FORCE Final Report 2005

Project:
GOC-Vapor Odor Control for Biosolids Tipping Floors and MSW Tipping Floors

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Abstract

In 2004 and 2005 an odor control system was pilot tested at the Sumter County Solid Waste Facility. The facility was responding to intermittent odor complaints received from a neighboring residential area. This project was designed to test the efficacy of odor control systems that vaporizes odor-control compounds and distributes them in un-enclosed areas to both react with and mask odorous air emanating from the facility's solid waste tipping building and biosolids handling area. Minor issues were encountered with regard to the equipment and odor control compounds, but nothing severe which the County considers impacted the systems efficacy. Nevertheless, the final system installed was effective at masking odors. The results of the project will be helpful for Sumter County as it implements a long-term odor control solution.

Introduction & Purpose

Odor problems are a major potential problem for organics recycling facilities and thus can be a significant barrier to the organics recycling industry as a whole. Effective odor control is one of the prerequisites for a successful organics recycling facility. They must be able to consistently handle material without causing an odor nuisance. Any implemented odor treatment process must be reliable, efficient and cost effective. From a technological perspective any odor problem can be solved, but a cost-acceptable solution is more complicated to achieve. Odor-control systems rely on two primary strategies: 1) use of chemical compounds that convert odor compounds into odorless compounds and 2) use of fragrances or neutralizing agents that mask odor compounds.

Prior to this project, the Sumter County Solid Waste Facility had received odor complaints from neighboring residents. The County had determined that the most likely cause of these complaints was odor emanating from two sources: the MSW Tipping Building and the Biosolids Handling Area. According to County staff the Biosolids Handling Area was the greater odor source of the two.

The vast majority of problem odors in the solid waste industry are the result of either reduction reactions, or incomplete oxidation reactions. Sulfides and mercaptans are by-products of reduction reactions, while alcohols, aldehydes, and ketones are by-products

of incomplete oxidations. All such compounds can be ionized, oxidized or further oxidized into odorless end products and eventually into ionic forms of their nutrients, along with carbon dioxide, and water or water vapor as by-products. For example, hydrogen sulfide may be oxidized to sulfate, alcohols may be oxidized to aldehydes and ketones, aldehydes and ketones may be esterified, and then hydrolized. The reactions associated with these processes may be found in any freshman chemistry text, and need not be discussed here.

The purpose of this project was to evaluate the performance of a new air-contact odor-control system called GOC Vapor supplied by GOC Technologies. Traditional air-contact odor-control systems treatments involve tubes that feed pressurized liquid to atomizing nozzles. Trouble-free operation of a nozzle system is problematic in the often dirty, dusty, moist conditions of at solid waste handling facilities. The GOC Vapor system was designed to eliminate reliability problems by pre-mixing the treatment compound into an airstream and increase the efficiency of treatment over a broad spectrum of odors.

The principal investigator for this project was RKB Enterprises.

Methodology

Target Areas for Odor Control

The odor control system was designed to fully treat odors from the Biosolids Handling Area. The system for the MSW Tipping Building was limited to treat odor from one overhead door on the eastern side of the building. This treated doorway was chosen because it faces the residential area adjacent to the facility and the source of odor complaints.

Chronology

August 2003	RKB Enterprises submits grant proposal to FORCE.
December 2003	RKB briefs FL DEP on the project.
June 2004	DEP approval delayed; RKB consults with Sumter County regarding changes in odor control system; County & RKB agree to changes in design.
October 2004	Installation of HDLA 100 and 300 equipment.
December 2004	RKB inspects installation, making adjustments as required.
March 2005	Final inspection of the system
March 2005 – May 2005	County operates odor control system.
May 2005	RKB prepares final report.

Equipment

The original proposal specified use of the GOC Vapor System. However, after this project was approved, RKB experienced problems with reliability of the GOC equipment

at a compost facility in North Carolina. The equipment was sensitive to power surges and thus unreliable for use even when used with surge protectors. The system was not, therefore, ready for continuous low maintenance operation at that time. This compelled RKB Enterprises to recommend a switch to an alternative vapor system. RKB recommended switching to equipment designed and manufactured by Hinsilblon that had a proven track record of long term reliability. The Hinsilblon HDLA100 System was used in the MSW Tipping Building and the Hinsilblon HDLA300 Systems was used in the Biosolids Handling Area. The systems have the following specifications:

- HDLA100: up to 100ft x 2" of air line, 14.5 amp 115/1/60 blower, CFM 80@ 1psi
- HDLA300: up to 300ft x 3" of air line, 8.85 amp 460/3/60 blower, CFM 200@ 2psi

Both systems employ similar design consisting of a large capacity blower, an evaporator for mixing the treatment compound with air, and network of perforated hose that distributes the odor control airstream. The odor control compound is held in the evaporator sump. The blower then forces air down into the evaporator sump; the product is carried with the air down the air line and out of the holes. The air flow within the evaporator can be adjusted to alter the amount of odor control compound that is vaporized. In addition, the evaporator was redesigned to blend two separate odor control compounds by introducing air into the evaporator base as well as the top. (see Figure 1) The yellow handles adjust the balance of air flow, thus the blended compounds are agitated. The vapor enters the hose, the hose is arranged to provide vapor to the treated area.

Figure 1 – Cabinet with HDLA 100 Vapor System

Any air-contact odor-control system must get the necessary chemical reactions to occur safely and predictably. When an actual chemical change is desired, it is essential that contact occurs between the odorous gas and the agent for change. The Hinsilblon equipment is designed to mix odorant and reactant by releasing a vapor at an essentially similar weight to air, thus facilitating mixing and contact. When fragrance or neutralization products are used, application requires only that the associated perfume or neutralizer be released into the air in such a manner that it can be detected. Its use is not based on actual contact with offending gases.

However during the course of this project, it appeared that the HDLA equipment does not actually induce a phase change, i.e., converting the liquid odor control compound from a liquid to true vapor. It is however a very fine atomization such that the spray is dry.

Odor Control Compounds

The original proposal specified use of two compounds: GOC-Vapor 911UV in the MSW Tipping Building and GOC-Vapor 910UV in the Biosolids Handling Area. However, as noted above a change in equipment was recommended due to unreliability of GOC vapor equipment at the time of the project. At that time, performance data on Hinsilblon odor control compounds indicated that they would be effective for the Sumter County project, and so the decision was made to utilize two Hinsilblon products - EvaneZyme (EZ) and EvaneScent (ES).

- EvaneZyme is a protein-based deodorizing treatment that chemically reacts with odor compounds. It has the following properties: enhanced OH radicals; reactive proteins that survive evaporation; designed to react with sulfides, mercaptans, and organic acids; may be used in conjunction with neutralizers.
- ES is an odor neutralizing compound. It is an essential oil surfactant-based product with an orange peel fragrance.

Odor treatment for the MSW Tipping Floor was with EvaneZyme/EvaneScent**,** a combination of a vapor-phase and neutralizer products.

Installation and Operations

Two areas at Sumter with known intermittent odor problems were treated, the MSW tipping floor and biosolids handling area. The size and layout of the building/structure in each treated area and the nature of the tipped material required a different approach and treatment product for each:

MSW Tipping Building

The MSW Tipping Building is located at the northern end of the Sumter County Solid Waste building. The building has four truck-access overhead doors that are mostly left open. The building is an enclosed space of 250,000 cu ft (120'x 60'x 35'). The purpose

of the treatment was to control odor to unnoticeable levels downwind of the treated doorway. The HDLA 100 system was hard wired to the power supply by a 115/1/60 14.5 amp power supply box on the wall adjacent to the system. The odor-control vapor was distributed using 2" HDPE piping and Camclock hose to the sides and top of the doorway. (See Figure 2) Holes were drilled in the piping (3/16 inch diameter) to release the vapor where it was needed. The systems are capable of operating 24 hours per day, seven days per week. The site manager decided when to run the system during working hours. At the manager's discretion the system ran overnight or on weekends if an odorous load remained in the tipping floor.

Figure 2 – MSW Tipping Building Distribution Hose Attached to Sides & Top of Doorway

Biosolids Handling Area

The Biosolids handling area is located at the southern end of the Sumter County Solid Waste building. It is an open sided 100,000 cu ft (60'x 50'x 35') structure. The purpose of the treatment was to control odor to unnoticeable levels on the critical downwind side of the building. The HDLA 300 system was hard wired to a 460/3/60 7.9 amp power supply. The odor-control vapor was distributed through 3" HDPE piping and Camclock hose. (See Figure 3) Holes drilled in the piping (3/16 inch diameter) release vapor where it was needed. The odor control vapor formed a curtain barrier on one side of the biosolids handling area extending from the building wall to the end of the loading hopper. Treatment was concentrated in the area that historically is known to generate odor. The

system was capable of operating 24 hours per day, seven days per week or as determined by the site manager.

Figure 3 – Biosolids Handling Area

Recordkeeping

There were insufficient funds to measure any change in specific odorous compounds, i.e., collect air samples for quantitative chemical or odor analysis. Therefore all record taking was subjective. The facility manager, Chuck Jett, along with his site manager, Jimmy Wise, agreed to keep records. Based on discussions with FORCE and Sumter County staff, sheets were designed to record system consumption, hours of operation, and incidents. Five record sheets were designed for the trial. They were:

1. Frequency of Use on the tipping floor
2. Frequency of Use in the biosolids area
3. Quantity of Odor Control Chemicals on the tipping floor
4. Quantity of Odor Control Chemicals in the biosolids area
5. Facility Odor Complaints

Results

System Operations

The original objective of this FORCE project was advanced odor treatment utilizing a combination of an odor reacting compound (EZ) and odor masking and neutralizing compound (ES). However, it was found that EZ volatilization in the evaporator was unexpectedly inhibited by warm ambient temperatures. EZ was not successfully vaporized by the Hinsilblon equipment; it therefore did not work on the broad spectrum odors at Sumter. It was found that only the neutralizer ES functioned consistently in the Hinsilblon equipment, although this is also not effective against the sometimes strong odors at Sumter. The limitation of this equipment was not foreseen when the recommendation was made to change delivery systems for equipment reliability reasons. This trial clearly demonstrated the need to find reliable equipment that can efficiently deliver product to odorous areas at a reasonable operational cost.

Power outages and inconsistent procedures made it difficult to nail down the precise consumption of ES and EZ odor control compounds. The systems ran continuously during the working day and over some weekends. The initial 55 gallon quantities of ES and EZ lasted throughout the 100 days of the trial. This was consistent with Hinsilblon's predicted product consumption for the installed HDLA300 and HDLA100 systems, providing coverage around the biosolids tipping area and the doorway in the tipping floor.

The predicted operating cost for the HDLA 300 system was $2,160 monthly and for the HDLA 100 it was $720 monthly. Within the limitations of the records, these estimates are assessed as accurate. Therefore the total cost to continue running this system using the Hinsilblon and ES odor control system would be in the order of $3,000 monthly.

Permitting

Since the original equipment to be installed was presented to the DEP during the facilities permitting stage and a different system was installed, the County ran into some issues with the local DEP office due to this change without proper permit modification or deviation notice. This error occurred as a result of County/FORCE staffing at that time in conjunction with the RKB representative.

Odor Control

No off-site odor complaints were received during the 3 months of operation; however, RKB did not have full confidence in the performance of ES. The County did have confidence with the odor control system and felt that ES (without EZ treatment) did sufficiently neutralize or mask the biosolids odors. And that it was effective on both the MSW and biosolids tipping areas. And reduced odors were noticeable. Furthermore, confidence in ES performance during the warmer months was therefore put into question. But staff felt since there were no odor complaints that the system was effective in the objective of no complaints to DEP.

The project methodology did not include quantitative odor analysis; therefore, the effectiveness of odor control is based only on subjective assessments made during staff interviews and observations at the locality before, during and after the trial period.

Conclusions and Recommendations for Further Study

The trial was successful although limited. Sumter County, took responsibility for operating and keeping the installed system, running beyond the 3-month period funded by the project. To date the County has not had any odor complaints from the general public or the DEP. The following are relevant observations:

- For a site with only infrequent off-site odor problems, the effectiveness of the treatment was sufficient during the trial, but difficult to reasonably assess within the 3 month period for a yearly seasonal duration. Seasonal changes that affect odor generation were not evaluated during this trial. This type of trial should run for a year or should cover a period during which the highest number of complaints is historically generated. Additionally, the time lost during the permit consideration by DEP eliminated the flexibility to schedule accordingly.
    - Despite two negative findings by RKB's staff: 1) a lower confidence in the performance of the ES odor control compound, and 2) the EZ odor control compound was not being successfully vaporized by the Hinsilbolon equipment installed at the facility during the pilot period in which these odor control equipment and compounds were implemented; the County decided to continue with the use of both the EZ and ES odor control compounds in its normal operations as a part of its permit requirements. Specifically, the County cited their reason for the continued use of these products at the facility as a lack of any odor complaints made to the Solid Waste or DEP local office staffs during this pilot period.

- The system cost and the operating cost were higher than Sumter County had anticipated, but the County decided to keep the system in place due to no complaints about odor from the public during the trial.

- Non-point-source odor control is difficult to engineer, particularly within a limited budget. The compromise is to treat the areas that are known, from on-site experience, to generate odor. At Sumter there is potential for odor at the following locations:
    - Tipping floor/area
    - MRF
    - Biosolids storage area
    - Biosolids hopper
    - Primary screen
    - Primary windrows

- There are many terms used within the odor-control industry. Customers remain puzzled as to what is available from the odor control industry.

Based on the results of this study the following recommendations are offered for Sumter County to consider as it implements solutions for odor control.

- Put a dollar ($) figure on the ongoing monthly cost of the remedies. This is normally directly proportional to the scale of the problem. Anything can be solved with an unlimited quantity of money, but that is not normally the way odor problems are handled.

- Arrange an assessment/data collection period to cover the season that historically produces the most odor problems. This is particularly critical for sites with only infrequent off-site odor complaints.

- The relative high cost of Vapor treatment makes these odor remedy more suited to totally enclosed situations. Vapor costs are then competitive. The flexibility of these systems can be utilized with computer-controlled intermittent operation. They are then able to treat with equal efficiency large and small indoor areas.

- Non-point source odor control is difficult to engineer. Treat doorways and use odor barriers as a compromise. It will probably not be affordable to effectively treat the entire area when constrained by a limited budget even with the much less effective masking agents or neutralizer remedies.

- The list of odorous compounds generated by MSW and biosolids is long. Plus, odors at Sumter County Solid Waste Facility originate at multiple locations and are inconsistent in strength and possibly also seasonal. Accurate emissions analysis is problematic and expensive. The best compromise remedy is to selectively treat with a broad spectrum deodorizer and target the most obvious sources. This may not immediately resolve the situation, so keep an open mind as to the potential source(s) of your off-site odors.

- When selecting treatment technologies identify the goals:
    - To eliminate the nuisance of the odors for a short period of time only?
    - Seasonal or year round treatment?
    - To address odors in a manner that also addresses potential health risks?
    - For permit reasons?

- When selecting vendors and odor control products, address the following questions:
    - What are the ranges of options of anti-odor products that you can offer for this situation
    - How well and to what degree does each of the products actually reduce the target odor compounds?
    - Obtain test results for selected compounds showing the concentrations at which the recommended products will be effective.

- Development of vapor systems continues. The type of large scale vapor equipment needed by Sumter County for their multiple non-point source odors is now available, but, product production costs are higher because they must be free of minute mineral deposits. Large scale systems are therefore more expensive to

operate than other technologies such as atomizer systems. Currently, successful Vapor installations are limited to cigarette and foodwaste odors in hotel rooms and casinos. A GOC-HYDRA LP atomizer system, using either Evanscent or BAT 502, may be the best available technology for all non-confined, non-point-source odors that are typical at the Sumter SWF.

- The County received a 10-15% reduction in the costs of its odor treatment product when it purchased it directly from the equipment manufacturer than it did when it was purchased through RKB Enterprises. For a small, rural facility such as Sumter County this cost reduction is very important.