Health Consultation

QUITMAN SR 33 MUNICIPAL SOLID WASTE LANDFILL

QUITMAN, BROOKS COUNTY, GEORGIA

MAY 10, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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

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HEALTH CONSULTATION

QUITMAN SR 33 MUNICIPAL SOLID WASTE LANDFILL

QUITMAN, BROOKS COUNTY, GEORGIA

Prepared by:

Georgia Department of Human Resources
Division of Public Health
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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GLOSSARY OF ACRONYMS

GEPD – Georgia Environmental Protection Division

GDPH – Georgia Division of Public Health

ATSDR – Agency for Toxic Substance and Disease Registry

bLSE – below land surface elevation

VOC – volatile organic compound

EPA – U.S. Environmental Protection Agency

ppb – parts per billion

EMEG– Environmental Media Evaluation Guide

CREG – Cancer Risk Evaluation Guide

CV – comparison value

mg/kg/day – milligrams per kilogram per day

MCL – maximum contaminant level

MRL – minimal risk level

SUMMARY

During routine groundwater monitoring of the Quitman SR 33 Municipal Solid Waste Landfill, Brooks County detected contaminants in on-site monitoring wells located adjacent to residential property. In response, the Georgia Environmental Protection Division (GEPD) requested that the Georgia Department of Human Resources, Division of Public Health (GDPH) provide a health consultation to determine whether exposure to site contaminants is occurring and may pose a health hazard to nearby residents.

The Quitman Landfill is a closed municipal landfill. Volatile organic compounds, including vinyl chloride, were detected in groundwater beneath the landfill. Residents using individual water wells live southwest of the landfill in the direction of groundwater flow. Additionally, soil gases including methane have migrated off-site onto adjacent residential property. GEPD is concerned about adverse health effects from exposure to contaminated well water, and vapor intrusion into homes. To protect residents from exposure to contaminants, Brooks County is conducting monitoring and clean up of contaminated groundwater.

This document contains information about the environmental transport and extent of human exposure to hazardous chemicals, conclusions about the health risks posed to residents, and recommendations intended to protect public health. A health consultation is designed to provide the community with information about the public health implications from exposure to hazardous substances at a specific site, and to identify populations for which further health actions are needed. It is not intended to serve the purpose of addressing liability, zoning, remediation, or other non-health issues.

GDPH has determined that this site poses **No Apparent Public Health Hazard** because human exposure to contaminated groundwater is occurring, but the exposure is below a level of health concern. The potential for exposure in the future is unlikely because current remediation activities are sufficient to protect public health from future exposure.

There are no recommendations at this time. GDPH will respond to all requests for public health information about this site. GDPH will review additional data if it becomes available and provide documents, including a follow-up health consultation, if appropriate.

STATEMENT OF ISSUES AND BACKGROUND

Regulated contaminants were detected in groundwater at the boundary of the Quitman SR 33 Municipal Solid Waste Landfill (Quitman Landfill) site. The landfill is located within 100 feet of residential property with individual water wells. In addition, methane has been detected beneath the ground surface on residential property. In response, the Georgia Environmental Protection Division (GEPD) requested that the Georgia Division of Public Health (GDPH) conduct an investigation to assess whether residents using wells near the landfill may be exposed to contaminants in groundwater, and to methane gas at levels of health concern.

Site Description

The Quitman Landfill is a municipal landfill located at the corner of state Highway 33 and Johnson Short Road south of Quitman, in Brooks County, Georgia, approximately eight miles north of the Florida border (Figure 1). GDPH visited the site and surrounding areas in late 2005 accompanying GEPD during a routine inspection. The site has limited access; a fence surrounding the landfill encloses approximately four acres including the mound and a sedimentation pond at the south end. A dirt road bisects the landfill property at the southwest fence line; however, the landfill property extends beyond the fence and road [1]. A subdivision was observed located to the west, within 100 feet of the Landfill boundary. Quitman Landfill is bordered to the east and north by one private property, and to the south by undeveloped county property. No buildings or confined spaces were observed adjacent to the Landfill on the one single family residence property bordering the Landfill to the east and north during the site visit (for aerial view, see Figure 2).

A known release of contaminants in shallow groundwater is migrating toward residences at the southwestern boundary of the landfill. Shallow groundwater (approximately 15 to 100 feet below land surface elevation (bLSE)) generally flows toward waterways to the southwest [1]. The nearest residential well is approximately 100 feet southwest of the landfill down gradient of the contaminated groundwater plume. Construction records are not available for this or other older residential wells in the area.

Other properties observed down gradient from the landfill are five single-family mobile homes in the Pine Heights Subdivision, developed beginning circa 1996 [2, 3, 4]. In the late 1990s, two wells were constructed to a depth of approximately 150 feet. The Upper Floridan aquifer[1] is estimated to begin 100 feet bLSE; therefore, these wells use this deep aquifer as their water source. [1, 2]. These wells were drilled, and developed using approximately 125 feet of casing, a 10-foot bentonite seal, and a 20-foot screen [2]. There is another single family home with a residential well to the northwest of the subdivision.

A public water well used to supply water to the county prison taps the Upper Floridan aquifer and is located within ½ mile down gradient of the landfill [1]. The nearest municipal water supply well is up-gradient and over two miles northwest of the site [1].

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1 Aquifer: layers of groundwater beneath land surface. In this case, the upper surficial aquifer and the Floridan Aquifer are subdivided into the Upper Floridan and Lower Floridan by confining layers. The Floridan aquifer system is comprised of a thick sequence of carbonate rocks that are hydraulically connected in varying degrees [4].

Piscola Creek, which is a part of the Suwannee River Basin, is approximately two miles south of the landfill. A small creek flows northeast to southwest in an undeveloped area just north of the landfill toward Piscola Creek (Figure 2).

Demographics

Using 2000 Census data, 76 people are living within one mile of the Quitman Landfill. The Agency for Toxic Substances and Disease Registry (ATSDR) calculated population information for individuals residing within a 1-mile radius of the site using an area-proportion special analysis technique (Figure 1). For more information about ATSDR, visit *www.atsdr.cdc.gov* or see Appendix A.

Hydrogeology

Topography, soils, and hydrogeology of an area play a key role in groundwater flow. The topography of the site is generally flat (Figure 3) [1]. Groundwater in Brooks County is shallow, ranging from an estimated 15-40 feet below ground surface, and flows from the northeast to the southwest [1]. Groundwater in the area of the landfill is layered geologically with rock/soil type and depth. Layers begin in sandy clay soils to approximately 100 feet deep, transitioning to limestone layers greater than 100 feet deep [1, 2, 5, 6].

Site History

The Quitman Landfill began operations in 1969 for permitted disposal of municipal solid waste including household garbage, animal carcasses, wood, stumps, lumber, and metal. Liquid wastes from a packing company were also disposed of at the landfill [1]. The landfill was sectioned for the various types of wastes it was to receive. Waste was disposed of at various depths, including at land surface. Initial deposits were made at the northwestern corner of the landfill [1]. Between 1991 and 1993, Brooks County made approved modifications to vertically expand the landfill.

Brooks County conducted an evaluation in 1992 to determine the hydrogeology of the area, and a contamination plume was discovered [1]. In 1993, seventeen groundwater monitoring wells were installed along the boundaries of the landfill and sampled semi-annually since 1994. In 1995, groundwater sampling determined that contamination migration had reached the site’s western boundary [1]. Since then, several additional groundwater and methane monitoring wells were installed around the perimeter of the site. In fall 1994, the landfill was closed and capped. The landfill is currently undergoing groundwater cleanup and remediation activities under post closure care, and is in compliance of its GEPD permit [7].

Since closing in 1994, GEPD has conducted regular site inspections and is requiring Brooks County to continue groundwater and methane monitoring, and soil gas sampling. Beginning in 1995, results revealed that vinyl chloride was detected above levels of health concern in two monitoring wells at the western boundary beginning [1, 2]. In 1997, methane vents were installed to reduce methane gas migration. Additional on-site methane monitoring wells, methane probes, and methane vents were installed in 1999, 2001, and 2002 [1, 2, 8]. Non-methane volatile organic compounds (VOCs) in gas form are the expected cause of the groundwater contamination plume [1, 2].

Delineation of the vertical and horizontal extent of contamination began in 1999. Results of all on-site monitoring well groundwater sampling revealed the VOC, vinyl chloride, in groundwater in several wells at the western boundary [1, 2]. Off-site methane monitoring wells and vents, and groundwater monitoring wells were installed on adjacent properties in 1999 and 2001, respectively [1]. No contaminants were detected in off-site monitoring wells [1]. Groundwater in five residential wells were sampled in the spring of 2002 and analyzed for VOCs, and none were detected.

During a routine inspection by GEPD in April 2004, several rusting 55-gallon drums were found and removed by Brooks County [7]. No further information about the drums, such as content and condition, was found.

In November 2004, vinyl chloride was detected in groundwater in an off-site monitoring well. However, vinyl chloride was not detected in this off-site well in June 2005. Follow-up sampling results were not available at the time this consultation was published. All groundwater and methane monitoring wells are currently being sampled semi-annually.

VOC landfill gases were first sampled for on site from methane probes and groundwater monitoring wells in late 2004. Several VOC gases were detected; however, based on data from on and off site wells, the gas contamination plumes had not migrated off-site. Remediation activities are ongoing to reduce the levels of landfill gases.

In late 2005, GDPH was asked to conduct an investigation to determine whether exposure to site contaminants is occurring and may pose a health hazard to nearby residents. GDPH met with GEPD and Brooks County officials, and visited the site and surrounding areas. GDPH also issued a Notice of Involvement and distributed the brochure, *Landfill Gases and Odors*, among GEPD and county officials for distribution to the public. GEPD staff and Brooks County are working with property owners to address concerns about potential well water contamination, ongoing remediation strategies, and the risk of explosion from methane gas venting from soil [9].

Health Outcome Data

No health outcome data such as cancer, mortality or birth defects were evaluated for this health consultation because the number of people exposed (fewer than 30) is too small to be evaluated. No site-specific health outcome data related to this site exist.

Physical and Other Hazards

There are no observed physical hazards on site. The site is enclosed by a locked fence, but there is site access through the fence at a few locations. However, there are no reports or concerns that the site is trespassed.

DISCUSSION

Environmental Sampling Data

Site sampling activities have been conducted at Quitman SR 33 Landfill since 1994 to characterize the extent of contamination associated with releases to groundwater and air from the site. Monitoring data include groundwater and methane off-gassing samples collected at methane probes and groundwater monitoring wells located along the perimeter on site, and off-site approximately 100 feet from the property line to the east [1]. Groundwater samples were collected from on and off-site groundwater monitoring wells in the shallow groundwater and from deep residential wells [1, 2, 10]. Monitoring well depths range between 25 and 57 feet [1]. All residential wells are probably drilled and tap the Upper Floridan Aquifer over 100 feet bLSE [1, 2].

Four groundwater sampling events occurred in 1994, two sampling events per year through 2004, and one sampling event in June 2005. Results revealed that one VOC, vinyl chloride, and one metal, cadmium, were detected above health-based screening values in two monitoring wells at the western boundary in 1995 [1, 2]. No site-related contaminants have been detected in residential wells [1].

Landfill gases have been detected on site, and current remediation activities are attempting to minimize landfill gases migrating off site.

Methane has been detected 100 feet off-site on private property to the east. A methane vent was installed on private property in1999, and is regularly monitored [1]. Three additional methane vents were installed off site to the west in 2005 [1].

Exposure Pathways

GDPH determines exposure to environmental contamination by examining exposure pathways. An exposure pathway is generally classified by environmental medium (e.g., water, soil, air, food). A completed exposure pathway exists when people are actually exposed through ingestion or inhalation of, or by skin contact with a contaminated medium. An exposure pathway consists of five elements: a source of contamination; transport through an environmental medium; a point of exposure; a route of exposure; and a receptor population.

In completed exposure pathways, all five elements exist, and exposure to a contaminant has occurred in the past, is occurring, or will occur in the future. In potential pathways, at least one of the five elements is not definitely documented to be present, but could exist. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present.

GDPH reviewed the site's history, community concerns, and available environmental sampling data. Based on this review, GDPH has determined that a completed exposure pathway does not exist for this site in the past because, since no residential well water had been contaminated, there is no exposed population. However, two potential exposure pathways are identified for Quitman SR 33 Landfill and listed in Table 1.

Table 1. Exposure Pathways

Pathway	Exposure Pathway Elements					Time
	Sources	**Transport**	**Point of Exposure**	**Route of Exposure**	**Exposed Population**	
Groundwater	Migration of Contamination Plume in Groundwater	Shallow Groundwater	Residential Well Water	Ingestion, Inhalation, and Dermal Absorption	Residents	Present, Future
Ambient Air	Gas Vents	Air	Landfill Perimeter	Inhalation	Residents	Future
Vapor Intrusion	Landfill Gas	Air	Basements in New Structures	Inhalation	Residents	Future

Evaluation Process

Since a site related contaminant was detected in a residential well at a level of health concern during the most recent sampling event, a completed exposure pathway exists. Past residential well sample results did not detect any contaminants in groundwater at levels of health concern. Therefore, GDPH will evaluate present exposure to site-related contaminants in groundwater. There is potential for future exposure because the contaminated groundwater plume could migrate to residential water wells. There is also the potential for future exposure to landfill gas venting from shallow groundwater into homes. These potential exposure pathways will also be evaluated.

When a completed or potential exposure pathway exists, GDPH uses ATSDR and other established comparison values to screen contaminant levels and select chemicals of concern--a chemical that exceeds one or more comparison values--that warrant further evaluation. Comparison values (CVs) are concentrations of chemicals that can reasonably (and conservatively) be regarded as harmless, assuming the most likely conditions of exposure. The CVs include ample safety factors to ensure protection of human health. Because CVs do not represent thresholds of toxicity, exposure to contaminant concentrations above CVs will not necessarily lead to adverse health effects.

RESULTS

Groundwater

Approximately 500 samples were taken from 20 on-site monitoring wells, two off-site monitoring wells, and six residential water wells during 1994-2005 [1, 11]. Samples were obtained using U.S. Environmental Protection Agency (EPA) approved methods, and analyzed at state certified laboratories.

<u>On-site Groundwater</u>

Vinyl chloride, benzene, and cadmium have been detected above CVs on site .Vinyl chloride has been detected consistently since 1995 in several wells at the western boundary of the site. The highest concentration of vinyl chloride detected was 17.0 parts vinyl chloride per billion parts water (ppb) in 1998 from groundwater monitoring well 14A [11]. Benzene has been detected intermittently in a few wells on the western and southern perimeters. The highest level of benzene detected was 5.3 ppb in a well on the southern boundary of the landfill. Cadmium was detected above a CV (6.6 ppb) once in 2004 in monitoring well 14B on the western boundary [11]. All sampling results show a general trend of decreasing concentrations since 2001.

Table 2. Highest Concentrations Above CVs in On-Site Groundwater

Contaminant	Level (ppb)	CV* (ppb)	CV Type
Vinyl Chloride	17.0	0.03 2.0 Child: 30 Adult: 100	CREG MCL EMEG EMEG
Benzene	5.3	0.6 5.0 Child: 40 Adult: 100	CREG MCL RMEG REMG
Cadmium	6.6	Child: 2.0	EMEG
		5.0	MCL
		Adult: 7.0	EMEG

ppb: parts per billion
CREG: Cancer Risk Evaluation Guide
MCL: Maximum Contaminant Level; regulatory level established by the U.S. EPA
EMEG: Environmental Media Evaluation Guide
RMEG: Reference Dose Media Evaluation Guide
* Source: ATSDR, *Water Comparison Values,* 2/17/06

There has never been a water well on site for potable (drinking, bathing, etc.) use; therefore, there is no exposure pathway on site to workers, visitors, or trespassers. Maximum levels of contaminants in groundwater found on site are discussed in this health consultation to assess potential exposures if the contamination plume is allowed to continue to migrate toward residential properties with water wells. Current sampling and remediation efforts are acceptable public health measures to prevent future exposure.

<u>Off-site Groundwater</u>

Although off-site groundwater sampling data are available from 2002, contaminants were not detected off-site until 2004. Vinyl chloride was detected in one sample from an off-site monitoring well southwest of the landfill in November 2004. Subsequent sampling did not detect any contaminants in any off-site wells. Results are summarized in Table 3.

Cadmium and lead were detected in residential wells below CVs. Lead was detected in all residential wells in June 2005 at levels below the U.S. Environmental Protection Agency's Maximum Contaminant Level (MCL) of 15 parts per billion (ppb). No other CV currently exists for lead in drinking water; therefore, the MCL is used [13]. Exposure to lead at this level is not considered to result in adverse health effects.

Note: lead was found in all residential wells at slightly elevated levels (above normal background levels). The levels found for lead do not exceed state or federal regulatory levels, but are mentioned because repeated exposure to lead at low levels may result in adverse health effects in children. In addition to lead in well water, there are several other potential sources of lead in the environment that can lead to increased blood lead levels in children. See Appendix B for best practices to reduce exposure to all sources of lead.

Cadmium was detected in one residential well above a CV for children in June 2005. Table 3 lists the highest levels of contaminants found in residential wells that were above a CV.

Table 3: Highest Concentrations Above CVs in Residential Wells

Contaminant	Level (ppb)	Number of Wells	CV* (ppb)	CV Type
Cadmium	5.0	1	Child: 2.0	EMEG-i
			5.0	MCL
			Adult: 7.0	EMEG

ppb: parts per billion
EMEG-i: Environmental Media Evaluation Guide
MCL: Maximum Contaminant Level; regulatory level established by U.S. EPA
* Source: ATSDR, *Water Comparison Values*, 2/17/06

The highest level of cadmium found in one residential well in June 2005 was 5 ppb. This is at the MCL and above the CV for children of 2 ppb for intermediate exposure (more than two weeks but less than one year). There is no CV for chronic exposure (one year or more) to cadmium.

Toxicological Evaluation

For the groundwater pathway, ingestion is defined as *direct ingestion* or actively and passively drinking water; and, *indirect ingestion*, or inhalation of shower steam that is expelled from the respiratory tract and swallowed (ingested). It is important to note that the other route of exposure, direct skin contact (dermal absorption), may contribute additional exposure to specific contaminants but, because they are found at very low levels at this site, are considered to be minimal and not of health concern.

Cadmium is a natural element in the earth's crust and is usually found as a mineral combined with other elements. All soils and rocks, including coal and minerals, contain some cadmium. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

Based on groundwater sample results, exposure to cadmium at a level above a CV was evaluated to determine the likelihood of adverse health effects. Adult and child exposure doses were calculated for the highest concentration of cadmium detected in a residential well. Because the residential well was sampled previously in November 2002, June 2004, and November 2004, and cadmium was not detected until the sampling event in June 2005, the worst-case scenario for exposure to contaminated groundwater was established as 2 liters/day, 7 days/week, 52 weeks/year, for 1 year. This approximate exposure period is considered a conservative estimate and protective for potential maximum exposure. Appendix D contains an explanation of the equations used to estimate the exposure doses in this health consultation.

Estimated exposure doses are then compared to ATSDR's minimal risk level (MRL). A MRL is an estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects [ATSDR, *Glossary of Terms*, www.atsdr.cdc.gov]. Based on the calculations conducted using the conservative exposure scenario discussed above, there is no increased risk for adverse health effects from exposure to the levels of cadmium found in the residential well. Estimated doses for adults and children were compared to health guidelines and are presented in Table 4.

Table 4. Calculated Exposure Doses from Ingestion of Contaminants in Groundwater Compared To Health Guidelines

Contaminant	Level (ppb)	Dates Detected	Total Estimated Dose (mg/kg/day)	Health Guideline* (mg/kg/day)
Cadmium	5	11/2004	Adult: 0.00014 Child: 0.0002	MRL: 0.0002

ppb: parts per billion
mg/kg/day: milligrams per kilogram per day
MRL: Minimal Risk Level
* Source: ATSDR, *Health Guidelines*, 2/17/06

The calculated exposure doses of cadmium for adults and children at Quitman Landfill, (0.00014, 0.0002) are equal to or below the established health guideline of 0.0002 mg/kg/day (chronic oral MRL), which is considered protective of human health. The dose for children was almost 10 times lower than the no observed adverse effect level (NOAEL) of 0.005 mg/kg/day, which was established for humans undergoing lifetime exposure to cadmium where renal (kidney) damage was observed [14]. The NOAEL is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. These toxicological values are doses derived from human and animal studies that are summarized in ATSDR's Toxicological Profiles, *(www.atsdr.cdc.gov/toxpro2.html).* Therefore, non-carcinogenic adverse health effects are not expected to result from ingestion of groundwater from exposure to cadmium from this residential water well.

The EPA has determined that based on sufficient animal studies, cadmium is a probable human carcinogen (causes cancer); however, human studies are limited [14]. The International Agency for Research on Cancer classifies cadmium as a known human carcinogen based on available human data [14]. However, EPA has not established a slope factor for cadmium from which guidelines for cancer risks can be assessed (see Appendix D).

Outdoor Air

Exposure to VOC vapors present in shallow groundwater is possible through inhalation of contaminated air. Contaminants in gas form present in a shallow groundwater plume could migrate upward to the ground's surface. VOC gases are naturally attenuated (through soil adsorption, dispersion, and biodegradation) as they travel to the ground's surface and into ambient (outdoor) air, reducing the VOC concentrations that enter the air. Once in the sunlight, VOCs break down quickly and are diluted by the air. As a result of dilution with large quantities of ambient air, however, contaminants released to air will typically dissipate quickly, (further reducing concentrations), and the resulting concentrations will be very low. Exposure to VOC vapor off gassing from groundwater is not occurring because the VOCs in groundwater are at such low levels at this site. These conditions eliminate outdoor air as an exposure pathway to VOCs. Cadmium and lead do not produce vapors under the conditions found at the Landfill.

Exposure to methane gas and explosion hazards as a result of methane off-gassing from landfills is a potential health hazard to residents living near the Quitman Landfill. Sampling has shown subsurface methane gas migration from the landfill to soil on residential properties to the east [1, 3]. In response, on- and off-site methane monitoring and ventilation wells were constructed in 2001. Subsequent sampling shows methane consistently detected off-site on residential property at levels above GEPD regulatory levels. Remediation measures are being installed to ensure that methane does not migrate further onto residential properties and beneath houses.

When methane is released to ambient air, it is quickly diluted. Additionally, for methane gas to be an explosive hazard, it must collect in a confined space to a concentration at which it could potentially explode (see Appendix C for more information about methane gas); however, no confined spaces were observed in the vicinity of the methane plume. The levels of methane gas measured in outside air at this Landfill do not pose an exposure or explosion hazard [10]. For more information about methane gas hazards, please contact the GEPD Land Protection Branch.

Measures are currently in place to remediate subsurface methane gas [1]. Additionally, gas collection performed at the Landfill minimizes the impact to groundwater, thereby reducing the potential for off-site migration of methane and other contaminants in groundwater.

Indoor Air

Soil vapor intrusion is a potential health risk to residents near the site, therefore GDPH investigated this potential. Soil vapor intrusion occurs through cracks in housing foundation, windows, and floors. All existing structures adjacent to the site, however, are raised mobile homes, and are therefore not at risk for soil vapor intrusion. In addition, groundwater, methane, and vapor monitoring results show that contaminants have not migrated to adjacent structures.

Current remediation efforts are effective in preventing the contamination plume from impacting indoor air.

CHILD HEALTH CONSIDERATIONS

The ATSDR Child Health Initiative recognizes the unique vulnerabilities of young children exposed to chemicals in the environment. Because of their size, body weight, frequent hand to mouth activity, and developing systems, children require special emphasis in communities faced with contamination. Also, they receive higher doses of exposure because children's growing bodies absorb more contamination and can sustain permanent damage if exposures occur during critical growth stages.

There is no evidence that children are being exposed to contaminants from the landfill at levels that could cause adverse health effects. However, residents with young children should exercise caution that children do not trespass onto the Quitman Landfill to avoid physical hazards and exposure to the low levels of on-site contamination.

CONCLUSIONS

GDPH has determined that this site currently poses **No Apparent Public Health Hazard.** Although human exposure to contaminated groundwater is occurring, the exposure is below a level of health concern. The potential for exposure in the future is unlikely because current remediation activities are sufficient to protect public health from future exposure. See appendix E for a description of the ATSDR Public Health Hazard Categories.

Exposure to VOC vapors from contaminated groundwater did not occur in the past or present through vapor intrusion, and is unlikely to occur in the future. Residents who are concerned about vapors and methane gas exposures are encouraged to discuss their concerns with Brooks County and GEPD.

Although methane is not a health concern currently at this site, GDPH has categorized this site as an **Indeterminate Public Health Hazard** for future *public safety* issues associated with methane because remediation is not yet complete.

RECOMMENDATIONS

To protect public health, and public safety, Brooks County should continue current residential well sampling, groundwater monitoring and remediation activities to ensure that future exposures do not occur to contaminated groundwater or vapors and methane gas from the Quitman Landfill.

PUBLIC HEALTH ACTION PLAN

Actions Completed

In late 2005, GDPH staff conducted a site visit of the Quitman Landfill with GEPD. GDPH reviewed environmental sampling data to determine the extent of contamination and potential threats to public health.

GEPD and Brooks County are addressing concerns about the potential for exposure to contaminated groundwater vapor and methane and remediation activities.

Actions Planned

GDPH will continue to work with GEPD and Brooks County to protect public health near the Quitman Landfill. GDPH will review additional data and other information as it becomes available to ensure that remediation measures are successful and protective of public safety.

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12. Agency for Toxic Substances and Disease Registry (ATSDR), *Ambient Air Comparison Values*, updated January 10, 2005.

13. ATSDR, *Drinking Water Comparison Values*, February 17, 2006.

14. ATSDR, *Toxicological Profile for Cadmium*, July 1999.

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CERTIFICATION

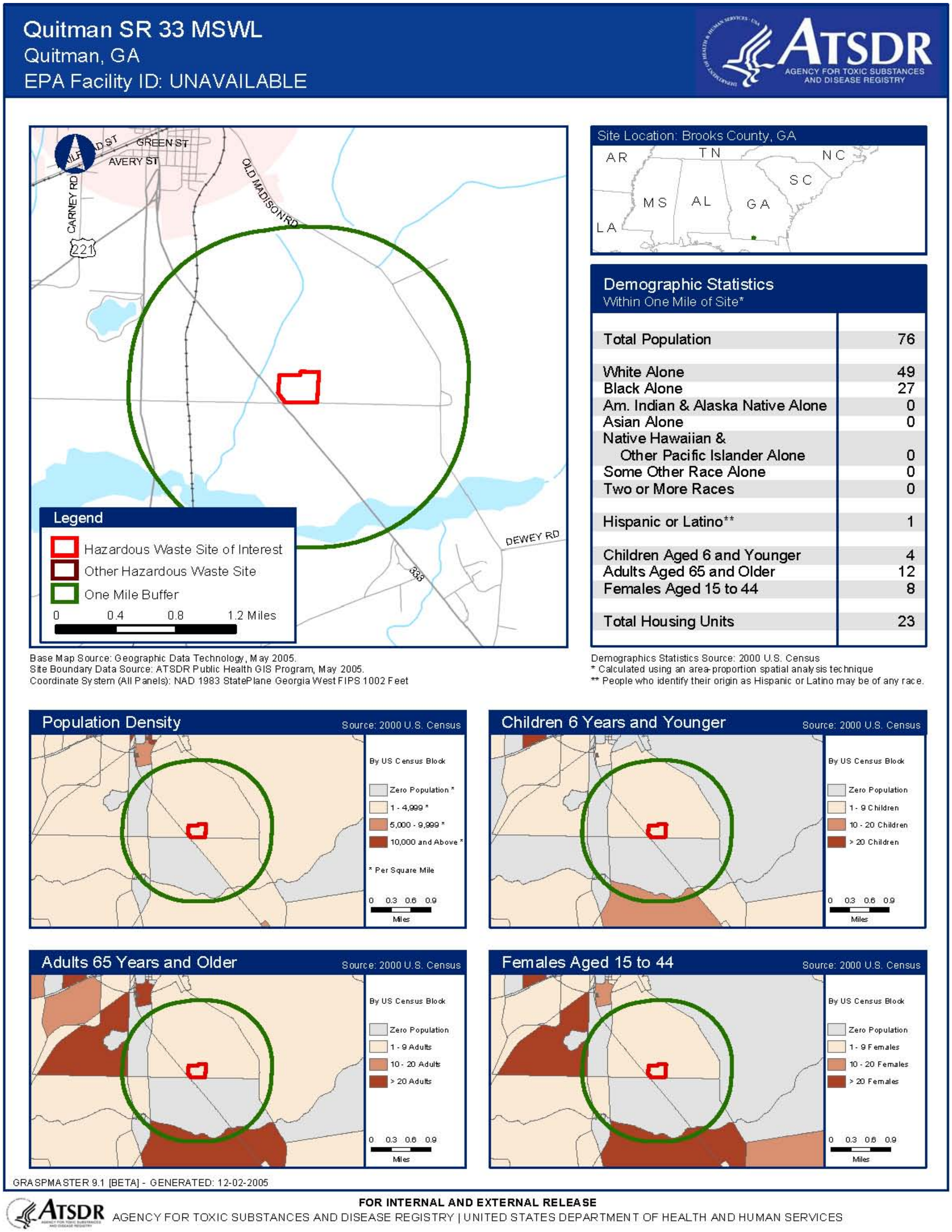
The Georgia Division of Public Health prepared this Quitman SR 33 MSWL, Quitman, Brooks County, Georgia, health consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time that the health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, SPAB, DHAC

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

Team Lead, CAT, SPAB, DHAC, ATSDR

Figure 1: Site Map and Demographic Characteristics



Demographic Statistics Within One Mile of Site*	
Total Population	76
White Alone	49
Black Alone	27
Am. Indian & Alaska Native Alone	0
Asian Alone	0
Native Hawaiian & Other Pacific Islander Alone	0
Some Other Race Alone	0
Two or More Races	0
Hispanic or Latino**	1
Children Aged 6 and Younger	4
Adults Aged 65 and Older	12
Females Aged 15 to 44	8
Total Housing Units	23

Figure 2: Aerial Photograph

Satellite photograph of the Quitman Landfill and surrounding area. The site is bordered to the north, south, and east by private residences and undeveloped land, and to the west by a subdivision.

Figure 3: West Boundary Soil Profile [1]

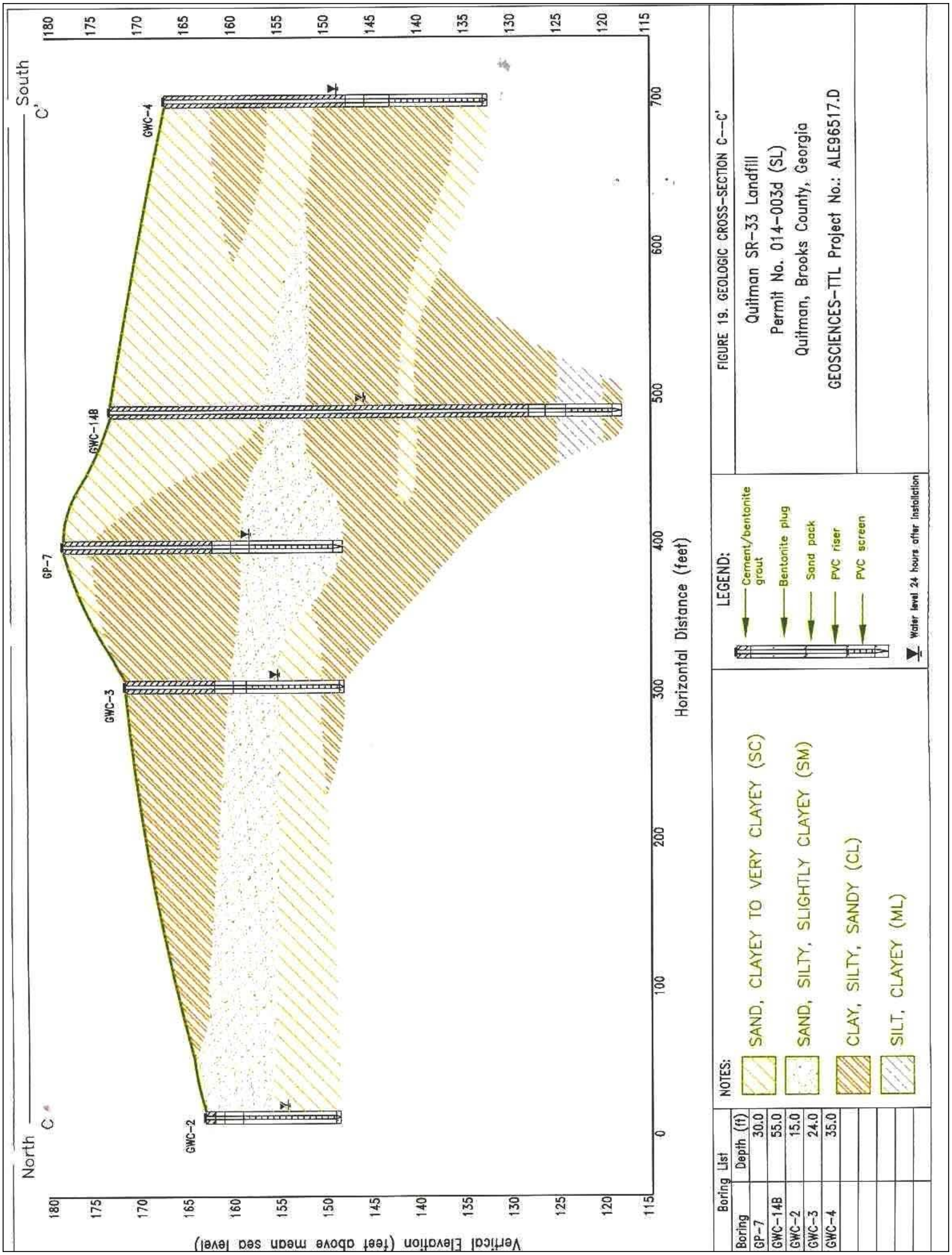


Figure 4: Site Photographs

From the western landfill boundary showing the proximity of a residence using an individual water well in the path of the groundwater contamination plume.

On-site monitoring well at the landfill boundary across the road from residential property.

Figure 4: Site Photographs (Cont.)

On-site methane ventilation well located within 100 feet of residential property to the east.

55-gallon drums removed from the Landfill by Brooks County. The contents of the drums are unknown.

APPENDICES

APPENDIX A: ATSDR PUBLIC HEALTH HAZARD CATEGORIES

ATSDR Public Health Hazard Categories

Depending on the specific properties of the contaminant, the exposure situations, and the health status of individuals, a public health hazard may occur. Using data from public health assessments and consultations, sites are classified using one of the following public health hazard categories:

Category 1: Urgent Public Health Hazard
Sites that pose a serious risk to public health as the result of short-term exposures to hazardous substances.

Category 2: Public Health Hazard
Sites that pose a public health hazard as the result of long-term exposures to hazardous substances.

Category 3: Potential/Indeterminate Public Health Hazard
Sites for which no conclusions about public health hazard can be made because data are lacking.

Category 4: No Apparent Public Health Hazard
Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

Category 5: No Public Health Hazard
Sites for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.

APPENDIX B: THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

What is the Agency for Toxic Substances and Disease Registry (ATSDR)?

ATSDR is the principal federal public health agency involved with hazardous waste issues. The agency helps prevent or reduce the harmful effects of exposure to hazardous substances on human health. The Superfund Law created ATSDR, an agency of the U.S. Department of Health and Human Services, in 1980.

Where is ATSDR located? How big is it?

ATSDR's headquarters are in Atlanta, Georgia. The agency has 10 regional offices and an office in Washington D.C. The multi- disciplinary staff of approximately 400 includes epidemiologists, physicians, toxicologists, engineers, public health educators, health communication specialists, and support staff.

What does ATSDR do?

ATSDR conducts a number of activities to help prevent or reduce the harmful effects of exposure to hazardous substances, including:

- Advises federal and state agencies, community members, and other interested parties on the health impacts of Superfund sites and other petitioned sites.
- Identifies communities where people might be exposed to hazardous substances in the environment.
- Determines the level of public health hazard posed by a site.
- Recommends actions that need to be taken to safeguard people's health.
- Conducts health studies in some communities that are located near Superfund sites or in locations where people have been exposed to toxic materials.
- Funds research conducted by colleges, state agencies, and others who study the relationship between hazardous waste exposure and illnesses.
- Educates physicians, other health care professionals, and community members about the health effects of--and how to lessen exposure to--hazardous substances.
- Provides technical support and advice to other federal agencies and state and local governments.
- Maintains registries of people who are exposed to the most dangerous substances.

What can ATSDR do to help a community that may be exposed to hazardous substances?

ATSDR helps communities in a variety of ways, including:

- Helps communities by working with them to resolve their health concerns.
- Determines whether the community is or was exposed to hazardous substances.
- Visits the community to hear residents voice their health concerns.
- Educates residents about any health hazards posed by environmental contaminants.

- Works with local health care providers to ensure they have the information needed to evaluate possible exposures to hazardous substances in their community.
- Visits a community to draw blood or to collect urine to determine if people have been or are being exposed to a hazardous substance when such actions are required.
- Provides medical monitoring in communities exposed to hazardous substances if such action is needed.

What can't ATSDR do to help a community?

- ATSDR does not have the legal authority to conduct certain activities, such as the following:
- Cannot provide medical care or treatment to people who have been exposed to hazardous substances, even if the exposure has made them ill.
- Cannot provide funds to relocate affected residents or to clean up a site.
- Cannot close down a plant or other business, but can make recommendations to the U.S. Environmental Protection Agency (EPA).

How is ATSDR's role in helping communities different from EPA's role?

Unlike EPA, ATSDR is not a regulatory agency. ATSDR is a public health agency that advises EPA on the health aspects of hazardous waste sites or spills. ATSDR makes recommendations to EPA when specific actions are needed to protect the public's health. For example, ATSDR might recommend providing an alternative water supply, removing contaminated material, or restricting access to a site. EPA usually follows these recommendations. However, ATSDR cannot require EPA to follow its recommendations.

How does ATSDR become involved with a site? How can I get ATSDR involved with a site?

ATSDR is required by the Superfund law to become involved with all sites that are on or proposed for the National Priorities List (NPL). Specifically, ATSDR conducts public health assessments of NPL sites, as well as of all sites proposed for the NPL. EPA, states, local governments, or other federal agencies may request ATSDR's help with a site, such as in cases of accidental spills or releases. Anyone may request or "petition" that ATSDR to do a health consultation. Most requests for health consultations come from EPA and state and local agencies. Anyone may also petition ATSDR to conduct a public health assessment of a site. For more information about how to petition ATSDR to conduct a public health assessment, call ATSDR's toll-free information line, 1-888-42-ATSDR (1-888-422-8737), or send an e-mail request to ATSDRIC@cdc.gov

How does ATSDR work with states and local health departments?

ATSDR has cooperative agreements (partnerships) with 23 states to conduct site-related public health assessments or health consultations, health studies, and health education. In states that have co-operative agreements, ATSDR provides technical assistance and oversees site evaluations and related activities done by state staff. ATSDR also assists local health departments.

Does ATSDR assist communities located near hazardous waste sites that are not on the NPL?

Yes. More than half of the sites ATSDR has worked at are not on the NPL.

What information does ATSDR provide through its Internet web site?

Information that can be accessed through ATSDR's web site includes these items: information about ATSDR; a database containing information on all sites where ATSDR has worked; short, easy-to-read fact sheets on 60 of the most common contaminants at Superfund sites; and links to related sites.

APPENDIX C: METHANE GAS EXPLOSION HAZARDS

Methane is the constituent of landfill gas that is mot likely to pose the greatest explosion hazard. Three conditions must be met when considering explosion hazards from landfill methane gas release.

1. The landfill must produce methane gas.
2. Methane gas must be able to migrate.
3. Methane gas must collect in a confined space *and* be at a concentration which it could explode.

Explosion hazards as a result of methane gas migration from landfills rely on all three conditions being met. Methane explosions are not a risk in outdoor air. Additional criteria are considered when addressing concerns about methane including:

How much gas is the landfill producing?
Because methane and carbon dioxide are the main components of landfill gas and these chemicals are both odorless and colorless, monitoring data are necessary to answer this question.

Is gas migrating from the landfill?
Off-site monitoring data may be necessary to answer this question.

If gas is migrating from the landfill and reaching structures, are there places for gas to collect?
Uncontrolled gases escaping from a landfill may migrate to structures on the landfill itself or in the surrounding area. However, the further a structure is from the landfill, the less likely it is that gases are migrating to it at concentrations great enough to pose an explosion threat. The most common places for gases to collect are basements, crawl spaces, or buried utility entry ports. Homes with basements, especially those with pipes or cracks in the basement that would allow gas to enter, are more likely to collect gases.

Is gas collecting at concentrations that are high enough to pose an explosion hazard?
Monitoring data are needed to answer this question. Caution should be used in selecting sampling equipment to ensure that an ignition source is not introduced into the area.

Is there an ignition source?
Gases can be ignited by many different sources, such as a furnace in the basement or a pilot light on a gas stove. Other sources may include candles, matches, cigarettes, or a spark. Because there are so many ignition sources, it is safest to assume that the potential for an ignition source is always present.

When methane is able to migrate, is being produced, and is collecting in a confined space, the greatest variable is the concentration.

Gas collection in a confined space. The gas must collect in a confined space to a concentration at which it could potentially explode. A confined space might be a manhole, a subsurface space, a utility room in a home, or a basement. The concentration at which a gas has the potential to explode is defined in terms of its lower and upper explosive limits (LEL and UEL), as defined.

Lower and Upper Explosive Limits (LEL and UEL)
The concentration level at which gas has the potential to explode is called the explosive limit. The potential for a gas to explode is determined by its 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 is explosive between its LEL of 5% by volume and its UEL of 15% by volume. Because methane concentrations within the landfill are typically 50% (much higher than its UEL), methane is unlikely to explode within the landfill boundaries. As methane migrates and is diluted, however, the methane gas mixture may be at explosive levels. Also, oxygen is a key component for creating an explosion, but the biological processes that produce methane require an anaerobic, or oxygen-depleted, environment. At the surface of the landfill, enough oxygen is present to support an explosion, but the methane gas usually diffuses into the ambient air to concentrations below the 5% LEL. In order to pose an explosion hazard, methane must migrate from the landfill and be present between its LEL and UEL.

The final consideration that must be made when addressing explosion issues with landfill gases in relation to public health is the proximity of the potential hazard to populations, and ease of access to the potentially explosive area.

References

1. Agency for Toxic Substance and Disease Registry, *Landfill Gas Primer*, November 2001

APPENDIX D: EXPLANATION OF TOXICOLOGICAL EVALUATION

Step 1--The Screening Process

In order to evaluate the available data, GDPH used comparison values (CVs) to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific environmental media (for example: air, soil, or water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, soil, or water that someone may inhale or ingest each day. CVs are generated to be conservative and non-site specific. The CV is used as a screening level during the public health assessment process where substances found in amounts greater than their CVs might be selected for further evaluation. CVs are not intended to be environmental clean-up levels or to indicate that health effects occur at concentrations that exceed these values.

CVs can be based on either carcinogenic (cancer-causing) or non-carcinogenic effects. Cancer-based CVs are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factors for ingestion exposure, or inhalation risk units for inhalation exposure. Non-cancer CVs are calculated from ATSDR's minimal risk levels, EPA's reference doses, or EPA's reference concentrations for ingestion and inhalation exposure. When a cancer and non-cancer CV exist for the same chemical, the lower of these values is used as a conservative measure. The chemical and media-specific CVs used in the preparation of this public health assessment are:

An **Environmental Media Evaluation Guide (EMEG)** is an estimated comparison concentration for exposure that is unlikely to cause adverse health effects, as determined by ATSDR from its toxicological profiles for a specific chemical.

A **Cancer Risk Evaluation Guide (CREG)** is an estimated comparison concentration that is based on an excess cancer rate of one in a million persons exposed over a lifetime (70 years), and is calculated using EPA's cancer slope factor.

Step 2--Evaluation of Public Health Implications

The next step in the evaluation process is to take those contaminants that are above their respective CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Separate child and adult exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific scenarios, using assumptions regarding an individual's likelihood of accessing the site and contacting contamination. Usually little or no information is available for a site to know exactly how much exposure is actually occurring, so assessors assume that maximum exposure is taking place. That assumption would include any worse case scenarios where someone received a maximum dose. Actual exposure is likely much less than the assumed exposure.

An explanation of the calculation of estimated exposure doses used in this public health assessment are presented below. Calculated doses are reported in units of milligrams per kilogram per day (mg/kg/day).

Ingestion of contaminants present in groundwater

Exposure doses for ingestion of contaminants present in water were calculated using the maximum detected concentrations of contaminants in milligrams per liter (mg/L [mg/L = 1000 x ppb]). The following equation is used to estimate the exposure doses resulting from ingestion of contaminated groundwater:

$$ED_w = \frac{C \times IR \times EF \times CF}{BW}$$

where;
ED_w = exposure dose water (mg/kg/day)
C = contaminant concentration (mg/kg)

IR = intake rate of contaminated medium (based on default values of 2 L/day for adults; 1 L/day for children
EF = exposure factor (based on frequency of exposure, exposure duration, and time of exposure). The exposure factor used is 1, based on exposure for 1 year, 24 hours/day, 7 days/week, 52 weeks/year.
CF = kilograms of contaminant per liter of water (10^{-6} kg/L)
BW = body weight (based on average rates: for adults, 70 kg; children, 25 kg)

* *1 year was used as the length of time for exposure because off-site contamination has not been detected in off-site wells until November 2004. There is no evidence that previous site activity contributed additional exposure and remediation will eliminate future exposure.*

Non-cancer Health Risks

The doses calculated for exposure to individual chemicals are then compared to an established health guideline, such as an ATSDR minimal risk level (MRL) or an EPA reference dose (RfD), in order to assess whether adverse health impacts from exposure are expected. Health guidelines are chemical-specific values that are based on available scientific literature and are considered protective of human health. Non-carcinogenic effects, unlike carcinogenic effects, are believed to have a threshold, that is, a dose below which adverse health effects will not occur. As a result, the current practice to derive health guidelines is to identify, usually from animal toxicology experiments, a no observed adverse effect level (NOAEL), which indicates that no effects are observed at a particular exposure level. This is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. The known toxicological values are doses derived from human and animal studies that are summarized in ATSDR's *Toxicological Profiles (www.atsdr.cdc.gov/toxpro2.html).* The NOAEL is modified with an uncertainty (or safety) factor, which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the human population. The magnitude of the uncertainty factor considers various factors such as sensitive subpopulations (e.g., children, pregnant women, the elderly), extrapolation from animals to humans, and the completeness of the available data. Thus, exposure doses at or below the established health guideline are not expected to cause adverse health effects because these values are much lower (and more human health protective) than doses, which do not cause adverse health effects in laboratory animal studies.

For non-cancer health effects, the following health guidelines were used in this public health assessment:

A **minimal risk level (MRL)** is an estimate of the daily human exposure to a chemical that is likely to be without a significant risk of harmful effects over a specified period of time. MRLs are developed for ingestion and inhalation exposure, and for lengths of exposures; acute (less than 14 days), intermediate (between 15-364 days), and chronic (365 days or greater). ATSDR has not developed MRLs for dermal exposure (absorption through skin).

If the estimated exposure dose to an individual is less than the health guideline value, the exposure is unlikely to result in non-cancer health effects. If the calculated exposure dose is greater than the health guideline, the exposure dose is compared to known toxicological values for the particular chemical and is discussed in more detail in the text of the public health assessment. A direct comparison of site-specific exposure and doses to study-derived exposures and doses found to cause adverse health effects is the basis for deciding whether health effects are likely to occur.

It is important to consider that the methodology used to develop health guidelines does not provide any information on the presence, absence, or level of cancer risk. Therefore, a separate cancer risk evaluation is necessary for potentially cancer-causing contaminants detected at this site.

Cancer Risks

Exposure to a cancer-causing chemical, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes. The estimated risk for developing cancer from exposure to contaminants associated with the site was calculated by multiplying the site-specific doses by EPA's chemical-specific cancer slope factors (CSFs) available at *www.epa.gov/iris*. This calculation estimates a theoretical excess cancer risk expressed as a proportion of the population that may be affected by a carcinogen during a lifetime of exposure. For example, an estimated risk of 1 x 10^{-6} predicts the probability of one additional cancer over background in a population of 1 million. An increased lifetime cancer risk is not a specified estimate of expected cancers. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime in his or her lifetime following exposure to a particular contaminant under specific exposure scenarios. For children, the theoretical excess cancer risk is not calculated for a lifetime of exposure, but from a fraction of lifetime; based on known or suspected length of exposure, or years of childhood.

Because of conservative models used to derive CSFs, using this approach provides a theoretical estimate of risk; the true or actual risk is unknown and could be as low as zero. Numerical risk estimates are generated using mathematical models applied to epidemiologic or experimental data for carcinogenic effects. The mathematical models extrapolate from higher experimental doses to lower experimental doses. Often, the experimental data represent exposures to chemicals at concentrations orders of magnitude higher than concentrations found in the environment. In addition, these models often assume that there are no thresholds to carcinogenic effects--a single molecule of a carcinogen is assumed to be able to cause cancer. The doses associated with these estimated hypothetical risks might be orders of magnitude lower than doses reported in toxicology literature to cause carcinogenic effects. As such, a low cancer risk estimate of 1 x 10^{-6} and below may indicate that the toxicology literature supports a finding that no excess cancer risk is likely. A cancer risk estimate greater than 1 x 10^{-6}, however, indicates that a careful review of toxicology literature before making conclusions about cancer risks is in order.