SCS ENGINEERS

Odor Investigation Report

Region 2000 Regional Landfill
Livestock Road Facility
Rustburg, Virginia

Prepared for:

REGION 2000 SERVICES AUTHORITY

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Table of Contents

List of Exhibits

Appendices

INTRODUCTION

SCS Engineers (SCS) has prepared this Odor Investigation Report (Report) for the Region 2000 Regional Landfill – Livestock Road Facility (Landfill) located in Rustburg, Virginia. The Region 2000 Services Authority (Authority) retained SCS to perform various field activities as part of an odor investigation during April through June 2015 for the purpose of assisting the Authority in evaluating whether on-site sources are contributing to nuisance odors detected and reported in the general vicinity of the Landfill. SCS' odor investigation work efforts focused on identifying and evaluating potential on-site sources of odors, specifically fugitive landfill gas (LFG) emissions from Phase III, the Phase II LFG collection and control system, routine working face operations, disposal of special wastes, leachate management, and other aspects of the site activities. SCS' field work during the odor investigation consisted of the following activities:

- Observations and reconnaissance of working-face and site conditions during waste placement activities;
- Observations and reconnaissance of adjacent properties and surrounding communities during waste placement activities;
- Surface emissions monitoring (SEM) immediately above the landfill surface and adjacent to leachate cleanout pipes to measure concentrations of methane (CH4) as an indicator of fugitive LFG emissions;
- Ambient air monitoring within the facility boundary as well as on adjacent properties within surrounding communities to measure concentrations of hydrogen sulfide (H2S) as an indicator constituent for odors;
- Sampling of the LFG produced within the Phase III waste mass for laboratory analysis to identify the concentrations of various constituents which have generally low odor thresholds; and,
- LFG pump test as part of a pilot study to evaluate LFG collection and control from the Phase III fill area.

Based on the data collected during the LFG pump test, the Authority decided to proceed with the installation of a pilot-scale LFG collection and control system (referred to as the Pilot-Scale LFG System) in Phase III, which was completed and commenced operation in June 2015. This Report presents SCS' observations, monitoring and sampling results, and conclusions and recommendations related to the odor investigation, as well as a summary of the design, construction, and operation of the Pilot-Scale LFG System.

Odor Descriptions

Landfill odors are often associated with the following routine operational activities: daily waste placement operations at the working face, periodic exposure of buried waste during trenching and/or extraction well installation, earthwork during capping activities, management of landfill

leachate, fugitive (uncollected) LFG emissions, or operations of the LFG collection and control system.

A common byproduct of the decomposition of waste at a landfill is LFG, in which the two predominant chemical constituents present in the LFG are methane and carbon dioxide, both of which are odorless gases. Hydrogen Sulfide (H_2S) is one chemical constituent that has a strong odor, which is typically present in the LFG produced at most sanitary landfills at low concentrations relative to the primary LFG components of methane and carbon dioxide. Along with compounds such as ammonia, aldehydes, ketones, the reduced sulfur constituents, which include H_2S, mercaptans, carbonyl sulfide, and dimethyl sulfide, are most commonly associated with landfill odors related to fugitive LFG emissions. H_2S is a colorless gas with a distinctive odor associated with rotten eggs. Because H_2S is the sulfide which is usually measured at the highest concentration in LFG, many landfills utilize it as an indicator for odors. However, LFG-related odors are not always characterized as H_2S/rotten egg.

Other odors that may be identified from landfill operations can potentially originate from trash odors associated with the working face, odors associated with exposed waste during construction or excavation activities, and odors associated with leachate collection, pumping/transfer, and storage.

At the Livestock Road Facility, the most prominent non-landfill activity on surrounding properties that is a likely source of odors is animal waste from surrounding livestock farms and, more specifically, the Lynchburg Livestock Market facility that is located immediately west of the Landfill. This facility hosts routine auctions and events during which livestock is transported to/from the facility. Based on SCS' reconnaissance, it does not appear that this facility is equipped with odor control or neutralizing systems. SCS did not contact the owners/operators of the facility to obtain information related to the facility's practices for handling and managing the animal waste and bedding materials.

Summary of Nuisance Odor Complaints

The Landfill is equipped with a weather station and datalogger and the Authority maintains a record of odor complaints that are received at the Landfill. Information recorded includes the date/time, location, meteorological conditions, general weather conditions, character of the odor, and relative intensity. Based on SCS' review of odor complaints recorded for the period of January through May 2015, the odor complaints originate primarily from homeowners located to the west and southwest of the Phase III Landfill during overcast conditions at times when the barometric pressure is low and wind direction is from the east or northeast according to the on-site weather station data. Based on discussions with Authority staff, the majority of odor complaints are reported during early morning and late in the evening.

BACKGROUND

Landfill Description

The Region 2000 Regional Landfill – Livestock Road Facility (Solid Waste Permit No. 610) is an active landfill that is owned by the Region 2000 Services Authority (Authority). The facility

has been owned and operated by the Authority since June 8, 2012 and consists of about 159 acres. The Facility, as originally permitted, was comprised of waste disposal units identified as Phases III and IV. The Campbell County Sanitary Landfill (Solid Waste Permit No. 285), which includes waste disposal units identified as Phase II and Phase II Old, is owned by Campbell County. The Virginia Department of Environmental Quality (VDEQ) determined that the two landfills constitute a single facility for purposes of permitting and compliance with air quality requirements. The two landfills have been issued a single Stationary Source Air Permit and Title V Air Operating Permit (No. 21547).

The Facility is located at 361 Livestock Road, Rustburg, Virginia and commenced operations in July 1978 and was temporarily closed in 2008. The Authority resumed landfilling operations in Phase III in April 2012 and currently accepts approximately 200,000 tons of municipal solid waste per year. As originally permitted, the two landfills have approximately 74 acres permitted for municipal solid waste (MSW) disposal. Phase II Old and Phase II are closed landfill areas consisting of approximately 25.4 acres. The existing Phase III fill area consists of approximately 28.4 acres. This portion of the Landfill has a geosynthetic liner system and leachate collection system, including 19 leachate cleanouts.

In October 2015, the VDEQ issued an amendment to Solid Waste Permit No. 610 to include a Lateral Expansion and reconfigure the existing and future waste disposal units in a manner which will increase the design capacities of the Phase III and IV waste disposal units and incorporate the design capacity associated with the Phase V waste disposal unit. The permitted waste disposal units at the site include the following:

- Closed Phase II Old;
- Closed Phase II;
- Active Phase III; and,
- Future Phases IV and V.

Of particular interest regarding potential odors originating from daily waste placement operations at the working face is the Facility's practices related to the acceptance and disposal of wastewater treatment plant sludge generated by the City of Lynchburg's regional wastewater treatment plant. The Landfill receives approximately 21,000 tons of the sludge per year, which works out to an average of approximately five truckloads per day.

Landfill Gas Collection and Control System

The Landfill is not yet required to install and operate a mandatory LFG collection and control system per the New Source Performance Standards (NSPS) for municipals solid waste landfills under 40 CFR 60 Subpart WWW that require installation and operation of a LFG system to control emissions of non-methane organic compounds (NMOCs). The site-specific NMOC concentration measured during the Tier 2 sampling event conducted in December 2011 enabled the Landfill to defer installation of a regulatory-mandated LFG system for at least a 5-year period until the next sampling event, which is scheduled to be performed prior to December 2016.

Campbell County Landfill

In December 2003, a LFG collection and control system consisting of a regenerative blower, four Solar Spark flares, collection piping, and condensate management system, was installed for the Phase II waste disposal unit. The construction project converted 14 of the 15 existing deep passive vents (GV-51 through GV-57 and GV-59 through GV-65) to active LFG extraction wells. After 2009, the 14 existing wells were abandoned, except GV-53 and GV-54 which remained to help control leachate. In 2010, the LFG collection system was expanded and currently consists of 24 extraction wells in the Phase II Closed Unlined Landfill Area. The blower/flare station has a maximum capacity of 560 cfm of LFG at 50 percent methane.

Livestock Road Facility

At the time of SCS' initial field reconnaissance in April 2015, the LFG being produced within the Phase III waste disposal unit was being fugitively emitted through the landfill surface since there was not an active or passive LFG collection system installed in this fill area. As discussed in this Report, a LFG pump test was performed in May which involved connection of a mobile blower station to several leachate cleanouts within the Phase III waste disposal unit. Based on the results of this initial pump test, the mobile blower station was connected to eight of the leachate cleanout pipes as a pilot-scale LFG collection and control system (referred to as the Pilot-Scale LFG System). The primary objective of the Pilot-Scale LFG System is to reduce fugitive LFG emissions and control odors at the Facility. The Pilot-Scale LFG System consists of the following:

- Wellheads at eight leachate cleanout riser pipes (LC-01, LC-02, LC-03, LC-14, LC-15, LC-16, LC-17, and LC-18) for purposes of extracting LFG from the bottom leachate collection system in Phase III;
- 6-inch belowgrade LFG perimeter header piping extending from the southwest corner near LC-16 to the road crossing in the northeast corner near LC-08;
- 12-inch belowgrade LFG header piping from the northeast corner near LC-08 that crosses the perimeter access road and extend to a buried condensate manhole near the leachate pump house;
- 18-inch-diameter HDPE belowgrade condensate manhole near the leachate pump house; and,
- Trailer-mounted mobile LFG blower station consisting of a 5-hp Ametek Rotron regenerative blower, which applies vacuum to eight leachate cleanouts. Flow is measured via a Thermal Instruments 62-9 flowmeter and data is stored in a Yokogawa DX-1002 datalogger. Collected LFG is conveyed through a Carbtrol highly activated carbon canister and/or a CF-10 solar spark vent flare. The Pilot-Scale LFG System was activated on 6/15/15.

Surrounding Properties

The land surrounding the Landfill is mostly comprised of timber, agricultural, and residential properties. The Authority purchased the Bennett property, located southeast of the Phase III Landfill in the fall of 2014 to use as a borrow source. The neighborhood of Poplar Ridge is located to the west of the Landfill and, based on SCS' review of the odor complaint log maintained by the Authority, the majority of the complaints related to odors received by the Authority originate from residents located within this neighborhood. A number of complaints also have originated from homeowners along Calohan Road living in low lying areas. To the north of the landfill are the two mobile home communities of Hyland Acres and Twin Oaks where minimal odor complaints have been received.

Meteorological Data

SCS observed and recorded forecasts generated from the National Weather Service's National Digital Forecast Database (NDFD). SCS documented the general prevailing weather conditions before initiating odor monitoring activities. The Authority also monitors and records weather conditions with an on-site weather station.

SCS reviewed the Wind Frequency Table for Lynchburg covering the 13-year period of 2000 through 2012 which demonstrates that the wind direction was most frequently from the south, southwest, and west. This means the neighborhood of Popular Ridge and residences along Calohan Road have historically been downwind of the Landfill for less than 15 percent of the time during this 13-year period. According to this Wind Frequency Table, the areas in the northeast quadrant relative to the Landfill were most likely to be affected by potential odors originating from the Landfill since the northeast quadrant was downwind approximately 50 percent of the time.

Based on the Wind Rose for Lynchburg Municipal Airport covering the 3-year period of 2013 through 2015, the historical pattern appears to such that communities in the southwest quadrant relative to the Landfill are downwind on a more frequent basis (nearly 35 percent of the time). However, the prevailing wind direction continues to be from the south, southwest, and west for more than 50 percent of the time.

Our review of the monthly Wind Frequency Tables for 2012 revealed that the northeast quadrant is most frequently downwind of the Landfill during December through May. Areas positioned southwest of the Landfill are most frequently downwind during October and November. The wind direction during the summer months is more uniformly distributed. The Wind Frequency Tables and Wind Rose are presented in **Appendix D**.

ODOR INVESTIGATION FIELD ACTIVITIES

Field Reconnaissance of Leachate Cleanouts

SCS' odor monitoring field activities at the Facility commenced with a field reconnaissance on 4/1/15. During this reconnaissance, 18 leachate cleanout pipes (LC-09 could not be located) along the perimeter of the Phase III fill area were visually inspected and labeled both in the field

and on a drawing for recordkeeping purposes. Each cleanout pipe is composed of a 6-inch SCH80 PVC inner pipe that is sleeved inside a 6-foot-long, 12-inch-diameter steel casing pipe. Several of the inner PVC cleanout pipes were missing caps, thus allowing the free venting of LFG out of the steel casing pipe, which is not airtight. SCS recorded physical conditions at each cleanout and also noted whether SCS' field technician observed LFG emitting from the cleanout pipes and whether odors were detected in the vicinity of the cleanouts. The conditions observed at the cleanouts during this initial field reconnaissance are presented on **Exhibit A-1** in **Appendix A**. SCS' daily field log summarizing field activities and observations is included in **Appendix E**.

Although the odors in the vicinity of the leachate cleanouts did not exhibit strong indication of elevated H_2S concentrations, SCS concluded that LFG emissions directly from the leachate cleanout inner and casing pipes, as well as at the soil interface around the casing pipe, were likely a primary source of odors at the facility. Accordingly, on 4/30/15, SCS mobilized to the site and made provisions to equip the leachate cleanout pipes with caps, threaded plugs, and sample ports to enable monitoring of LFG composition and pressure. Monitoring was conducted at the 18 leachate cleanout pipes (LC-01 through LC-19, excluding LC-09) along the toe-of-slope of the Phase III Active Landfill on 4/30/15. LFG composition (i.e., concentrations of methane, carbon dioxide, oxygen, and balance gas) from within each cleanout was measured using the GEM-5000 Infrared Gas Analyzer (GEM). Pressure at each inner cleanout pipe was measured using the GEM. The results of these monitoring activities are presented in **Exhibit A-2** in **Appendix A**. The monitoring activities at the leachate cleanout pipes under passive conditions indicated the presence of good quality LFG (high methane, low oxygen) but the cleanouts exhibited little to no pressure, suggesting that there was a relatively negligible driving force for LFG to be emitted from and around the cleanout pipes, which was contrary to SCS' observations.

As noted previously, H_2S is often used as an indicator parameter to evaluate the extent to which LFG emissions are contributing to malodorous conditions at or around a landfill. On 5/4/15, SCS monitored the leachate cleanouts for H_2S concentrations within the LFG using an Industrial Scientific H2S267 field meter. The results of these monitoring activities are presented on **Exhibit A-2** in **Appendix A** and indicated that H_2S concentrations within the LFG generally ranged between 1 and 8 parts per million (ppm), which is substantially below the default value of 35.5 ppm published in EPA's Compilation of Air Pollutant Emission Factors (AP-42), Volume I, Section 2.4 revised November 1998. This monitoring confirmed SCS' olfactory observations during the initial field reconnaissance that indicated the LFG produced at the Landfill does not contain elevated concentrations of reduced sulfur compounds.

Field Reconnaissance of Waste Placement Activities

SCS personnel observed waste disposal operations of sludge from the City's regional wastewater treatment plant at the Landfill working face on several occasions during field reconnaissance activities between 4/30/15 and 5/6/15. Significant odors were noted associated with the vehicles that deliver the sludge to the facility, such that SCS believes some odor complaints from surrounding communities could potentially be attributed to transport of the sludge material prior to unloading at the Landfill. According to the Authority personnel, there are approximately five loads disposed on-site daily.

SCS noted the texture of the incoming sludge appeared cake-type and the moisture content appeared relatively dry, similar to potting soil. There was a strong odor emitted during the unloading, handling, and placement of the sludge that was considered typical of sewage treatment plant sludge and was characterized as an ammonia-based odor. SCS observed the Authority's practice of applying a deodorizer spray product directly onto the pile of sludge shortly after unloading. While the application of the deodorizer product did appear to have a short-term positive effect to reduce odors, the process of handling and spreading the sludge to mix it with the MSW resulted in noticeable odors. SCS also observed the disposal of a sand slag waste material, which emitted a slight sulfur odor. The odors associated with the slag material are not as prevalent as those associated with the sludge.

Landfill Gas Sampling

SCS analyzed the LFG produced within the Phase III waste mass by obtaining a sample of the LFG at leachate cleanout pipe LC-01 under passive conditions on 5/4/15 and submitting the sample to AtmAA for laboratory analysis per the following methods:

- EPA Method 3C to determine the concentrations of methane (CH4), carbon dioxide (CO2), oxygen (O2), and nitrogen (N2).
- SCAQMD Method 307-91 to determine the concentration of total reduced sulfur (TRS) compounds using gas chromatography.
- Method TO-15 to determine the concentrations of volatile organic compounds (VOC) by gas chromatography/mass spectrometry.

Each analytical test on the LFG sample was performed twice. The results of the LFG sampling indicated that most VOC and reduced sulfur compounds exhibited concentrations below their minimum detection thresholds. Mean values of compounds detected at concentration levels above the minimum threshold of detection are shown below in **Exhibit 1**. The laboratory report presenting the complete analytical results is presented in **Appendix C-1**.

Exhibit 1. Concentration of Compounds In LFG Sample (ppb)

Compound	Run #1	Run #2	Mean Conc.
Freon-12	170	161	166
Vinyl Chloride	1580	1380	1480
Chloroethane	203	199	201
2-Butanone	1100	1160	1130
cis-1,2-Dichloroethene	159	159	159
n-Hexane	1160	984	1070
Benzene	640	623	632
n-Heptane	1460	1350	1400
Toluene	9820	9940	9880
Ethylbenzene	1010	1030	1020
m,p-Xylene	1840	1810	1820
Hydrogen sulfide	9.52	10	9.76
Iso-propyl mercaptan	1.30	1.32	1.31

Note: Additional compounds in the Method TO-15 analysis which may have been present in the LFG but exhibited concentrations below the laboratory's minimum threshold of detection are not included in this table.

Based on SCS' review of the data, while the concentrations of certain constituents may exceed the typically accepted odor threshold range, a comparison of these concentrations with the default values in LFG as published in EPA's AP-42 document indicates that the site-specific concentrations for this Landfill are below the default values. Therefore, the LFG being produced and emitted at this Landfill does not appear to be uncharacteristically malodorous when compared to other MSW landfills.

Surface Emissions Monitoring

On 5/4/15, SCS monitored and recorded instantaneous methane gas concentrations at 62 selected landfill surface locations, including at the soil interface around the leachate cleanout casing pipes, for purposes of measuring fugitive LFG emissions. Sampling was conducted with a Foxboro TVA-1000B Flame Ionization Detector (FID) at approximate 30-meter intervals and where visual observations indicated a potential for elevated concentrations of LFG, such as distressed vegetation, leachate seeps, and surface cover cracks. The monitoring was performed in general accordance with the requirements of 40 CFR 60.755(c) and (d), and 40 CFR 60, Appendix A, Method 21. For reference, for landfills that are subject to the LFG collection system operational performance standards stipulated in the NSPS provisions, the methane concentration is required to be less than 500 ppm above background at the landfill surface.

Surface monitoring was conducted at the following locations while taking into consideration the prevailing wind direction and speed.

- At specific intervals immediately above the landfill surface and along the perimeter of the waste disposal units;

- In proximity to LFG system infrastructure, such as the leachate cleanout pipes and manholes; and,

- Around other potential sources of LFG fugitive emissions.

The monitoring locations are depicted on an aerial map presented in **Exhibit 2**. The surface methane concentrations measured by SCS are presented on **Exhibit A-3** in **Appendix A**. Of the 62 locations that were monitored, there were 19 points that recorded methane concentrations greater than 500 ppm above background. Thirteen of these points were at the leachate cleanout riser pipes located around the Phase III active landfill, some of which recorded methane concentrations in excess of 10,000 ppm, and a maximum value of 66,762 ppm was recorded at LC-06. These values measured at the soil interface around the leachate cleanout casing pipes were contrasted with the numerous sampling points on the landfill surface that demonstrated methane concentrations well below 100 ppm. This monitoring demonstrates that LFG emissions from, and around, the leachate cleanout pipes are likely a primary source of odors at the Facility; whereas, the daily and intermediate cover appear to be performing adequately to reduce fugitive LFG emissions from within the cell footprint.

SCS noted that elevated methane concentrations were measured at four sampling points along the edge of the southwest corner of the Landfill (ID Nos. 50, 51, 54, and 55) that were positioned in an area where the aggregate drainage layer was exposed (since the initial waste lift had not been placed yet) and the rain tarp terminated. The Authority immediately accomplished waste placement activities in this area and added compacted clay cover in the southwest corner of the landfill to reduce the fugitive LFG emissions.

Exhibit 2 presents the surface emissions monitoring locations along with the approximate methane concentration measured at select sampling points.

Exhibit 2. SEM Monitoring Route and Results

Ambient Air Monitoring

On 5/4/15, SCS monitored the ambient air in the vicinity of the leachate cleanouts and recorded detectable concentrations of H_2S using a Jerome 631-X H_2S Analyzer with a detection range of 1 part per billion (ppb). SCS monitored and recorded H_2S concentrations at a height of generally 4 feet above the ground surface. During the ambient air monitoring, the meteorological conditions remained generally the same with the wind coming from the south at a wind speed of approximately 5 to 10 mph. During monitoring activities, SCS also recorded any olfactory observations coinciding with the ambient air monitoring.

SCS monitored and recorded 36 instantaneous H_2S concentrations in the ambient air around each of the 18 leachate cleanouts; one measurement was obtained immediately above the cleanout on the slope of the landfill, and a second measurement was obtained at a location immediately below the cleanout on the access road. The monitoring results are presented on **Exhibit A-4** in **Appendix A** and the ambient air monitoring locations along with the H_2S concentration measured upslope and downslope of each cleanout are depicted in **Exhibit 3**. Most of the sampling points in the immediate vicinity of the leachate cleanouts demonstrated H_2S concentrations less than 10 ppb, which is believed to be below the odor threshold range for most individuals. The landfill slope measurement for LC-17, recorded a H_2S concentration of 120 ppb, although the access road measurement corresponding to this location was 8 ppb.

On 5/7/15, SCS monitored the ambient air and measured and recorded detectable concentrations of H_2S using a Jerome 631-X H_2S Analyzer at 12 locations at or outside the Landfill boundary, including the following locations:

- At multiple off-site locations near adjacent properties and surrounding residential neighborhoods; and,
- Near the locations where the odor complaints were most often reported.

The monitoring results are presented on **Exhibit A-5** in **Appendix A** and the ambient air monitoring locations along with the H_2S concentrations measured in the surrounding communities are depicted in **Exhibit 4**. The 12 off-site sampling locations around the vicinity of Landfill demonstrated H_2S concentrations less than or equal to 10 ppb, which is believed to be below the odor threshold range for most individuals. The monitoring conducted on this date suggests that H_2S concentrations in LFG produced at the Landfill do not appear to be contributing to nuisance odors complaints. SCS' daily field reports containing the results of ambient air monitoring performed around the cleanouts are provided in **Appendix E**.

Exhibit 3. Ambient Air H2S Concentrations Around Leachate Cleanouts

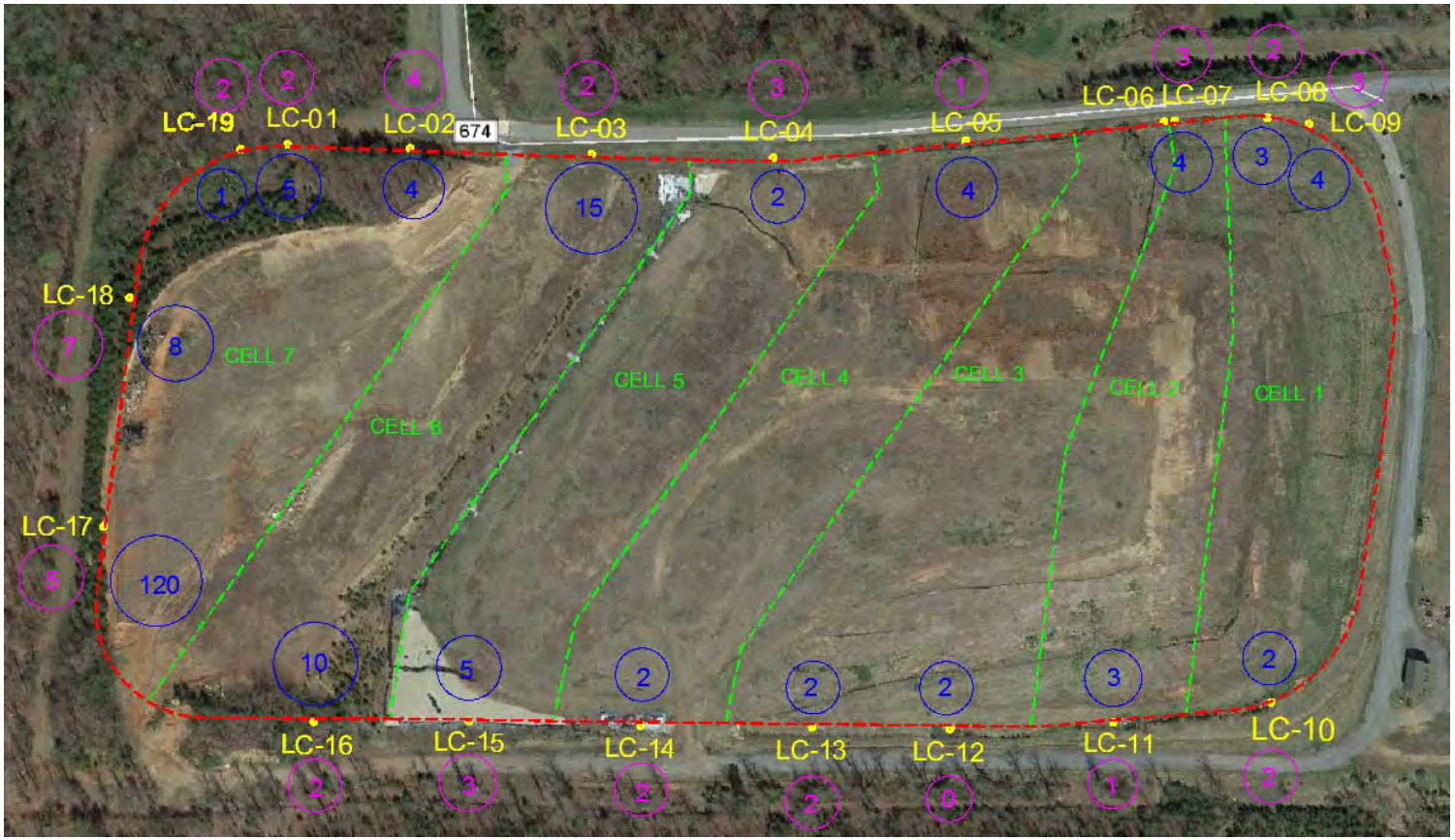


Exhibit 4. Ambient Air H2S Concentrations of Surrounding Area – 5/7/15

Cover Integrity Observations

SCS personnel made visual observations of the integrity of the cover materials that are currently being implemented at the Landfill to cover waste during field reconnaissance activities between 4/30/15 and 5/6/15. SCS personnel observed that the Landfill operators appeared to be accomplishing sufficient efforts to cover the active working face operations on a daily basis, utilizing methods such as Posi-Shell, tarps, and cover soil. Observations of the intermediate cover were also made. As noted previously, during the SEM monitoring activities conducted on 5/4/15, SCS observed an area of visible LFG emissions in the southwest corner of Phase III where the rain tarp and underlying aggregate drainage layer were exposed. **Exhibit 2** presents the approximate locations where the SEM results indicated elevated methane concentrations. The Authority immediately accomplished waste placement activities in this area and added compacted clay cover in the southwest corner of the landfill to reduce the fugitive LFG emissions.

LFG PUMP TEST FIELD ACTIVITIES

Pump Test Preparation

During the field activities on 4/30/15, SCS accomplished maintenance activities to prepare the leachate cleanouts for conducting brief LFG pump tests at individual cleanouts. Many of the outer casing pipes were silted in or sealed shut, and SCS subsequently uncovered them for access to the inner PVC pipes.

Caps were attached to cleanouts where they were missing. This was the case for two 8-inch diameter cleanouts. Plugs were purchased and installed for two additional cleanouts which were discovered to be uncapped with female threading. Also, some existing caps were glued onto the pipe and could not be removed, but sample ports were installed on all the caps. Finally, 6-inch clay and 6-inch cast iron Fernco couplings were purchased to connect wellheads to the cleanouts. During the pump tests, the wellheads enable control of LFG flowrates and applied vacuum.

As part of the preparatory activities, measurements of LFG composition and pressures under passive conditions were recorded at each leachate cleanout to document baseline conditions. Parameters measured include methane, oxygen, and balance gas content as well as static pressure. The results of this monitoring are presented on **Exhibit A-2** in **Appendix A**.

Pump Test Procedures

On 5/1/15, SCS commenced the LFG pump test on LC-01. Vacuum was applied to the individual cleanouts via a trailer-mounted 5-hp Ametek Rotron regenerative LFG blower. Flow was measured via a Thermal Instruments 62-9 flowmeter and data was stored in a Yokogawa DX-1002 datalogger. Collected LFG was conveyed through a Carbtrol highly activated carbon canister. A 4-inch PVC and 4-inch flexible tubing was used to connect to the individual wellheads on each leachate cleanout tested. The blower and electronic equipment was powered by a 200-kW generator.

During the pump test on leachate cleanout LC-01, the applied vacuum was increased gradually in increments from -0.8 in-wc to -4.1 in-wc vacuum, which increased the LFG flow from 50 to 109 standard cubic feet per minute (scfm). The methane concentration decreased from 59.8 percent under static conditions to 48.5 percent over a 9-hour period of active LFG extraction.

On 5/5/15, SCS conducted the LFG pump test on leachate cleanout LC-04. The methane concentration decreased significantly from 46.9 percent under static conditions with only -1.0 in-wc applied vacuum. SCS decreased vacuum to -0.06 in-wc but the methane concentration never recovered. Therefore, LC-04 was not considered to be a viable candidate for the Pilot-Scale LFG system and the pump test was discontinued.

On 5/5/15, during the pump test on leachate cleanout LC-16, the applied vacuum was increased after 4 hours from -1.0 in-wc to -1.5 in-wc vacuum, which increased the LFG flow from 47 to 62 scfm. The methane concentration decreased from 60.6 percent under static conditions to 53.1 percent over a 6-hour period of active LFG extraction, during which 18,300 scf of LFG was collected.

On 5/5/15, during the pump test on leachate cleanout LC-15, the applied vacuum was increased from -0.75 in-wc to -2.25 in-wc vacuum, which increased the LFG flow from 48 to 85 scfm. The methane concentration decreased from 60.0 percent under static conditions to 59.4 percent over a 3-hour period of active LFG extraction, during which 12,000 scf of LFG was collected. On 5/6/15, the pump test at LC-15 was resumed and the applied vacuum was increased to -3.6 in-wc which yielded an LFG flowrate of 110 scfm. The methane content remained above 59 percent for the duration of the 5-hour pumping event, during which 25,650 scf of LFG was collected.

On 5/6/15, during the pump test on leachate cleanout LC-13, the applied vacuum was increased from -0.9 in-wc to -3.75 in-wc vacuum, which increased the LFG flow from 52 to 110 scfm. The methane concentration remained steady at approximately 53 percent over a 4-hour period of active LFG extraction, during which 25,300 scf of LFG was collected. SCS also conducted a pump test on LC-17 on 5/7/15.

The LFG pump tests on individual leachate cleanout pipes was performed as an evaluation of the feasibility and viability of reducing fugitive LFG emissions from the Phase III waste mass by extraction via the leachate cleanout pipes as an odor mitigation strategy. During the active LFG pump test, SCS conducted monitoring at adjacent leachate cleanouts to evaluate the zone-of-influence being exerted on the leachate collection piping network. Testing was conducted at a total of six cleanouts (LC-01, LC-04, LC-13, LC-15, LC-16, and LC-17) culminating in the pumping of LC-17. As stated above, the test on LC-04 revealed that LFG recovery was limited and decreasing in quality, so the test was terminated early. Cleanouts LC-05, LC-06, LC-07, LC-08, and LC-11 were not pumped or monitored during the pump tests due to their very low baseline gas quality. A summary of pump test activities is shown in **Exhibit 5** below.

Exhibit 5. Summary of Pumping Activities

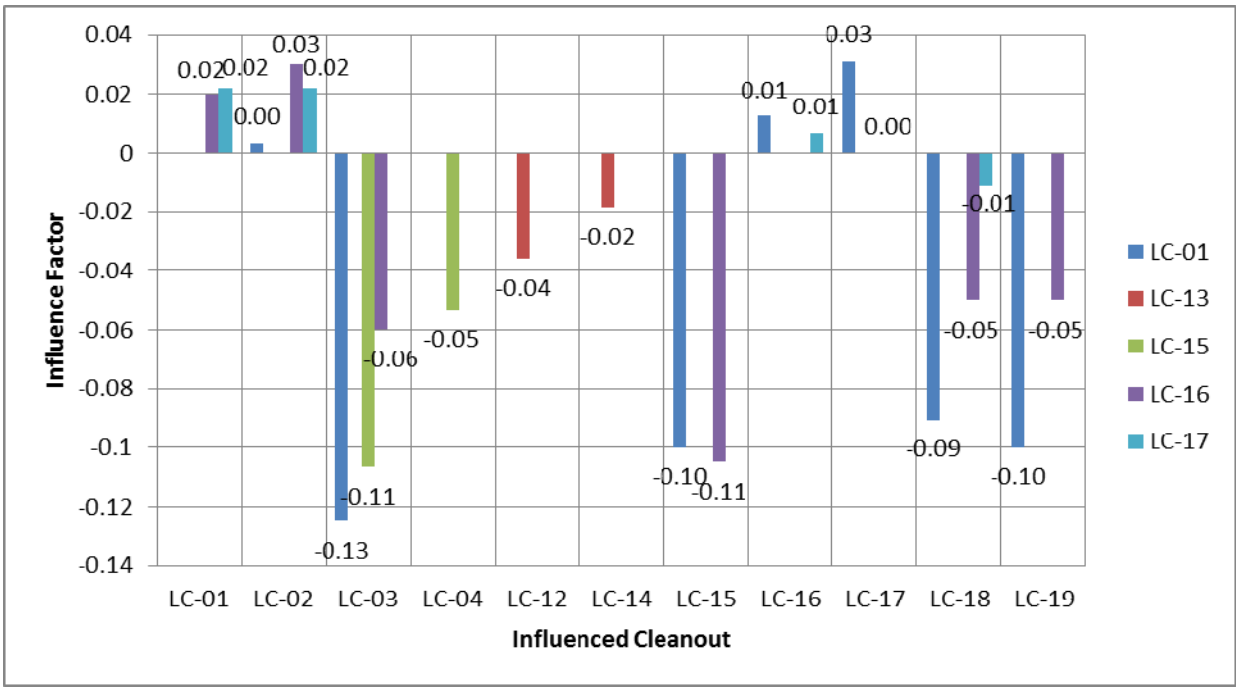
Leachate Cleanout Name	Test Date	Other Cleanouts Measured for Influence
LC-01	5/1/15	2, 3, 15, 16, 17, 18, 19
LC-04	5/5/15	N/A
LC-16	5/5/15	1, 2, 3, 15, 17, 18, 19
LC-15	5/5-6/15	3, 4
LC-13	5/6/15	12, 14
LC-17	5/7/15	1, 2, 16, 18

Pump Test Results

SCS concluded that the pump tests demonstrated the feasibility of extracting LFG from the leachate collection system, which would likely exert a minimal influence on the bottom-most portion of the waste mass, and that leachate cleanouts LC-01, LC-02, LC-03, LC-14, LC-15, LC-16, LC-17, and LC-18 should be considered as candidates for a Pilot-Scale LFG System. These cleanouts recorded the highest LFG quantity totals and sustained good quality LFG (high methane concentrations) under vacuum. SCS noted that although the odors and fugitive emissions around each cleanout diminished under vacuum, the cleanouts returned to positive pressure shortly after vacuum was removed. The LFG monitoring data recorded during the pump tests, as well as graphical representations of the conditions at the start and end of each pump test, is presented in **Appendix B**.

Exhibit 6 shows the degree of influence that active LFG extraction at the five individual leachate cleanouts had on other cleanouts that SCS monitored during each test event. The unitless "Influence Factor" was calculated by first finding the average pressure (in-wc) for each pumped cleanout-monitored cleanout pairing during pumping operations (note that some cleanouts had multiple readings during the entire duration of pumping) and then subtracting the baseline in-wc for each cleanout from this number. This resulting value (the "Change from Static") was then divided by the amount of vacuum applied during each test to normalize the values across different blower set points. The resulting exhibit shows that LC-01 overall had strong influence on the other cleanouts, as did LC-16 and to some degree LC-15.

Exhibit 6. Influence of Pumped Cleanouts on Other Cleanouts



Based on the pump test results, SCS believes that the potential sustainable LFG recovery rate from extracting from eight or more leachate cleanouts is at least 200 cfm and that the composite methane concentration from multiple cleanouts will remain in the 50 percent range. This assumes that leachate levels within the drainage layer are maintained low enough to prevent liquid from blocking the perforated piping. SCS suspects that this approach will exert only a minimal zone-of-influence on the lower portion of the waste mass. Field notes recorded during the pump tests are presented in the SCS Field Logs in **Appendix E**.

PILOT-SCALE LFG SYSTEM

Pilot-Scale LFG System Construction

On 6/1/15, SCS mobilized to the Landfill to commence construction of the Pilot-Scale LFG System involving connection of eight designated leachate cleanouts to the mobile LFG blower station (same unit used during the LFG pump tests) for purposes of collecting and treating LFG from the leachate collection system to reduce odors generated at the Facility. Per the Authority's direction, the LFG collection pipe diameter was upgraded so that the Pilot-Scale piping network could be integrated into a future permanent LFG Collection System. SCS began welding 6-inch HDPE pipe to serve as the common header to connect leachate cleanouts LC-01, LC-02, LC-03, and LC-14 through LC-18. The Authority excavated the trench for the LFG header pipe outside of the anchor trench. The Authority also surveyed the grade of the trench to maintain two percent fall on all LFG header piping.

The Authority had all utilities (water, electric, and fiber optic) located, field marked, and exposed via hand excavation. Toney Construction, Inc. mobilized on 6/4/15 to horizontal directional drill (HDD) and install a 40-foot section of 12-inch LFG header pipe under the existing access road near the northeast corner of the Phase III landfill. A 12-inch x 12-inch x 6-inch tee with a blind flange was installed for future expansion onto the HDD 40-foot section of LFG header on the landfill side of the haul road. The 6-inch LFG lateral header was tied into the 12-inch x 12-inch x 6-inch tee. Refer to photographs of the construction activities presented in **Appendix F**.

Leachate cleanouts LC-14 and LC-15 were connected via remote wellheads at the high point adjacent to LC-16. SCS installed 4-inch HDPE lateral piping to connect these two cleanouts to the remote wellheads. SCS and the Authority installed the remote wellhead lateral piping under the haul road entrance onto the landfill. SCS installed WM-style 2-inch PVC wellheads on the eight leachate cleanouts to connect to the lateral header. Refer to photographs of the construction activities presented in **Appendix F**.

SCS welded 12-inch HDPE main header piping and connected to the existing 12-inch header on the downslope side of the access road via electrofusion coupling. The 12-inch header turns parallel to the existing haul road lying within the berm. The 12-inch header cuts around the sediment pond towards the pump house. The 12-inch header connects to a 10-foot-deep condensate sump via bolted flange. The condensate sump outlet reduces from the 12-inch bolted flange to 4-inch HDPE header pipe. The 4-inch HDPE connects to the LFG mobile blower station via 4-inch flexible tubing. Refer to photographs of the construction activities presented in **Appendix F** and the as-built drawing in **Appendix G** which depicts LFG header pipe layout and tie-in connections.

The Authority's electrician installed power for the 230V single-phase blower at the pump house for direct plug in connection from the control panel mounted on the blower station. The Pilot-Scale LFG System was designed to convey collected LFG from the eight leachate cleanouts to the blower, which discharges the LFG through a 55-gallon highly activated carbon (HAC) canister to remove volatile organic compounds and mitigate odors prior to venting to the atmosphere.

Pilot-Scale LFG System Operations

The Pilot-Scale LFG System commenced operations on 6/15/15. The initial LFG flowrate was approximately 125 scfm with a composite methane concentration of approximately 60 percent at the blower inlet. Treatment of the LFG via the HAC canister was deemed to be effective in reducing odors. Changes to the flexible hoses to the HAC canisters and an increased orifice plate diameter at all eight cleanouts yielded an increase in the LFG flow to 135 scfm. However, the vacuum measured at the wellheads on the eight cleanouts have generally remained below 1 in-wc, suggesting that the LFG is accumulating in the leachate collection system under positive pressure.

The Authority observed strong LFG odors emitting from the blower station and notified SCS via e-mail on 8/3/15. On 8/6/15, SCS responded to the Authority's notification that the new HAC canister was likely spent. SCS collected pre-HAC and post-HAC Tedlar bags samples for TO-15 analysis at Air, Water, and Soil Laboratories. The analytical results, which are presented in

Appendix C-2, confirmed no significant reduction in volatile organic compounds between the pre-HAC and post-HAC samples. A used HAC canister that was provided with the mobile blower station was utilized as an interim treatment vessel while a new HAC canister was procured, which was installed by the Authority on 8/14/15.

Upon conducting an analysis of the projected HAC life expectancy, the Authority opted to obtain a CF-10 Solar Spark flare which was installed in August 2015 to provide destruction of the malodorous compounds in the LFG collected from the cleanouts via combustion. On 8/17/15, SCS mobilized on-site and installed a rental CF-10 Solar Spark flare. The rental CF-10 flare combusted the collected LFG but limited the LFG flowrate to approximately 115 scfm. On 9/23/15, SCS installed the Authority's CF-10 flare equipped with a crown ring and heat shroud. The inlet piping of the Authority's flare was 2-inch, rather than the 1.5-inch diameter piping on the rental flare. Therefore, LFG flowrates of approximately 130 scfm are maintained.

CONCLUSIONS

Based on SCS' odor investigation, the conditions at the Landfill appear to have the potential to produce working face odors and malodorous LFG emissions that may be the source of recent odor complaints reported by residential neighbors, primarily to the west of the Landfill. Furthermore, SCS observed significant odors associated with incoming and outgoing trucks hauling sludge from the wastewater treatment plant. However, SCS' observations and field monitoring results suggested that the odors were not particularly strong or considered atypical within the active landfill cells and generally not detectable beyond the Landfill boundary. Based on our subsequent site visits and communications with Authority and City personnel, SCS understands that the City's wastewater treatment plant implemented changes to their sludge processing procedures which dramatically reduced the odors associated with the sludge being accepted at the Landfill. SCS believes the Lynchburg Livestock Market positioned adjacent to the Landfill is contributing odors that are distinctive to livestock activities (e.g. animal manure) but may often be interpreted as originating from the Landfill since receptors may not accurately distinguish between waste-related odors and livestock-related odors.

The field monitoring results indicate that the primary sources of fugitive LFG emissions at the site prior to SCS' initial field reconnaissance were the leachate cleanout pipes and the exposed drainage layer in the southwest corner of the Phase III waste disposal unit. The Authority has implemented corrective actions to restrict LFG emissions from these features. The LFG analytical results did not identify reduced sulfur or volatile organic compounds at concentrations that exceed typical default values for LFG produced at sanitary landfills. In fact, the H_2S concentrations measured in the LFG and ambient air at the Facility were substantially lower than at landfills that exhibit what SCS would label as "chronic odor problems". The H_2S concentrations measured in the ambient air within the surrounding communities were at or below the odor threshold range for most individuals.

RECOMMENDATIONS

Based on SCS' odor investigation and on-going work activities at the Landfill, we offer the following recommendations for the Authority's consideration related to continued odor control and monitoring activities:

- The Authority should work diligently to continue to implement the strategies for controlling odors at the Landfill as identified in Section 3.0 of the Facility's existing Odor Management and Control Plan, which include minimizing open working face area, timely placement of daily/intermediate cover, curtailing receipt of high-sulfur containing wastes, etc.

- The Authority should continue to maintain a record of odor complaints that are received at the Landfill and document the date/time, location, meteorological conditions, general weather conditions, character of the odor, and relative intensity. We suggest the Authority should implement a policy of dispatching personnel to the location of the complaint to corroborate the odor intensity and characterization near the time of the complaint.

- The Authority should continue coordinating with the City's wastewater treatment plant regarding future changes to the sludge processing procedures, if any, that could potentially affect the odors associated with the sludge being accepted at the Landfill. Regarding the current standard operating procedures, SCS suggests the Authority attempt to limit the extent to which the sludge is handled after unloading and evaluate methods for spreading and mixing the sludge with the MSW that do not disturb the deodorizer product being applied after unloading. The areas of the working face onto which the sludge is spread should be covered with additional waste or cover soils as soon as practical during the working face operations. Alternatively, the areas onto which the sludge is spread may need to have the deodorizer product re-applied or receive an interim coating of Posi-shell.

- The Authority should continue to evaluate use of a system to disperse odor neutralizer product(s) along the southern and western boundaries of the Phase III fill area and other application methods where they may be effective (alternate daily cover, dust control, etc.).

- The Authority should implement improvements to the cover integrity around the leachate cleanout outer casing pipes along the perimeter of the Phase III area using a soil/bentonite mix to restrict fugitive emissions at these locations (and similar pipe penetrations of the cover soils where penetrations may exist elsewhere on site).

- The Authority should continue to operate the Pilot-Scale LFG System which extracts LFG from the leachate cleanout pipes located around the perimeter of the Phase III fill area. We recommend the Authority consider upgrades to the gas mover and combustion equipment (blower/flare unit) to enable collection and combustion of increased LFG quantities that could potentially be recovered from the bottom of the waste mass through the leachate collection system. SCS has provided documentation

regarding the availability of a larger blower/flare station to the Authority in a separate communication.

- The Authority should consider the potential for installation and operation of a comprehensive, full-scale, active LFG collection and control system in Phase III that utilizes a combination of vertical LFG extraction wells and horizontal collectors to accomplish recovering LFG from the entire Phase III waste mass. This full-scale system would improve and enhance control of malodorous LFG emissions and reflect better collection efficiency compared to the current Pilot-Scale LFG System.

- SCS does not believe that supplemental monitoring needs to be implemented, unless the Authority deems it to be valuable during a future, sustained, intense odor event. At this time, SCS believes ongoing quantitative monitoring of ambient conditions on a routine basis (weekly or monthly) is not likely to produce findings that are substantially different than those documented herein. Several monitoring activities that could be implemented to further address odors and respond to odor complaints are:

  - Note that the Phase III fill area appeared to have adequate daily/intermediate cover integrity and the surface emissions monitoring that SCS performed up on the Phase III sideslopes did not identify elevated methane concentrations at the landfill surface. However, additional surface emissions monitoring on the sideslopes and flat, top deck area may be helpful to identify areas where excess fugitive LFG emissions are occurring.

  - When responding to odor complaints, Authority personnel could obtain ambient air samples from the property where the odor complaint was reported and have the samples analyzed for typical parameters (ammonia, VOCs, etc.) as well as odors (ASTM E679 or equivalent). By obtaining air samples at the impacted properties within a relatively short duration after a complaint is reported, the Authority can build a database of what the actual concentrations of malodorous constituents are.

- The Authority may want to assess the feasibility and potential of installing an interim exposed geomembrane cap (EGC) on the sideslopes that are at or near final grade to reduce fugitive LFG emissions and thereby reduce odors. An interim EGC would be expected to reduce fugitive LFG emissions and would serve as a temporary cap until the final cover system is installed under a future partial capping project for Phase III. Please note that the Facility would need to have a permanent, full-scale LFG collection system to extract the LFG from beneath the EGC so it does not build up pressure and create a stability concern.

Appendix A

Monitoring Results

SCS ENGINEERS

EXHIBIT A-1. SUMMARY OF LEACHATE CLEANOUTS DURING SCS FIELD RECONAISSANCE
LIVESTOCK ROAD FACILITY - RUSTBURG, VIRGINIA

Date: April 1, 2015
Project No: 02195001.07-5
Weather: Clear, 65°F; 30.1 in-Hg; Wind E 5-10 mph

Personnel: JTA and DBK
Equipment: Tool Truck

Leachate Cleanout No.	Cover Attribute: Blind Flange	Cover Attribute: Slip Collar	Cover Attribute: No Cap	Gas/ Pressure Observed?	Odor Present?
LC-01	✓			YES	YES
LC-02	✓			YES	YES
LC-03	✓			YES	YES
LC-04				YES	No
LC-05				No	No
LC-06				No	No
LC-07		✓	✓	No	No
LC-08		✓	✓	No	No
LC-09				No	No
LC-10		✓		No	No
LC-11		✓	✓	YES	No
LC-12				YES	YES
LC-13				YES	YES
LC-14				YES	YES
LC-15				YES	YES
LC-16	✓			YES	YES
LC-17	✓			YES	YES
LC-18	✓			YES	YES
LC-19	✓			YES	YES

Notes:

SCS ENGINEERS

EXHIBIT A-2. LEACHATE CLEANOUT MONITORING
LIVESTOCK ROAD FACILITY - RUSTBURG, VIRGINIA

Date: April 30 and May 4, 2015
Project No: 02195001.07-5
Weather: April 30 - Variable with Afternoon T-storm, 73°F; 29.7 in-Hg; Wind SW Shifting NE 5-12 mph
May 4 - Clear, 85°F; 30.3 in-Hg; Wind SSW 5-10 mph

Personnel: JTA and DBK
Equipment: GEM-2000/5000; IS HS267

GEM LFG ANALYZER STATIC CONDITIONS (4/30/15)

Leachate Cleanout No.	Time (24-hr)	Methane (% vol)	Carbon Dioxide (% vol)	Oxygen (% vol)	Balance Gas (% vol)	Pressure (in-wc)
LC-01	13:44	59.8	40.1	0.0	0.1	0.0
LC-02	13:46	51.7	36.9	0.8	10.6	0.0
LC-03	14:14	54.6	36.3	0.2	8.9	0.1
LC-04	15:30	46.9	28.8	4.7	19.6	0.0
LC-05	15:27	33.2	23.2	4.5	39.1	0.1
LC-06	15:25	10.3	8.3	13.1	68.3	0.0
LC-07	15:23	12.8	4.5	18.0	64.7	0.0
LC-08	15:21	1.8	0.2	20.3	77.7	0.0
LC-09	N/A	N/A	N/A	N/A	N/A	N/A
LC-10	15:18	1.8	0.4	20.1	77.7	0.0
LC-11	15:15	34.0	22.8	1.8	41.4	0.0
LC-12	15:13	63.9	35.9	0.2	0.0	0.1
LC-13	13:56	53.4	37.3	0.0	9.3	0.1
LC-14	15:10	62.6	36.0	1.4	0.0	0.1
LC-15	15:08	60.0	39.6	0.5	-0.1	0.1
LC-16	15:05	60.6	39.1	0.2	0.1	0.0
LC-17	15:02	60.3	39.3	0.4	0.0	0.0
LC-18	14:07	59.6	40.1	0.1	0.2	0.1
LC-19	14:10	59.7	39.8	0.0	0.5	0.1

IS HS267 (5/4/15)

Leachate Cleanout No.	H_2S (ppm)
LC-01	7
LC-02	2
LC-03	2
LC-04	3
LC-05	2
LC-06	4
LC-07	2
LC-08	2
LC-09	N/A
LC-10	2
LC-11	0
LC-12	3
LC-13	1
LC-14	3
LC-15	1
LC-16	4
LC-17	4
LC-18	8
LC-19	3

Notes: ppm = parts per million
GEM-2000/GEM-5000 and IS HS267 measured LFG quality and hydrogen sulfide concentrations respectively inside leachate cleanouts
TVA 1000B and Jerome 631-X measured fugitive methane and hydrogen sulfide concentrations respectively adjacent to the leachate cleanouts

EXHIBIT A-3. METHANE SURFACE EMISSIONS MONITORING RESULTS
PHASES II & III
LIVESTOCK ROAD FACILITY - RUSTBURG, VIRGINIA

Date	Time	ID #	Methane Concentration (ppm)	Greater than 500 ppm?	Location/Comments
5/4/15	10:43	1	5,850.0	YES	LC-01
5/4/15	10:45	2	15,666.0	YES	LC-02
5/4/15	10:48	3	33,161.0	YES	LC-03
5/4/15	10:52	4	13,354.0	YES	LC-04
5/4/15	10:53	5	814.0	YES	LC-05
5/4/15	10:55	6*	66,762.0	YES	LC-06
5/4/15	10:55	7	97.8	No	LC-07
5/4/15	10:57	8	97.6	No	LC-08
5/4/15	11:02	9	3.2	No	LC-10
5/4/15	11:03	10	64.4	No	LC-11
5/4/15	11:07	11	22,459.0	YES	LC-12
5/4/15	11:12	12	22,432.0	YES	LC-13
5/4/15	11:16	13	448.0	No	LC-14
5/4/15	11:18	14	38,505.0	YES	LC-15
5/4/15	11:19	15	49,145.0	YES	LC-16
5/4/15	11:22	16	3,488.0	YES	LC-17
5/4/15	11:26	17	29,532.0	YES	LC-18
5/4/15	11:29	18	1,897.0	YES	LC-19
5/4/15	11:35	6*	2,085.0	YES	
5/4/15	11:38	19	8.3	No	LC-09
5/4/15	11:57	20	70.6	No	
5/4/15	11:58	21	8.9	No	
5/4/15	11:59	22	10.9	No	
5/4/15	12:00	23	23.6	No	
5/4/15	12:01	24	63.5	No	
5/4/15	12:02	25	10.7	No	
5/4/15	12:03	26	46.3	No	
5/4/15	12:04	27	13.6	No	
5/4/15	12:05	28	9.9	No	
5/4/15	12:06	29	36.6	No	
5/4/15	12:07	30	51.8	No	
5/4/15	12:07	31	21.1	No	
5/4/15	12:08	32	22.6	No	
5/4/15	12:09	33	52.2	No	
5/4/15	12:10	34	14.5	No	
5/4/15	12:10	35	17.7	No	
5/4/15	12:11	36	490.0	No	
5/4/15	12:12	37	859.0	YES	up top Cell 7
5/4/15	12:13	38	25.2	No	
5/4/15	12:14	39	6.3	No	
5/4/15	12:15	40	4.4	No	
5/4/15	12:16	41	91.4	No	
5/4/15	12:17	42	15.1	No	
5/4/15	12:18	43	53.8	No	
5/4/15	12:19	44	186.0	No	
5/4/15	12:20	45	358.0	No	
5/4/15	12:20	46	14.6	No	
5/4/15	12:21	47	140.0	No	
5/4/15	12:21	48	43.4	No	
5/4/15	12:22	49	52.3	No	
5/4/15	12:23	50	1,175.0	YES	SW corner edge of waste/liner
5/4/15	12:24	51	1,793.0	YES	SW corner edge of waste/liner
5/4/15	12:25	52	482.0	No	SW corner edge of waste/liner
5/4/15	12:25	53	185.0	No	SW corner edge of waste/liner
5/4/15	12:26	54	22,172.0	YES	SW corner edge of waste/liner
5/4/15	12:28	55	12,120.0	YES	SW corner edge of waste/liner
5/4/15	13:41	56	5.0	No	Northern edge of waste Phase II

EXHIBIT A-3. METHANE SURFACE EMISSIONS MONITORING RESULTS
PHASES II & III
LIVESTOCK ROAD FACILITY - RUSTBURG, VIRGINIA

Date	Time	ID #	Methane Concentration (ppm)	Greater than 500 ppm?	Location/Comments
5/4/15	13:42	57	4.4	No	Northern edge of waste Phase II
5/4/15	13:44	58	4.8	No	Northern edge of waste Phase II
5/4/15	13:44	59	4.8	No	Northern edge of waste Phase II
5/4/15	13:45	60	4.3	No	Northern edge of waste Phase II
5/4/15	13:47	61	4.6	No	Northern edge of waste Phase II
5/4/15	13:53	62	5.0	No	Northern edge of waste Phase II

Number of locations sampled:	62
Number of locations CH_4 > 500 ppm:	19

NoTES:

Site Observations: Sunny and Clear, 85°F

Pre-Sampling Calibration: methane - 500 ppm, zero air - 0.0 ppm

5/4/15	10:09	ZERO	1.4	OK
5/4/15	10:12	SPAN	509.0	HIGH_ALRM

Background Reading:

5/4/15	10:31	Upwind	2.5	OK
5/4/15	10:42	Downwind	109.0	OK

*Indicates duplicate measurements at a sampling point.

SCS ENGINEERS

EXHIBIT A-4. LEACHATE CLEANOUT H2S AMBIENT AIR MONITORING
LIVESTOCK ROAD FACILITY - RUSTBURG, VIRGINIA

Date: May 4, 2015
Project No: 02195001.07-5
Weather: Clear, 85°F; 30.3 in-Hg; Wind SSW 5-10 mph

Personnel: JTA and DBK
Equipment: Jerome 631-X

Leachate Cleanout No.	JEROME 631-X (5/4/15) Above LC on Slope (ppb)	Below LC on Road (ppb)
LC-01	5	2
LC-02	4	4
LC-03	15	2
LC-04	2	3
LC-05	4	1
LC-06	N/A	N/A
LC-07	4	3
LC-08	3	2
LC-09	4	3
LC-10	2	2
LC-11	3	1
LC-12	2	0
LC-13	2	2
LC-14	2	2
LC-15	5	3
LC-16	10	2
LC-17	120	5
LC-18	8	7
LC-19	1	2

Notes: ppb = parts per billion
Jerome 631-X measured hydrogen sulfide concentrations adjacent to the leachate cleanouts

EXHIBIT A-5. H_2S AMBIENT AIR MONITORING RESULTS

FACILITY PERIMETER AND SURROUNDING AREA
LIVESTOCK ROAD FACILITY - RUSTBURG, VIRGINIA

Date	Hydrogen Sulfide Concentration (ppb)	Location/Comments
5/7/15	7	Buzz's Shop
5/7/15	10	West edge of LF
5/7/15	7	South edge of LF near aggregate storage pile
5/7/15	2	Administrative Building
5/7/15	7	Along western portion of Barringer Dr.
5/7/15	7	Along Barringer Dr.
5/7/15	7	Turnaround of Barringer Dr.
5/7/15	7	Along Holland Ct.
5/7/15	4	Turnaround of Holland Ct.
5/7/15	6	Home Immedietely south of the Phase III LF
5/7/15	4	Home farther south of the Phase III LF
5/7/15	5	Home farther south of the Phase III LF

Number of locations where H_2S sampled: 12

NOTES:

Site Observations: Mostly Cloudy, 75°F, 30.15 in-Hg

Appendix B

LFG Pump Test Data

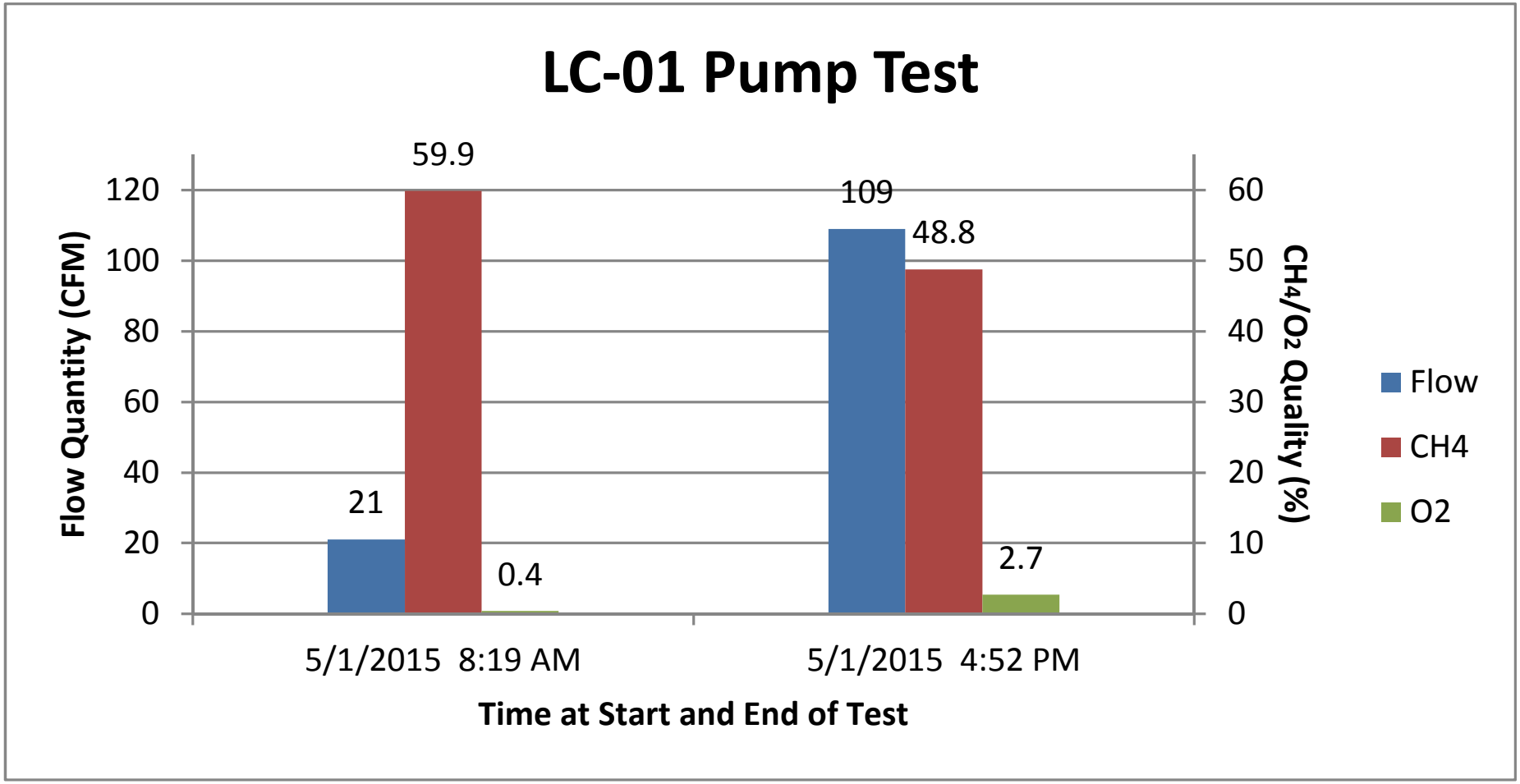
SCS ENGINEERS

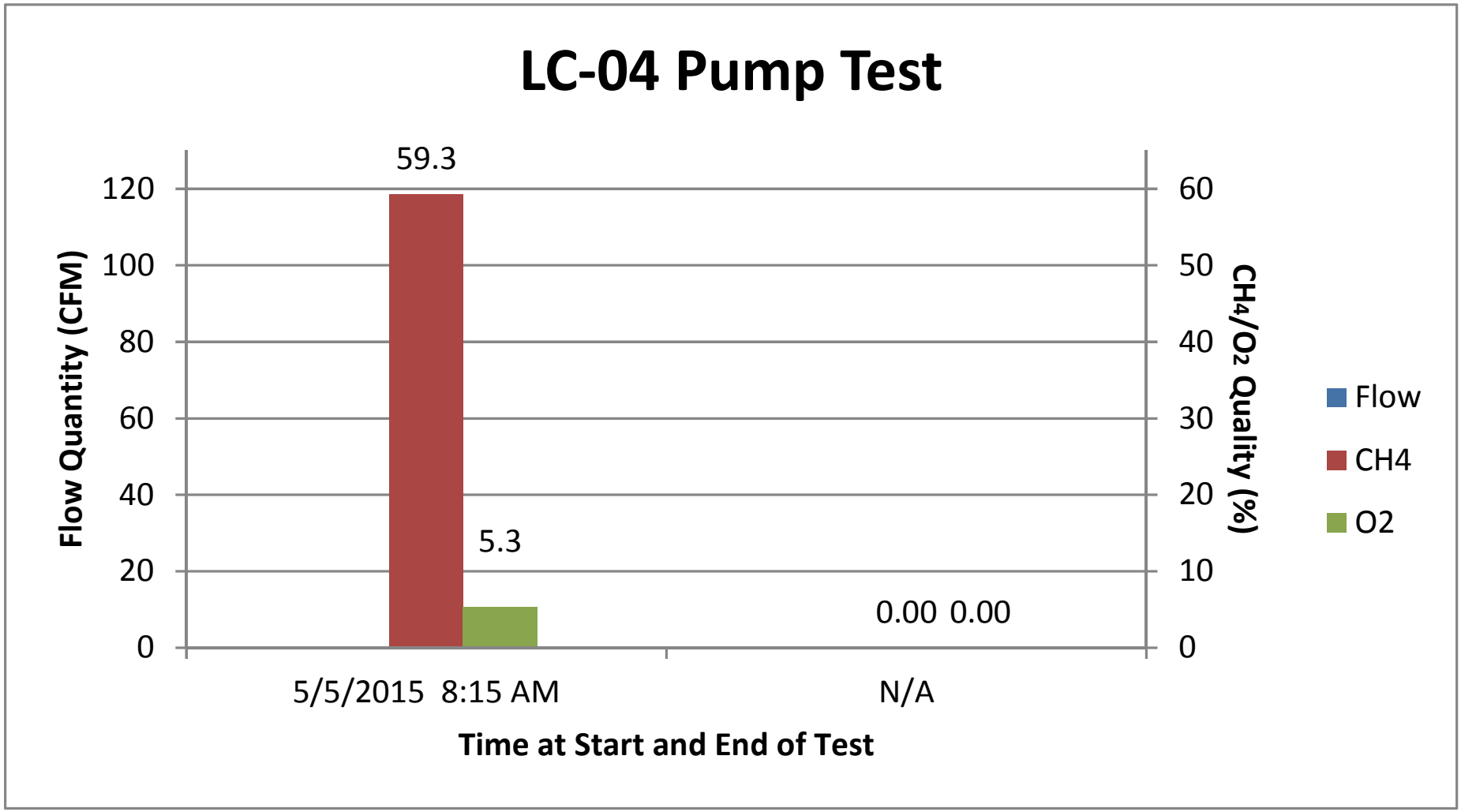
EXHIBIT B. LEACHATE CLEANOUT PUMP TEST MONITORING RESULTS
LIVESTOCK ROAD FACILITY - RUSTBURG, VIRGINIA

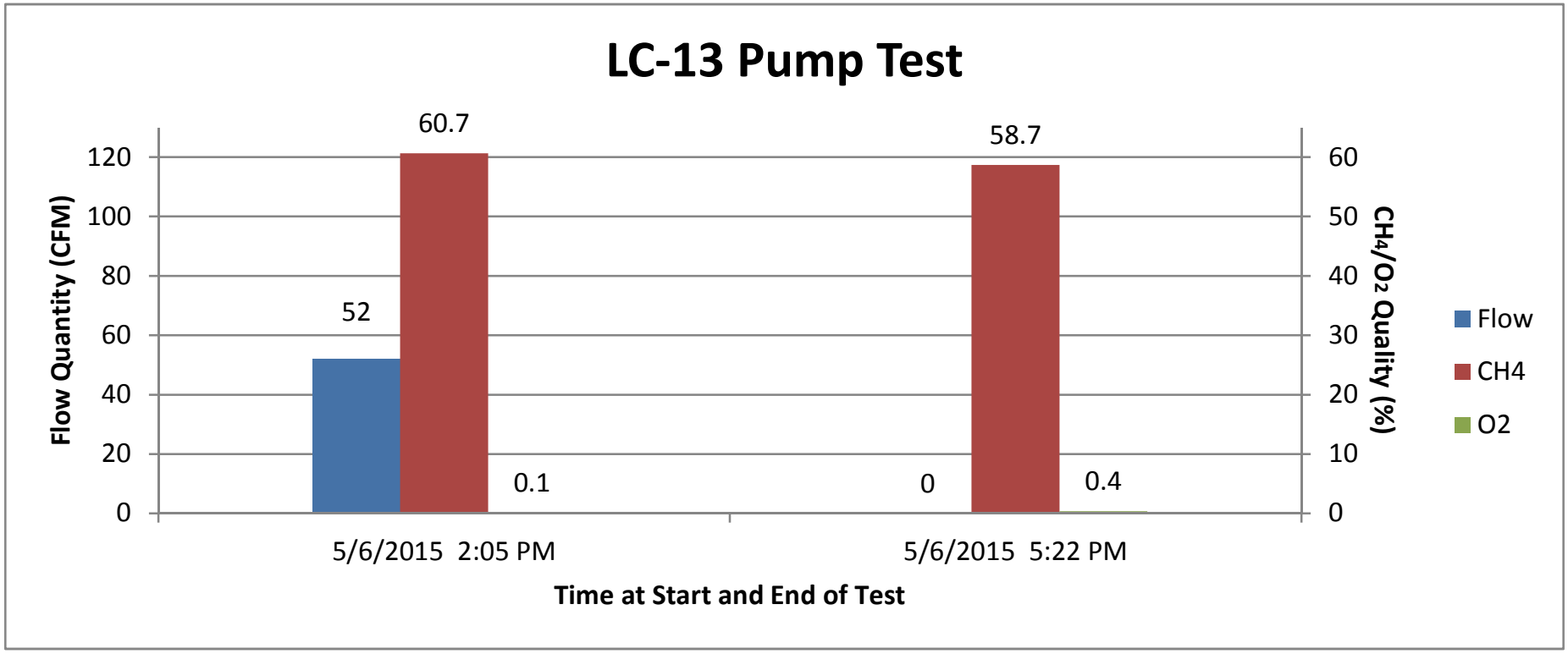
Date: May 1; May 5-7, 2015 Personnel: JTA and DBK
Project No: 02195001.07-5 Equipment: GEM-2000/5000
Weather: May 1 was rain, 61°F, 29.9 in-Hg; May 5 was mostly clear, 84°F, 30.3 in-Hg;
May 6 was variable clouds, 82°F, 30.2 in-Hg; May 7 was variable clouds, 76°F, 30.2 in-Hg

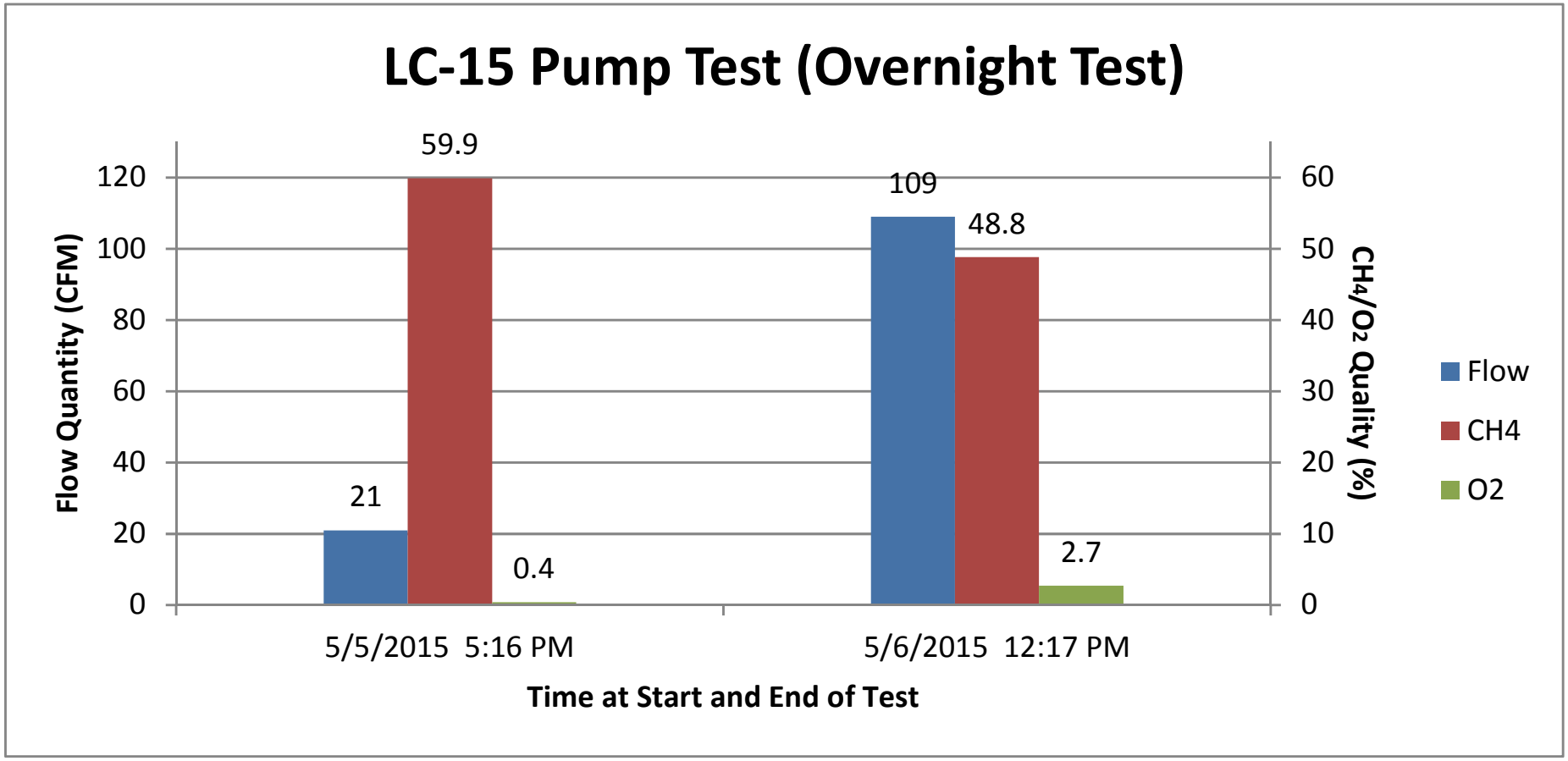
Leachate Cleanout No.	Date (mm/dd/year)	Time (24-hr)	Methane (% vol)	Carbon Dioxide (% vol)	Oxygen (% vol)	Balance Gas (% vol)	Initial Pressure (in-wc)	Adjusted Pressure (in-wc)
LIVELC01	5/1/2015	8:19	59.9	39.3	0.8	0.0	-0.8	-0.8
LIVELC01	5/1/2015	10:51	54.0	34.0	2.1	9.9	-0.8	-0.8
LIVELC01	5/1/2015	12:15	55.1	35.4	1.7	7.8	-0.8	-0.8
LIVELC01	5/1/2015	13:23	58.4	35.7	1.3	4.6	-0.8	-0.8
LIVELC01	5/1/2015	13:49	48.8	33.5	2.7	15.0	-0.8	-0.8
LIVELC01	5/1/2015	13:55	52.2	35.6	1.5	10.7	-0.8	-0.8
LIVELC01	5/1/2015	14:16	52.6	36.1	1.6	9.7	-0.8	-1.5
LIVELC01	5/1/2015	15:02	54.2	34.6	1.7	9.5	-1.5	-2.2
LIVELC01	5/1/2015	16:08	53.2	35.0	1.8	10.0	-2.2	-4.2
LIVELC01	5/1/2015	16:52	48.5	34.5	2.3	14.7	-4.1	-4.1
LIVELC04	5/5/2015	8:15	30.0	24.5	5.3	40.2	-0.1	-0.1
LIVELC16	5/5/2015	10:00	59.3	40.3	0.4	0.0	0.0	-1.0
LIVELC16	5/5/2015	10:44	58.9	41.0	0.2	N/A	-0.9	-1.5
LIVELC16	5/5/2015	12:05	54.0	38.3	1.6	6.1	-1.4	-1.4
LIVELC16	5/5/2015	13:40	53.4	36.3	2.0	8.3	-1.5	-1.5
LIVELC16	5/5/2015	14:02	51.3	35.9	2.3	10.5	-1.5	-1.5
LIVELC15	5/5/2015	15:26	59.6	40.3	0.1	0.0	0.1	-0.8
LIVELC15	5/5/2015	17:16	58.4	41.5	0.1	0.0	-0.8	-0.8
LIVELC15	5/5/2015	17:45	58.7	41.3	0.0	0.0	-0.9	-2.3
LIVELC15	5/5/2015	18:22	59.4	40.6	0.0	0.0	-2.2	-2.2
LIVELC15	5/6/2015	8:15	59.1	40.8	0.1	0.0	-2.9	-2.9
LIVELC15	5/6/2015	10:32	58.2	38.9	0.4	2.5	-2.6	-3.6
LIVELC15	5/6/2015	11:29	60.1	39.5	0.0	0.4	-3.6	-3.6
LIVELC15	5/6/2015	12:17	59.6	40.3	0.1	0.0	-3.7	-3.6
LIVELC13	5/6/2015	14:05	60.7	39.3	0.1	N/A	-0.9	-0.9
LIVELC13	5/6/2015	14:45	60.1	39.9	0.0	0.0	-0.8	-2.3
LIVELC13	5/6/2015	15:34	59.7	40.3	0.0	0.0	-2.3	-3.7
LIVELC13	5/6/2015	16:51	59.3	40.5	0.1	0.1	-3.9	-3.8
LIVELC13	5/6/2015	17:22	58.7	39.7	0.4	1.2	-3.8	-3.7
LIVELC17	5/7/2015	10:57	51.7	35.7	2.3	10.3	-4.4	-4.5
LIVELC17	5/7/2015	12:30	55.5	36.2	1.2	7.1	-1.9	-1.6
LIVELC17	5/7/2015	16:07	51.8	34.1	2.0	12.1	-4.3	-4.0

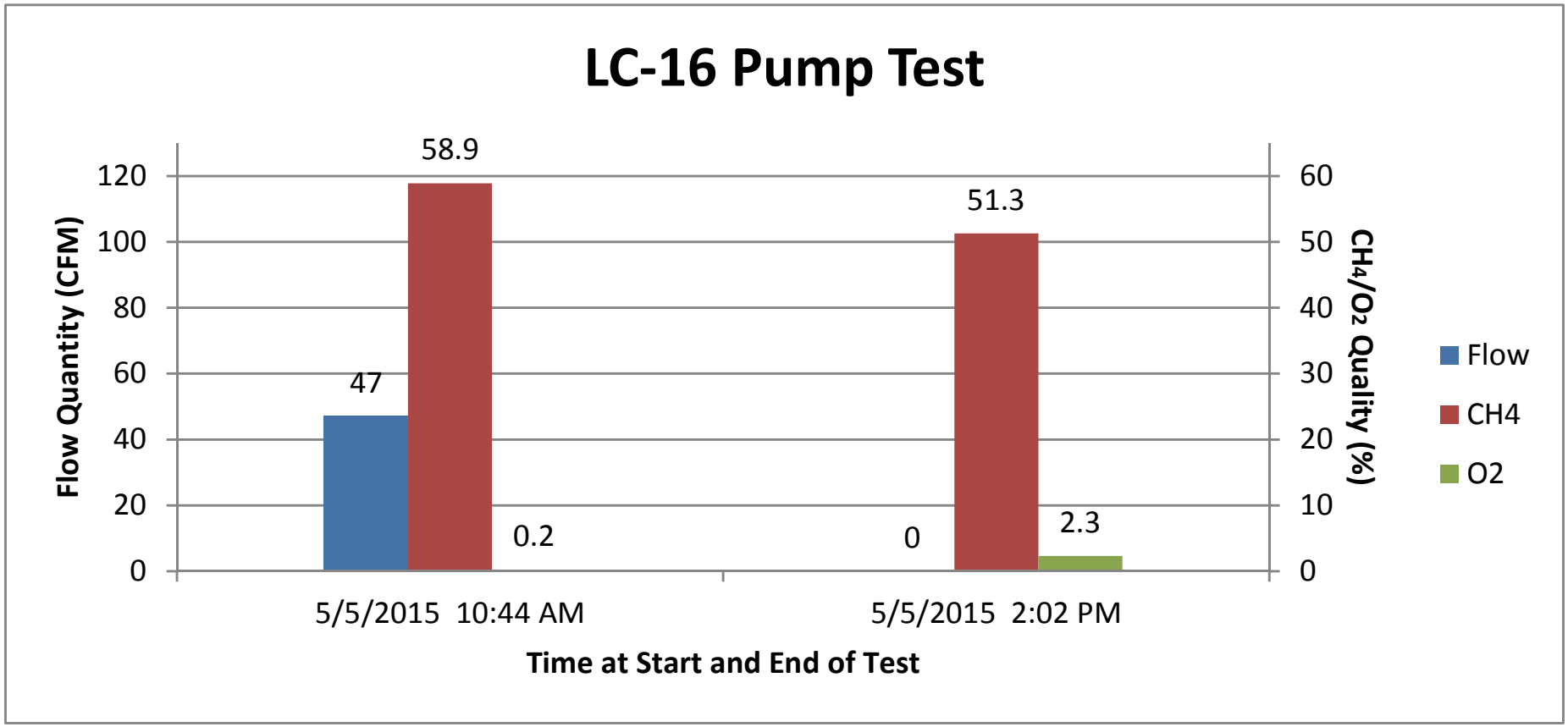
Notes:

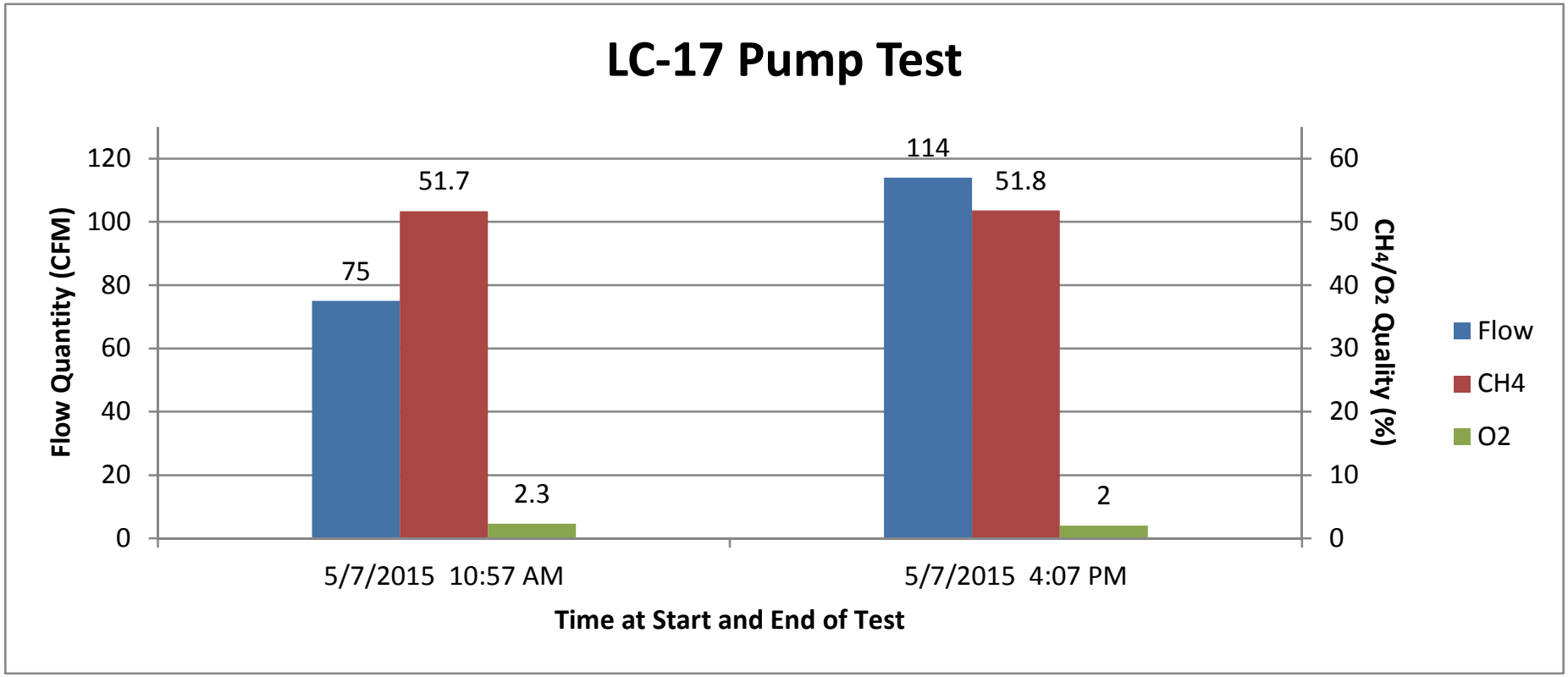

LC-01 Pump Test
59.9
109
48.8
21
0.4
2.7
120
100
80
60
40
20
0
60
50
40
30
20
10
0
Flow Quantity (CFM)
CH4/O2 Quality (%)
5/1/2015 8:19 AM
5/1/2015 4:52 PM
Time at Start and End of Test
Flow
CH4
O2


LC-04 Pump Test
59.3
5.3
0.00 0.00
120
100
80
60
40
20
0
60
50
40
30
20
10
0
Flow Quantity (CFM)
CH4/O2 Quality (%)
5/5/2015 8:15 AM
N/A
Time at Start and End of Test
Flow
CH4
O2


LC-13 Pump Test
60.7
58.7
52
0.1
0
0.4
120
100
80
60
40
20
0
60
50
40
30
20
10
0
Flow Quantity (CFM)
CH4/O2 Quality (%)
5/6/2015 2:05 PM
5/6/2015 5:22 PM
Time at Start and End of Test
Flow
CH4
O2


LC-15 Pump Test (Overnight Test)
59.9
109
48.8
21
0.4
2.7
120
100
80
60
40
20
0
60
50
40
30
20
10
0
Flow Quantity (CFM)
CH4/O2 Quality (%)
Flow
CH4
O2
5/5/2015 5:16 PM
5/6/2015 12:17 PM
Time at Start and End of Test


LC-16 Pump Test
Flow Quantity (CFM)
120
100
80
60
40
20
0
58.9
47
0.2
51.3
0
2.3
5/5/2015 10:44 AM
5/5/2015 2:02 PM
Time at Start and End of Test
60
50
40
30
20
10
0
CH4/O2 Quality (%)
Flow
CH4
O2


LC-17 Pump Test
Flow Quantity (CFM)
120
100
80
60
40
20
0
75
51.7
2.3
114
51.8
2
60
50
40
30
20
10
0
CH4/O2 Quality (%)
Flow
CH4
O2
5/7/2015 10:57 AM
5/7/2015 4:07 PM
Time at Start and End of Test

Appendix C-1

LFG Laboratory Analysis Report – LC-01

AtmAA Inc.
23917 Craftsman Rd., Calabasas, CA 91302 • (818) 223-3277 • FAX (818) 223-8250
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LABORATORY ANALYSIS REPORT

Permanent Gases Analysis in Tedlar Bag Sample by Method EPA 3C

Report Date: May 13, 2015
Client: SCS Engineers
Project Location: Livestock Road Regional LF
Project No.: 02195001.07 Task 5
Date Received: May 2, 2015
Date Analyzed: May 4, 2015

ANALYSIS DESCRIPTION

Permanent gases were measured by thermal conductivity detection/gas chromatography (TCD/GC), EPA Method 3C.

AtmAA Lab No.:	11225-1
Sample I.D.:	LRRLF-LC01

Components	*(Concentration in %,v)*
Nitrogen	2.18
Oxygen	0.74
Methane	59.8
Carbon dioxide	37.0

The reported oxygen concentration includes any argon present in the sample. Calibration is based on a standard atmosphere containing 20.95% oxygen and 0.93% argon.
The accuracy of permanent gas analysis by TCD/GC is +/- 2%, actual results are reported.

Michael L. Porter
Laboratory Director

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)

Project Location: Livestock Road Regional LF
Date Received: May 2, 2015
Date Analyzed: May 4, 2015

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in %,v)			
Nitrogen	LRRLF-LC01	2.16	2.21	2.18	1.1
Oxygen	LRRLF-LC01	0.73	0.76	0.74	2.0
Methane	LRRLF-LC01	59.8	59.8	59.8	0.0
Carbon dioxide	LRRLF-LC01	37.1	37.0	37.0	0.13

One Tedlar bag sample, laboratory number 11225-1, was analyzed for permanent gases. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean". The average % difference from mean for 4 repeat measurements from one Tedlar bag sample is 0.81%.

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LABORATORY ANALYSIS REPORT

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TO-15 Component Analysis in Tedlar Bag Sample, by GC/MS

Report Date: May 13, 2015
Client: SCS Engineers
Project Location: Livestock Road Regional LF
Project No.: 02195001.07 Task 5
Date Received: May 2, 2015
Date Analyzed: May 4, 2015

Components	AtmAA Lab No.: 11225-1 Sample ID: LRRLF-LC01 *(Concentations in ppbv)*
Freon 12	166
Chloromethane	<150
Freon 114	<150
Vinyl Chloride	1480
1,3-Butadiene	<200
Bromomethane	<150
Chloroethane	201
Bromoethene	<200
Acetone	<1400
Freon 11	<150
Isopropyl Alcohol	<500
1,1-Dichloroethene	<150
Methylene Chloride	<150
3-Chloro-1-Propene	<200
Carbon Disulfide	<200
Freon 113	<150
trans-1,2-Dichloroethene	<150
1,1-Dichloroethane	<150
MTBE	<200
Vinyl Acetate	969
2-Butanone	1130
cis-1,2-Dichloroethene	159
n-Hexane	1070
Chloroform	<150
Ethyl Acetate	<200
Tetrahydrofuran	<200
1,2-Dichloroethane	<150
1,1,1-Trichloroethane	<150
Benzene	632
Carbon Tetrachloride	<150
Cyclohexane	<200
1,2-Dichloropropane	<150
Bromodichloromethane	<150
Trichloroethene	<150
1,4-Dioxane	<200
2,2,4-Trimethyl Pentane	<150
n-Heptane	1400
cis-1,3-Dichloropropene	<150
4-Methyl-2-pentanone	<200
trans-1,3-Dichloropropene	<150
1,1-2-Trichloroethane	<150
Toluene	9880
2-Hexanone	<200
Dibromochloromethane	<200
1,2-Dibromomethane	<150
Tetrachloroethene	<150
Chlorobenzene	<150
Ethylbenzene	1020
m,p-Xylene	1820
Bromoform	<150
Styrene	<150
1,1,2,2-Tetrachloroethane	<150
o-Xylene	<150
Benzyl Chloride	<150
4-Ethyl Toluene	<150
1,3,5-Trimethyl Benzene	<150
1,2,4-Trimethyl Benzene	<150
1,3-Dichlorobenzene	<150
1,4-Dichlorobenzene	<150
1,2-Dichlorobenzene	<150
1,2,4-Trichlorobenzene	<200
Hexachlorobutadiene	<200

Michael L. Porter
Laboratory Director

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)

Project Location: Livestock Road Regional LF
Date Received: May 2, 2015
Date Analyzed: May 4, 2015

Components	Sample ID	Repeat Analysis		Mean Conc.	% Diff. From Mean
		Run #1	Run #2		
		(Concentration in ppbv)			
Freon-12	LRRLF-LC01	170	161	166	2.7
Chloromethane	LRRLF-LC01	<150	<150	---	---
Freon 114	LRRLF-LC01	<150	<150	---	---
Vinyl Chloride	LRRLF-LC01	1580	1380	1480	6.8
1,3-Butadiene	LRRLF-LC01	<200	<200	---	---
Bromomethane	LRRLF-LC01	<150	<150	---	---
Chloroethane	LRRLF-LC01	203	199	201	1.0
Bromoethene	LRRLF-LC01	<200	<200	---	---
Acetone	LRRLF-LC01	<1400	<1400	---	---
Freon 11	LRRLF-LC01	<150	<150	---	---
Isopropyl Alcohol	LRRLF-LC01	<500	<500	---	---
1,1-Dichloroethene	LRRLF-LC01	<150	<150	---	---
Methylene Chloride	LRRLF-LC01	<150	<150	---	---
3-Chloro-1-Propene	LRRLF-LC01	<200	<200	---	---
Carbon Disulfide	LRRLF-LC01	<200	<200	---	---
Freon 113	LRRLF-LC01	<150	<150	---	---
trans-1,2-Dichloroethene	LRRLF-LC01	<150	<150	---	---
1,1-Dichloroethane	LRRLF-LC01	<150	<150	---	---
MTBE	LRRLF-LC01	<200	<200	---	---
Vinyl Acetate	LRRLF-LC01	969	969	969	0.0
2-Butanone	LRRLF-LC01	1100	1160	1130	2.6

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)
(continued)

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppbv)			
cis-1,2-Dichloroethene	LRRLF-LC01	159	159	159	0.0
n-Hexane	LRRLF-LC01	1160	984	1070	8.2
Chloroform	LRRLF-LC01	<150	<150	---	---
Ethyl Acetate	LRRLF-LC01	<200	<200	---	---
Tetrahydrofuran	LRRLF-LC01	<200	<200	---	---
1,2-Dichloroethane	LRRLF-LC01	<150	<150	---	---
1,1,1-Trichloroethane	LRRLF-LC01	<150	<150	---	---
Benzene	LRRLF-LC01	640	623	632	1.3
Carbon Tetrachloride	LRRLF-LC01	<150	<150	---	---
Cyclohexane	LRRLF-LC01	<200	<200	---	---
1,2-Dichloropropane	LRRLF-LC01	<150	<150	---	---
Bromodichloromethane	LRRLF-LC01	<150	<150	---	---
Trichloroethene	LRRLF-LC01	<150	<150	---	---
1,4-Dioxane	LRRLF-LC01	<200	<200	---	---
2,2,4-Trimethyl Pentane	LRRLF-LC01	<150	<150	---	---
n-Heptane	LRRLF-LC01	1460	1350	1400	3.9
cis-1,3-Dichloropropene	LRRLF-LC01	<150	<150	---	---
4-Methyl-2-pentanone	LRRLF-LC01	<200	<200	---	---
trans-1,3-Dichloropropene	LRRLF-LC01	<150	<150	---	---
1,1-2-Trichloroethane	LRRLF-LC01	<150	<150	---	---
Toluene	LRRLF-LC01	9820	9940	9880	0.61
2-Hexanone	LRRLF-LC01	<200	<200	---	---

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)
(continued)

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppbv)			
Dibromochloromethane	LRRLF-LC01	<200	<200	---	---
1,2-Dibromomethane	LRRLF-LC01	<150	<150	---	---
Tetrachloroethene	LRRLF-LC01	<150	<150	---	---
Chlorobenzene	LRRLF-LC01	<150	<150	---	---
Ethylbenzene	LRRLF-LC01	1010	1030	1020	0.98
m,p-Xylene	LRRLF-LC01	1840	1810	1820	0.82
Bromoform	LRRLF-LC01	<150	<150	---	---
Styrene	LRRLF-LC01	<150	<150	---	---
1,1,2,2-Tetrachloroethane	LRRLF-LC01	<150	<150	---	---
o-Xylene	LRRLF-LC01	<150	<150	---	---
Benzyl Chloride	LRRLF-LC01	<150	<150	---	---
4-Ethyl Toluene	LRRLF-LC01	<150	<150	---	---
1,3,5-Trimethyl Benzene	LRRLF-LC01	<150	<150	---	---
1,2,4-Trimethyl Benzene	LRRLF-LC01	<150	<150	---	---
1,3-Dichlorobenzene	LRRLF-LC01	<150	<150	---	---
1,4-Dichlorobenzene	LRRLF-LC01	<150	<150	---	---
1,2-Dichlorobenzene	LRRLF-LC01	<150	<150	---	---
1,2,4-Trichlorobenzene	LRRLF-LC01	<200	<200	---	---
Hexachlorobutadiene	LRRLF-LC01	<200	<200	---	---

One Tedlar bag sample, laboratory number 11225-1, was analyzed for TO-15 components by GC/MS. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean". The average % difference from mean for 12 repeat measurements from one Tedlar bag sample is 2.4%.

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LABORATORY RESULTS

Hydrogen Sulfide and Reduced Sulfur Compounds
Analysis in Tedlar Bag Sample by Method SCAQMD 307.91

Report Date: May 12, 2015
Client: SCS Engineers
Project Location: Livestock Road Regional LF
Date Received: May 2, 2015
Date Analyzed: May 4, 2015

ANALYSIS DESCRIPTION

Hydrogen sulfide was analyzed by gas chromatography with a Hall electrolytic conductivity detector operated in the oxidative sulfur mode. All other components were measured by GC/ Mass Spec.

	AtmAA Lab No.:	11225-1
	Sample I.D.:	LRRLF-LC01
Components		*(Concentration in ppmv)*
Hydrogen sulfide		9.76
Carbonyl sulfide		<0.2
Methyl mercaptan		<0.2
Ethyl mercaptan		<0.2
Dimethyl sulfide		<0.2
Carbon disulfide		<0.2
isopropyl mercaptan		1.31
n-propyl mercaptan		<0.2
Dimethyl disulfide		<0.2
TRS		11.1

TRS - total reduced sulfur

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)

Project Location: Livestock Road Regional LF
Date Received: May 2, 2015
Date Analyzed: May 4, 2015

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppmv)			
Hydrogen sulfide	LRRLF-LC01	9.52	10.0	9.76	2.4
Carbonyl sulfide	LRRLF-LC01	<0.2	<0.2	---	---
Methyl mercaptan	LRRLF-LC01	<0.2	<0.2	---	---
Ethyl mercaptan	LRRLF-LC01	<0.2	<0.2	---	---
Dimethyl sulfide	LRRLF-LC01	<0.2	<0.2	---	---
Carbon disulfide	LRRLF-LC01	<0.2	<0.2	---	---
iso-propyl mercaptan	LRRLF-LC01	1.30	1.32	1.31	0.76
n-propyl mercaptan	LRRLF-LC01	<0.2	<0.2	---	---
Dimethyl disulfide	LRRLF-LC01	<0.2	<0.2	---	---

One Tedlar bag sample, laboratory number 11255-1, was analyzed for total reduced sulfur compounds. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean". The average % difference from mean for 2 repeat measurements from one Tedlar bag sample is 1.6%.

Appendix C-2

LFG Laboratory Analysis Report – HAC Canister

AIR WATER & SOIL LABORATORIES, INC.

1941 Reymet Road ● Richmond, Virginia 23237 ● Tel: (804)-358-8295 Fax: (804)-358-8297

Certificate of Analysis

Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received:	August 7, 2015 16:02
		Date Issued:	August 14, 2015 14:08
		Project Number:	02195001.07
Submitted To:	Brandon King	Purchase Order:	02RI00320
Client Site I.D.:	Livestock Rd		

Enclosed are the results of analyses for samples received by the laboratory on 08/07/2015 16:02. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

Ted Soyars

Laboratory Manager

End Notes:

The test results listed in this report relate only to the samples submitted to the laboratory and as received by the Laboratory.

Unless otherwise noted, the test results for solid materials are calculated on a wet weight basis. Analyses for pH, dissolved oxygen, temperature, residual chlorine and sulfite that are performed in the laboratory do not meet NELAC requirements due to extremely short holding times. These analyses should be performed in the field. The results of field analyses performed by the Sampler included in the Certificate of Analysis are done so at the client's request and are not included in the laboratory's fields of certification nor have they been audited for adherence to a reference method or procedure.

The signature on the final report certifies that these results conform to all applicable NELAC standards unless otherwise specified. For a complete list of the Laboratory's NELAC certified parameters please contact customer service.

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Certificate of Analysis

Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received:	August 7, 2015 16:02
		Date Issued:	August 14, 2015 14:08
		Project Number:	02195001.07
Submitted To:	Brandon King	Purchase Order:	02RI00320
Client Site I.D.:	Livestock Rd		

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Post Filter	15H0148-01	Air	08/06/2015 12:00	08/07/2015 16:02
Pre Filter	15H0148-02	Air	08/06/2015 12:00	08/07/2015 16:02

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Certificate of Analysis

Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received: Date Issued:	August 7, 2015 16:02 August 14, 2015 14:08
Submitted To:	Brandon King	Project Number:	02195001.07
Client Site I.D.:	Livestock Rd	Purchase Order:	02RI00320

ANALYTICAL RESULTS

Project Location:
Field Sample #: Post Filter
Sample ID: 15H0148-01
Sample Matrix: Air
Sampled: 8/6/2015 12:00
Sample Type:

Sample Description/Location:
Sub Description/Location:
Canister ID:
Canister Size:

Initial Vacuum(in Hg):
Final Vacuum(in Hg):
Receipt Vacuum(in Hg):
Flow Controller Type:
Flow Controller ID:

EPA TO-15

	ppbv			ug/m3				Date/Time	
Analyte	**Results**	**RL**	**Flag/Qual**	**Results**	**RL**	**Dilution**	**Prep Factor**	**Analyzed**	**Analyst**
1,1,1-Trichloroethane	ND	2.00		ND	11	1	10	8/10/15 18:26	RJW
1,1,1,2-Tetrachloroethane	ND	2.00		ND	0.082	1	10	8/10/15 18:26	RJW
1,1,2,2-Tetrachloroethane	ND	2.00		ND	14	1	10	8/10/15 18:26	RJW
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.00		ND	15	1	10	8/10/15 18:26	RJW
1,1,2-Trichloroethane	ND	2.00		ND	11	1	10	8/10/15 18:26	RJW
1,1-Dichloroethane	ND	2.00		ND	8.1	1	10	8/10/15 18:26	RJW
1,1-Dichloroethylene	ND	2.00		ND	7.9	1	10	8/10/15 18:26	RJW
1,2,4-Trimethylbenzene	3.70	2.00		18	9.8	1	10	8/10/15 18:26	RJW
1,2-Dibromoethane (EDB)	ND	2.00		ND	15	1	10	8/10/15 18:26	RJW
1,2-Dichlorobenzene	ND	2.00		ND	12	1	10	8/10/15 18:26	RJW
1,2-Dichloroethane	ND	2.00		ND	8.1	1	10	8/10/15 18:26	RJW
1,2-Dichloropropane	ND	2.00		ND	9.2	1	10	8/10/15 18:26	RJW
1,2-Dichlorotetrafluoroethane	ND	2.00		ND	14	1	10	8/10/15 18:26	RJW
1,3,5-Trimethylbenzene	2.10	2.00		10	9.8	1	10	8/10/15 18:26	RJW
1,3-Butadiene	ND	2.00		ND	4.4	1	10	8/10/15 18:26	RJW
1,3-Dichlorobenzene	ND	2.00		ND	12	1	10	8/10/15 18:26	RJW
1,4-Dichlorobenzene	ND	2.00		ND	12	1	10	8/10/15 18:26	RJW
1,4-Dioxane	ND	2.00		ND	7.2	1	10	8/10/15 18:26	RJW
2-Butanone (MEK)	29.2	2.00		86	5.9	1	10	8/10/15 18:26	RJW
4-Methyl-2-pentanone (MIBK)	2.10	2.00		24	23	1	10	8/10/15 18:26	RJW
Acrolein	26.2	2.00		60	4.6	1	10	8/10/15 18:26	RJW
Allyl chloride	ND	2.00		ND	6.3	1	10	8/10/15 18:26	RJW
Benzene	2.70	2.00		8.6	6.4	1	10	8/10/15 18:26	RJW
Benzyl Chloride	ND	2.00		ND	10	1	10	8/10/15 18:26	RJW
Bromodichloromethane	ND	2.00		ND	13	1	10	8/10/15 18:26	RJW
Bromoform	ND	2.00		ND	21	1	10	8/10/15 18:26	RJW

AIR WATER & SOIL LABORATORIES, INC.
1941 Reymet Road ● Richmond, Virginia 23237 ● Tel: (804)-358-8295 Fax: (804)-358-8297

Certificate of Analysis

Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received: Date Issued:	August 7, 2015 16:02 August 14, 2015 14:08
Submitted To:	Brandon King	Project Number:	02195001.07
Client Site I.D.:	Livestock Rd	Purchase Order:	02RI00320

ANALYTICAL RESULTS

Project Location:
Field Sample #: Post Filter
Sample ID: 15H0148-01
Sample Matrix: Air
Sampled: 8/6/2015 12:00
Sample Type:

Sample Description/Location:
Sub Description/Location:
Canister ID:
Canister Size:

Initial Vacuum(in Hg):
Final Vacuum(in Hg):
Receipt Vacuum(in Hg):
Flow Controller Type:
Flow Controller ID:

EPA TO-15

Analyte	ppbv Results	ppbv RL	Flag/Qual	ug/m3 Results	ug/m3 RL	Dilution	Prep Factor	Date/Time Analyzed	Analyst
Bromomethane	ND	2.00		ND	7.8	1	10	8/10/15 18:26	RJW
Carbon Disulfide	ND	5.00		ND	16	1	10	8/10/15 18:26	RJW
Carbon Tetrachloride	ND	2.00		ND	13	1	10	8/10/15 18:26	RJW
Chlorobenzene	ND	2.00		ND	9.2	1	10	8/10/15 18:26	RJW
Chloroethane	15.6	2.00		41	5.3	1	10	8/10/15 18:26	RJW
Chloroform	ND	2.00		ND	9.8	1	10	8/10/15 18:26	RJW
Chloromethane	8.20	2.00		17	4.1	1	10	8/10/15 18:26	RJW
cis-1,2-Dichloroethylene	ND	2.00		ND	7.9	1	10	8/10/15 18:26	RJW
cis-1,3-Dichloropropene	ND	2.00		ND	9.1	1	10	8/10/15 18:26	RJW
Cyclohexane	ND	2.00		ND	6.9	1	10	8/10/15 18:26	RJW
Dichlorodifluoromethane	13.1	5.00		65	25	1	10	8/10/15 18:26	RJW
Ethyl acetate	ND	2.00		ND	7.2	1	10	8/10/15 18:26	RJW
Ethylbenzene	9.30	2.00		40	8.7	1	10	8/10/15 18:26	RJW
Heptane	4.80	2.00		20	8.2	1	10	8/10/15 18:26	RJW
Hexane	ND	2.00		ND	7.0	1	10	8/10/15 18:26	RJW
Isopropylbenzene	ND	2.00		ND	9.8	1	10	8/10/15 18:26	RJW
m+p-Xylenes	18.5	4.00		80	17	1	10	8/10/15 18:26	RJW
Methyl methacrylate	2.00	2.00		8.2	8.2	1	10	8/10/15 18:26	RJW
Methylene chloride	17.2	10.0		60	35	1	10	8/10/15 18:26	RJW
Methyl-t-butyl ether (MTBE)	ND	2.00		ND	7.2	1	10	8/10/15 18:26	RJW
Naphthalene	ND	2.00		ND	10	1	10	8/10/15 18:26	RJW
o-Xylene	6.80	2.00		30	8.7	1	10	8/10/15 18:26	RJW
Propylene	1800	50.0		3100	86	1	250	8/11/15 16:03	RJW
Styrene	ND	2.00		ND	8.5	1	10	8/10/15 18:26	RJW
TBA	23.7	5.00		72	15	1	10	8/10/15 18:26	RJW
Tetrachloroethylene (PCE)	ND	2.00		ND	14	1	10	8/10/15 18:26	RJW

AIR WATER & SOIL LABORATORIES, INC.
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Certificate of Analysis

Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received: Date Issued:	August 7, 2015 16:02 August 14, 2015 14:08
Submitted To:	Brandon King	Project Number:	02195001.07
Client Site I.D.:	Livestock Rd	Purchase Order:	02RI00320

ANALYTICAL RESULTS

Project Location:
Field Sample #: Post Filter
Sample ID: 15H0148-01
Sample Matrix: Air
Sampled: 8/6/2015 12:00
Sample Type:

Sample Description/Location:
Sub Description/Location:
Canister ID:
Canister Size:

Initial Vacuum(in Hg):
Final Vacuum(in Hg):
Receipt Vacuum(in Hg):
Flow Controller Type:
Flow Controller ID:

EPA TO-15

Analyte	ppbv Results	ppbv RL	Flag/Qual	ug/m3 Results	ug/m3 RL	Dilution	Prep Factor	Date/Time Analyzed	Analyst
Tetrahydrofuran	13.9	2.00		41	5.9	1	10	8/10/15 18:26	RJW
Toluene	24.4	2.00		92	7.5	1	10	8/10/15 18:26	RJW
trans-1,2-Dichloroethylene	ND	2.00		ND	7.9	1	10	8/10/15 18:26	RJW
trans-1,3-Dichloropropene	ND	2.00		ND	9.1	1	10	8/10/15 18:26	RJW
Trichloroethylene	ND	2.00		ND	11	1	10	8/10/15 18:26	RJW
Trichlorofluoromethane	ND	2.00		ND	11	1	10	8/10/15 18:26	RJW
Vinyl acetate	ND	2.00		ND	7.0	1	10	8/10/15 18:26	RJW
Vinyl bromide	ND	2.00		ND	8.7	1	10	8/10/15 18:26	RJW
Vinyl chloride	10.5	2.00		27	5.1	1	10	8/10/15 18:26	RJW
Xylenes, Total	25.3	6.00		110	26	1	10	8/10/15 18:26	RJW

Surrogates	% Recovery	% REC Limits	
4-Bromofluorobenzene	101	80-120	8/11/15 16:03
4-Bromofluorobenzene	100	80-120	8/10/15 18:26

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Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received: Date Issued:	August 7, 2015 16:02 August 14, 2015 14:08
Submitted To:	Brandon King	Project Number:	02195001.07
Client Site I.D.:	Livestock Rd	Purchase Order:	02RI00320

ANALYTICAL RESULTS

Project Location:
Field Sample #: Pre Filter
Sample ID: 15H0148-02
Sample Matrix: Air
Sampled: 8/6/2015 12:00
Sample Type:

Sample Description/Location:
Sub Description/Location:
Canister ID:
Canister Size:

Initial Vacuum(in Hg):
Final Vacuum(in Hg):
Receipt Vacuum(in Hg):
Flow Controller Type:
Flow Controller ID:

EPA TO-15

	ppbv			ug/m3				Date/Time	
Analyte	**Results**	**RL**	**Flag/Qual**	**Results**	**RL**	**Dilution**	**Prep Factor**	**Analyzed**	**Analyst**
1,1,1-Trichloroethane	ND	2.00		ND	11	1	10	8/10/15 19:42	RJW
1,1,1,2-Tetrachloroethane	ND	2.00		ND	0.082	1	10	8/10/15 19:42	RJW
1,1,2,2-Tetrachloroethane	ND	2.00		ND	14	1	10	8/10/15 19:42	RJW
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.00		ND	15	1	10	8/10/15 19:42	RJW
1,1,2-Trichloroethane	ND	2.00		ND	11	1	10	8/10/15 19:42	RJW
1,1-Dichloroethane	ND	2.00		ND	8.1	1	10	8/10/15 19:42	RJW
1,1-Dichloroethylene	ND	2.00		ND	7.9	1	10	8/10/15 19:42	RJW
1,2,4-Trimethylbenzene	3.80	2.00		19	9.8	1	10	8/10/15 19:42	RJW
1,2-Dibromoethane (EDB)	ND	2.00		ND	15	1	10	8/10/15 19:42	RJW
1,2-Dichlorobenzene	ND	2.00		ND	12	1	10	8/10/15 19:42	RJW
1,2-Dichloroethane	ND	2.00		ND	8.1	1	10	8/10/15 19:42	RJW
1,2-Dichloropropane	ND	2.00		ND	9.2	1	10	8/10/15 19:42	RJW
1,2-Dichlorotetrafluoroethane	ND	2.00		ND	14	1	10	8/10/15 19:42	RJW
1,3,5-Trimethylbenzene	2.10	2.00		10	9.8	1	10	8/10/15 19:42	RJW
1,3-Butadiene	ND	2.00		ND	4.4	1	10	8/10/15 19:42	RJW
1,3-Dichlorobenzene	ND	2.00		ND	12	1	10	8/10/15 19:42	RJW
1,4-Dichlorobenzene	ND	2.00		ND	12	1	10	8/10/15 19:42	RJW
1,4-Dioxane	ND	2.00		ND	7.2	1	10	8/10/15 19:42	RJW
2-Butanone (MEK)	30.2	2.00		89	5.9	1	10	8/10/15 19:42	RJW
4-Methyl-2-pentanone (MIBK)	ND	2.00		ND	23	1	10	8/10/15 19:42	RJW
Acrolein	36.0	2.00		83	4.6	1	10	8/10/15 19:42	RJW
Allyl chloride	ND	2.00		ND	6.3	1	10	8/10/15 19:42	RJW
Benzene	3.10	2.00		9.9	6.4	1	10	8/10/15 19:42	RJW
Benzyl Chloride	ND	2.00		ND	10	1	10	8/10/15 19:42	RJW
Bromodichloromethane	ND	2.00		ND	13	1	10	8/10/15 19:42	RJW
Bromoform	ND	2.00		ND	21	1	10	8/10/15 19:42	RJW

AIR WATER & SOIL LABORATORIES, INC.
1941 Reymet Road ● Richmond, Virginia 23237 ● Tel: (804)-358-8295 Fax: (804)-358-8297

Certificate of Analysis

Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received: Date Issued:	August 7, 2015 16:02 August 14, 2015 14:08
Submitted To:	Brandon King	Project Number:	02195001.07
Client Site I.D.:	Livestock Rd	Purchase Order:	02RI00320

ANALYTICAL RESULTS

Project Location:
Field Sample #: Pre Filter
Sample ID: 15H0148-02
Sample Matrix: Air
Sampled: 8/6/2015 12:00
Sample Type:

Sample Description/Location:
Sub Description/Location:
Canister ID:
Canister Size:

Initial Vacuum(in Hg):
Final Vacuum(in Hg):
Receipt Vacuum(in Hg):
Flow Controller Type:
Flow Controller ID:

EPA TO-15

Analyte	ppbv Results	ppbv RL	Flag/Qual	ug/m3 Results	ug/m3 RL	Dilution	Prep Factor	Date/Time Analyzed	Analyst
Bromomethane	ND	2.00		ND	7.8	1	10	8/10/15 19:42	RJW
Carbon Disulfide	ND	5.00		ND	16	1	10	8/10/15 19:42	RJW
Carbon Tetrachloride	ND	2.00		ND	13	1	10	8/10/15 19:42	RJW
Chlorobenzene	ND	2.00		ND	9.2	1	10	8/10/15 19:42	RJW
Chloroethane	15.6	2.00		41	5.3	1	10	8/10/15 19:42	RJW
Chloroform	ND	2.00		ND	9.8	1	10	8/10/15 19:42	RJW
Chloromethane	7.90	2.00		16	4.1	1	10	8/10/15 19:42	RJW
cis-1,2-Dichloroethylene	ND	2.00		ND	7.9	1	10	8/10/15 19:42	RJW
cis-1,3-Dichloropropene	ND	2.00		ND	9.1	1	10	8/10/15 19:42	RJW
Cyclohexane	ND	2.00		ND	6.9	1	10	8/10/15 19:42	RJW
Dichlorodifluoromethane	13.2	5.00		65	25	1	10	8/10/15 19:42	RJW
Ethyl acetate	ND	2.00		ND	7.2	1	10	8/10/15 19:42	RJW
Ethylbenzene	10.8	2.00		47	8.7	1	10	8/10/15 19:42	RJW
Heptane	7.00	2.00		29	8.2	1	10	8/10/15 19:42	RJW
Hexane	ND	2.00		ND	7.0	1	10	8/10/15 19:42	RJW
Isopropylbenzene	ND	2.00		ND	9.8	1	10	8/10/15 19:42	RJW
m+p-Xylenes	21.6	4.00		94	17	1	10	8/10/15 19:42	RJW
Methyl methacrylate	2.50	2.00		10	8.2	1	10	8/10/15 19:42	RJW
Methylene chloride	12.0	10.0		42	35	1	10	8/10/15 19:42	RJW
Methyl-t-butyl ether (MTBE)	ND	2.00		ND	7.2	1	10	8/10/15 19:42	RJW
Naphthalene	ND	2.00		ND	10	1	10	8/10/15 19:42	RJW
o-Xylene	7.80	2.00		34	8.7	1	10	8/10/15 19:42	RJW
Propylene	1790	50.0		3100	86	1	250	8/11/15 16:40	RJW
Styrene	ND	2.00		ND	8.5	1	10	8/10/15 19:42	RJW
TBA	25.9	5.00		79	15	1	10	8/10/15 19:42	RJW
Tetrachloroethylene (PCE)	ND	2.00		ND	14	1	10	8/10/15 19:42	RJW

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Certificate of Analysis

Final Report

Laboratory Order ID 15H0148

Client Name:	SCS Engineers-Midlothian 15521 Midlothian Turnpike Suite 305 Midlothian, VA 23113	Date Received: Date Issued:	August 7, 2015 16:02 August 14, 2015 14:08
Submitted To:	Brandon King	Project Number:	02195001.07
Client Site I.D.:	Livestock Rd	Purchase Order:	02RI00320

ANALYTICAL RESULTS

Project Location:
Field Sample #: Pre Filter
Sample ID: 15H0148-02
Sample Matrix: Air
Sampled: 8/6/2015 12:00
Sample Type:

Sample Description/Location:
Sub Description/Location:
Canister ID:
Canister Size:

Initial Vacuum(in Hg):
Final Vacuum(in Hg):
Receipt Vacuum(in Hg):
Flow Controller Type:
Flow Controller ID:

EPA TO-15

Analyte	ppbv Results	ppbv RL	Flag/Qual	ug/m3 Results	ug/m3 RL	Dilution	Prep Factor	Date/Time Analyzed	Analyst
Tetrahydrofuran	16.9	2.00		50	5.9	1	10	8/10/15 19:42	RJW
Toluene	28.4	2.00		110	7.5	1	10	8/10/15 19:42	RJW
trans-1,2-Dichloroethylene	ND	2.00		ND	7.9	1	10	8/10/15 19:42	RJW
trans-1,3-Dichloropropene	ND	2.00		ND	9.1	1	10	8/10/15 19:42	RJW
Trichloroethylene	ND	2.00		ND	11	1	10	8/10/15 19:42	RJW
Trichlorofluoromethane	ND	2.00		ND	11	1	10	8/10/15 19:42	RJW
Vinyl acetate	ND	2.00		ND	7.0	1	10	8/10/15 19:42	RJW
Vinyl bromide	ND	2.00		ND	8.7	1	10	8/10/15 19:42	RJW
Vinyl chloride	10.2	2.00		26	5.1	1	10	8/10/15 19:42	RJW
Xylenes, Total	29.4	6.00		130	26	1	10	8/10/15 19:42	RJW

Surrogates	% Recovery	% REC Limits	
4-Bromofluorobenzene	103	80-120	8/11/15 16:40
4-Bromofluorobenzene	102	80-120	8/10/15 19:42

AIR WATER & SOIL LABORATORIES, INC.

1941 REYMET ROAD
RICHMOND, VIRGINIA 23237
(804) 358-8295 PHONE
(804)358-8297 FAX

Chain of Custody
Form #: D1331
Rev. 1.0
Effective: Feb 14, 2014

CHAIN OF CUSTODY

PAGE _____ OF _____

COMPANY NAME: SCS ENGINEERS	INVOICE TO:	PROJECT NAME/Quote #:
CONTACT: 804-283-0327	INVOICE CONTACT:	SITE NAME: LIVESTOCK ROAD
ADDRESS:	INVOICE ADDRESS:	PROJECT NUMBER: 02196001.07
PHONE #:	INVOICE PHONE #:	P.O. #: 02RI00320
FAX #: EMAIL:		Pretreatment Program:
Is sample for compliance reporting? YES (NO)	Is sample from a chlorinated supply? YES (NO)	PWS I.D. #:
SAMPLER NAME (PRINT): JAMES ANDERSON	SAMPLER SIGNATURE:	Turn Around Time: 5 Day(s)

Matrix Codes: WW=Waste Water/Storm Water GW=Ground Water DW=Drinking Water S=Soil/Solids OR=Organic A=Air WP=Wipe OT=Other_____

CLIENT SAMPLE I.D.	Grab	Composite	Field Filtered (Dissolved Metals)	Composite Start Date	Composite Start Time	Grab Date or Composite Stop Date	Grab Time or Composite Stop Time	Time Preserved	Matrix (See Codes)	Number of Containers	ANALYSIS / (PRESERVATIVE)	COMMENTS
1) POST-FILTER	✓					08/06/15	1200					
2) PRE-FILTER	✓					08/06/15	1200					
3)												
4)												
5)												
6)												
7)												
8)												
9)												
10)												

Preservative Codes: N=Nitric Acid C=Hydrochloric Acid S=Sulfuric Acid H=Sodium Hydroxide A=Ascorbic Acid Z=Zinc Acetate T=Sodium Thiosulfate M=Methanol

PLEASE NOTE PRESERVATIVE(S), INTERFERENCE CHECKS or PUMP RATE (L/min)

RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
[signature]	08/07/15 11:40	[signature]	8/7/15 1140
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME

QC Data Package
Level I ☐
Level II ☐
Level III ☐
Level IV ☐

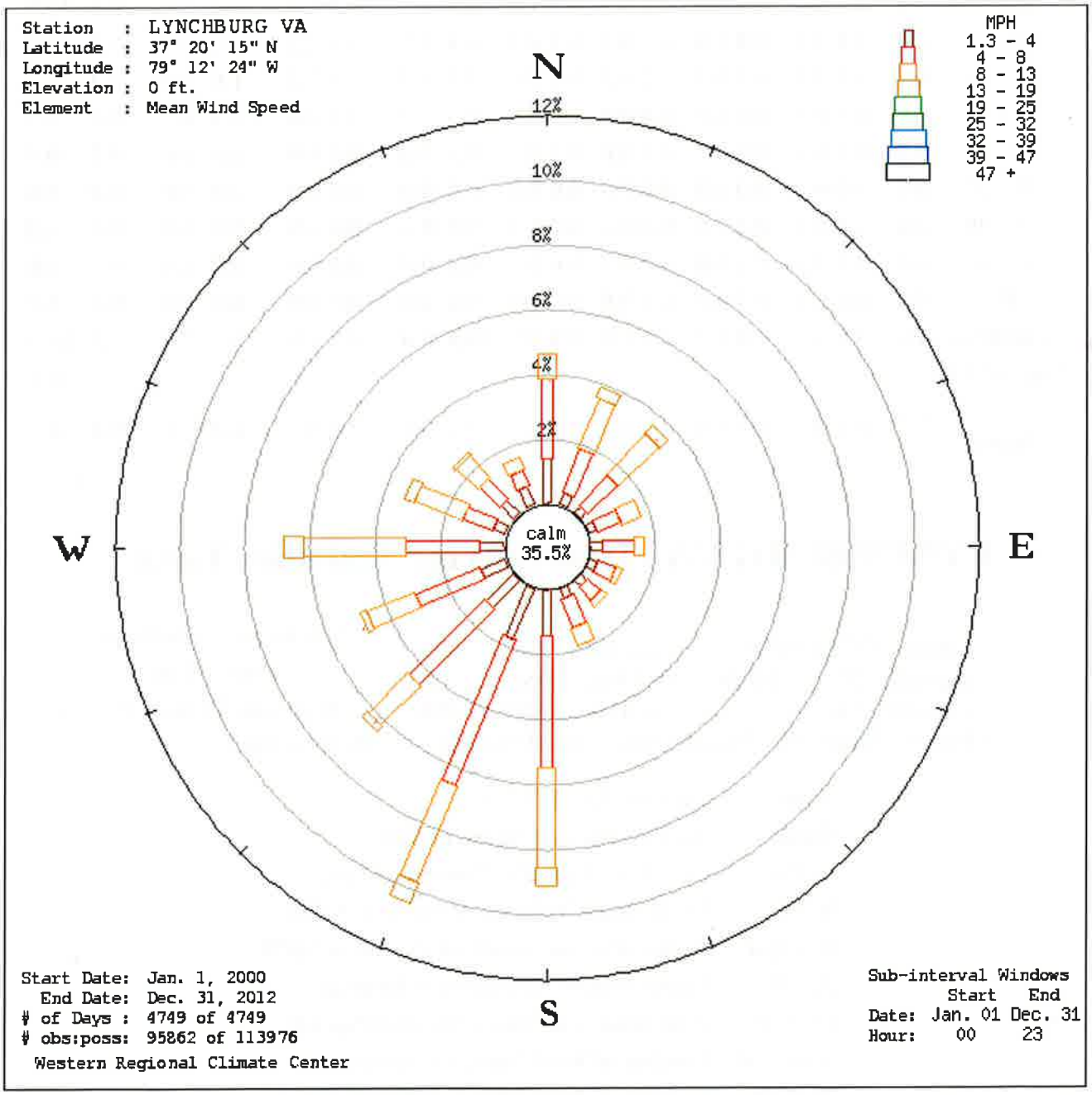
LAB USE ONLY COOLER TEMP 21.9 °C

SCS-P 15H0148
Livestock Rd
Recd: 08/07/2015 Due: 08/14/2015

Appendix D

Wind Roses

LYNCHBURG VA



LYNCHBURG VA - Wind Frequency Table (percentage)

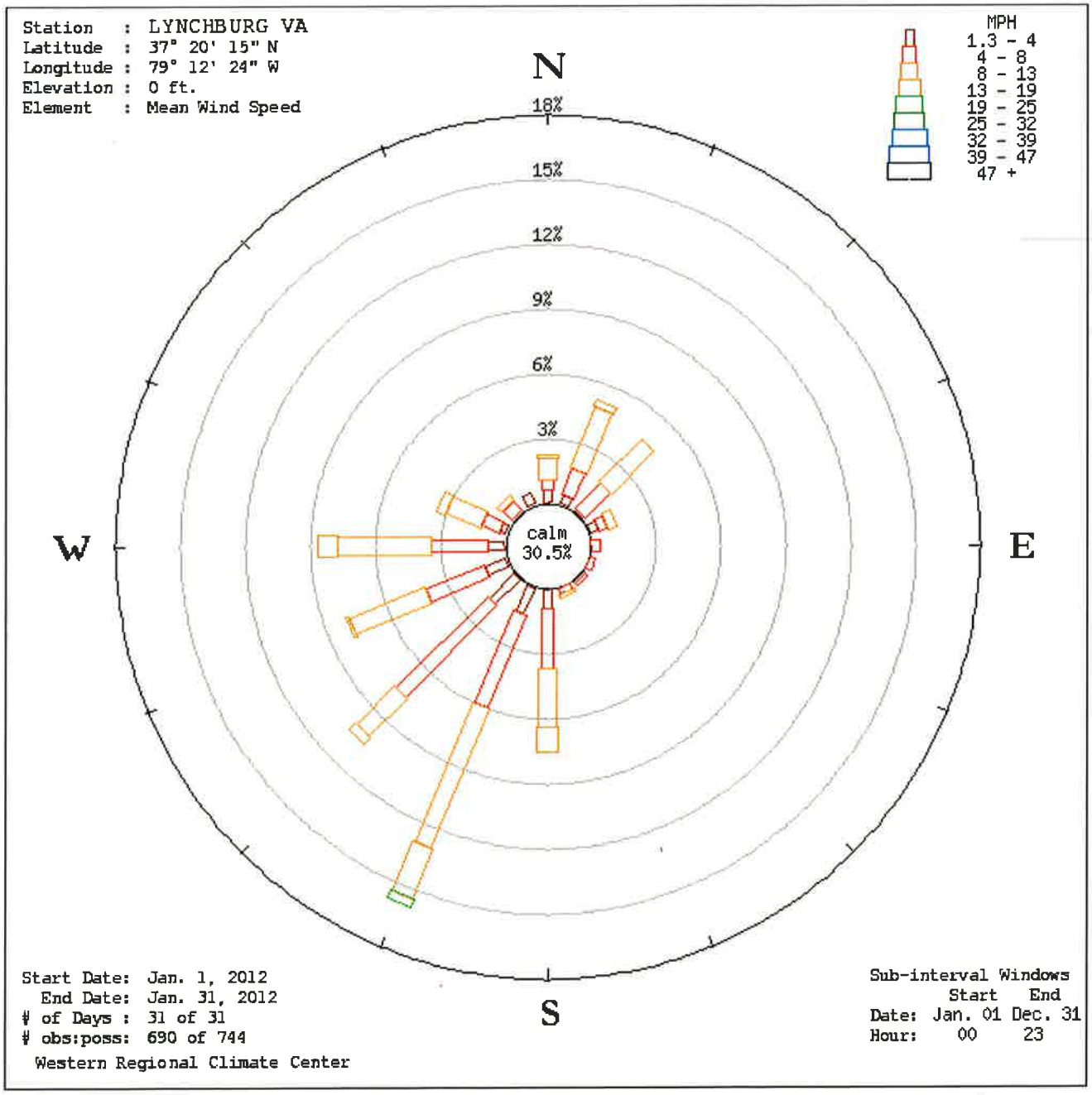
Latitude : 37° 20' 15" N
Longitude : 79° 12' 24" W
Elevation : 0 ft.
Element : Mean Wind Speed

Start Date : Jan. 1, 2000
End Date : Dec. 31, 2012
# of Days : 4749 of 4749
obs : poss : 95862 of 113976

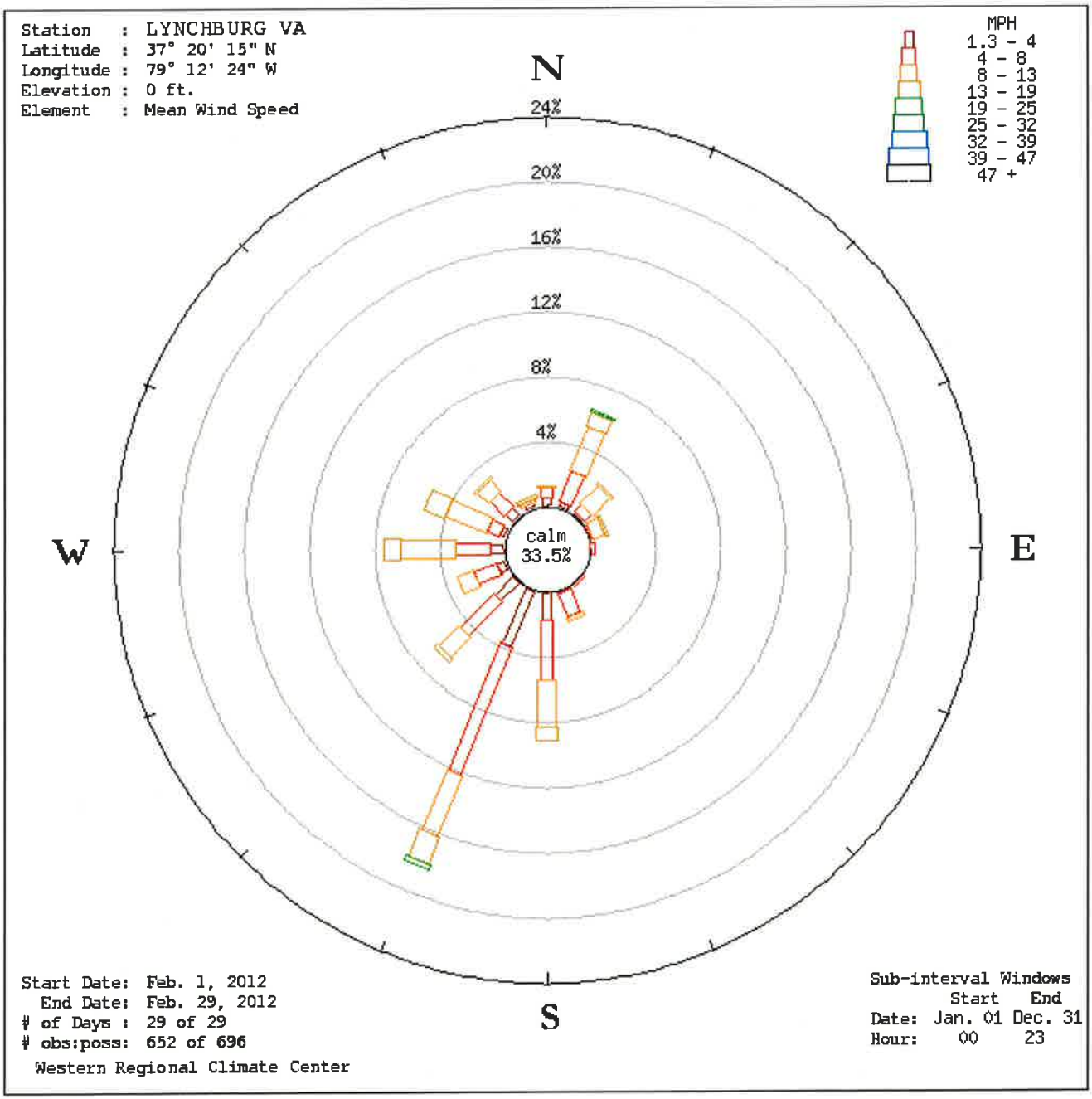
Sub Interval Windows

	Start	End
Date	Jan. 01	Dec. 31
Hour	00	23

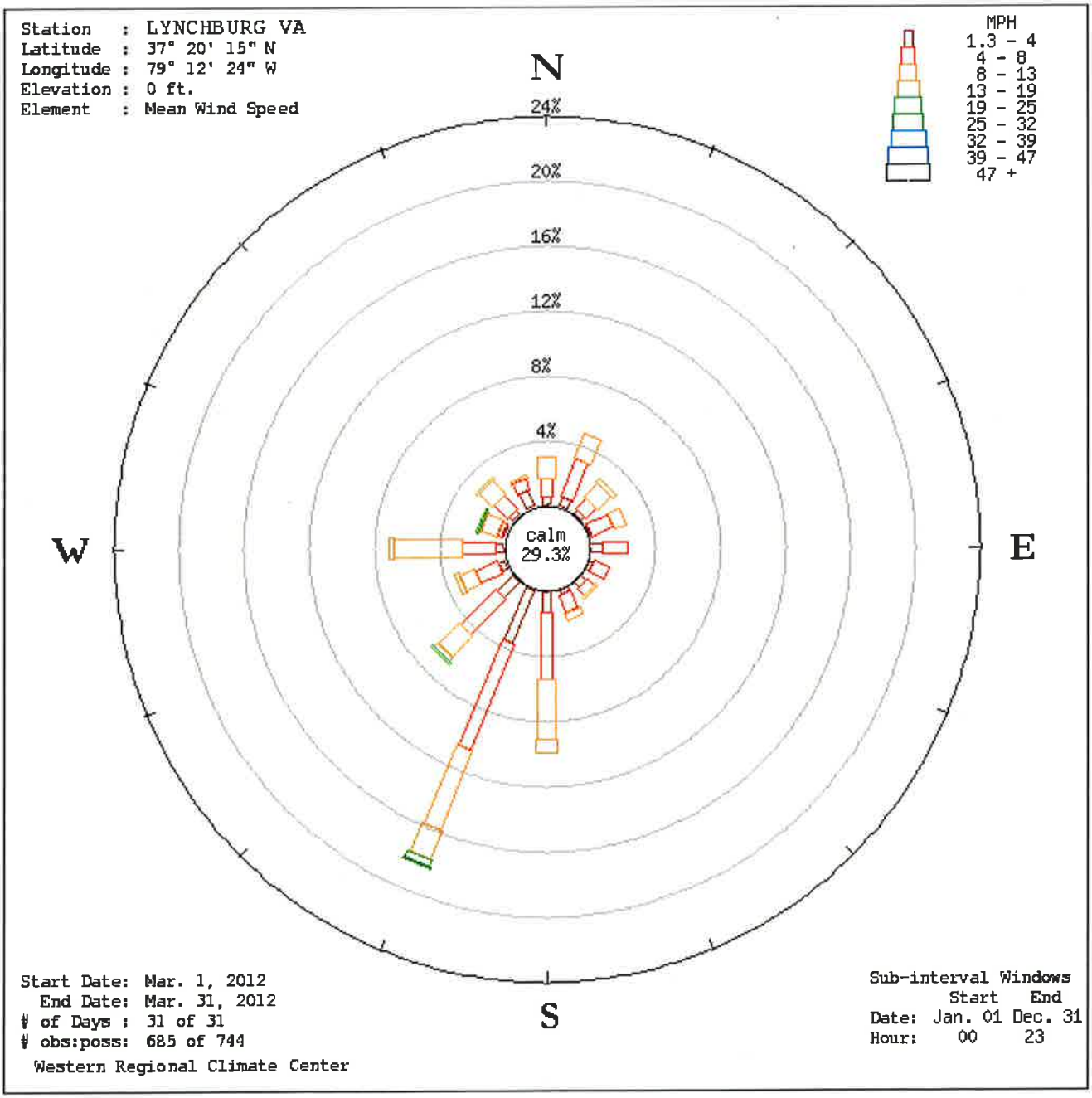
LYNCHBURG VA



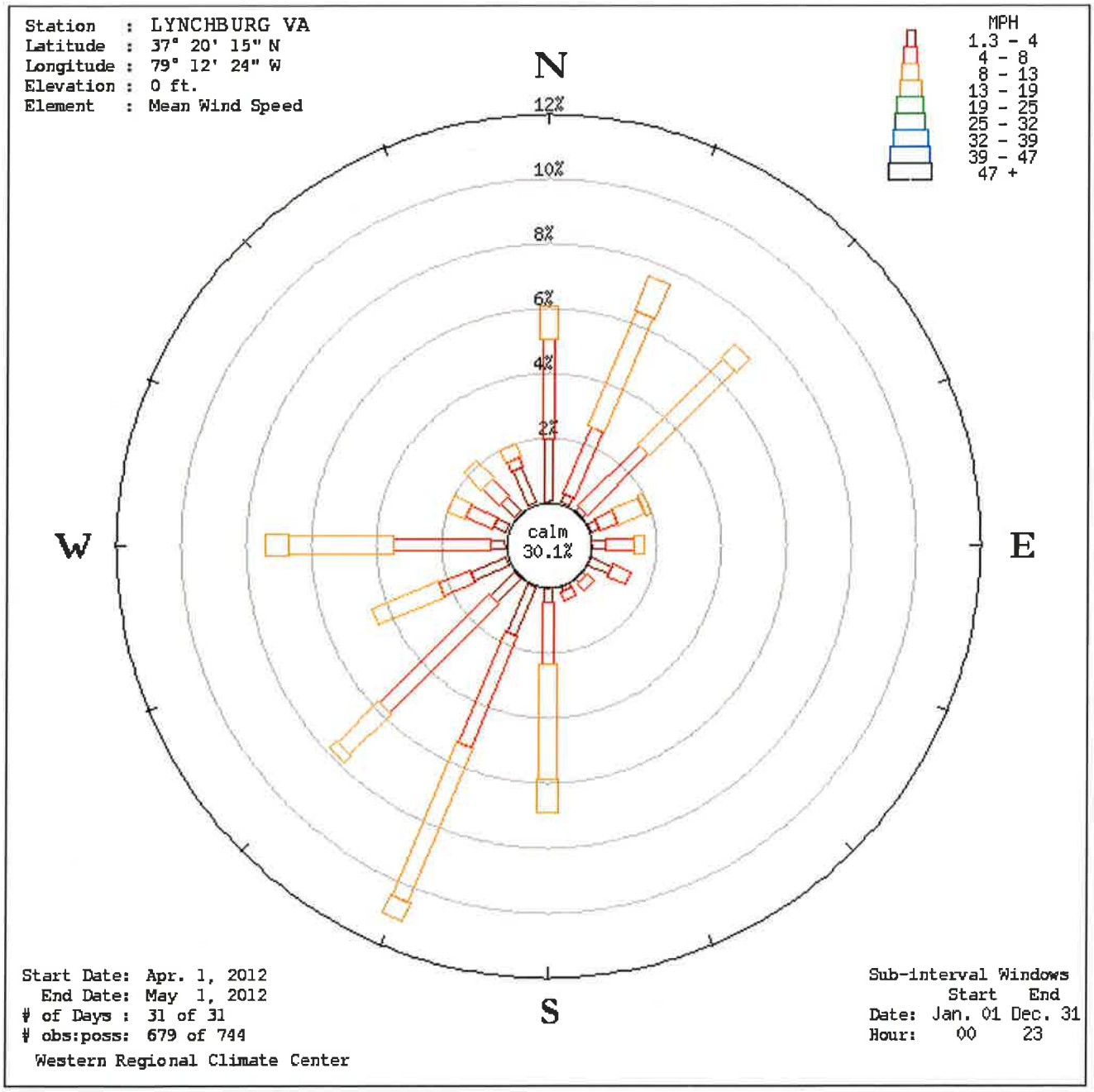
LYNCHBURG VA



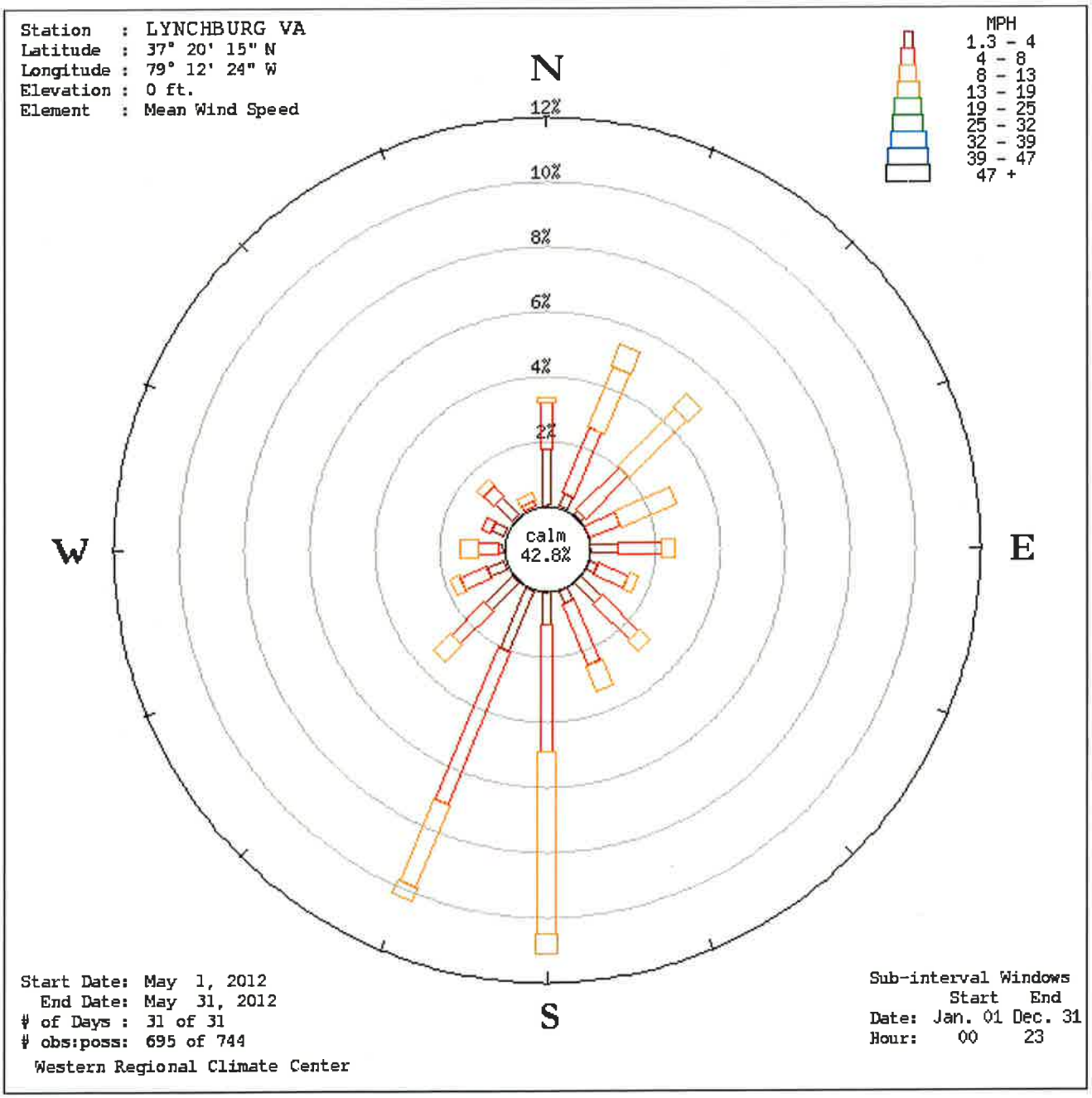
LYNCHBURG VA



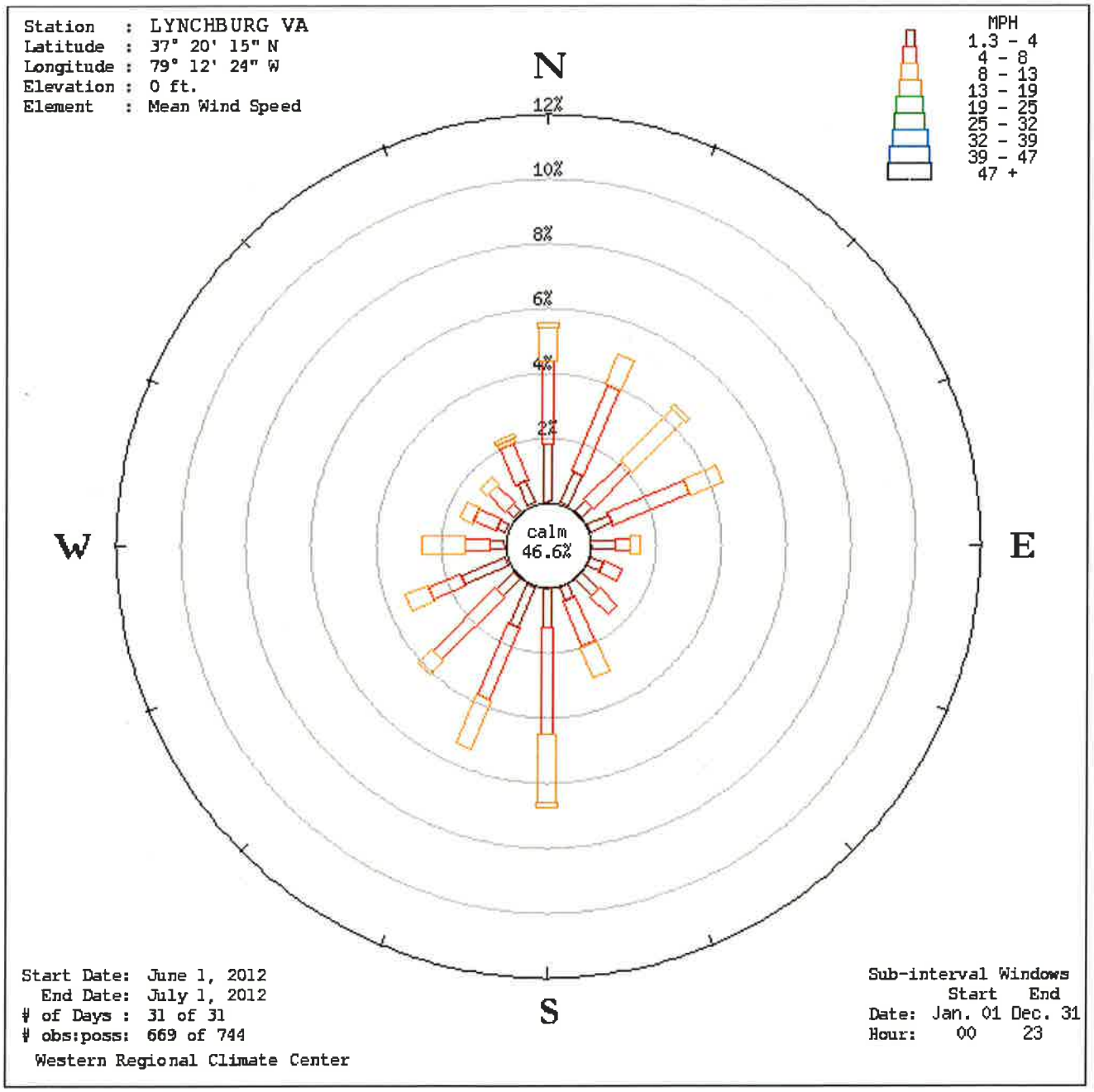
LYNCHBURG VA



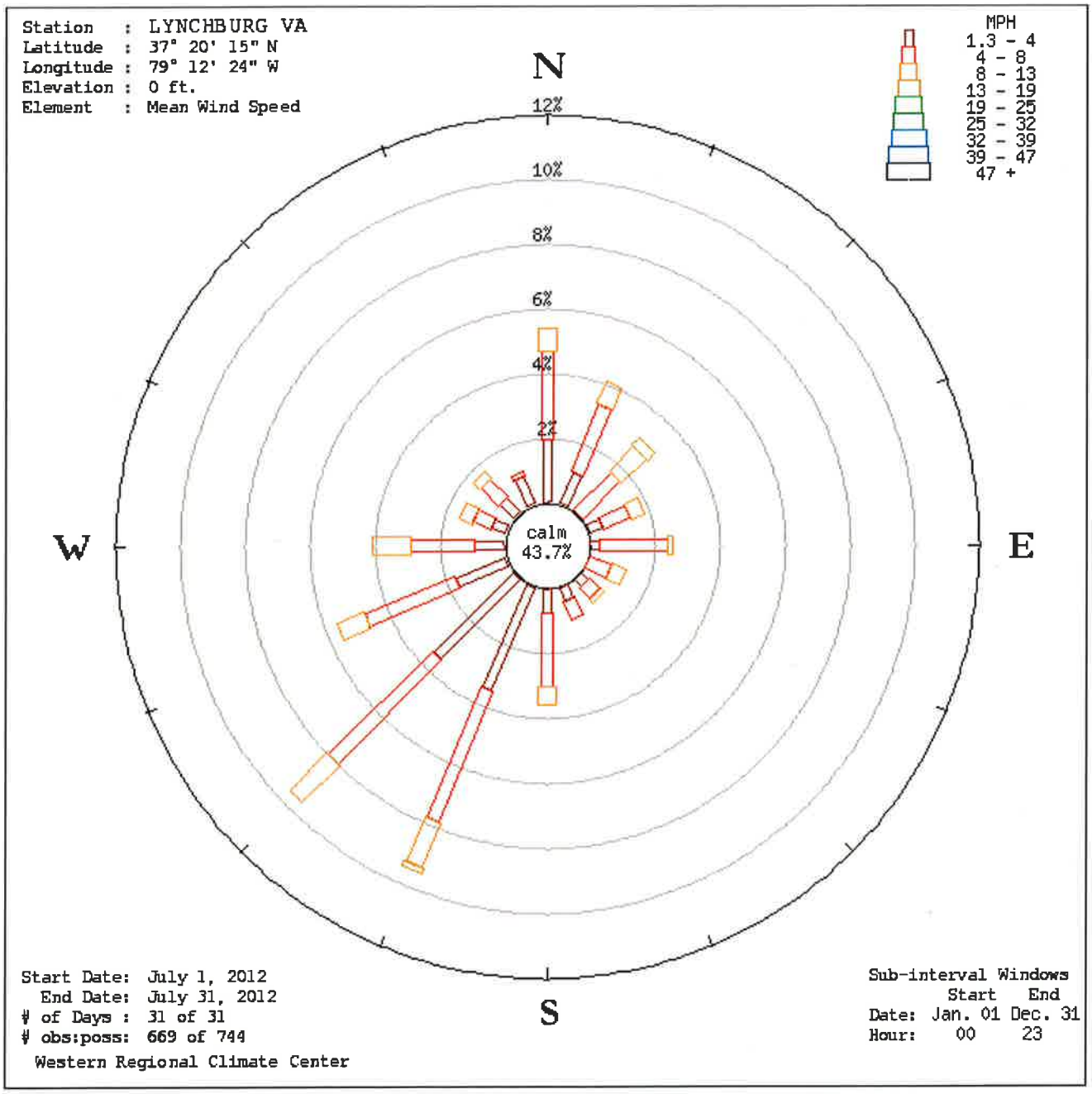
LYNCHBURG VA



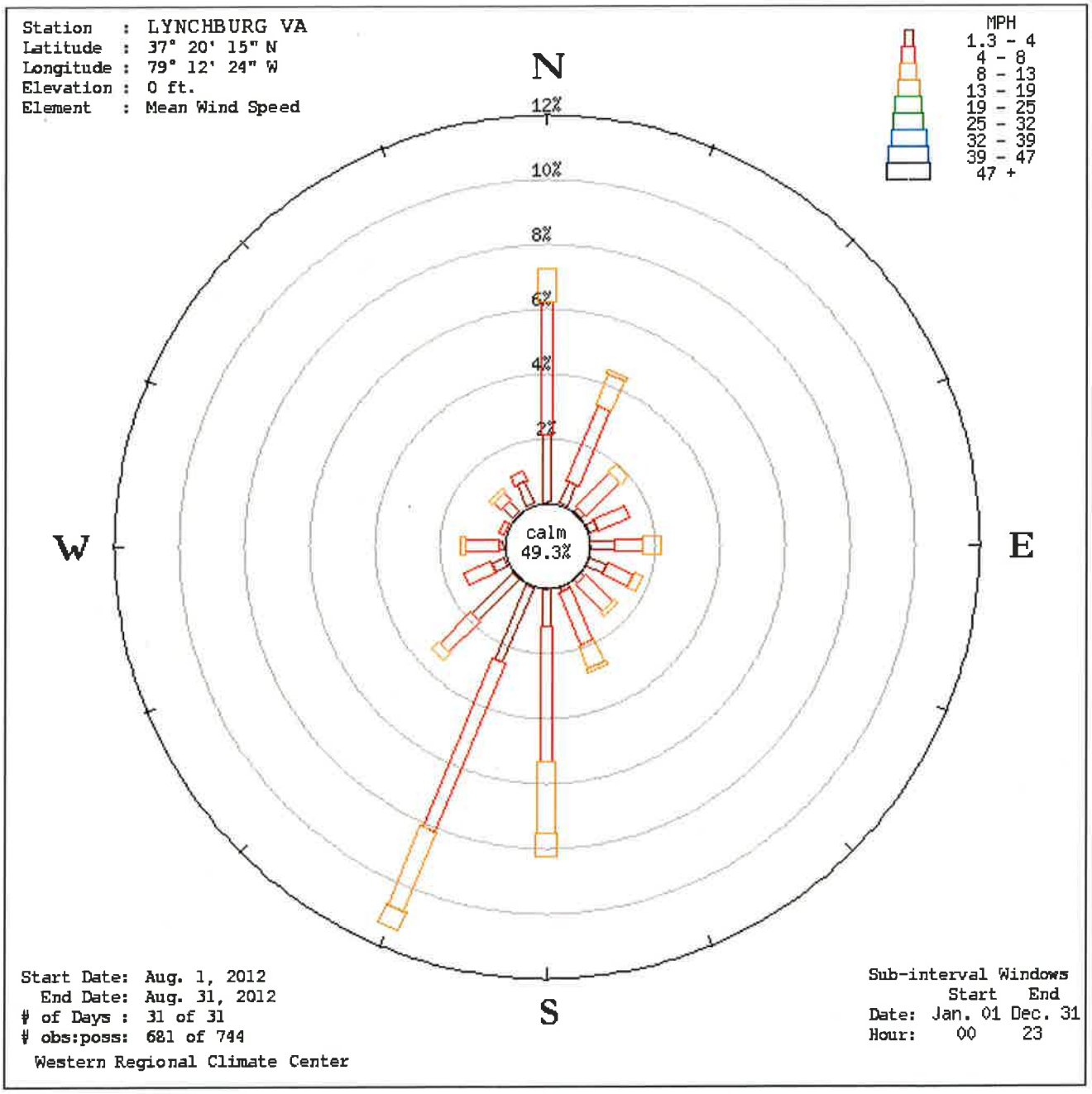
LYNCHBURG VA



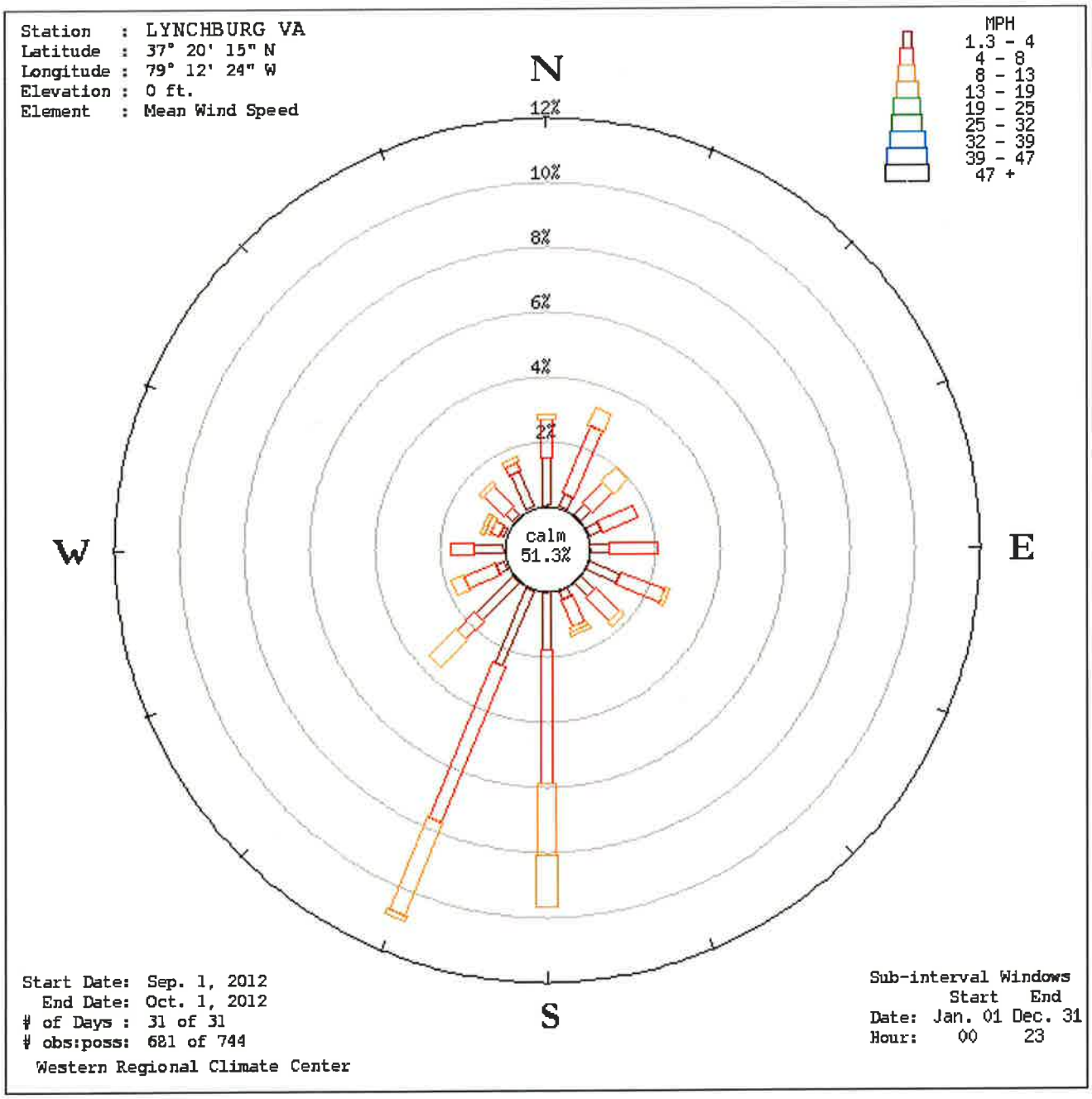
LYNCHBURG VA



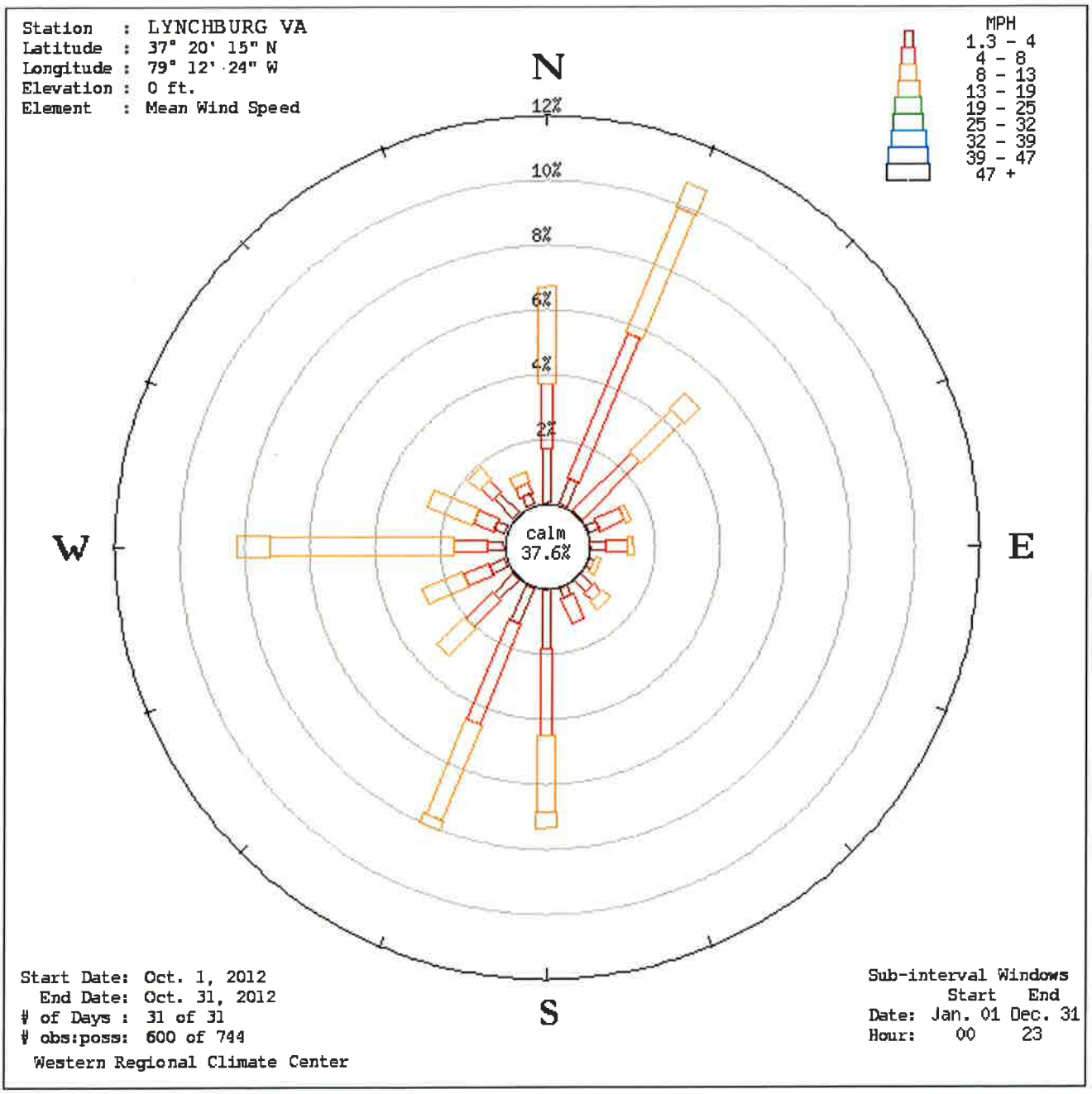
LYNCHBURG VA



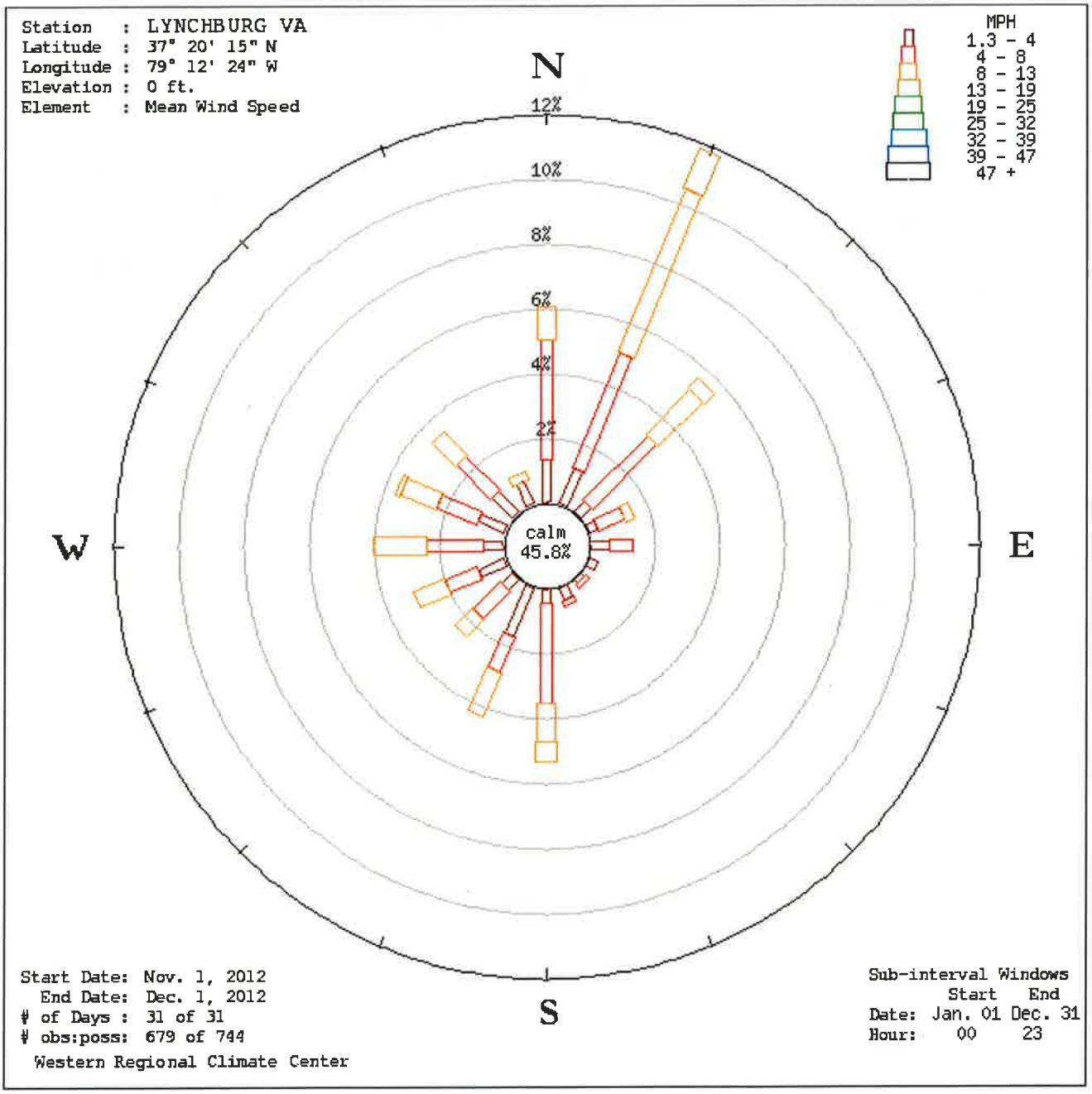
LYNCHBURG VA



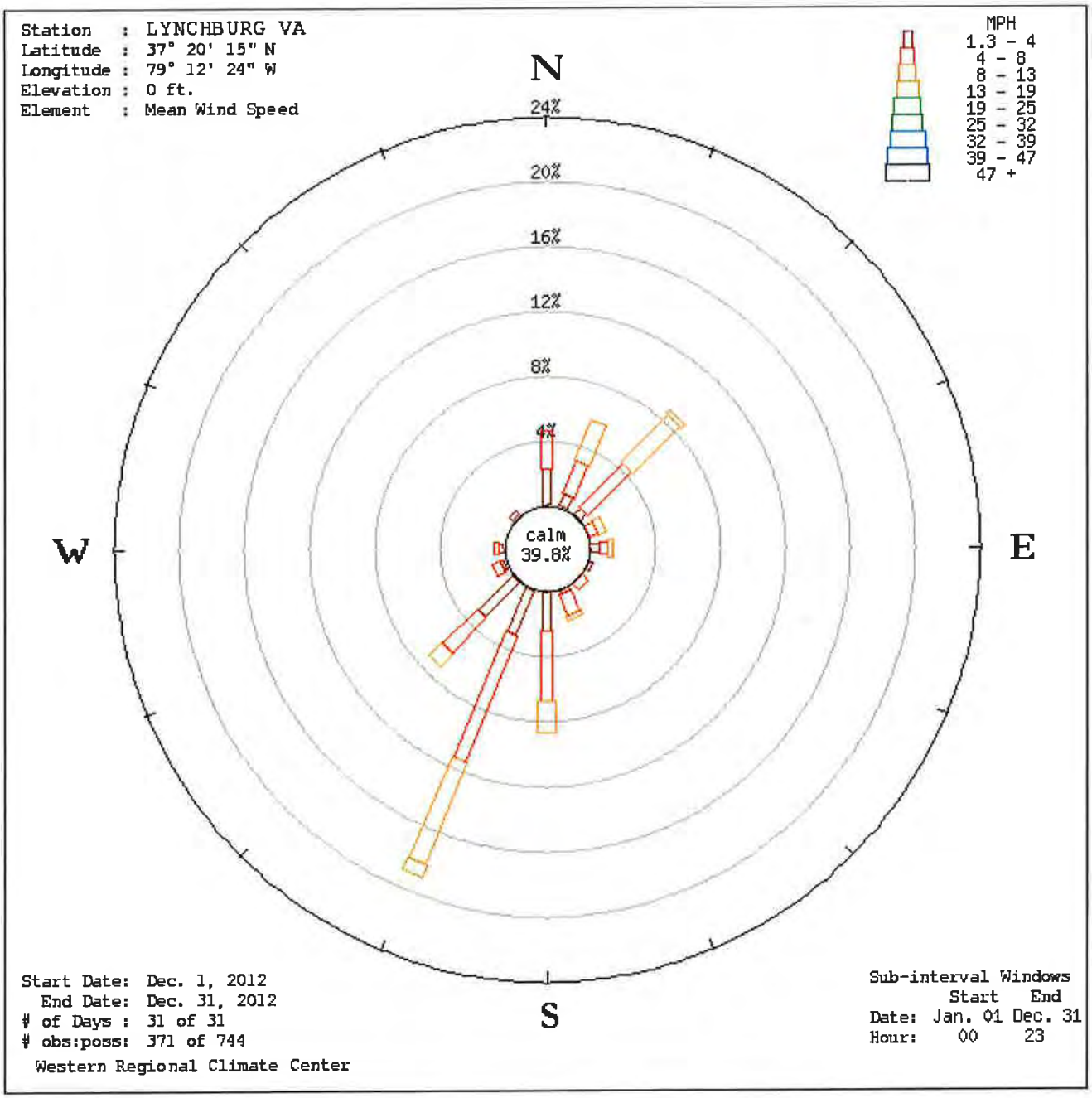
LYNCHBURG VA



LYNCHBURG VA



LYNCHBURG VA



LYNCHBURG VA - Wind Frequency Table (percentage)

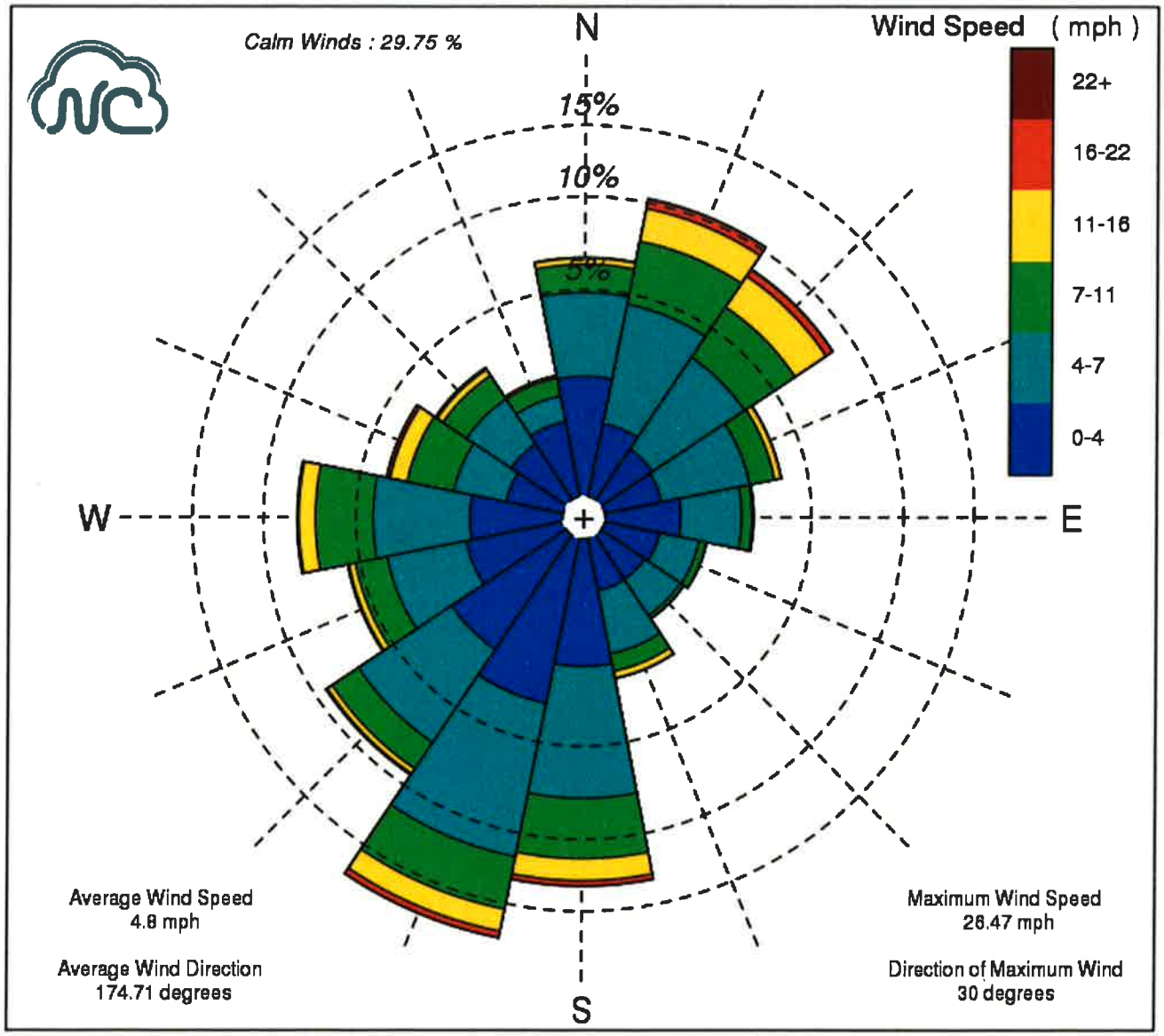
Latitude : 37° 20' 15" N
Longitude : 79° 12' 24" W
Elevation : 0 ft.
Element : Mean Wind Speed

Start Date : Dec. 1, 2012
End Date : Dec. 31, 2012
# of Days : 31 of 31
obs : poss : 371 of 744

Sub Interval Windows

	Start	End
Date	Jan. 01	Dec. 31
Hour	00	23

Wind Rose for Lynchburg Municipal Airport (KLYH)
Jan. 1, 2013 to Dec. 16, 2015



Appendix E

SCS Daily Field Logs

SCS FIELD SERVICES DAILY LOG

JOB NO.	02195001.07	**TASK NO.**	5	**DATE**	04/01/15	**PROJECT NAME**	Livestock Road
TEMP	65°F	**WEATHER**	Mostly Clear	**B.P.**	"Hg	**WIND**	

SCS-FS LABOR		OT		HOURS	OT
James Anderson	10		Labor Code 99		
			DAILY TOTAL		

EQUIP, SVCS, MLG	QTY	UNITS		QTY	UNITS
Tool Truck	1	each			

INSTRUMENT CALIBRATION (CAL. GAS)		CH_4 (%-VOL)	CH_4 (%-LEL)	O_2 LOW SCALE (%-VOL)	CO_2 (%-VOL)	H_2S (PPM)
MODEL	S/N					

SUMMARY On site to investigate potential for connecting leachate cleanouts for vacuum extraction. The cleanouts are 6" SCH80 PVC, with the final above ground portion sleeved inside of a 6' long 12" steel pipe. Most of the steel pipes have flange collars w/ blind flange, though some have slip collars with water meter covers. Numbered the cleanouts and on drawing – could not locate cleanout #9.

No cleanouts had tremendous pressure where the gas was "blowing" out of the cleanout, though many had enough pressure that the gas flowing out of cleanout was visible due to the light refraction. Did not notice H_2S odor at any cleanout; the cleanouts that had gas present had typical LFG odor.

#1 – some pressure, strong gas odor.
#2 – some pressure, strong gas odor.
#3 – some pressure, strong gas odor.
#4 – no blind flange, marginal gas present.
#5 – no blind flange, no gas observed.
#6 – no blind flange, no gas observed.
#7 – slip collar, no cap, no gas observed.
#8 – slip collar, no cap, no gas observed.
#9 – could not locate.
#10 – slip collar, with water meter cap – did not have five-point tool to remove cap.
#11 – slip collar, no cap, little gas observed.
#12 – no blind flange, some pressure / gas odor.
#13 – no blind flange, a lot of gas, strong odor.
#14 – no blind flange, some pressure / gas odor.
#15 – no blind flange, some pressure / gas odor.
#16 – some pressure / gas odor.
#17 – some pressure, strong odor.
#18 – a lot of gas, strong odor.
#19 – some pressure / gas odor.

Met with site personnel and discussed options and took measurements for the gas collection system to be installed:
Measured 40' for the road crossing from ditch to slope on other side of road were pipe will daylight.
Measured 455' from other side of road crossing at cleanout #8 to the leachate loadout area.
Measured 475' from other side of road crossing to small building near retention pond.

PREPARED BY: James Anderson ACCEPTED BY: _____

SCS FIELD SERVICES DAILY LOG

JOB NO. 02195001.07 **TASK NO.** 5 **DATE** 04/30/15 **PROJECT NAME** Livestock Road

TEMP 73°F **WEATHER** Stormy **B.P.** "Hg **WIND**

SCS-FS LABOR		OT		HOURS	OT
James Anderson	9		Labor Code 99		
Brandon King			DAILY TOTAL		

EQUIP, SVCS, MLG	QTY	UNITS		QTY	UNITS
Tool Truck	1	each			

INSTRUMENT CALIBRATION (CAL. GAS)		CH_4	CH_4	O_2 LOW SCALE	CO_2	
MODEL	S/N	(%-VOL)	(%-LEL)	(%-VOL)	(%-VOL)	H_2S (PPM)
GEM 5000	500393	50.0		20.9	35.0	
GEM 2000		50.0		20.9	35.0	

SUMMARY

On site to prep cleanouts, and perform sampling and pump testing.

Went around landfill and exposed cleanouts (some were silted in), removed blind flanges and installed caps on the 6" PVC cleanouts. Two cleanouts had female threaded fittings and two cleanouts had 8" pipes. Purchased threaded 6" plugs and 8" caps to close up these clean-outs. Installed sample ports in the caps and installed caps on cleanouts.

At some cleanouts the 6" caps were glued on, with no practical way to remove them. Purchased 6" clay x 6" cast iron Fernco couplings in order to connect the wellheads to the cleanouts.

Took static readings at all the cleanouts.

Due to coolant issues, generator was not ready for use until mid afternoon. Set up blower, generator, piping and wellhead at LC-01. Will begin pump test tomorrow at LC-01.

PREPARED BY: James Anderson ACCEPTED BY: _____

SCS FIELD SERVICES DAILY LOG

JOB NO.	02195001.07	**TASK NO.**	5	**DATE**	05/01/15	**PROJECT NAME**	Livestock Road
TEMP	63°F	**WEATHER**	Rain	**B.P.**	"Hg	**WIND**	

SCS-FS LABOR		OT		HOURS	OT
James Anderson	11		Labor Code 99		
			DAILY TOTAL		

EQUIP, SVCS, MLG	QTY	UNITS		QTY	UNITS
Tool Truck	1	each			

INSTRUMENT CALIBRATION (CAL. GAS)		CH_4 (%-VOL)	CH_4 (%-LEL)	O_2 LOW SCALE (%-VOL)	CO_2 (%-VOL)	H_2S (PPM)
MODEL	S/N					
GEM 5000	500393	50.0		20.9	35.0	

SUMMARY On site to perform pump testing at cleanouts.

Began pump test at LC-01. Started at -0.8"wc and 21 SCFM. Realized that gas was restricted by the 1 1/4" hole in cap (cap is glued on, used clay / cast iron Fernco to connect over cap). Drilled 3 1/8" hole in cap to allow for more gas flow.

With larger hole, vacuum was at -0.8"wc, flow at about 50 SCFM. Gas quality decreased some, but still >50% CH_4.

Increased vacuum in increments up to -4.1"wc, flow at 109 SCFM. Final readings were 48.5% CH_4, 2.3% O_2. Pump tested LC-01 approximately nine hours, and extracted approximately 25250 SCF of gas.

Applying the vacuum did not have a noticeable effect on other cleanouts, except that it did stop the gas coming out of the 12" steel pipes at LC-01, LC-02 and LC-19 (not much at LC-19 to begin with), and decreased the gas coming out of steel pipe at LC-03.

LC-01 went positive very shortly after shutting down blower and removing vacuum.

PREPARED BY: James Anderson ACCEPTED BY: _____

SCS FIELD SERVICES DAILY LOG

JOB NO.	02195001.07	**TASK NO.**	5	**DATE**	05/04/15	**PROJECT NAME**	Livestock Road
TEMP	85°F	**WEATHER**	Clear	**B.P.**	"Hg	**WIND**	SSW @ 5-10 mph

SCS-FS LABOR		OT		HOURS	OT
James Anderson	9.5		Labor Code 99		
Brandon King			DAILY TOTAL		

EQUIP, SVCS, MLG	QTY	UNITS		QTY	UNITS
Tool Truck	1	each			

INSTRUMENT CALIBRATION (CAL. GAS)						
MODEL	S/N	CH_4 (%-VOL)	CH_4 (%-LEL)	O_2 LOW SCALE (%-VOL)	CO_2 (%-VOL)	H_2S (PPM)
GEM 5000	500393	50.0		20.9	35.0	
GEM 2000		50.0		20.9	35.0	
HS267	00285					25ppm
TVA-1000B						500ppm
Jerome 631						Factory Calibrated

SUMMARY On site to perform pump testing at cleanouts and H_2S testing.

Used Industrial Scientific HS267 meter to monitor hydrogen sulfide at cleanouts. Connected HS267 meter to exhaust of GEM and took static readings at cleanouts.

CL-01 @ 7 ppm	CL-02 @ 2 ppm	CL-03 @ 2 ppm	CL-04 @ 3 ppm	CL-05 @ 2 ppm	CL-06 @ 4 ppm
CL-07 @ 2 ppm	CL-08 @ 2 ppm	CL-10 @ 2 ppm	CL-11 @ 0 ppm	CL-12 @ 3 ppm	CL-13 @ 1 ppm
CL-14 @ 3 ppm	CL-15 @ 1 ppm	CL-16 @ 4 ppm	CL-17 @ 4 ppm	CL-18 @ 8 ppm	CL-19 @ 3 ppm

Used TVA-1000B to perform surface emissions monitoring around landfill.

Used Jerome H_2S meter to monitor ambient H_2S around cleanouts. First readings are from slope above cleanouts, second readings are from road below cleanouts.

CL-01 @ 0.005 and 0.002 ppm	CL-02 @ 0.004 and 0.004 ppm	CL-03 @ 0.015 and 0.002 ppm
CL-04 @ 0.002 and 0.003 ppm	CL-05 @ 0.004 and 0.001 ppm	CL-07 @ 0.004 and 0.003 ppm
CL-08 @ 0.003 and 0.002 ppm	CL-09 @ 0.004 and 0.003 ppm	CL-10 @ 0.002 and 0.002 ppm
CL-11 @ 0.003 and 0.001 ppm	CL-12 @ 0.002 and 0.000 ppm	CL-13 @ 0.002 and 0.002 ppm
CL-14 @ 0.002 and 0.002 ppm	CL-15 @ 0.005 and 0.003 ppm	CL-16 @ 0.010 and 0.002 ppm
CL-17 @ 0.120 and 0.005 ppm	CL-18 @ 0.008 and 0.007 ppm	CL-19 @ 0.001 and 0.002 ppm

Performed gas sampling at LC-01, and shipped samples out to lab.

Set up blower and generator trailers and connected wellhead and piping at CL-04.

PREPARED BY: James Anderson ACCEPTED BY: _____

SCS FIELD SERVICES DAILY LOG

JOB NO. 02195001.07 **TASK NO.** 5 **DATE** 05/05/15 **PROJECT NAME** Livestock Road

TEMP 82°F **WEATHER** Clear **B.P.** "Hg **WIND**

SCS-FS LABOR		OT		HOURS	OT
James Anderson	10		Labor Code 99		
			DAILY TOTAL		

EQUIP, SVCS, MLG	QTY	UNITS		QTY	UNITS
Tool Truck	1	each			

INSTRUMENT CALIBRATION (CAL. GAS)		CH_4 (%-VOL)	CH_4 (%-LEL)	O_2 LOW SCALE (%-VOL)	CO_2 (%-VOL)	H_2S (PPM)
MODEL	S/N					
GEM 5000	500393	50.0		20.9	35.0	

SUMMARY

On site to perform pump testing at cleanouts.

Started pump test at LC-04 – at first gas reading after applying vacuum the gas quality was poor and dropping. Reduced vacuum from -1.0"wc to -0.06"wc. Checked gas again after about 30 minutes, but it had not recovered. Concluded there is not much gas to be recovered from LC-04.

Moved generator / blower and connected to LC-16. Set vacuum at -1.0"wc and 47 SCFM flow with good quality gas. Gas quality did drop some. After about four hours, increased vacuum to -1.5"wc and flow to 62 SCFM. After about two hours the gas quality had dropped to 51.3% CH_4 and 2.3% O_2. Extracted approximately 18300 SCF of gas. Did not have noticeable effect on surrounding cleanouts. Cleanout went positive shortly after vacuum was removed .

Moved and connected to LC-15. Set vacuum at -0.75"wc and 48 SCFM. Gas quality held steady and after about two hours increased vacuum to -2.25"wc, flow to 85 SCFM. Gas quality was still high after about 35 minutes – final gas readings at 59.4% CH_4 and 0.0% O_2. Extracted approximately 12000 SCF. Cleanout went positive a few minutes after removing vacuum. Did not have noticeable effect on surrounding cleanouts.

PREPARED BY: James Anderson ACCEPTED BY: _____

SCS FIELD SERVICES DAILY LOG

JOB NO.	02195001.07	**TASK NO.**	5	**DATE**	05/06/15	**PROJECT NAME**	Livestock Road
TEMP	83°F	**WEATHER**	Partly Cloudy	**B.P.**	"Hg	**WIND**	

SCS-FS LABOR		OT		HOURS	OT
James Anderson	12		Labor Code 99		
			DAILY TOTAL		

EQUIP, SVCS, MLG	QTY	UNITS		QTY	UNITS
Tool Truck	1	each			

INSTRUMENT CALIBRATION (CAL. GAS)		CH_4 (%-VOL)	CH_4 (%-LEL)	O_2 LOW SCALE (%-VOL)	CO_2 (%-VOL)	H_2S (PPM)
MODEL	S/N					
GEM 5000	500393	50.0		20.9	35.0	

SUMMARY

On site to perform pump testing at cleanouts.

Resumed pump test at LC-15. Increased vacuum to -2.9"wc, flow to 95 SCFM. After about two hours gas quality held steady and vacuum was increased to -3.6"wc and flow to 110 SCFM. Air dilution valve was closed fully and wellhead valve was opened fully. This appears to be the maximum flow through the wellhead with this blower.

Pumped 110 SCFM through wellhead at LC-15 for about 2.5 hours and gas held steady. Final readings at 59.6% CH_4 and 0.1% O_2. Did not appear to effect surrounding cleanouts. Cleanout was under positive pressure soon after vacuum was removed. Pump a total today of 25650 SCF, with 12000 SCF pumped yesterday.

While pumping at LC-15, observed a couple truckloads of the sewage treatment sludge being disposed of in the landfill. The sludge was fairly dry, with a consistency of potting soil. There was a "sewage treatment plant" odor, along with some earthy and ammonia odors. Deodorizer was sprayed on the pile as soon as it was dumped. The sludge was mixed in with the MSW as it was dumped (negating some-what the effect of the deodorizer). There are usually four to five loads disposed of here daily.

A load of slag from a local foundry was also dumped at the same time as the sludge. There was a slight sulfur odor associated with the slag, but according to site personnel odors from the slag are not as persistent as odors from the sludge.

Moved pumping operation over to LC-13. Started cleanout at -0.9"wc with flow at 52 SCFM. After about 40 minutes, increased vacuum to -2.3"wc, flow up to 85 SCFM. After another 50 minutes increased to full vacuum and flow, -3.75"wc and 110 SCFM flow. Slight effect on cleanouts LC-12 and LC-14, more so on LC-12. Continued for about two hours. Gas quality was steady. Pumped around 25300 SCF total. Cleanout was under positive pressure soon after vacuum was removed.

Moved blower to cleanout LC-17 for pump test tomorrow.

PREPARED BY: James Anderson ACCEPTED BY: _____

Appendix F

Construction Photo Log

PRELIMINARY LFG SYSTEM CONSTRUCTION PHOTOS – JUNE 2015
REGION 2000 REGIONAL LANDFILL - LIVESTOCK ROAD FACILITY
RUSTBURG, VIRGINIA

Horizontal directional drilling by Toney Construction. The borehole was for the 12" header under the paved access road at the northeast corner of the landfill (6/8/15).

Horizontal directional drill bit surfacing from underneath paved haul road. The borehole was lubricated with water prior to header pipe being pulled through (6/8/15).

12-inch HDPE header pipe prior to being pulled through the horizontal borehole underneath the access road. As shown the pullhead (cap with pull loop) was fused onto the pipe (6/8/15).

90 degree tee immediately before the road crossing, accomplished with an electrofusion coupling. Note the blind flange allowing for future expansion to the south (6/11/15).

90 degree bend immediately after the road crossing, leading to condensate manhole and blower/flare station. The 90 was accomplished with a butt-fusion weld (6/11/15).

Stub-ups for remote wellheads located near the southwest corner of the landfill (6/11/15).

10-foot deep by 18-inch diameter sump installed across road near northeast corner of the landfill (6/11/15).

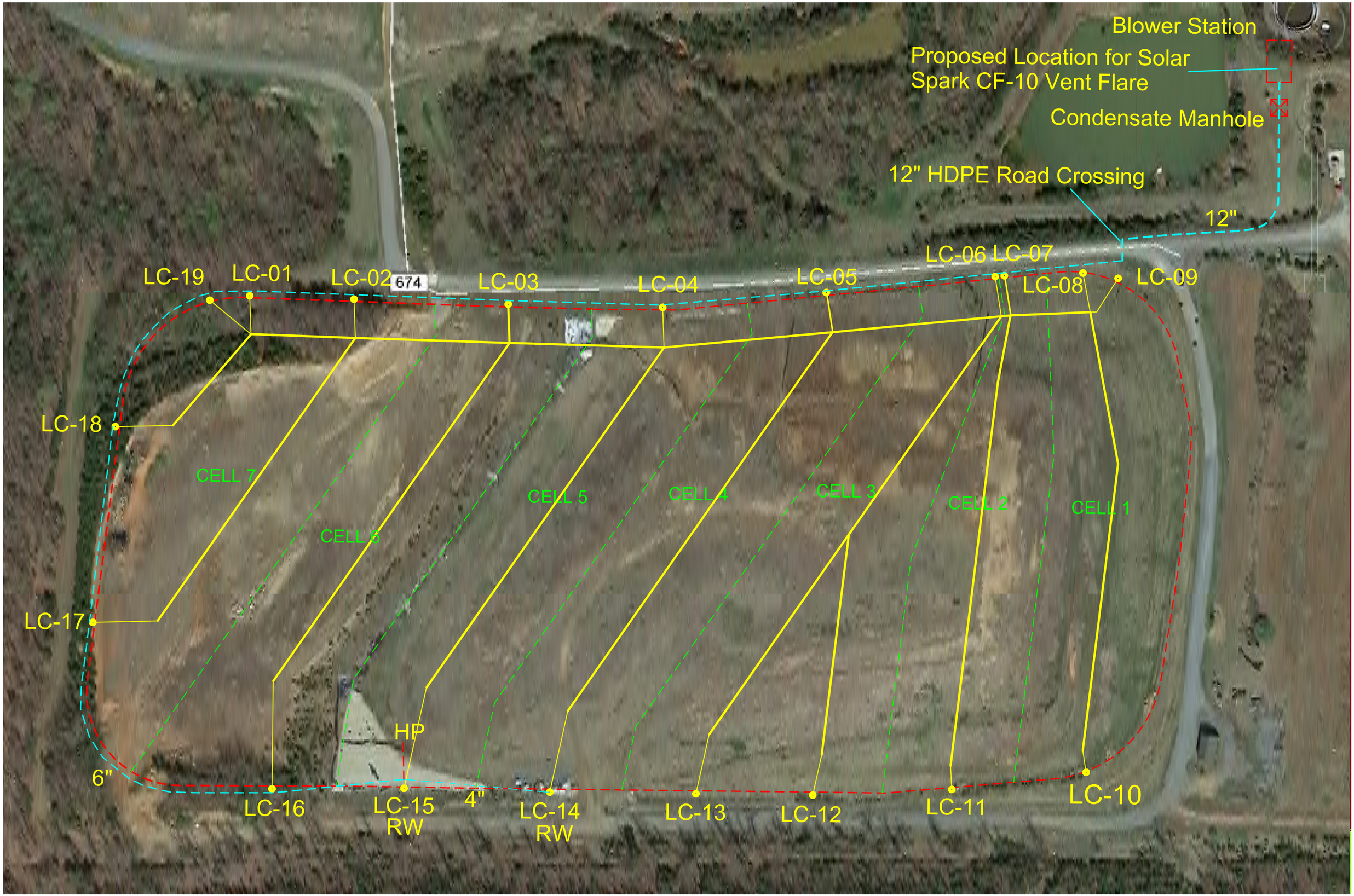
Example of leachate cleanout utilizing Waste Management-style wellhead for connection to LFG collection system (6/23/15). Eight total leachate cleanouts were connected to vacuum.

Mobile blower station and temporary SCS-rental flare setup (8/17/15).

Mobile blower station and Authority-owned flare setup, installed 9/23/15. The flare is a CF-10 Solar Spark flare with a crown ring and heat shield to promote combustion and minimize emissions.

Appendix G

Pilot-Scale LFG System As-Built Drawing


Blower Station
Proposed Location for Solar
Spark CF-10 Vent Flare
Condensate Manhole
12" HDPE Road Crossing
12"
LC-19
LC-01
LC-02
674
LC-03
LC-04
LC-05
LC-06
LC-07
LC-08
LC-09
LC-18
LC-17
CELL 7
CELL 6
CELL 5
CELL 4
CELL 3
CELL 2
CELL 1
HP
6"
LC-16
LC-15
RW
4"
LC-14
RW
LC-13
LC-12
LC-11
LC-10