# Athens-Clarke County Solid Waste Department Landfill Division
# ODOR MANAGEMENT PLAN

## FACILITY INFORMATION

The Unified Government of Athens-Clarke County (ACCUG) operates a Subtitle D Municipal Solid Waste Landfill located at 5700 Lexington Road at the extreme eastern edge of Athens-Clarke and western edge of Oglethorpe counties. The Landfill and its operations are permitted by the Georgia Environmental Protection Division (EPD) and are managed to:

- process waste generated by the citizens and organizations within Athens-Clarke and Oglethorpe counties;
- improve community sustainability by increasing recycling of yard debris, food scraps, and biosolids through composting;
- improve the environment by reducing greenhouse gas emissions caused by burying biosolids, food scraps, and other organic materials in the Landfill; and
- operate a viable Landfill enterprise.

The Mayor and Commission have set a goal of providing "infrastructure that is supportive of sustainable growth, is environmentally sensitive, and is fiscally sound." Within this goal, the Mayor and Commission set a long term strategy of achieving waste reductions (over base year FY10, measured in pounds per capita) of no less than 60% by 2018, and 75% by 2020 of Athens –Clarke community-generated solid waste directed toward landfills. The ability to reach these thresholds involves the composting of yard debris, food scraps, and biosolids.

A one mile radius around the Landfill includes approximately 2,040 acres and ACCUG owns 17.8% of that amount (Table 1). 83% of the non-ACCUG land is agricultural and natural. There are approximately 175 residential units within one mile of the Landfill.

**Table 1**

| LANDCOVER* | ACC ACRES | NON-ACC ACRES | TOTAL |
|---|---|---|---|
| Agricultural | 172.6 | 634.2 | 806.8 (39.5%) |
| Developed | 16.5 | 312.7 | 329.2 (16.1%) |
| Natural | 175.1 | 729.8 | 904.9 (44.3%) |
| Total: | 364.2 | 1,676.7 | 2,040.9 |

*2011 Landcover Data

Due to the feedstocks that have to be deposited in a landfill – **landfills smell.** There are a variety of odors at a landfill that landfill operators have to control. Odors are difficult to control and manage because they are invisible. Furthermore, the presence of an unfavorable odor is subjective. Recognizing this, the Odor Management Plan was developed to:

- describe potential odor sources;
- outline the Odor Monitoring Plan;
- explain operational strategies to mitigate odors;
- describe the protocol used to evaluate effectiveness; and
- if necessary remediate odor complaints and concerns.

This document is not intended to supersede Federal or State regulations, or the Facility's approved Design and Operational (D&O) Plan.

## POTENTIAL ODOR SOURCES ON LANDFILL PROPERTY

The Landfill is a comprehensive solid waste management facility with multiple potential sources of malodorous emissions. Potential odor sources at the site include:

- **Uncontrolled, fugitive Landfill Gas (LFG) emissions from the waste mass -** LFG is the by-product of decomposition within a landfill after available oxygen has been depleted and an anaerobic state is attained in the confined space of the landfill. LFG is primarily made up of between 35% to 50% carbon dioxide (CO2) and between 40% to 60% methane (CH4). If the composition of the LFG was only those two odorless and colorless gases, it would render the LFG undetectable to the human nose. But LFG has trace amounts of other gases (typically found at levels of less than 2%) that include water vapor, carbon monoxide, hydrogen sulfide, and volatile organic compounds. It is this small percentage of the composition, principally hydrogen sulfide and volatile organic compounds, that give LFG it's unique odor of "rotten eggs." Because of this characteristic, LFG can smell strong quite a distance from its source. It takes a good mixing breeze to sufficiently reduce the odor below levels detectable by the human nose.

  Efficient use of landfill space dictates compaction, which provides for the maximum placement of waste within the smallest space possible. Compaction of waste in thin layers (or lifts) reduces the amount of air and limits the opportunity for water to infiltrate into the waste pile. Air and water are necessary components for aerobic decomposition. When the air runs out (consumed in biological processes) anaerobic decomposition begins with the production of LFG as a by-product. Because the waste has been compacted into a relatively small space, the production of LFG also produces pressure within the landfill – the landfill becomes, in essence, a pressure-vessel.

  Gases move from areas of high pressure/high concentration to areas of low pressure/low concentration. LFG is no exception. Because the landfill is not a perfectly sealed vessel, the low pressure/low concentration area may be outside the landfill. If the low pressure/low concentration is outside the landfill, the LFG will migrate – via paths of least resistance, and may eventually pass through the sides of the landfill and into open air.

  When LFG reaches the ambient air, the gas escapes into the atmosphere as "fugitive" emissions. Barometric pressure (air pressure of the atmosphere) is a factor in fugitive emissions. (Remember: High pressure/concentration moves to low pressure/concentration). High barometric pressure reduces fugitive emissions. Low barometric pressure encourages fugitive emissions. In addition, wind, humidity, rain, snow, summer heat and other environmental

influences determine how LFG moves. Changes in weather bring changes to LFG production, migration, and control.

- **The active working face -** The "fresh" trash smell is the most common aroma at a landfill. This smell is created during the decomposition of organic waste materials. Since a municipal solid waste (MSW) landfill typically contains over 60% organic waste material such as food and paper products, this smell of rot/decomposition is often the most prevalent. The odor is present during the decomposition process when oxygen is available in the atmosphere around the waste material; this smell usually dissipates quickly with air movement. It is less noticeable the farther one is from the source. The odor is caused by sulfides and ammonia. The sulfides produce strong, rotten-egg smells that humans often detect in even low concentrations.

- **Wood debris grinding storage pile -** Leaf and limb material accepted at the landfill is ground to a mulch-sized material (wood chips) and stockpiled for use in the compost operation. The stockpiles are generally linear rows not exceeding fourteen feet in height. These stockpiles can have a "musty," "woody," or "earthy" odor.

- **The disposal of bio-solids, either through landfilling, composting, soil amendment or mixing for intermediate cover -** ACCUG wastewater treatment process utilizes naturally occurring bacteria to consume the organic pollutants in sewage and thereby clean the wastewater. These bacteria are the same bacteria found in any freshwater river, lake, or stream. As this is a biological process, the bacteria reproduce and a certain percentage has to be periodically removed from the wastewater treatment process stream to avoid overpopulation and process upset, and the bacteria removed is called "waste-activated sludge." When the waste-activated sludge is removed and dewatered, the resulting dewatered material is called "bio-solids." Approximately 25% of the bio-solids generated in ACC are composted; the remaining bio-solids are disposed of at the ACCUG Landfill, either through burial, intermediate cover, or amending soil on the Landfill cap – all uses permitted by the Environmental Protection Division (EPD). The amount of bio-solids composted is limited by the availability of compost pad space and carbon material (wood chips).

  Bio-solids may have their own distinctive odor depending on the type of processing treatment that they undergo. Much of the odor is caused by compounds containing sulfur and ammonia. These compounds cause the bio-solids to produce a musty or sweet odor, ammonia and/or rotten eggs odor.

- **Composting operations -** Once bio-solids or food scraps are incorporated into the composting system, subsequent odor problems are usually a result of low oxygen or anaerobic conditions. Anaerobic odors include a wide range of compounds. **Appendix A: Bio-solids Composting Fact Sheet.** Anaerobic conditions are prevented by introducing oxygen into the compost piles. This is accomplished by periodically turning the piles. Much of the odor is caused by compounds containing sulfur and ammonia. Again, these compounds cause the compost to produce a musty or sweet odor, ammonia and/or rotten eggs odor. Additionally, actinomycetes are aerobic microbes that exist in compost. They are a cross between bacteria and a fungus, are important to forming humus, and are responsible for the earthy smell of finished compost or freshly turned soil.

- **Construction activities involving drilling, trenching, and otherwise excavating into waste -** These activities may cause odors similar to those at the active working face listed above.

- **Waste-hauling vehicles, including spills from liquids along the roadway -** Vehicles used to haul waste may have a "fresh" trash smell similar to that of the working face. Again, this is due to the decomposition of organic materials. Additionally, liquids that have been in contact with the waste will have a similar odor. These liquids may spill or leak from improperly sealed, aged, and/or poorly maintained vehicles and result in an odor. Lastly, exhaust fumes from waste vehicles will have an odor and the severity of vehicle odor depends on age of the vehicle and maintenance record.

- **Leachate handling** - Leachate refers to the liquid that accumulates in the bottom of a landfill. Leachate forms as water percolates through the waste from rainwater, from within the waste itself and through decomposition of wastes. Leachate must be handled according to the EPD approved D&O plan for a landfill. There are two main types of leachate produced in landfills which contain biological municipal solid waste (MSW). These are known as acetogenic leachate and methanogenic leachate. The acetogenic type is often black in color and is always smelly and may smell of bad eggs. Methanogenic has only a slight smell and is brown or golden colored. Leachate, whether acetogenic or methanogenic, has a distinct odor.

## POTENTIAL ODOR SOURCES OFF THE LANDFILL PROPERTY

There are other potential sources of odors in close proximity to the Landfill, but outside the control of ACCUG. These include:

**Immediately contiguous and within .5 mile radius of the Landfill:**

- Poultry Farm
- Periodic land applications of chicken manure

**Between.5 mile and 1 mile radius of the Landfill:**

- Two additional poultry farms
- Periodic land applications of cattle manure
- University of Georgia (UGA) Teaching Dairy

**Between 1 mile and 1.5 mile radius of the Landfill:**

- Three to four additional poultry farms
- UGA Beef and Sheep Unit

All of the above external potential sources of odors near the Landfill are manure-intensive operations. Depending on applications and weather conditions, these odor sources can sometimes be mistakenly attributed to the Landfill. **Appendix B: Map of Odor Sources Adjacent to the ACCUG Landfill.**

## STRATEGIES FOR CONTROLLING ODOR

There are a number of operational strategies and best management practices that ACCUG continually implements to mitigate odors emanating from the Landfill. While they are largely successful, landfills are not a totally odor-free operation.

1. **Effective Landfill Gas Collection and Control System Operation**
   Because LFG behaves according to physics, landfills can create paths of least resistance and areas of low pressure/concentration within a landfill. The process is simple: install a system of pipes in the landfill with a vacuum device attached. Within the Landfill, the pipes must be perforated to create a path for the gas. By adjusting the vacuum on the collection system, areas of low pressure/low concentration are created and become the preferred pathways for the gas. Connect the collection system to a destruction device, such as a flare or internal combustion engine, and the LFG with its odorous components are destroyed.

   The ACCUG Landfill includes a landfill gas collection system that includes vertical wells and horizontal collectors connected to a blower that creates low pressure in the collection pipes. LFG is drawn to the blower and then directed for use as fuel in internal combustion engines for generation of electricity.

   The LFG collection system includes an on-site electrical generation power plant operated by Energyneering Solutions, Inc., through a public-private partnership. The system diverts the collected LFG for combustion in engine generators. The power is sold back to the grid as "green energy."

2. **Landfill Gas Monitoring**
   Landfill gas monitoring is performed as directed in the approved facility Design and Operation (D&O) Plan. The objective of the methane gas monitoring program is to detect the lateral movement of potentially explosive gases in the subsoil and along man-made migration pathways toward on-site and off-site structures. The information gathered from the gas monitoring stations aid in the efforts to determine and evaluate the potential hazard which is associated with the accumulation of methane gas concentrations between the methane explosive limits, 5 to 15 percent by volume. Monitoring stations are monitored quarterly and results are recorded on the EPD form SWM/19.

3. **Limit Working Face Areas**
   As per the Landfills approved Design and Operation Plan, the unloading of waste is restricted to a working face limited to a maximum of 200 feet wide by 200 feet long.

4. **Timely Placement and Compaction of Daily/Interim Cover Materials**
   All waste streams are required to be covered by a tarp or in an enclosed container upon acceptance at the Landfill. The loads will remain covered until they reach the un-tarping area near the working face. Malodorous waste acceptance will be generally restricted. Malodorous waste typically consists of sludge materials. To provide for an adequate mixture ratio between malodorous waste and non-malodorous waste, malodorous waste tonnages will be limited to 25%

of the total daily incoming waste tonnage. Other waste streams with foul odors will be treated as malodorous wastes as determined by the Landfill Administrator. After disposal in the landfill, malodorous wastes will be covered immediately with a minimum of 6 inches of garbage, cover dirt or other approved daily cover. Inspections of the landfill cover will take place to ensure that the integrity of the daily and intermediate cover is adequate.

**5. Cover Integrity Monitoring**

Intermediate and final cover is monitored to ensure that it meets the requirements of the D&O Plan. The primary purpose of intermediate cover is to reduce the quantity of moisture entering the landfill.

**6. Final Cap Construction**

When areas of the landfill reach their capacity, Final Cover will be installed as per the approved D&O Plan. The final cover used by ACCUG is a thick layer of soil (18 inches of compacted soil (clay) and 6 inches of soil suitable for vegetative growth). The Cap is designed and installed to prevent water from infiltrating into the buried mass of the solid waste. The sides of the cap are sloped enough to prevent ponding, but not so steep as to encourage erosion. Water that does not infiltrate into the soil evaporates. The cap soil is amended with biosolids which contain nutrients that promote growth of native plants. Plants growing on the cap absorb water in their root system and then transpire the water back into the atmosphere.

**7. Curtailed Receipt of Fats, Oils, or Greases (FOG)**

Used cooking oils are accepted at the Landfill for recycling. Otherwise, Fats, Oils, and Greases are not accepted at the ACCUG Landfill.

**8. Effective Compost Operations**

Materials used in the composting process include ground leaf and limb debris (mulch), bio-solids and food scraps. Because of the potential for bio-solids and food scraps to create odors, they are managed as follows:

- These loads are accepted for composting between 7:30 a.m. and 2:00 p.m. Monday through Friday.
- These materials are unloaded in the designated mixing area and combined with wood chips at a 3:1 ratio by volume. To ensure odor minimization, the bio-solids or food scraps are mixed within 20 minutes of being unloaded in the mixing area. The mixture is then added to a wood chip base on a windrow and covered with additional wood chips if necessary. All materials in the mixing area are removed before facility closing hours.
- Windrows are only turned on Monday and Thursday mornings.
- Finished unscreened and screened compost are periodically turned to aid in the curing process.

**9. Effective Leachate Management**

After collection, the ACCUG Landfill recirculates leachate according to the D&O Plan. In extreme weather events the ACCUG Landfill, has the ability to load leachate into tanker trucks and transfer the leachate to an ACCUG Wastewater Treatment Facility.

If at any time during the operation of the Landfill and compost facility odors become a nuisance in the opinion of the EPD or the Operator, an Odor Remediation Plan will be implemented in a step-by-step method. If the initial steps of the Plan do not control the odors at the Landfill, additional odor control techniques will be implemented. Below are standard operating procedures intended to minimize the potential for the facility to create malodors.

## ODOR MONITORING PLAN

Landfill staff performs several odor monitoring events weekly to measure the intensity, frequency, location, and character of odors produced or brought on site, at multiple stations at the Landfill. **Appendix C: Map of Nasal Ranger Monitoring Points.** The staff measure odor intensity using a Nasal Ranger®, an olfactometer manufactured by St. Croix Sensory. Intensity is a primary nuisance indicator because it is quantitative and repeatable. Character, frequency, and duration of odors are used as secondary nuisance indicators since they are subjective and are dependent upon the intensity of the odor.

### Observation Methods

The staff describes the character of detected odors using the odor description wheel provided by St. Croix Sensory. The wheel separates odors into distinctive groups including: floral, fruity, vegetable, earthy, offensive, fishy, chemical, and medicinal. Each of these groups is further divided into more specific odors such as: garbage, grassy, woody, soapy, etc. **Appendix D: Odor Description Wheel.**

The Nasal Ranger® olfactometer measures odor intensity by calculating the "Dilution-to-Threshold" (D/T) ratio. This is accomplished by mixing inhaled odiferous ambient air with odor-free carbon-filtered air. The D/T ratio functions as a measure of the number of dilutions needed to make the odor of the ambient air non-detectable. It is calculated by dividing the volume of filtered air by the volume of odorous air.

The Nasal Ranger® olfactometer uses a gauged dial to change the amount of filtered air added to the ambient air. It includes the following industry-standard concentration levels: 2, 4, 7, 15, 30, and 60. The higher the number of dilutions, the more intense the odor. During a monitoring event, the staff member cycles through each size aperture until an odor is detected and records the relevant D/T ratio as well as the character of the odor. Odors that equal or exceed a D/T ratio of 7 at the perimeter of the Facility are classified as problematic odors that require remedial action.

### Odor Monitoring Practices

Currently, staff records odors up to four times weekly on the following days: Monday, Wednesday, Friday, with the fourth day alternating between Sunday and Saturday. Each weekly observation is performed by a different qualified staff member using uniform methods of data collection. Odors are recorded at ten locations on site near the active landfill, the composting pad and along the property line. Additional monitoring locations are used to address specific complaints if and when they occur if possible. **Appendix E: Sample Odor and Weather Station Monitoring Log**

### Data Collecting and Reporting

Field data is collected and compiled by a staff member into a spreadsheet that details the date, time, location of the sampling, as well as, the odor intensity and character. Weather information including wind

direction, speed, and barometric pressure are also included in the report. Data sheets are printed off weekly and stored in a binder on site. **Appendix E: Sample Odor and Weather Station Monitoring Log**

**Odor Monitoring Protocol**

Prior to monitoring, the weather forecast is reviewed. Conditions that may intensify and direct odors are noted. This includes factors such as: barometric pressure, wind direction, wind speed, and humidity. Additional weather information is collected from the on-site weather station to ensure consistency. Samples are not collected during storm events.

**Conducting an Odor Survey:**

**Note:** The use of the Nasal Ranger is described in greater detail within the Nasal Ranger Operational Manual.

1. Attach the nose piece to the Nasal Ranger and turn on the power switch that measures inhalation rate, this ensures that the optimal air flow is inhaled into the olfactometer.
2. Position the D/T dial at a blank position above the highest D/T value.
3. Determine wind direction and point the Nasal Ranger perpendicular to the wind direction.
4. With the nosepiece sealed over nose, breathe in through nose and out through nose normally for 60 seconds.
5. Turn the D/T dial to the first D/T position while still sealed to face. Breathe in through nose, ensuring the target inhalation rate indicated by the green circle icon is maintained for three breaths. *Eyewear may obstruct seal, remove if target inhalation rate is difficult to maintain*. If an odor was detected, odor survey is complete, record the D/T.
6. If no odor was detected, turn the dial to the next filtered position while still sealed over nose and inhale filtered air through nose normally twice.
7. Inhale three times through nose at target inhalation rate, if odor is detected, record the D/T.
8. If no odor was detected, repeat the steps through the rest of the D/T dial until an odor is detected, or until all D/T settings on the dial are completed.
9. If no odor was detected at D/T = 2, then the sample is recorded as ND (No Detection) on the report.

## ODOR COMPLAINT PROTOCOL

**Internal (Staff or Customer on the Landfill Property)**

Internal odor complaints or concerns are those originating from Landfill staff and on-site visitors. Because these individuals are on the Landfill property, they are more likely to experience odors coming from the site and able to identify the source of the odors and report them in a timely manner. All Landfill operators are encouraged and authorized to investigate potential concerns and take corrective action when necessary. All concerns and issues requiring corrective action are to be reported to the Landfill Administrator. **Appendix F: Odor Complaint Response System**

**External (Staff, Neighbor or Individual off the Landfill Property)**

External odor complaints or concerns are those made by facility neighbors and individuals outside the Landfill property. Landfill staff has a much greater opportunity to identify the source of odors and remediate a situation if external complaints or concerns are made in a timely manner. Complaints that are

received by the Solid Waste Department Director or other Solid Waste Department Staff Member will be recorded (date, complainant, odor complaint – all details, and person recording complaint) and send to the Landfill Administrator. When an odor complaint is received by the Landfill Administrator, staff will be directed to the area to determine if the complaint is valid. If valid, staff will try to identify the source of the odor and determine its intensity and character. If the facility is the source of the odor and the odor has a D/T threshold equal to or greater than 7 at the Facility's perimeter, corrective action will be taken. All complaints will be added to the Odor Management Plan file along with weather station data, the validity of the complaint, the source of the odor, and, if the odor originated from the facility, action taken to remediate the odor. When odor complaints are not made in a timely manner, they will be added to the Odor Management Plan file along with weather station data and Nasal Ranger sampling results. Additionally, staff will evaluate the potential for operations to have caused a malodor at the time of the complaint. **Appendix G: Sample Odor Complaint Log**

## ODOR REMEDIATION TECHNIQUES

If at any time during the operation of the landfill and or compost facility odors become a nuisance in the opinion of the EPD or the Operator, an Odor Remediation Plan will be created and implemented in a step-by-step method. If the initial steps of the Plan do not control the odors at the landfill, additional odor control techniques will be implemented.

Possible response to nuisance odors that the Landfill will evaluate and consider as part of a remediation plan may include, but not limited to, the following:

- Waste Acceptance Alterations;
- Compost Feedstock Limitations or Alterations;
- Increased soil cover quantities or use an alternate daily cover - **Appendix H: Daily Cover Specifications**;
- Expansion of the wellfield with additional LFG extraction components;
- Limit leachate recirculation and use an alternative disposal method; and
- Explore odor misting systems or other odor treatment products.

**Appendix A: Bio-solids Composting Fact Sheet**

**Appendix B: Map of Odor Sources Adjacent the ACCUG Landfill**

**Appendix C: Map of Nasal Ranger Monitoring Sites**

**Appendix D: Odor Description Wheel**

**Appendix E: Sample Odor and Weather Station Monitoring Log**

**Appendix F: Odor Complaint Response System**

**Appendix G: Sample Odor Complaint Log**

**Appendix H: Daily Cover Specifications**