Health Consultation

E. H. Glass County Landfill

N.C. DENR Site: NCD980557607
Greensboro, Guilford County, North Carolina

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SUMMARY

The Guilford County Health Department requested the N.C. Department of Health & Human Services, Division of Public Health (DPH) to evaluate environmental data collected for the inactive E.H. Glass County Landfill to determine the potential for public health issues. This report summarizes the information reviewed by N.C. DPH and provides conclusions and recommendations. The environmental reports and data were collected by the N.C. Department of Environment and Natural Resources (DENR) and their contractors.

The inactive E.H. Glass County Landfill site consists of a 15.9 acre unlined waste disposal area ("disposal area B" in Appendix Figure 1) located across 2 properties in eastern Greensboro, Guilford County, N.C. The 2 properties are identified as located at 1103 and 1307 Nealtown Road and include a total of 57 acres. Wastes were disposed of on the site from 1965 to 1973, prior to the time of State regulations for the operation and monitoring of landfills. A second area ("disposal area A" in Appendix Figure 1) on the property was also investigated and found to not be an area of waste disposal. The site is being evaluated by DENR because the owners wish to develop the property. No environmental data are available for the inactive landfill prior to DENR's investigations.

N.C. DPH concluded:

1. *There is no indication that people have been harmed by ingestion of groundwater on the property as a primary drinking water source*.

   Groundwater in the vicinity is not currently used as a drinking water source. Records provided by the county indicate that it is unlikely that private wells were in use in the area during the time the landfill began taking waste.
2. Chemicals may be moving from the sub-surface waste disposal areas into the shallow groundwater and are being discharged into the stream. Chemicals found in the groundwater were also detected in the surface water in the unnamed stream flowing through the property adjacent to the landfill. These chemicals would not be expected to occur naturally in the groundwater or surface water.
3. *Adverse health effects were not indicated for children that play in the stream and accidently ingest small amounts of the water or sediment for the compounds that could be identified in the stream water and sediments*.

   (This assessment is based on children 1-6 years of age playing in the stream 6 hours per week, for 7 months of the year.) There is no way to assess the potential health effects of ingestion or contact with the number of unidentified chemicals that were detected in the surface water and sediment.
4. *We do not know and cannot predict the potential health risks associated with ingesting or having direct skin contact with all of the chemicals present at the property.*

A number of metals and organic chemicals were identified in the groundwater, surface water and sediment samples collected on the property. The identity and concentration of many additional organic compounds could not be confirmed ("tentatively identified compounds" included in the laboratory reports) due to limitations of the analytical methods and a lack of health-effects data.

5. *People are not likely to have been exposed to gases from the landfill. Tests indicate that landfill gases/vapors present in the subsurface in and near the waste disposal areas are not escaping through the intact soil cover*.

   Thirty (30) volatile organic compounds (VOCs) were detected in sub-surface gas samples taken in and adjacent to the waste disposal areas. Five of the VOCs (benzene, chloroform, 1,2-dichloroethane, trichloroethylene, vinyl chloride) are known or suspected human carcinogens and were detected in the sub-surface at concentrations greater than the cancer screening level (CREG). Three additional VOCs (dichlorodifluoromethane, 1,1-dichloroethane, tetrachloroethylene) were detected in the sub-surface at concentrations greater than non-cancer health screening levels for inhalation exposures.

Recommendations

The environmental investigations conducted on the inactive E.H. Glass County Landfill site and the 2 associated adjacent properties were performed by DENR under the State's cooperative agreement program established to address pre-regulatory waste disposal sites. Under this agreement DENR provides investigative services to identify and remediate environmental risks on these sites in exchange for the property owners' agreement to DENR-specified land-use restrictions to prevent future harm to the environment or to human-health (DWM 2012a, DWM 2012b).

DENR has indicated the following negotiable remedies and land-use restrictions likely will be specified for the inactive landfill site and adjacent properties:

1. Placement of a soil cover ("cap") over the waste disposal area. A typical soil cover consists of a minimum of 2 feet of clean soil over the waste disposal area. Disturbance of the soil cover by excavation or penetration will be prohibited. Disturbance of the soil cover for surface structures such as parking lots or walking paths may be allowed with prior approval from DENR.
2. No enclosed structures are to be constructed over the waste disposal area. DENR will monitor for the migration of subsurface landfill gas from the waste disposal area for a minimum of 2 years. Indoor air monitoring will be conducted if DENR detects the migration of subsurface gas during the monitoring period and buildings are constructed within 100 feet of the waste disposal area.
3. To restrict the access and use of groundwater on the site. (In addition, a minimum 500 foot separation from the edge of the delineated waste disposal area and a drinking water supply well is required by state regulation 15A NCAC 02C .0107(J). Counties were given further authority to regulate water supply wells under GS 87-97.)

N.C. DPH recommends the following additional conditions to reduce the potential for adverse impacts to human health due to the chemicals associated with the inactive E.H. Glass County Landfill:

1. *Restrict use of the contaminated groundwater on the property as a source of water that would result in direct skin contact (such as for a swimming pool, showering or bathing), ingestion (such as a drinking water source or for watering vegetable or fruit plants) or inhalation (through activities such as washing dishes or laundry, or watering lawns).*

   Treatment of these waters to remove the organic chemical contaminants would eliminate this concern.

2. *Prevent children from having direct contact with the surface waters and sediments on the property.*

   Restrict the potential for children to be exposed to the surface water or sediments during recreational activities such as playing in the stream/ponds.

3. *Implement land use restrictions that prevent excavation and disturbance of the soil cap as long as the waste remains in place.*
4. *Prevent access to the waste disposal areas and surface water and sediment areas if the property is not re-developed or the site control activities identified above are not implemented or maintained.*
5. *If the subsurface landfill gas monitoring detects gas levels that exceed U.S. EPA or NC indoor air levels monitor indoor air quality of enclosed structures constructed on the property within 100 yards of the waste disposal area for volatile organic compounds (VOCs), methane and hydrogen sulfide on an every 4 months schedule for 1 year after construction. As an alternative, implement engineering controls to prevent entry of subsurface vapors into the enclosed structures*.
6. *Adequate training and protective measures should be implemented to prevent construction or remediation workers from being exposed to surface or sub-surface chemical and physical hazards that exist on the property.*
7. *Test any new or existing drinking water wells within one-half mile of the inactive E.H. Glass County Landfill for metals (arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, zinc), VOCs + TICs, sulfate, ammonia nitrogen, pH, and conductivity. If there are detections of VOCs also test for SVOCs + TICs.*

Questions about the *E.H. Glass County Landfill Site Health Consultation* can be forwarded to:

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SITE BACKGROUND INFORMATION

Site location -

The inactive E.H. Glass County Landfill site is located on adjacent properties located at 1103 and 1307 Nealtown Road, Greensboro, N.C. 27405. The inactive landfill "site" is identified as an area in the northwest and central portions of the 2 properties (identified as "disposal area B", Appendix Figure 1).

Site description -

The inactive E.H. Glass County Landfill site encompasses a 15.9 acre unlined waste disposal area ("disposal area B", Appendix Figure 1). The remaining area of the 2 adjacent properties includes 2 ponds and an unnamed stream that runs south to north along the southwestern perimeter of the property. A sanitary sewer easement also crosses the southern portion of the property (Appendix Figure 1). No wastes were found in a second area located in the southeast corner of the 2 properties ("disposal area A", Appendix Figure 1) also investigated as a possible waste disposal area. The smaller of the 2 properties is privately owned (15 acres, the northwest property on Appendix Figure 1 identified as "Tract A"). The remaining acreage is owned by a non-profit corporation (approximately 42 acres, the southeast property identified as "Tract B" on Appendix Figure 1). The owner of the Tract B property recently sold a portion of their property to a second non-profit corporation ("Tract C", Appendix Figure 1).

The N.C. Department of Environment and Natural Resources (DENR) noted evidence of trespassing on the property (illegal waste dumping, fishing and hunting). Waste material was reported in the stream bed in 2009, including buried 55-gallon drums, tires, metal debris, plastic and glass (SSR 2009). The property slopes from the east to the west side toward the stream. The groundwater also flows from the east toward the west/northwest side of the property. Groundwater was measured at depths from 1.1 to 19.3 feet below the ground surface with the shallowest groundwater located along the stream (CDP 2011).

The E.H. Glass County Landfill is an inactive unlined landfill that operated from 1965 to 1973, at a time prior to disposal facility regulations. Because the landfill operated prior to regulatory oversight there are no records of what and where waste was buried. Documents provided by Guilford County and DENR indicate Vicks® cough, cold and nasal products were likely disposed at the facility.

Adjacent areas -

Residential areas are located to the north, south and west adjacent to the inactive landfill property. These residences are served by a public water supply and there are no known water supply wells within 1000 feet of the former landfill property. One private well that was not being used for drinking water was identified in the vicinity (SSR 2009).

Proposed development and site use restrictions -

One of the property owners has submitted a proposal for development on a portion of their property to include a building, parking lot and conservation areas (SSR 2009). DENR will likely implement land-use restrictions for the site that require a clean soil cover of a specified depth over the waste disposal area and a limitation on the location and type of structures that may be placed over the waste disposal area. In addition, state regulations do not allow the placement of water supply wells within 500 feet of a waste disposal area (State code 15A NCAC 02C .0107(J)).

Site investigations by DENR -

North Carolina created the Inactive Hazardous Sites Act to provide a state program to assess and remedy environmental hazards associated with pre-regulatory landfills. The bill is administered by N.C. DENR Division of Waste Management (DWM). The bill provides for assessment of environmental hazards and application of measures to control and remedy identified hazards such as landfill capping, installation of security measures and groundwater or land-use restrictions. DENR assessment activities began at the inactive E.H. Glass County Landfill in 2009 and a condition of “no immediate hazard was observed” was reported following initial investigation activities. Additional assessment activities continue on the site and adjacent properties.

DESCRIPTION OF THE HEALTH CONSULTATION PROCESS

The N.C. Division of Public Health (DPH) evaluated the potential for harmful health effects from contact with the contamination identified on the inactive E.H. Glass County Landfill site and the 2 adjacent properties included in DENR’s investigations. The evaluation focused on the potential contact of the community living in the vicinity of the inactive landfill and persons that may visit the property in the future if the property is redeveloped. The health consultation included:

1. Gathering all the environmental analytical data.
2. Determination of how persons may have in the past / are currently / or may in the future come into contact with chemicals that may be present on the property.
3. Determine which chemicals are present on the property at concentrations that could have presented or could present a potential health hazard in the future.
4. Summarize the findings of the health consultation for the community.
5. Provide recommendations as needed:
    a. for additional environmental investigations to better define potential public health concerns;

b. to reduce or eliminate exposures to site contaminants or physical hazards; or,
c. to monitor the effectiveness of selected strategies to detect, reduce or eliminate potential exposures

Environmental data evaluated -

DPH reviewed environmental data collected on the inactive E.H. Glass County Landfill site and the 2 adjacent properties by DENR and their contractors. These included:

1. The *2009 Site Summary Report* that reviewed historical and current site uses, structures, and physical features including visual delineation of waste disposal areas (SSR 2009).
2. The *Contamination Delineation Phase Report* which reported analytical data for 15 groundwater monitoring wells and an above-ground landfill gas survey. The samples for this study were collected in 2010 (CDP 2011).
3. The *2011 Remedial Investigation* which reported analytical data for 57 soil samples, 25 landfill gas sample locations collected on multiple occasions, 13 sediment samples, and 12 surface water samples (RI 2011).
4. Laboratory reports for sub-surface gas samples collected in May and July 2011 and analyzed for volatile organic compounds (VOCs) (ESC 2011).

How Persons Could Be Exposed -

The inactive E.H. Glass County Landfill site and the adjacent properties are privately owned. No one lives on the properties. The remnants of a dwelling are present on the property, but it is not known when persons may have lived in the dwelling. It may have been prior to waste disposal on the property. There were no environmental data gathered on the property prior to the studies evaluated in this report.

The health consultation process followed for this report considered how persons can be exposed to (come into contact with) the substances and chemicals detected in the environmental samples collected on the property. Likely exposure scenarios were evaluated for both children and adults. The exposure of children is of particular concern because children may be at a greater risk of harmful health effects than adults when exposed to some substances. Children are more likely to be exposed to contaminants in the environment because they play outdoors, have more “hand-to-mouth” activity and have higher inhalation (breathing) rates than adults. They are also smaller, resulting in higher doses (concentration of chemical per body weight). If toxic exposures occur during critical growth stages, the developing body systems of children can sustain permanent damage.

We identified “trespassing” and “recreational” activities as the likely exposure scenarios for this property. DENR observed evidence of trespassing during their activities at the property. We also considered activities such as children playing in the stream on the

property and having contact with the surface water and sediment. We did not include activities associated with remediation work.

The Evaluation Process -

The concentration of each substance or chemical detected in the environmental samples collected on the property in the groundwater, surface water, sediment and gas/vapor samples were screened for further evaluation using health-based "comparison values" (CVs) prepared by the Agency for Toxic Substances and Disease Registry (ATSDR 2012). If an ATSDR comparison value is not available for a chemical an alternative health-based source is sought, such as the U.S. Environmental Protection Agency's (EPA) Regional Screening Levels (RSL, EPA 2012) or the Integrated Risk Information System (IRIS). Substances or chemicals detected at concentrations greater than comparison values do not indicate harm, but indicate the need for additional investigation to determine if harm is possible to persons that may inhale (breathe), ingest (swallow), or have dermal (skin) contact with these chemicals.

Site-specific exposure dose estimates are calculated for substances or chemicals detected at concentrations exceeding the comparison values. An exposure dose is an estimate of the amount of a substance a person may come into contact with in the environment over a specific time period, expressed relative to body weight. The exposure dose estimate is then compared to ATSDR's minimum risk levels ("MRLs"). MRLs are health-based dose values used to identify when the exposure concentration, frequency and route (ingestion, inhalation, dermal) of exposure may lead to concentrations of the chemical in the body high enough to potentially cause non-cancer adverse health effects. Calculated dose estimates that exceed MRLs do not necessarily mean people will be harmed, but indicate the need for a case-by-case evaluation of the calculated dose estimates to health study data.

Health study data relates dose and the length and route of exposure to specific adverse health effects. Available health study data may include human or animal studies. N.C. DPH preferentially uses human study data when it is available and compares the site-specific dose estimates against sensitive health endpoints. This comparison is used to judge the likelihood of non-cancer illness from the chemicals detected on the site.

Potential health risks associated with substances identified as suspect or known to cause cancer in humans ("carcinogens") are evaluated by calculating an estimated increased cancer risk. The increased cancer risk is calculated from the site-specific dose estimate and the substance-specific cancer potency factor developed by ATSDR or U.S. EPA. The term "increased cancer risk" represents the risk in addition to the "background cancer risk". In North Carolina, approximately 1 out of every 2 men (50%) and 1 out of every 3 women (33%) (about 40% for the combined N.C. population) will be diagnosed with cancer from a variety of causes in their life-time. This is referred to as the "background cancer risk". The estimated increased cancer risk is not a prediction that cancer will occur, but represents the highest probability (or chance) of additional cancers. The actual additional risk may be much lower, or there may be no additional

risk. A "one-in-a-thousand" increased cancer risk ("1/1,000" or "1 x 10^{-3}" increased cancer risk) represents:

> In 1,000 people exposed to the cancer-causing substance one additional person may develop cancer above the background number of cancer cases (40% or 400 expected "background" cases of cancer for every 1,000 people).
>
> 400 "background" cancers + 1 "additional cancer" =
> 401 cancers in 1000 exposed persons

DISCUSSION OF THE DATA

Consideration of Site-Specific Exposure Scenarios -

The surface water and sediment data were considered for "incidental ingestion" exposures, such as may occur when children are playing, wading or swimming in the stream. Exposure factors for children 1 to 6 years of age were used because children of this age range will have the highest calculated dose (the highest internal concentration relative to their weight) and represent the greatest potential for health risks for all age groups (1 year through adult). The exposure factors used for the evaluations are summarized in Appendix Table 1. Values selected for the amount of water and sediment ingested while playing are based on surveys of exposure data collected by the U.S. EPA (EPA 2011).

Gas (vapor) sample data were compared to ATSDR's air comparison values for inhalation (breathing) exposures. Short-term exposure comparison values ("acute" CVs) were used for screening since the likely exposure scenario is for periods of minutes to several hours at less than a daily frequency. If short-term (acute) comparison values were not available, an alternative value was selected.

Health Effects Summary -

The following discussions summarize the environmental analytical data, exposure estimates and potential health-effect evaluations for each environmental medium (water, sediment, air/gas).

Groundwater –

The detection of 11 metals, sulfate, ammonia nitrogen, and 9 organic compounds (1 semi-volatile and 8 volatile chemicals) were reported for shallow groundwater samples collected in 2010. Six of the metals (arsenic, chromium, copper, lead, manganese, iron), sulfate and 3 volatile organic compounds (1,1-dichloroethane, 1,2-dichloroethane, vinyl chloride) were detected at concentrations exceeding health comparison values (CVs). Appendix Table 2 summarizes the number of detections, number of detections exceeding CVs, and the CVs. One (21 µg/L[1]) of the 11 detections of lead was the only

[1] µg/L = micrograms per liter (often referred to as "parts per billion")

detected substance that exceeded a drinking water regulatory level (15 µg/L lead MCL[2]). Of the detected substances arsenic and vinyl chloride are classified as "known human carcinogens" and 1,2-dichloroethane (1,2-DCA) as a "probable human carcinogen" by the U.S. EPA and the National Toxicology Program (NTP). None of the arsenic, vinyl chloride or 1,2-DCA detections exceeded their MCL drinking water regulatory limit.

In addition to the substances listed in Table 2, there were 57 "tentatively identified (organic) compounds (TICs)"[3] detected in 15 groundwater samples that could not be identified or quantified with certainty due to limitations of the analytical methods. The estimated concentrations of these compounds ranged from 1 to 111 µg/L. Health comparison values are not available for the tentatively identified compounds. The tentatively identified organic compounds are not naturally-occurring chemicals expected to be in the groundwater.

The groundwater was not evaluated as a primary drinking water source. Based on information supplied by Guilford County Health Department it is unlikely that groundwater in the area was used, or used for any length of time, as a drinking water source. The area was developed from farmland to residential properties in 1955. At approximately the same time the land was annexed and provided municipal water (DPH 2009). The E.H. Glass County Landfill accepted wastes from 1965 to 1973. We do not know when contaminants may have first appeared in the groundwater and what the concentrations may have been over the period since they first appeared.

DENR has identified they will likely negotiate land-use restrictions that include no use of groundwaters on the property as a drinking water source. DPH supports use restrictions on the groundwater because of the number and concentration of organic compounds and carcinogens indentified in the groundwater samples. In addition, DPH recommends not using the groundwater for purposes that may involve direct skin contact or breathing chemicals that move from the water into the air (such as for swimming pools, showering or bathing, watering lawns). Treatment of the water to remove these chemicals, and confirmation of the effective removal, would eliminate DPH's concerns with dermal or ingestion exposures.

Surface water –

Surface water samples were collected at 12 locations on the property in May 2011. One sample was collected from each of the 2 ponds and the remaining 10 samples were collected in the unnamed stream that runs across the southern end of the southeastern adjacent property to the waste disposal area. Seven metals, nitrate,

[2] The ***MCL*** (maximum contaminant level) is EPA's enforceable drinking water standard presented as the highest level of contaminant that is allowed in drinking water by law. ***MCLGs*** (maximum contaminant level goal) are EPA's value for the level of contaminant in drinking water below which there is no known or expected risks to health, MCLGs allow for a margin of safety. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

[3] ***Tentatively Identified Compounds*** (TICs) are a tool used by scientists to characterize hazardous sites. TICs are unknown chemicals observed in the analysis that are not on the "Target Compound List" and that have not been compared to a known standard. The identification is made by comparing the sample analysis to a software "library" of chemicals and is not considered "absolute" or "confirmed". The reported concentration for a TIC is always an estimate. Because of the uncertainty of the identification of the TIC the interpretation of these results is difficult. http://www.epa.gov/region3/esc/qa/pdf/tics.pdf

sulfate and ammonia nitrogen were detected. The metals arsenic and manganese were the only substances detected at concentrations greater than comparison values. The single arsenic detection did not exceed the drinking water regulatory level (10 µg/L MCL). Appendix Table 3 summarizes the substances detected in the surface water and those that exceeded comparison values. Fifteen (15) "tentatively identified" semi-volatile organic compounds (SVOCs) were also detected.

Site-specific surface water incidental ingestion exposure dose estimates for children (1-6 years of age) for the metals arsenic and manganese were less than their MRL values. Arsenic is classified as a "known human carcinogen" by EPA and the National Toxicology Program (NTP). The increased cancer risk estimate for children was less than 1 in a million ($<1 \times 10^{-6}$). Adverse health effects are not indicated for arsenic or manganese. The dose, health guideline values and arsenic cancer risk are summarized in Appendix Table 8.

The tentatively identified organic compounds may be an indication that the surface waters on the property are being impacted by chemicals moving from the waste disposal area into the shallow groundwater and ultimately discharging to the surface waters. Two of the VOCs and several of the tentatively indentified organic compounds reported in the groundwater were also reported in the surface water.

The estimated concentrations of the tentatively identified SVOCs ranged from 1 to 5 µg/L. These chemicals could not be identified or quantified with certainty due to limitations of the analytical methods. The information is not available to determine the potential for adverse health effects associated with incidental ingestion or dermal contact to the tentatively identified organic compounds. Because of this uncertainty, DPH recommends that children or persons with skin sensitivities be discouraged from having contact with the surface waters on the property.

Sediment –

Surface sediment samples were collected at 13 locations on the property in May 2011. One surface sediment sample was collected from each of the 2 ponds and the remaining 11 samples were collected in the unnamed stream. Fourteen metals, sulfate, 5 volatile organic compounds (VOCs) and 2 polynuclear aromatic hydrocarbons (PAHs) were detected. The metals arsenic and thallium were the only sediment detections at concentrations greater than comparison values. Arsenic and thallium dose estimates were calculated for incidental ingestion exposures to children. Sediment detections were compared to soil comparison values since there are no sediment-specific values. The site-specific dose estimates are less than the soil MRL values (Appendix Table 8). Arsenic is classified as a "known human carcinogen" by EPA and NTP. The increased cancer risk estimate for children exposed for up to 6 years through incidental sediment ingestion is less than 1 in a million ($<1 \times 10^{-6}$). The combined increased cancer risk for incidental ingestion by children of the surface water and sediment is also less than 1 in a million ($<1 \times 10^{-6}$). Adverse health effects are not indicated for arsenic or thallium.

Four tentatively identified volatile organic compounds (VOCs) and 44 tentatively identified semi-volatile organic compounds (SVOCs) were reported in the sediment. Health comparison values are not available for the tentatively identified organic compounds. The information is not available to determine the potential for adverse health effects associated with incidental ingestion or dermal contact to the tentatively identified organic compounds. Because of this uncertainty, DPH recommends that children or persons with skin sensitivities be discouraged from having contact with the contaminated sediments on the property.

Landfill gases, surface-level survey -

No landfill gases were detected in an above-ground survey conducted above the areas identified as waste disposal areas A and B (Figure 1). The survey was conducted over 4 days in October 2010 using field instruments capable of detecting methane, hydrogen sulfide, mercury vapors, and non-chemical-specific detections of organic compound vapors. Instrument readings were taken at 6 inches above ground level over the un-disturbed soil on a 100-foot grid pattern. A total of 162 readings were recorded. All instrument readings were indicated to be at background concentrations. No detections of methane, carbon dioxide, hydrogen sulfide or mercury were recorded, indicating that the landfill gases were not breaking through the intact soil layer.

The above-ground survey indicates that persons are not exposed to landfill gases as long as a sufficient undisturbed layer of soil covers the waste disposal. DENR has identified that they will likely negotiate land-use restrictions for the properties to include a minimum of 2 feet of clean soil (the landfill “cap”) be placed over the waste disposal area with no disturbance of the cap be allowed without prior DENR approval. DPH supports the land-use restriction and a recommendation that a clean soil cap be required to cover the waste disposal areas, as well a width of area beyond the perimeter of the disposal areas to provide an appropriate safety margin. The depth of the soil cap and width of the cap around the perimeter should be based on appropriate engineering practices as specified by DENR and allow for an appropriate margin of safety to protect public health.

Landfill gases, sub-surface survey –

Sub-surface landfill gas readings were taken at 25 locations in and adjacent to the waste disposal area on 4 occasions in May, July and September 2011. Landfill “gas probes” (hollow tubes) were driven to a depth at least 5 feet below ground surface (bgs) and 2 feet above the top of the groundwater. The total depths of the probes ranged from 8-12 feet bgs. The gas samples were collected inside and adjacent to the waste disposal area, in an area where the property owner would like to place a building. Two of the sample locations were inside the perimeter of the waste disposal area (at the northeast corner) and the remaining 23 were within approximately 150 feet of perimeter of the waste disposal area. The approximate location of the sub-surface gas probes are noted on Figure 1. The gas readings were taken with field instruments capable of detecting methane, hydrogen sulfide, mercury vapors, and non-chemical-specific detections of volatile organic compounds. The field instruments detected methane, hydrogen sulfide, mercury vapors and volatile organic compounds. The sub-surface

gas data is summarized in Appendix Table 5. Persons are not exposed to these gases under current site conditions of an intact soil cap over the waste disposal area. Future exposure to sub-surface gases can be eliminated by land-use restrictions that include maintenance of an intact soil cap over the waste disposal area and a suitable width buffer around the waste disposal area.

Summa canister sub-surface gas samples -

A total of 8 “Summa” canister sub-surface vapor samples were collected from the landfill gas probes in May and July 2011. Three samples were collected in May (1 location in duplicate). Four samples were collected in July (1 location in duplicate) and included one of the locations sampled in May. Two of the sample locations were inside the waste disposal area and the other 2 were placed east of the waste disposal area to assess landfill gas migration. All Summa canister samples were sent for laboratory analysis for 68 volatile organic compounds (VOCs).

Thirty (30) different VOCs were detected in the Summa canister samples. Five of the detected VOCs (benzene, chloroform, 1,1-dichloroethane, trichloroethylene and vinyl chloride) are known or suspected human carcinogens and were detected at concentrations greater than their cancer screening level (ATSDR’s “CREG”, cancer risk evaluation guide). Tetrachloroethylene, an EPA “likely human carcinogen” (ATSDR 2012), was detected at a concentration less than its cancer screening level. Two (2) additional VOCs were detected at concentrations greater than their non-cancer acute exposure screening values (dichlorodifluoromethane and 1,1-dichloroethane). The data is summarized in Appendix Table 6. Area residents are not exposed to these gases under current site conditions. While the data indicates that there is no exposure to these chemicals as long as the surface soil layer (the “cap”) remains intact, these chemicals can potentially be harmful if the surface is disturbed. Persons are not exposed to these gases under current site conditions of an intact soil cap over the waste disposal area. Future exposure to sub-surface gases can be eliminated by land-use restrictions that include maintenance of an intact soil cap over the waste disposal area and a suitable width buffer around the waste disposal area.

Laboratory mercury analysis of sub-surface gas samples -

Five sub-surface gas samples were collected for laboratory analysis to better define the previously measured and highly variable sub-surface mercury levels collected with the field instruments. Eight-hour sub-surface gas samples were collected from 5 landfill gas probe locations in September 2011 and sent to a laboratory for mercury analysis. Two of the sample locations were in the waste disposal area. The laboratory mercury data is summarized Appendix Table 7. There were no mercury detections, however the sample reporting limits were greater than ATSDR’s mercury inhalation chronic comparison value. While no mercury was detected in the laboratory analyses and greater confidence can be placed on the laboratory analysis relative to the field-instrument measurements, some uncertainty remains since the reporting limits are greater than the comparison values.

Gas sample data summary –

The sub-surface gas samples collected with landfill gas probes and analyzed in the laboratory indicate that volatile organic compounds (VOCs) are present in the sub-surface of the waste disposal area. The surface survey (readings collected 6 inches above ground) indicates that these gases are not at escaping at concentrations that can be detected with field instruments through the intact soil layer. Disturbing the soil, particularly in the waste disposal area, may result in the release of the gases to the surface to where they can be inhaled by persons in the immediate vicinity. Building structures in the area over, or adjacent to, the waste disposal area may alter the location of these gases. Appropriate precautions are recommended during site activities (such as excavation or site investigations) to prevent persons from being exposed to these sub-surface gases. If the property is to be developed, appropriate precautions should be taken to prevent persons from being exposed to the sub-surface gases. DPH agrees with DENR's proposed recommendation of a soil cap placed over the waste disposal area and the implementation of a monitoring schedule to confirm that sub-surface gases are not escaping.

CONCLUSIONS AND RECOMMENDATIONS

Based on review of the environmental data the N.C. DPH concludes:

1. *There is no indication that people have been harmed by ingestion of groundwater on the property as a primary drinking water source*.

   Groundwater in the vicinity is not currently used as a drinking water source. Records provided by the county indicate that it is unlikely that private wells were in use in the area during the time the landfill began taking waste.

2. Chemicals may be moving from the sub-surface waste disposal areas into the shallow groundwater and are being discharged into the stream. Chemicals found in the groundwater were also detected in the surface water in the unnamed stream flowing through the property adjacent to the landfill. These chemicals would not be expected to occur naturally in the groundwater or surface water.

3. *Adverse health effects were not indicated for children that play in the stream and accidently ingest small amounts of the water or sediment for the compounds that could be identified in the stream water and sediments*.

   (This assessment is based on children 1-6 years of age playing in the stream 6 hours per week, for 7 months of the year.) There is no way to assess the potential health effects of ingestion or contact with the number of unidentified chemicals that were detected in the surface water and sediment.

4. The appropriate information is not available to assess the potential health effects of ingestion or direct contact with the unidentified chemicals ("tentatively identified chemicals") reported in the surface water and sediment. The analyses completed to date did not confirm the identity and concentration of these chemicals, and health effect data is not available for these chemicals.

5. *People are not likely to have been exposed to gases from the landfill. Tests indicate that landfill gases/vapors present in the subsurface in and near the waste disposal areas are not escaping through the intact soil cover*.

   Thirty (30) volatile organic compounds (VOCs) were detected in sub-surface gas samples taken in and adjacent to the waste disposal areas. Five of the VOCs (benzene, chloroform, 1,2-dichloroethane, trichloroethylene, vinyl chloride) are known or suspected human carcinogens and were detected in the sub-surface at concentrations greater than the cancer screening level (CREG). Three additional VOCs (dichlorodifluoromethane, 1,1-dichloroethane, tetrachloroethylene) were detected in the sub-surface at concentrations greater than non-cancer health screening levels for inhalation exposures.

Recommendations -

The environmental investigations conducted on the inactive E.H. Glass County Landfill site and the 2 associated adjacent properties were performed by DENR under the State's cooperative agreement program established to address pre-regulatory waste disposal sites. Under this agreement DENR provides investigative services to identify and remediate environmental risks on these sites in exchange for the property owners' agreement to DENR-specified land-use restrictions to prevent future harm to the environment or to human-health (DWM 2012a, DWM 2012b).

DENR has indicated the following negotiable remedies and land-use restrictions likely will be specified for the inactive landfill site and adjacent properties:

1. Placement of an soil cover ("cap") over the waste disposal area. A typical soil cover consists of a minimum of 2 feet of clean soil over the waste disposal area. Disturbance of the soil cover by excavation or penetration will be prohibited. Disturbance of the soil cover for surface structures such as parking lots or walking paths may be allowed with prior approval from DENR.
2. No enclosed structures are to be constructed over the waste disposal area. DENR will monitor for the migration of subsurface landfill gas from the waste disposal area for a minimum of 2 years. Indoor air monitoring will be conducted if DENR detects the migration of subsurface gas during the monitoring period and buildings are constructed within 100 feet of the waste disposal area.
3. To restrict the access and use of groundwater on the site. (In addition, a minimum 500 foot separation from the edge of the delineated waste disposal area and a drinking water supply well is required by state regulation 15A NCAC 02C .0107(J). Counties were given further authority to regulate water supply wells under GS 87-97.)

N.C. DPH recommends the following additional conditions to reduce the potential for adverse impacts to human health due to the chemicals associated with the inactive E.H. Glass County Landfill :

1. *Restrict use of the contaminated groundwater on the property as a source of water that would result in direct skin contact (such as for a swimming pool,*

showering or bathing), ingestion (such as a drinking water source or for watering vegetable or fruit plants) or inhalation (through activities such as washing dishes or laundry, or watering lawns).

Treatment of these waters to remove the organic chemical contaminants would eliminate this concern.

2. *Prevent children from having direct contact with the surface waters and sediments on the property.*

   Restrict the potential for children to be exposed to the surface water or sediments during recreational activities such as playing in the stream/ponds.

3. *Implement land use restrictions that prevent excavation and disturbance of the soil cap as long as the waste remains in place.*
4. *Prevent access to the waste disposal areas and surface water and sediment areas if the property is not re-developed or the site control activities identified above are not implemented or maintained.*
5. *If the subsurface landfill gas monitoring detects gas levels that exceed U.S. EPA or NC indoor air levels monitor indoor air quality of enclosed structures constructed on the property within 100 yards of the waste disposal area for volatile organic compounds (VOCs), methane and hydrogen sulfide on an every 4 months schedule for 1 year after construction. As an alternative, implement engineering controls to prevent entry of subsurface vapors into the enclosed structures*.
6. *Adequate training and protective measure should be implemented to prevent construction or remediation workers from being exposed to surface or sub-surface chemical and physical hazards that exist on the property.*
7. *Test any new or existing drinking water wells within one-half mile of the inactive E.H. Glass County Landfill for metals (arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, zinc), VOCs + TICs, sulfate, ammonia nitrogen, pH, and conductivity. If there are detections of VOCs also test for SVOCs + TICs.*

Limitations of the Health Consultation process -

All studies include uncertainties associated with the available historical and environmental data, as well as what is known about the potential health effects associated with identified chemicals. The limitations specific to this Health Consultation include:

1. A significant number of “tentatively identified” organic compounds (TICs) were identified in the groundwater, surface water and sediment samples collected in 2010 and 2011. It was not possible to identify potential health effects related to exposure to these compounds since neither the identification or concentration of these chemicals has been confirmed. Additionally, based on the unconfirmed identifications health effects data does not exist for most of these chemicals to determine if they could present a health hazard.

2. The data does not exist to determine potential health effects associated with dermal (skin) contact with the chemicals found in the surface water and sediments. Some chemicals, particularly some organic compounds, can be absorbed through the skin.
3. The reporting limits of the 8-hour subsurface gas laboratory mercury analyses were greater than the mercury inhalation comparison values.
4. It is not known if the concentrations of chemicals reported in this study are representative of concentrations present on the property since contamination first made its way into the groundwater, surface water, sediment and sub-surface air. N.C. DPH's conclusions and recommendations are only relevant to the available data and may not be representative of exposure conditions at other times.
5. Each person's general health, lifestyle choices, genetic make-up and exposure to other chemicals will impact the potential for harmful effects a person may experience when exposed to environmental contaminants. While highly health protective methods were used for this study these factors may result in unique sensitivities for some individuals that are not predicted by the methods used in this evaluation.

APPENDIX

Tables, Figures and References

Table 1. Exposure factors used for exposure dose calculations of chemicals and substances detected on the inactive E.H. Glass County Landfill site. Source: EPA 2011

Exposure component	Child (1-6 years of age)	Adult
Incidental ingestion of stream water while swimming/wading	49 mL (1.7 oz) water ingested per hour 200 mg (0.007 oz) sediment ingested per event 3 events per week 2 hours per event 7 months per year (91 total days per year) 6 years total	NA
Body weight	17 kg (37.5 lbs)	80 kg (176 lbs)
Life-time	NA	78 years

kg = kilogram; lbs = pounds; mg = milligram; mL = milliliter; NA = not applicable; oz = ounce

Table 2. Summary of groundwater detections and comparison values. Samples collected in 2010 at 15 locations on the inactive E.H. Glass County Landfill site. Bold/shaded values exceed CV. Data source: CDP 2011.

Chemical or substance detected	No. of detections greater than CV / no. detections[1]	Range of concentrations greater than CVs (µg/L)	Health-based CV (µg/L)	CV type / source
Nitrate	0/8	NA	20,000	EPA RMEG
Sulfate	1/13	**740,000**	500,000	EPA-DWA
Ammonia nitrogen	0/3	NA	30,000	EPA LTHA
Metals				
Arsenic	5/5	**1.3 – 9.8**	0.02 3, 10 10, 0	CREG Chronic EMEG (child, adult) MCL, MCLG
Beryllium	0/6	NA	4	MCL/MCLG
Cadmium	0/2	NA	1, 4	Chronic EMEG (child, adult)
Chromium	9/17	**12 – 99**	10, 40 100	Chronic EMEG (child, adult) MCL
Copper	2/17	**120 – 230**	100, 400 1300	Interm. NCA (child, adult) MCL
Lead	1/11	**21**	15 0	MCL AL MCLG
Manganese	10/17	**300 – 8,000**	300	LTHA, EPA HA
Nickel	0/17	NA	100	LTHA
Selenium	0/2	NA	50	LTHA / MCLG
Zinc	0/16	NA	2,000	LTHA
Iron	4/17	**34,000 – 180,000**	26,000 300	EPA RSL NC aesthetics
Volatile Organic Compounds (VOCs)				
Acetone	0/1	NA	9,000, 30,000	EPA RMEG (child, adult)
Chlorobenzene	0/7	NA	100	LTHA
Chloroethane	0/1	NA	21,000	EPA RSL
1,4-Dichlorobenzene	0/1	NA	75	LTHA
1,1-Dichloroethane	1/1	**46**	12	EPA RSL CA
1,2-Dichloroethane	1/1	**2.2**	0.4 5, 0	CREG MCL, MCLG
cis-1,2,-Dichloroethene	0/1	NA	20, 70	RMEG
Vinyl chloride	1/1	**1.7**	0.02 2, 0	CREG MCL, MCLG
Semi-volatile Organic Compounds (SVOCs)				
Bis(2-ethylhexyl)phthalate	0/1	NA	2	CREG
Tentatively Identified Organic Compounds (TICs)				
TICs	57 detected	All detections: 1 – 111	NA	NA

[1] Number of detections greater than health comparison value / total number of detections

AL (Action Level) = The concentration of a contaminant, which, if exceeded, triggers a treatment or other requirement, µg/L = micrograms per liter; ATSDR = Agency for Toxic Substances and Disease Registry; CREG = Cancer Risk Evaluation Guide, ATSDR CV; CV = comparison value; ATSDR health-based screening value; EMEG = Environmental Media Evaluation Guide, ATSDR CV; EPA = U.S. Environmental Protection Agency;

Table 2 notes continued on the next page -
Table 2 notes continued from the previous page -
EPA-DWA = EPA drinking water advisory, recommended non-regulatory level;
Interm. EMEG = Intermediate EMEG, ATSDR CV; LTHA = Lifetime Health Advisory for Drinking Water, EPA; MCL = Maximum Contaminant Level for drinking water, EPA regulatory value; MCLG = Maximum Contaminant Level goal for drinking water, EPA non-regulatory value; NA = not applicable; NC aesthetics = NC non-regulatory value; no. = number; RMEG = Reference Dose Media Evaluation Guide; RSL = EPA Regional Screening Levels

Table 3. Summary of surface water detections and comparison values. Samples collected in 2010 at 12 locations in the 2 ponds and unnamed stream on the inactive E.H. Glass County Landfill site. Bold/shaded values exceed CV. Data source: RI 2011.

Chemical or substance detected	No. detections greater than CV / no. detections	Range of concentrations greater than CVs (µg/L)	Health-based CV (µg/L)	CV type / source
Nitrate	0/9	NA	20,000	EPA RMEG
Sulfate	0/10	NA	500,000	EPA
Ammonia nitrogen	0/8	NA	30,000	EPA LTHA
Metals				
Arsenic	1/1	**1.0**	0.02 3, 10 10, 0	CREG Chronic EMEG MCL, MCLG
Copper	0/2	NA	100, 400	Interm. EMEG (child, adult)
Lead	0/4	NA	15	MCL
Manganese	6/12	**300 – 980**	300	LTHA, EPA HA
Nickel	0/7	NA	100	LTHA
Selenium	0/2	NA	50	LTHA / MCLG
Iron	0/12	NA	26,000	EPA RSL
Semi-volatile Organic Compounds (SVOCs)				
Tentatively identified organic compounds	15 detected	1 - 5	NA	NA

µg/L = micrograms per liter; ATSDR = Agency for Toxic Substances and Disease Registry; CREG = Cancer Risk Evaluation Guide, ATSDR CV ; CV = comparison value, ATSDR health-based screening value; EMEG = Environmental Media Evaluation Guide, ATSDR CV; EPA = U.S. Environmental Protection Agency; HA = health advisory, a non-regulatory value; Interm. EMEG = Intermediate EMEG, ATSDR CV; LTHA = Lifetime Health Advisory for Drinking Water, EPA; MCL = Maximum Contaminant Level for drinking water, EPA regulatory value; MCLG = Maximum Contaminant Level goal for drinking water, EPA non-regulatory value; NA = not applicable; no. = number; RMEG = Reference Dose Media Evaluation Guide; RSL = EPA Regional Screening Levels

Table 4. Summary of detections and comparison values for sediments. Samples collected at 13 locations in the 2 ponds and unnamed stream in 2011 on the inactive E.H. Glass County Landfill site. Bold/shaded values exceed CV. Data source: RI 2011.

Chemical / substance detected	No. detections greater than CV / no. detections[1]	Range of concentrations greater than CV (mg/kg)	Health-based comparison value (mg/kg)	CV type / source
Sulfate	0/1	NA	NA	NA
Volatile Organic Compounds (VOCs)				
Acetone	0/1	NA	100,000, 1,000,000	Interm. EMEG (child, adult)
cis-1,2-Dichloroethene	0/1	NA	20,000, 200,000	Interm. EMEG (child, adult)
2-Butanone	0/1	NA	30,000, 400,000	EPA RMEG (child, adult)
Tetrachloroethene	0/1	NA	330	CREG
Toluene	0/1	NA	1,000, 10,000	Interm. EMEG (child, adult)
Polynuclear Aromatic Compounds (PAHs)				
Fluoranthene	0/1	NA	20,000, 300,000	Interm. EMEG (child, adult)
Phenanthrene	0/1	NA	NA	NA
Metals				
Mercury	0/1	NA	5, 70	EPA RMEG (child, adult)
Arsenic	1/1	**1.6**	0.5	CREG
Beryllium	0/1	NA	100, 1000	Chronic EMEG (child, adult)
Cadmium	0/1	NA	30, 400	Interm. EMEG (child, adult)
Chromium	0/13	NA	80,000, 1,000,000	EPA RMEG (child, adult)
Copper	0/12	NA	500, 7000	Interm. EMEG (child, adult)
Iron	0/13	NA	55,000	EPA RSL
Lead	0/13	NA	400	EPA RSL
Manganese	0/13	NA	3000, 40,000	EPA RMEG (child, adult)
Nickel	0/13	NA	1000, 10,000	EPA RMEG (child, adult)
Selenium	0/6	NA	300, 4000	Chronic EMEG (child, adult)
Silver	0/3	NA	300, 4000	EPA RMEG (child, adult)
Thallium	1/5	**5.0**	4, 60	EPA RMEG (child, adult)
Zinc	0/13	NA	20,000, 200,000	Interm. EMEG (child, adult)
Tentatively Identified Compounds (TICs)				
Volatile organic compounds (VOC) TICs	4 detected in 4 samples	Estimated concentration range 0.005 – 0.015 mg/kg		
Semi-volatile organic compounds (SVOCs) TICs	44 detected in 10 samples	Estimated concentration range 0.030 – 1.90 mg/kg		

Table 4 notes continued on the next page -

Table 4 notes continued from the previous page –
[1] Number of detections greater than health comparison value / total number of detections
AL (Action Level) = the concentration of a contaminant, which, if exceeded, triggers a treatment or other requirement; ATSDR = Agency for Toxic Substances and Disease Registry; Chronic EMEG = Chronic (exposure of more than 364 days) Environmental Media Evaluation Guide, ATSDR CV; CREG = Cancer Risk Evaluation Guide, ATSDR CV ; CV = comparison value, ATSDR health-based screening value; EMEG = Environmental Media Evaluation Guide, ATSDR CV; EPA = U.S. Environmental Protection Agency; EPA-DWA = EPA drinking water advisory, recommended non-regulatory level; Interm. EMEG = Intermediate (exposure of 14 to 365 days) Environmental Media Evaluation Guide, ATSDR CV; LTHA = Lifetime Health Advisory for Drinking Water, EPA; MCL = Maximum Contaminant Level for drinking water, EPA regulatory value; MCLG = Maximum Contaminant Level goal for drinking water, EPA non-regulatory value; mg/kg = milligrams per kilogram; NA = not applicable; NC aesthetics = NC non-regulatory value; no. = number; RMEG = Reference Dose Media Evaluation Guide; RSL = EPA Regional Screening Levels; TIC = Tentatively Identified Compounds

Table 5. Summary of sub-surface landfill gas data. Includes data for 25 gas probes inserted into the subsurface and field instrument readings collected on 4 occasions in May through September 2011 on the inactive E.H. Glass County Landfill site. Data source: CDP 2011.

Gas detected	No. detections greater than CV / no. detections[1]	Range of concentrations greater than CVs	Health-based CV	CV type / source
Methane	50/50	0.2 – 20.3%	0.1%	OSHA TLV [2]
Hydrogen sulfide	8/80	100 – 2000 ppb-v	70 ppb-v	Acute EMEG/MRL
Mercury vapor	60/60	0.8 - 178.9 µg/m^3	0.2 µg/m^3 0.3 µg/m^3	Chronic EMEG/MRL EPA RSL-NCA [3]

[1] Number of detections greater than health comparison value / total number of detections
[2] OSHA TLV = Occupational Safety and Health Administration threshold limit value; a TLV is the level of a chemical to which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects
[3] Values for elemental mercury vapor
µg/m^3 = micrograms per cubic meter; ATSDR = Agency for Toxic Substances and Disease Registry; CV = comparison value, ATSDR health-based screening value; Acute EMEG = Acute (exposure of less than 14 days) Environmental Media Evaluation Guide, ATSDR CV; Chronic EMEG = Chronic (exposure of more than 364 days) Environmental Media Evaluation Guide, ATSDR CV; EPA = U.S. Environmental Protection Agency; MRL = Minimum Risk Level, ATSDR health guideline value; no. = number; ppb-v = parts per billion-volume; RSL-NCA = EPA regional screening level non-cancer effect level

Table 6. Summary of sub-surface landfill gas probe laboratory volatile organic analyses. Data collected in Summa canisters in May and July 2011 on the inactive E.H. Glass County Landfill site. Bold/shaded values exceed CV. Source RI 2011.

Chemical / substance detected	No. detections greater than CV / no. detections[1]	Range of concentrations greater than CVs, ppb-v	Health-based comparison value, ppb-v	CV type / source
Acetone	0/3	NA	30,000	Acute EMEG
Benzene	1/1	**57 µg/m^3**	1.6 µg/m^3 130 µg/m^3	EPA RSL-CA EPA RSL-NCA
2-Butanone (methyl ethyl ketone)	0/2	NA	2000	EPA RfC
Carbon disulfide	0/3	NA	3100 µg/m^3	EPA RSL-NCA
Chloroethane	0/2	NA	20,000	Acute EMEG
Chloroform	1/3	**730 µg/m^3** 4.2 ppb-v	0.53 µg/m^3 100	EPA RSL-CA Acute EMEG
Chloromethane	0/2	NA	400	Acute EMEG
Cyclohexane	0/2	NA	6000 µg/m^3	EPA RfC
1,3-Dichlorobenzene	0/1	NA	NA	NA
1,4-Dichlorobenzene	0/1	NA	2000	Acute EMEG
Dichlorodifluoromethane	1/4	**1500 µg/m^3**	440 µg/m^3	EPA RSL-NCA
1,1-Dichloroethane	1/1	**52 µg/m^3**	7.7 µg/m^3	EPA RSL-CA
cis-1,2-Dichloroethene	0/1	NA	200	Acute EMEG (for trans-1,2-dichloroethene)
1,2-Dichloro-tetrafluoroethane (freon 114)	0/3	NA	NA	NA
Ethanol	0/4	NA	NA	NA
Ethylbenzene	0/2	NA	5000	Acute EMEG
Heptane	0/2	NA	NA	NA
n-Hexane	0/4	NA	600	Chronic EMEG
Isopropylbenzene (cumene)	0/3	NA	80	EPA RfC
Methylene chloride	0/3	NA	600	Acute EMEG
2-Propanol (isopropanol)	0/1	NA	31,000 µg/m^3	EPA RSL-NCA
Tetrachloroethylene	2/2	**2.7 – 12 µg/m^3** 0.4-1.7 ppb-v	47 µg/m^3 200 ppb-v	EPA RSL-CA Acute EMEG
Tetrahydrofuran	0/2	NA	2000 µg/m^3	EPA-IRIS
Toluene	0/3	NA	1000	Acute EMEG
Trichloroethylene	1/1	**42 µg/m^3** **7.8 ppb-v**	3.0 µg/m^3 0.37 ppb-v	EPA RSL-CA Chronic EMEG
Trichlorofluoromethane	0/4	NA	3100 µg/m^3	EPA RSL-NCA
1,2,4-Trimethylbenzene	0/1	NA	31 µg/m^3	EPA RSL-NCA
Vinyl chloride	3/3	**4.6–7.5 µg/m^3** 0.51-2.8 ppb-v	2.8 µg/m^3 500 ppb-v	EPA RSL-CA Acute EMEG
m,p-Xylene	0/2	NA	2000	Acute EMEG
o-Xylene	0/2	NA		

Table 6 notes continued on the next page -

Table 6 notes continued from the previous page –
[1] Number of detections greater than health comparison value / total number of detections
µg/m^3 = micrograms per cubic meter; ATSDR = Agency for Toxic Substances and Disease Registry; CV = comparison value, ATSDR health-based screening value; Acute EMEG = Acute (exposure of less than 14 days) Environmental Media Evaluation Guide, ATSDR CV; Chronic EMEG = Chronic (exposure of more than 364 days) Environmental Media Evaluation Guide, ATSDR CV; EPA = U.S. Environmental Protection Agency; Interm. EMEG = Intermediate EMEG, ATSDR CV; MRL = Minimum Risk Level, ATSDR health guideline value; NA = not applicable; no. = number; ppb-v = parts per billion-volume; RfC = EPA non-cancer reference concentration; RSL-CA = EPA regional screening level cancer effect level; RSL-NCA = EPA regional screening level non-cancer effect level

Table 7. Summary of mercury in subsurface air laboratory analysis data for landfill gas samples collected in September 2011 on the inactive E.H. Glass County Landfill site.

Number of samples	Mercury results	Reporting limit	Health comparison values[1]
5	All not detected	0.41 – 0.42 µg/m^3	0.2 µg/m^3 Chronic EMEG 0.3 µg/m^3 EPA RfC

[1] All available ATSDR and EPA health comparison values for mercury inhalation are listed. Both are for chronic daily inhalation of mercury.
µg/m^3 = micrograms per cubic meter; ATSDR = Agency for Toxic Substances and Disease Registry; Chronic EMEG = Chronic (exposure of more than 364 days) Environmental Media Evaluation Guide, ATSDR CV; EPA = U.S. Environmental Protection Agency; Interm. EMEG = Intermediate EMEG, ATSDR CV; RfC = EPA non-cancer reference concentration

Table 8. Summary of E.H. Glass County Landfill site exposure dose estimates, health guideline values and increased cancer risk estimates for metals detected at concentrations greater than comparison values.

Chemical / substance	Estimated exposure dose[1], mg/kg/d	Non-cancer effect health guideline value (MRL), mg/kg/d	Cancer potency value (CSF) (unitless)	Estimated increased cancer risk	Estimated increased cancer risk qualitative descriptor
Surface water					
Arsenic	3.5e-06	5e-03	1.5	<1 x 10^{-6}	no increase
Manganese	3.4e-03	5e-02	NA	NA	
Sediment					
Arsenic	4.7e-06	3e-04	1.5	<1 x 10^{-6}	no increase
Thallium	1.5e-05	8e-05 [2]	NA	NA	
Combined risk for surface water and sediment exposures					
Arsenic				<1 x 10^{-6}	no increase

[1] Dose calculations for incidental ingestion to children using the maximum detected concentration
[2] Health value for chronic exposure (daily exposure for more than 1 year)
mg/kg/d = milligrams per kilogram per day; <1 x 10^{-6} = less than 1 in a million; ATSDR = Agency for Toxic Substances and Disease Registry; CSF = ATSDR cancer slope factor; NA = not applicable; MRL = Minimum Risk Level, ATSDR health guideline value

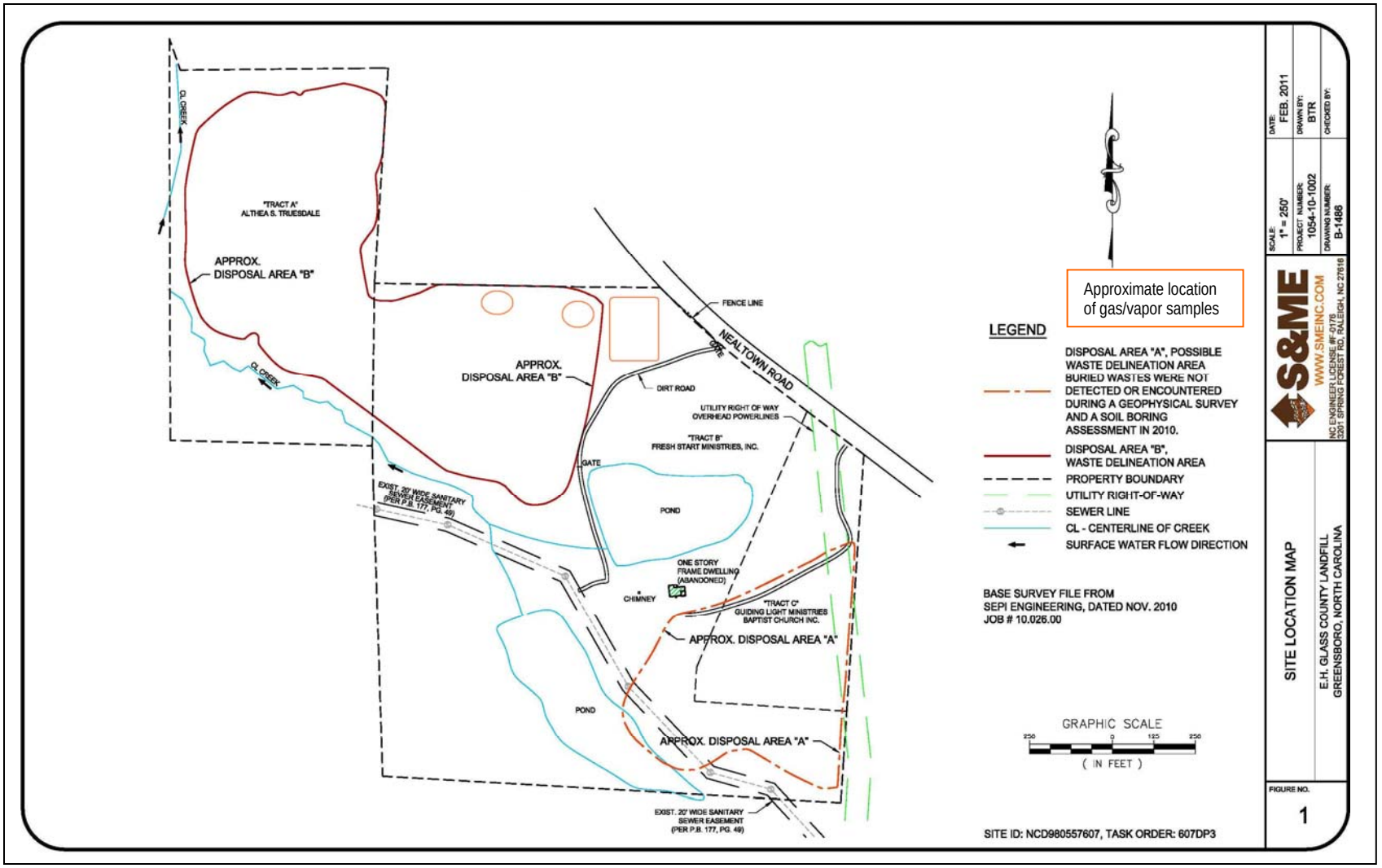

Figure 1. Site location map for the inactive E.H. Glass County Landfill. Delineated waste disposal areas, water features and areas of subsurface landfill gas sample collections are indicated. Source: CDP 2011.

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