brown Barge Middle School on April 19, 2004.

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References

[ATSDR] Agency for Toxic Substances and Disease Registry. 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Update. Atlanta: U.S. Department of Health and Human Services. Publication No.: PB/2000/108021

[ATSDR] Agency for Toxic Substances and Disease Registry. 1998. Guidance on Including Child Health Issues in Division of Health Assessment and Consultation Documents: U.S. Department of Health and Human Services. July 2, 1998.

[ATSDR]Agency for Toxic Substances and Disease Registry. 2000. Toxicological profile for arsenic. Update. Atlanta: U.S. Department of Health and Human Services. Publication No.: PB/2000/108021

[ATSDR] Agency for Toxic Substances and Disease Registry. 2001. Soil and Water Comparison Values. Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services, Atlanta, GA

[EPA] Environmental Protection Agency. 1997. U.S. Environmental Protection Agency. Exposure Factors Handbook, Volumes I, II, and III. EPA/600/P-95/002F a, b, c.

[Florida DEP] Florida Department of Environmental Protection. 1999. Development of Soil Target Cleanup Levels, for Chapter 62-777, F.A.C. Prepared for the Division of Waste Management, Florida DEP.

[E&E] Ecology & Environment. 2004. Expanded Site Screening Evaluation for Brown Barge Middle School Site, Pensacola, Escambia County, Florida. February 2004.

Florida DOH. 1990. Preliminary Health Assessment for Agrico Chemical Company, Pensacola Florida, CERCLIS No. FLD980221857. Published by the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service on May 31, 1990.

Florida DOH. 1995a. Health Consultation for Agrico Chemical Company/Neighborhood Soil Samples, Pensacola, Escambia County, Florida CERCLIS No. FLD980221857. Published by the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service on December 21, 1995.

Florida DOH. 1995b. Public Health Assessment for Agrico Chemical Company, Pensacola, Escambia County, Florida, CERCLIS No. FLD980221857. Published by the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service on February 7, 1995.

Florida DOH. 1996a. Health Consultation for Agrico Chemical Company/EPA Grid Samples, Pensacola, Escambia County, Florida CERCLIS No. FLD980221857. Published by the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service on February 6, 1996.

Florida DOH. 1996b. Health Consultation for Agrico Chemical Company/EPA Grid Samples, Pensacola, Escambia County, Florida CERCLIS No. FLD980221857. Published by the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service on February 6, 1996.

Florida DOH. 1996c. Health Consultation for Agrico Chemical Company/EPA Grid Samples, Pensacola, Escambia County, Florida CERCLIS No. FLD980221857. Published by the Agency for Toxic Substances and Disease Registry, U.S. Public Health Service on February 6, 1996.

Goodfellow F J L, V S G Murray, S K Ouki, A Iversn, A Sparks, T Bartlett. 2001. Public health response to an incident of secondary chemical contamination at a beach in the United Kingdom, Occupational Environmental Medicine, 2001; 58;232-238 (April)

Appendix A - Chronology of Agrico Site Ownership, Use, Testing, and Remediation:

1889-1963 An unknown company produced sulfuric acid at the site the site from 1889-1920. American Agricultural Chemical Company (AACC) made sulfuric acid in addition to fertilizer from phosphatic rock, from 1920 until 1963.

1963-1972 Conoco (Continental Oil Company) made fertilizer on the site.

1972-1975 Agrico made superphosphate and mononammonium phosphate on the site.

1975-1987 The Williams Companies bought the property. By 1979 they had removed all process buildings and equipment from the site, leaving only concrete foundations and waste disposal ponds. The concrete foundations are from the fertilizer factory, storage and shipping house, and a fluorine plant. Four unlined ponds north and east of the foundations stored solid wastes for the manufacture of sulfuric acid and fertilizer. The combined capacity of these four ponds exceeded 36,030 cubic yards.

1983 EPA conducted a hazardous waste site investigation at the site. They found lead, fluoride and chromium in soil and wastewater pond samples.

1987 Freeport-McMoran bought the property from The Williams Companies.

1988, 1989 Florida Department of Environmental Regulation, now Florida DEP, investigated groundwater contamination at the site. They found elevated fluoride and sulfate levels in both shallow and deep groundwater on and down gradient from the site. In 1989, EPA added this site to the National Priorities List (NPL) of Superfund sites. The NPL is maintained by EPA and lists those hazardous waste sites that require cleanup action.

1991, 1992 Contractors for the Agrico Potential Responsible Parties conducted remedial investigations that showed the site was contaminated with arsenic, chromium, fluoride, lead, manganese, sulfate, and vanadium. Surface and subsurface soils on and off the site were also contaminated with polycyclic aromatic hydrocarbons (PAHs). Florida DOH evaluated this site information and determined chemicals on the site posed a public health hazard (the report was finalized it in 1996). On September 29, 1992, EPA issued a Record of Decision regarding the selected soil cleanup method.

1993 On February 18, 1993, EPA concluded a Consent Agreement with the Agrico Potential Responsible Parties to implement the Cleanup.

1995 EPA contractors remediated and capped soil and sediments on the site. The EPA and Florida DEP required long-term groundwater monitoring to track the movement of groundwater contamination. EPA contractors also collected 8 surface and 2 subsurface (off-site) soil samples from near the Agrico site. They analyzed the samples for PAHs, pesticides, and metals. They took 2 surface soil samples and 1 subsurface soil sample on the Brown Barge Middle School property. Florida DOH found none of these samples had chemicals at levels likely to cause cancer or non-cancer illnesses.

1996 Florida DOH and ATDSR finalize the Agrico Public Health Assessment (see 1991, 1992).

2003 Florida DEP sampled soil at the Brown Barge Middle School for radionuclides, metals, pesticides, PAHs and PCBS.

Potential Environmental and Humans Exposure Pathways (Florida DOH 1990, Florida DOH 1995a and b, Florida DOH 1996a, b, and c)

Air *On-site contaminants: None found at levels of concern***.**
EPA collected 215 perimeter air-monitoring samples in 1995 whenever remedial activity occurred on the site. They analyzed these air samples for arsenic, lead and fluoride.

Groundwater *On-site contaminants: shallow, arsenic; deep, benzene,*
Off-site contaminants: shallow, chromium; deep benzene.
Public Supply well contaminants; nitrate, chromium.
The Sand and Gravel Aquifer, is a 280-foot layer of poorly sorted, coarse-grained quartz sand in this part of the Florida panhandle. Horizontal and vertical permeability in this formation are generally very high, facilitating the movement of contaminants into groundwater flowing toward the east-southeast. In 1958, a municipal potable supply well located 1.25 miles east-southeast of the site was closed down due to low pH and high fluoride concentration. The groundwater quality in the area has continued to deteriorate in the 40 years since this public well was abandoned. Three industrial supply wells and four municipal supply wells are located down gradient from this site. The total population served by groundwater within a three-mile radius is approximately 114,000 persons. Groundwater contamination from the site reached Bayou Texar, an environmentally sensitive estuary, by 1995.

Surface Water *On-site contaminants: Fluoride.*
At the time on-site surface water was tested, liquids in the holding ponds would have come from rainwater or surface water runoff. Apparently surface water dissolved fluoride from the soil before flowing into the ponds, or fluoride dissolved from the pond sludges. Trespassers could have incidentally ingested this water, in the past.

Sediments *On-site contaminants*: *Fluoride, nitrate, and nitrite.*
It would be difficult for persons to accidentally ingest or inhale chemicals from the sediments because they were mostly hard sludge. EPA's contractors remediated these sediments between 1995 and 1997.

Surface Soil *On-site contaminants: Fluoride, chromium, PAHs, arsenic, lead, manganese sulfate, and vanadium.*
These chemicals were present at levels that could have caused non-cancer illnesses and increased cancer risks ***had long-term repeated exposures occurred.*** On-site workers and trespassers could have accidentally inhaled or ingested these contaminants.

Off-Site soil tested in the neighborhood west of the site showed elevated levels of lead (the health consult did not tell give the location where the contamination was found). Additional samples in this neighborhood showed elevated levels of lead in surface soil at a automobile garage, and elevated levels of arsenic and lead at a drum manufacturing plant. EPA took three soil samples at the Brown Barge Middle School. The Escambia School District's contractor collected 6 surface and 6 subsurface soil samples from the schoolyard. They analyzed these soil samples for PAHs. Florida DOH determined that the levels of chemicals measured in the Brown Barge Middle School soil samples taken by EPA's contractors and the Escambia County School District were unlikely to cause either cancer or non-cancer illnesses.

Appendix B - TEQs for Polynuclear Aromatic Hydrocarbons (PAHs)

Total Equivalency (TEQ)s for carcinogenic PAHs to benzo[a]pyrene: the PAH analytical results are multiplied by the following factors and then added together to obtain one number to be compared with the screening value for benzo[a]pyrene.

PAH	Toxicity Equivalency Factor
Dibenz[a,h]anthracene	5
Benzo[a]pyrene	1
Benzo[a]anthracene	0.1
Benzo[b]fluoranthene	0.1
Benzo[k]fluoranthene	0.1
Indeno[1,2,3-c,d]pyrene	0.1
Anthracene	0.01
Benzo[g,h,i]perylene	0.01
Chrysene	0.01
Acenaphthene	0.001
Fluoranthene	0.001
Fluorene	0.001
Phenanthrene	0.001
Pyrene	0.001

Source: ATSDR , 1995b.