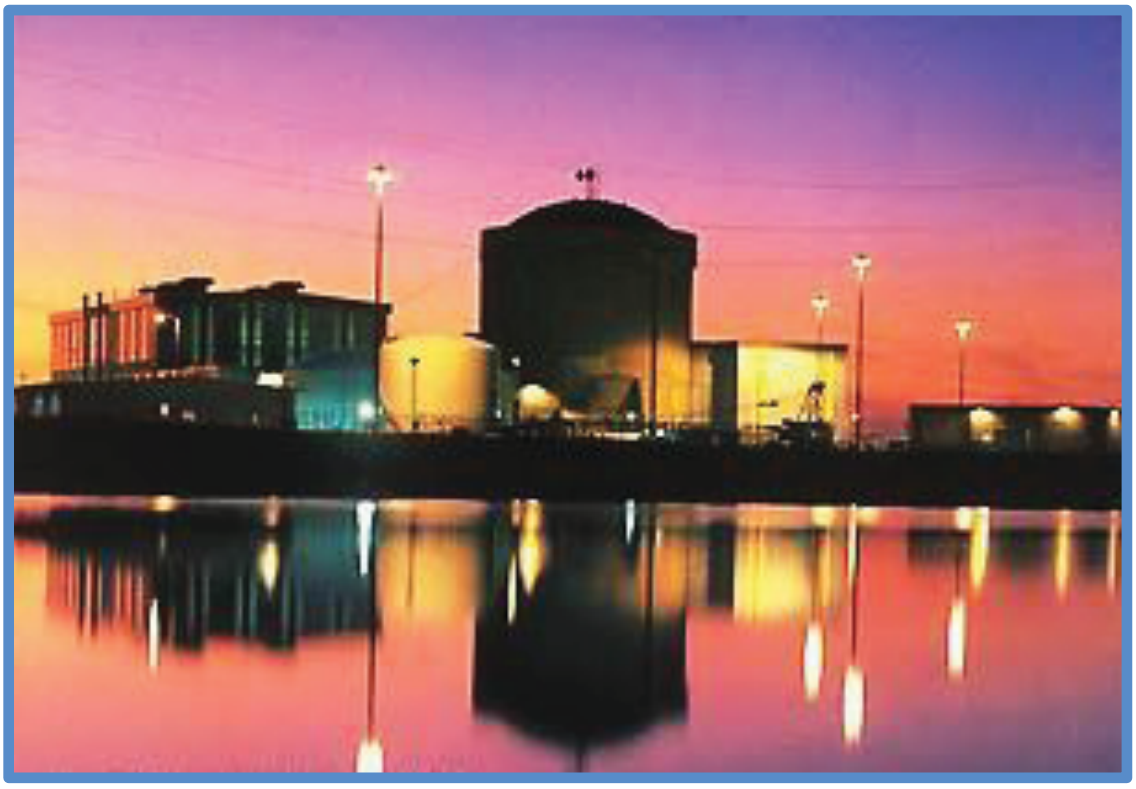
V. C. SUMMER NUCLEAR STATION

ALERT AND NOTIFICATION SYSTEM DESIGN REPORT



Revision 1
January 15, 2014

SIGNATURE PAGE

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VCSNS Emergency Preparedness Specialist/Engineer (Print/Signature) Date

Reviewed By:

VCSNS ANS Plant System Engineer (Print/Signature) Date

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VCSNS Emergency Preparedness Supervisor (Print/Signature) Date

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VCSNS Emergency Preparedness Manager (Print/Signature) Date

Department of Homeland Security
Region IV
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FEMA

October 21, 2014

Thomas D. Gatlin,
Senior Vice President-Nuclear Operations
VC Summer Nuclear Station
Post Office Box 88, Mail Code 830
Jenkinsville, South Carolina 29065

Re: Virgil C. Summer Nuclear Station Units 1, 2 and 3
Docket No.: 50-395, 52-027 & 52-028
Operating License No.: NPF-12, NPF-93 and NPF-94
ALERT NOTIFICATION SYSTEM DESIGN REPORT

Dear Mr. Gatlin:

FEMA Headquarters Technical Hazards Division (THD) Professional Services & Integration (PS&I) Branch received the Virgil C. Summer Nuclear Station Siren System Alert and Notification System (ANS) Design Report Revision I dated January 15, 2014 from FEMA Region RIV. FEMA Headquarters THD PS&I Branch has reviewed the submitted documentation. Consistent with current management processes and direction, the ANS system as described in the Design Report has been approved.

If you have any questions please contact Lawrence Robertson, my designated Section Chief for the States of Georgia and South Carolina, at 770/220-5466.

Sincerely,

Conrad S. Burnside, Chief
Technological Hazards Branch

cc: Mr. Kim Stenson, Director
SC Emergency Management Division
2779 Fish Hatchery Road
West Columbia, South Carolina 29172
R. E. (Bob) Williamson, Manager, Emergency Preparedness

REVISION HISTORY

1986 - The original VCSNS ANS Design Report titled "Verification and Testing of the Siren Prompt Notification System". This report was approved by FEMA as documented in the letter titled "Final Draft Report for the Alert and Notification System for the Virgil C. Summer Nuclear Plant" dated August 6, 1986

2009 – Upgrades to the entire ANS were made in order to improve system reliability. FEMA approved this upgrade and is documented in the letter titled "VCSNS Siren Replacement Upgrade 2009" dated June 26, 2009

2014 - Revision 1 of the VCSNS ANS Design Report includes the following changes: Information was added as required by FEMA-REP-10, Rev. 1 to describe ANS System overall design, testing, and maintenance details; Updated Acoustical Analysis; Added information for three additional sirens in the ANS; Information was added for expanded plume exposure Emergency Planning Zone (EPZ) due to the construction of Units 2 and 3; and a reversed 911 dialing system has been added to the Back-Up ANS, which currently uses route alerting.

2014 - An update to Revision 1 of the VCSNS ANS Design Report is required due to the following changes: the communication system at VCSNS has been upgraded from an analog to a digital system. The digital system and its supporting components will allow for better and more reliable communication capabilities. In addition, Attachment 1 of the Early Warning Siren System Acoustical Analysis was updated to correct siren addresses and to add sites 33, 69, and 105 that were not included in Revision 1 of this report. Changes were made to the wording in the ANS Operation, Maintenance and Testing Section for clarification.

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INTRODUCTION

South Carolina Electric & Gas (SCE&G) has developed the Alert and Notification System (ANS) Design Report Revision 1 for V.C. Summer Nuclear Station (VCSNS). This report provides details of how VCSNS meets the administrative and physical means to ensure initial alert and notification of the public within VCSNS's plume exposure Emergency Planning Zone (EPZ) as required by 44 CFR Part 350, Planning Standard E, Appendix 3 of NUREG 0654/FEMA-REP-1, and FEMA-REP-10.

VCSNS utilizes 109 fixed electro-mechanical sirens throughout the EPZ as the primary alerting method for local residents and the transient population. VCSNS calls this siren system the Early Warning Siren System (EWSS). VCSNS uses the EWSS along with broadcasted emergency information via local television and radio stations to notify the public on instructions, information, and necessary actions to be taken.

The purpose of this revision is to include changes made to VCSNS's EWSS. One of the changes is the expansion of VCSNS's EPZ. The expanded EPZ is being made at the request of the Lexington County Council, due to the construction of Units 2 and 3 which are located one mile south of Unit 1. The expanded EPZ is the area that extends beyond the original EPZ in Lexington County in Subzone D-2. The map in Figure 1 shows the EPZ.

Another change to the EWSS is the addition of three extra sirens. VCSNS contracted West Shore Services, Inc. in order to confirm coverage by the existing EWSS and to identify the new siren locations for the expanded EPZ. The complete acoustical study is located in the report titled "V. C. Summer Nuclear Station Early Warning Siren System Acoustical Analysis" located in Attachment 1. Two sirens will be added within the expanded EPZ in locations identified through field test data and computer modeling to provide the required coverage. Due to addition of a new high school near Prosperity, SC (Newberry County) and within Subzone E-2, SCE&G made the decision to add a new siren to this area. Specifics on the location of these sirens as well as all of the sirens in the EWSS can be found in Attachment 1 of this report.

The design report also captured a new more reliable and technologically advanced Back-Up ANS. This system utilizes a high-speed, reverse-911 type of system that is capable of notifying residents in the EPZ by way of available telephones. This system is also capable of sending text messages to resident's cell phones, if registered. Back-up Route Alerting will be maintained as an alternate method to notifying the public.

This design report supersedes the original Design Report approved by FEMA in August, 1986.

BACKGROUND OF CHANGES

The original FEMA approved ANS design report for VCSNS titled "Verification and Testing of the Siren Prompt Notification System of V.C. Summer Station" was prepared by Acoustic Technology Inc. in February 1982 (Ref. 5). This report contained two parts; Part 1 contained a computer analysis of the installed siren alerting system, Part 2 contained the field testing results of the siren alert system. The original system consisted of 58 Dual-tone Penatrator-10 rotating models, 19 Single-tone Screamer stationary models, and 23 stationary Dual-tone Banshee models, and three Federal Signal Thunderbolts. There were also two Whelen WS 2000 electronic sirens that had a public address capacity. The rotating sirens were located in the more densely populated areas within the EPZ. The following are the changes made to the EWSS from the original design to the present:

- In 2009, a design upgrade to the EWSS was done under ECR 50512. The upgrade to the EWSS included replacing all siren heads, siren power supply, control systems, activation equipment, and associated computers at the plant.

  All Banshee, Penetrator, and Screamer sirens were replaced with Federal Signal 2001SRNB rotating sirens. This provided a more reliable and consistent system since the original system consisted of a variety of different siren types and manufacturers. Finding spare parts for the original system was difficult due to obsolescence. All replacement electro-mechanical sirens have identical equipment and are simplistic in design, making troubleshooting and repair easier than the previous system. Additionally, this system is upgradable for years to come.

  The power supply for all sirens was replaced with 48VDC battery power with solar charging. This eliminated the dependence on less reliable and noisy AC power. Solar charging also eliminated damage from line surges that was a frequent problem with the previous system.

  The control equipment for each siren was replaced with Federal Signal's DCFCTB controller providing an enhanced two-way communication. This allowed all of the sirens to send a failure signal for practically any type of failure experienced without the need to be poled by the base station.

  The Motorola activation equipment was replaced with Federal Signal SS2000D Controller/Encoder. New siren activation equipment was installed in the Control Room, the Work Control Center, the Work Station in the EP area (located on the second floor, in the northeast corner of the New Nuclear Operation Building), and the Emergency Offsite Facility (EOF).

- In 2014, three additional sirens will be added to the EWSS. VCSNS contracted West Shore Services, Inc. to conduct an acoustical study to verify siren coverage in the original EPZ and provide optimal siren locations for coverage of the expanded EPZ. These studies were conducted in accordance with 10 CFR 50.47, Emergency Plans, NUREG-0654/FEMA-REP-1-Rev.1, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, and FEMA REP-10, Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants. VCSNS assumes the average-day-time ambient noise level for the EPZ to be 50dB since the population density in the EPZ is below 2,000 persons/square mile. This assumption was used in the analysis of the VCSNS siren system design to produce a minimum of 60 dB. two sirens will be added within the expanded EPZ in locations identified through field test data and computer modeling to provide coverage. Due to addition of a new high school near Prosperity, SC (Newberry County) and within Subzone E-2, SCE&G made the decision to add a new siren to this area.

- In November 2014, an update to Revision 1 of the ANS Design Report is required due to the following changes:

    a. Changes to the Communication Section were made due to an upgrade in the radio communication system from the VCS trunked system to a Digital Radio system. This is due to obsolescence issues of the existing controllers.
    b. In the ANS Operation, Maintenance, and Testing section, wording was changed to describe the requirement of conducting a quiet test or a growl test following maintenance of the EWSS to verify the siren is operational. Also in this section, wording was added that states if a growl test falls on the same date as the complete cycle test, the complete cycle test can be performed in lieu of the growl test.
    c. In Attachment 1 of the Early Warning Siren System Acoustical Analysis, corrected siren addresses and added sites 33, 69, and 105 that were not included in the table in Revision 1 of this report.

GENERAL SYSTEM OVERVIEW AND DESIGN

Off-Site Philosophy and Design

The primary EWSS consists of 109 fixed sirens located throughout the EPZ. These sirens are intended to promptly alert the residents and transient population in the EPZ so they will know to turn to a broadcast station or a communication media to receive information and instruction in the event of a major emergency at VCSNS. The EWSS is designed to meet the requirements of NUREG 0654/FEMA REP-1 and FEMA REP-10, "Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants." This was achieved through a comprehensive engineering study that took into consideration population density and geographical features in the EPZ.

The public residing in the EPZ is provided information on what actions to take in the event they hear the sirens. VCSNS provides this information every year in the form of a calendar that is mailed to all of the residents and businesses in the EPZ and students attending schools within the EPZ. This publication also identifies the local radio and television stations that the public should tune in for information related to the emergency. Transient populations in the EPZ can get this information regarding local radio and television stations from signs posted at recreational areas and local businesses.

Area of Coverage

VCSNS is located in Fairfield County, South Carolina which is approximately 25 miles North West of Columbia. Currently, there is one unit (Unit 1) that is active and two units (Unit 2 and Unit 3) under construction. Unit 1 was commissioned in 1984 and is located on the southern shore of Lake Monticello. Units 2 and 3 are located one mile south of Unit 1. The general landscape of the area surrounding VCSNS and in the EPZ consists of a combination of rural farmland and forests. The forests consist mainly of coniferous trees (pine trees) and deciduous trees.

The EPZ for Units 1, 2, and 3 of VCSNS is defined as an approximate 10 mile radius from the center point of Unit 1 and expanded into Lexington County from the center point of Unit 3. Parts of four Counties contribute to the entire EPZ; Lexington, Newberry, Fairfield, and Richland. Two sirens will be added to Subzone D-2 to provide coverage for the expanded area.

The population density within the EPZ is less than 2,000 per square mile according to the 2010 Census. Figure 1 shows the total population in the EPZ according to the Evacuation Time Estimate study that was performed by KLD Engineering, P.C. in April, 2012.

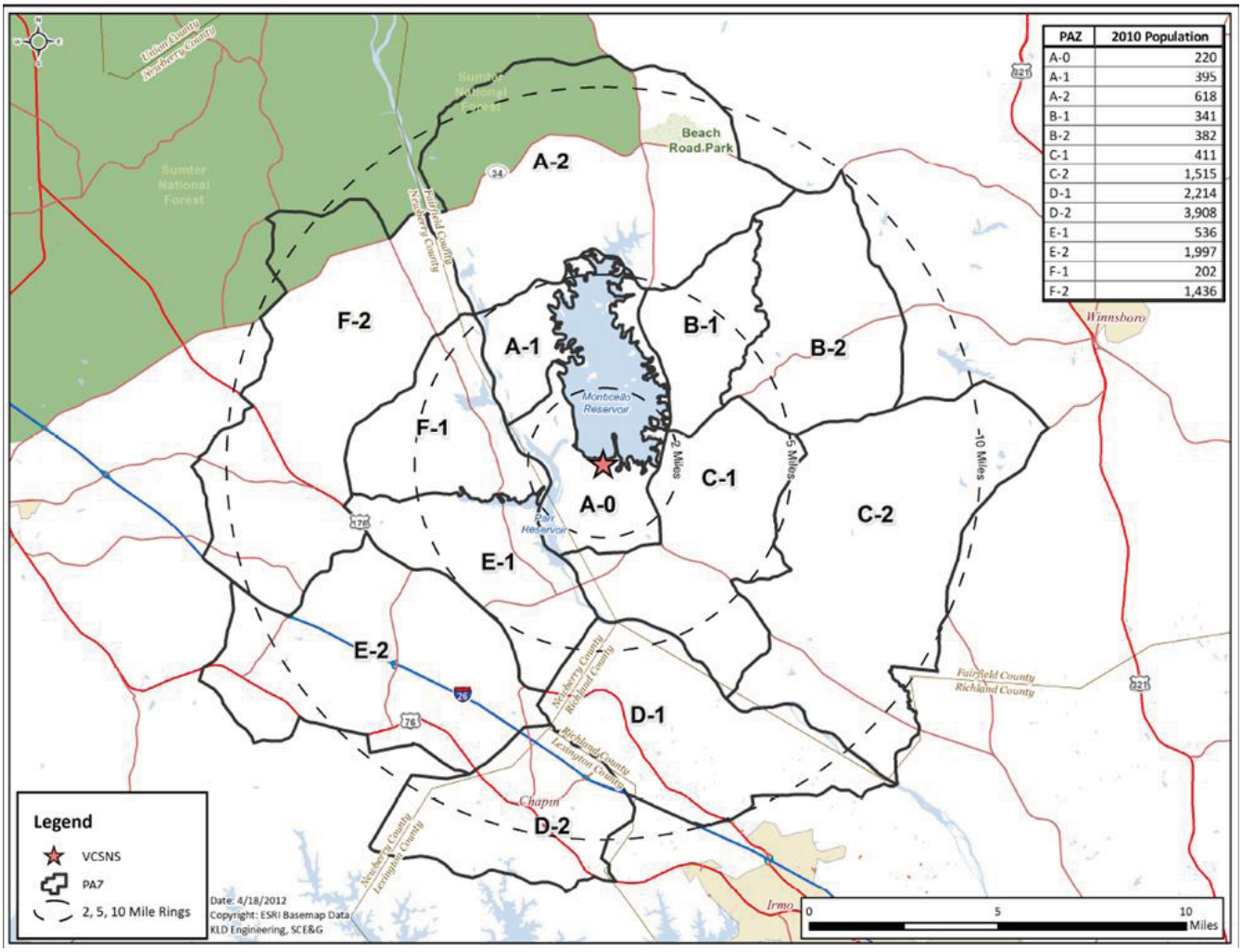


Figure 1 Population in VCSNS EPZ

Communication

The siren radio system consist of a Digital Motorola Mototrbo IP Site Connect System that allows a means of communications between facility control computer and field sirens. The system utilizes both base stations and remote units in conjunction with associated cabling, repeaters, and antennas to provide optimum coverage for two-way continuous transmission. Two transmitter locations are used for siren repeaters, the NND tower and the SCE&G Little Mountain tower. Little Mountain can also be accessed from the Siren Controller locations in the event of an NND repeater failure. Both the controller and siren radios contain both the NND and Little Mountain repeaters in them and they have the ability to select the one with the strongest signal to use and will roam to the other if a failure occurs to the one currently selected.

The communication portion of the EWSS uses the Federal Commander Digital Telemetry System (Commander) using SFCD Software. The Commander was developed by Federal Signal Corporation using reliable digital modem technology developed specifically for wireless communications. The performance of this system has proven to be reliable and secure for the EWSS.

The Commander System is comprised of the Central Computer Unit (CCU), the Siren Controller/Radio Modem Terminal Unit (SS2000), and the Remote Terminal Unit or Siren Controller at Remote Site (RTU). Figure 2 shows the basic configuration of the Commander system used at VCSNS.

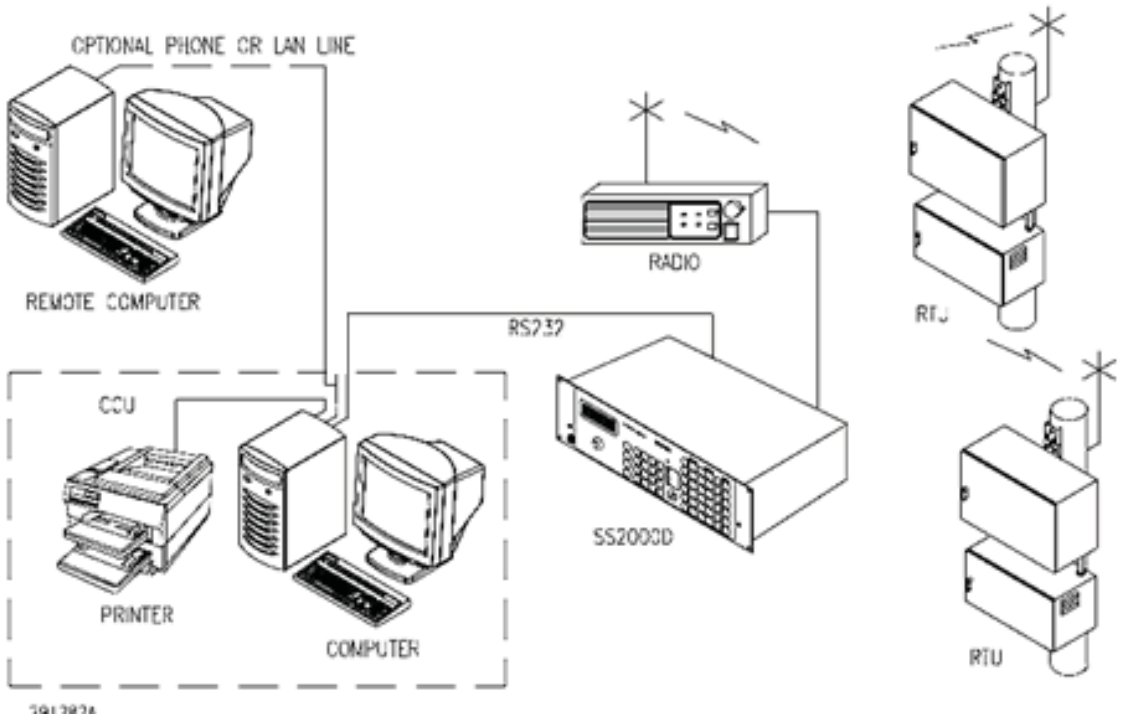


Figure 2: Configuration of the Commander System

The CCU provides the interface between the user and the siren system. It is used to control sirens, and to store all incoming alarm messages and status messages for later retrieval and analysis. Also the CCU can be used to initiate communications with the RTU(s) to obtain status data and to program sirens remotely. The CCU provides the following:

- as a control console to activate the RTUs
- as a data storage site to collect status and alarm data from all RTUs in the EWSS
- to provide real time alerting that an alarm has been triggered at an RTU, that an RTU has failed to respond to a command, or that an RTU's main power has failed
- as a programming console to configure radio communications parameters and remotely program RTUs

For permanent records, the CCU data can be printed out on any printer which can reproduce the entire ASCII character set as well as dot addressable graphics. This is used to maintain documentation for PMs and maintenance testing results.

The SS2000D serves as the interface between the CCU computer and the radio transceiver. It also functions as a stand alone terminal unit with activation and status reporting capability in case of a PC failure.

The RTU is a single board microprocessor based monitoring and control unit. It has the capacity to store siren activation functions uploaded from the CCU or SS2000D. It also collects siren status and diagnostic information for report back to the CCU. Each RTU communicates status and alarm data to one or more CCUs or other RTUs over a radio link.

Activation of Sirens

Activation of the sirens in the EWSS is done by qualified VCSNS personnel. The EWSS sirens can be activated from four control stations; the Control Room, the Work Control Center, the Work Station in the EP area (located on the second floor, in the northeast corner of the Nuclear Operations Building), and the Emergency Offsite Facility (EOF). At each location, the sirens can be activated using the Siren System computer terminals or the SS2000 bases.

Siren Design

VCSNS uses Federal Signal model 2001 series rotating, electro-mechanical sirens. These sirens receive power from 48VDC powered with solar panel charging. This has eliminated the need for the sirens to be dependent on line power and also eliminated the issue of electrical surges from the power lines which have caused damage to sirens in the past.

All sirens located within the EPZ are model 2001-SRNB, factory rated at 128 dBc at 100 feet, with the exception of Site 5 which is a model 2001-130, rated at 130 dBc at 100 feet. The 2001-SRNB siren is a single tone siren capable of sounding for a minimum of 15 minutes. It uses the 2001DCB Control Unit/Battery Box with fully charged, standard, deep-cycle, marine batteries.

The control equipment on each siren uses Federal Signal's DCFTB controller providing for reliable two-way communication. Each siren utilizes a grounding rod for surge protection. The grounding resistance is verified by VCSNS Electrical Maintenance personnel during the performance of annual siren preventative maintenance activities.

DESCRIPTION OF UPGRADED ALERT & NOTIFICATION SYSTEM

In the Spring of 2012, West Shore Services, Inc. and VCSNS conducted extensive acoustical sound level testing throughout the entire EPZ, including the expanded EPZ. During this study, empirical sound level data for both "A" and "C" scales were collected at predetermined locations. Most of these testing locations were centrally located by a group of sirens. The majority of these locations were identified by West Shore as representing areas that were predicted by computer based mathematical modeling as having weak sound levels therefore would be the most limiting.

Sound testing was also performed in the expanded EPZ as described above to provide VCSNS with the optimal locations and number of sirens that should be added in this area. These locations were verified with mathematical modeling. It was concluded that two additional sirens needed to be added. The exact locations of these sirens as well as all of the siren locations are located in the report titled "V. C. Summer Nuclear Station Early Warning Siren System Acoustical Analysis" located in Attachment 1.

With one additional siren installed in subzone E-2 and two additional sirens installed in the expanded EPZ in Subzone D-2, computer based mathematical models and in-field acoustical data demonstrated that the EWSS for VCSNS is in compliance with all Federal Regulatory requirements of 10 CFR50.47, Emergency Plans, NUREG-0654 FEMA-REP-1-Rev.1, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants and FEMA REP-10, Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants.

Another change to the ANS is the addition of an upgraded Back-Up ANS which utilizes a high speed telephone notification system. This upgrade is a more robust and efficient system that uses technology which is currently used by other business groups within SCE&G and by local and state agencies in the area. This system will notify residents within the EPZ quickly utilizing telephones, in the event that either part or all of the EWSS is deemed inoperable. Back-up Route Alerting will be maintained as an alternate methodology for notification of the public.

Beginning in November, 2014, the siren radio system was converted from an analog to a digital system. The VCS Sirens previously operated on a Motorola Smartnet stand alone analog trunked system, located in the Control Building, with the primary antenna on the Reactor Building. The sirens shared the trunked system with Operations, Security, and other groups that support the plant operation.

A Motorola Mototrbo IP Site Connect System has been selected as the replacement siren radio system. Two transmitter locations will be used for siren repeaters, the NND tower and the SCE&G Little Mountain tower. Field test measurements from the new siren locations (Sirens 9, 80, 108, and 109) have verified two-way coverage off of the Little Mountain tower as a source of reliable communications. Little Mountain can also be accessed from the Siren Controller locations in the event of an NND repeater failure. Both the controller and siren radios contain both the NND and Little Mountain repeaters in them and they will select the one with the strongest signal to use and will roam to the other if a failure occurs to the one currently selected.

SYSTEM ACTIVATION, CONTROL AND MONITORING

Activation and Control

The sirens in the EWSS are initiated by VCSNS personnel upon direction by state or local authorities as specified in existing agreements concerning activation of the system. The siren system is designed in such a fashion that it can be operationally segregated by county boundary within the 10-mile emergency zone radius. The EWSS signal will be a three-minute steady signal. Upon determination of the need for public notification, the ANS can be activated within 15 minutes. Upon failure of part or all of the system, the State of SC will direct notification methods in accordance with their plan.

Monitoring

The EWSS status is monitored continuously by plant personnel. Monitoring points are in the Shift Supervisor's office, the Emergency Preparedness (EP) work area, the Control Building/Work Control Center, and the Emergency Operations Facility with displays of the real time status of all of the sirens in the EPZ. The Emergency Plan Implementing Procedure for Activation of the Early Warning Siren System requires the Control Room to notify the Duty EP personnel when siren system operability falls below 95% (6 or more siren site dots displaying any color other than green). Routine notifications are made to EP personnel when any siren is in a trouble or fail condition.

Activation Points

After receiving direction by state or local authorities to activate, the EWSS is activated using the control console in the Control Room. If the siren control console in the Control Room is inoperable, the sirens can be activated using a analog to radio encoder, Federal Signal SS2000D, or other Siren System Computer Terminals. Activation points are in the Control Room, the Emergency Preparedness (EP) work area, the Control Building/Work Control Center, and the Emergency Operations Facility.

Reporting Results

Results for EWSS siren testing are maintained in the station's plant records repository (Filenet). Results are also typically attached to the Preventative Maintenance Task sheet If a siren fails any of the scheduled PMs, the condition is entered in the station's Corrective Action Program. The SCE&G Radio Group is notified and dispatched to perform an initial assessment and to troubleshoot the problem. If the siren(s) are determined to be inoperable, the affected County Warning Points and the Control Room are notified. The Emergency Plan Administrative Procedures for Maintenance of the Early Warning Siren System provides a specific definition of individual siren operability.

The EWSS is declared inoperable when less than 75% of the sirens are operable, or when there is a total loss of the capability to activate the EWSS. This does not apply to planned maintenance or repair activities. The Shift Supervisor declares the system inoperable once this criterion is met and refers to NL-122, Regulatory Notification and Reporting, for reportability requirements.

QUALITY ASSURANCE CONFIGURATION MANAGEMENT

The Emergency Plan is described in the Final Safety Analysis Report (FSAR) for VCSNS Unit 1 and for Units 2 and 3. Since the ANS supports the Emergency Plan for all three units, the sirens in the EWSS are considered plant equipment. As such, design changes to the EWSS are controlled under current governing procedures for design control, interface, and implementation.

Sirens in the EWSS are maintained using maintenance procedures and Emergency Plan implementing and administrative procedures. These procedures were developed and are controlled under a 10 CFR 50 Appendix B Quality Assurance Program. More detailed VCSNS plant procedures are available upon request. Documentation for maintenance activities or changes done on the EWSS is maintained in the station's plant records repository.

FAILURE MODES AND EFFECTS ANALYSIS

System Maintenance

The EWSS is included in the station's Preventative Maintenance Program. Planned preventative maintenance is performed annually by VCS Electrical Maintenance and also annually by the SCANA Radio Group. Scheduled preventative maintenance is performed to increase equipment reliability, to monitor and trend the equipment condition, and to find any failed conditions in equipment. The Plant Support Engineering (PSE) system owner monitors the health of the system as well as providing technical guidance and oversight as required.

Failure Modes

When a siren is deemed inoperable due to any failure mode, the affected county or counties and the Control Room are notified and that the Back-Up ANS is utilized for the affected area. The failure modes listed below were obtained from a review of the station's corrective program for the last five years. Below are the most common failure mechanisms that have been identified in the EWSS.

- Battery Failure - Since the EWSS relies completely on DC power, the sirens are vulnerable to this failure mode. Battery failure has been mainly due to the age of the batteries. Although there are PMs in place to replace all of the batteries for each siren on a three year cycle (recommended by the vendor), there have been times when they need replacing prior to the end of this three year interval.

Since the batteries are charged by solar panels, the system must rely on the availability of the sun. Low battery alarms/battery failures have occurred when there is too much shade from nearby trees, when there are several days in a row of heavy clouds, or when the sun is low in the sky as in winter months.

An additional cause for battery failure has been due to the failure of the battery charging sensor. Because of this, charging sensors are now replaced during PMs performed by VCSNS Electrical Maintenance.

- Communications Failure - Mechanisms causing communication failures have been poor signal strength due to battery failure, poor cable connections, failure of the radio, or failure of one or both of the circuit boards (all due to aging equipment).

- Chopper Failure - Failure mechanisms include a Chopper motor being seized as a result of debris and the presence of outside natural infestations or gasket seizure. The chopper is a device that produces sound by forcing out alternating compressed and rarefied air.

- Circuit Board Failure - Each siren operates using silicone circuit boards which may fail due to a power surge or a “bad/corrupted” card.

Trending

Several processes are used to trend and address failures to the EWSS. The primary method is the use of the stations’ Corrective Action Program (CAP). When a siren is deemed inoperable or if a siren fails a scheduled PM, this is entered into the CAP program for evaluation or for tracking and tending purposes. This also allows for common causes to be identified.

EP monitors the siren reliability by tracking performance indicators as described in the Emergency Preparedness Performance Indicator Procedure. This procedure describes the data collection and calculations for the Emergency Preparedness Cornerstone Performance Indicators (PI) in the Nuclear Regulatory Commission’s (NRC) Reactor Oversight Process (ROP). The Alert and Notification System Reliability is one of the indicators monitored by this procedure. An additional Performance Indicator monitored by this procedure is ANS Performance. Downward trends of a NRC Performance Indicator is documented in accordance with the station’s Corrective Action Program.

ANS OPERATION, MAINTENANCE AND TESTING

Routine testing and post maintenance testing of the EWSS is performed from the EP siren computer control station by EP personnel using approved VCSNS procedures. The sirens are tested at the following frequency, as a minimum:

- A silent test of the EWSS shall be performed at least biweekly
- A growl test of the EWSS shall be performed at least quarterly.
- A complete cycle test of the EWSS (full system activation) shall be performed at least annually

If a growl test falls on the same date as the complete cycle test, the complete cycle test can be performed in lieu of the growl test. Since the complete cycle test activates the sirens for a longer period of time, it will be credited for the growl test.

Following preventative or corrective maintenance on the EWSS, a quiet test or a growl test shall be conducted as required to verify the siren is operational. A quiet test activates the sirens for approximately fifteen seconds reaching full volume for approximately five seconds.

Documentation of all testing and maintenance activities performed on the EWSS is maintained as a record in accordance with the station's Preventative Maintenance Program or in accordance with the station's Corrective Action Program.

ACOUSTIC CRITERIA OF SIREN SYSTEMS

This has been described in the report titled "V. C. Summer Nuclear Station Early Warning Siren System Acoustical Analysis" located in Attachment 1.

SIREN ACOUSTIC COMPUTER MODEL ANALYSIS

This has been described in the report titled "V. C. Summer Nuclear Station Early Warning Siren System Acoustical Analysis" located in Attachment 1.

SIREN ACOUSTICAL TESTING PLAN

This has been described in the report titled "V. C. Summer Nuclear Station Early Warning Siren System Acoustical Analysis" located in Attachment 1.

REFERENCES

1. FEMA-REP-10, Rev.1, “Guide for the Evaluation of Alert and Notification Systems”, September, 2011.

2. NUREG-0654/FEMA-REP-1, Rev. 1, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants”, November,1980.

3. KLD Engineering, P.C. “Development of Evacuation Time Estimates Expanded EPZ Boundary”, April, 2012.

4. ECR 50512, “Alert and Notification System Replacement”, November, 2007.

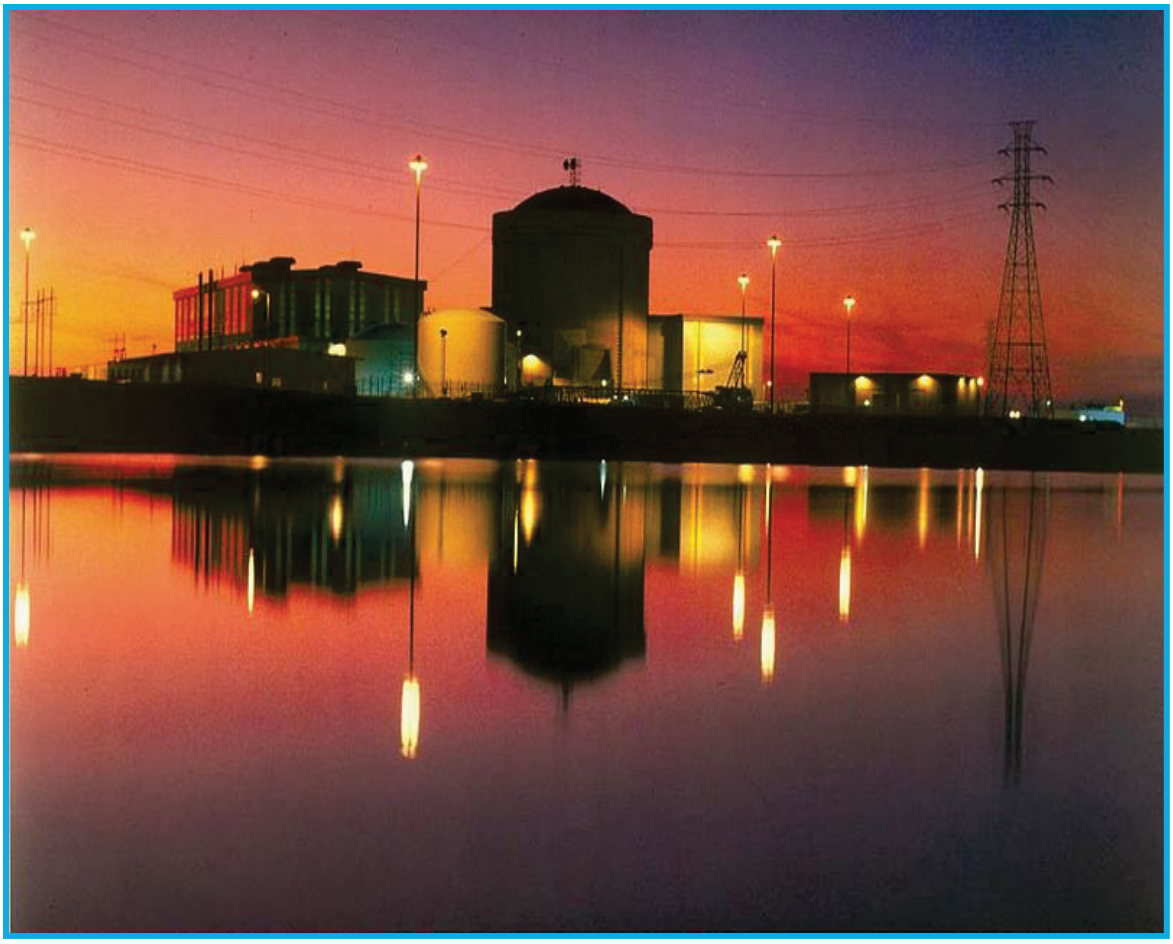
5. Acoustic Technologies, Inc., “Verification and Testing of the Siren Prompt Notification System of V.C. Summer Station”, February, 1982.

6. ISO 9613-2, “Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2 General Method of Calculation”, 1996.

7. Federal Signal SFCDWARE© Software Reference Manual, “The Federal Commander™ Digital Telemetry System”, Part No. 255327F Rev F5 (V10.x), November, 2009.

V. C. Summer Nuclear Station

Early Warning Siren System Acoustical Analysis



December 17, 2013

Work Performed By:

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LIST OF ATTACHMENTS

ADDENDUMS

Addendum (1) Displays Individual Noise Contour Maps CONCAWE P/TA Sites 1-109.

ACRONYMS and MEASUREMENTS

CONCAWE	Conservation of Clean Air and Water in Europe
EPZ	Plume Exposure Emergency Planning Zone
EWSS	Early Warning Siren System
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
inHg	inch mercury [0 °C]
LEQ	Equivalent Continuous Sound Levels
NOAA NWA	National Oceanic and Atmospheric Administration /National Weather Association
NUREG	Nuclear Regulations
SLM	Sound Level Meter
SPL	Siren Sound Pressure
USGS	United States Geological Service
VCSNS	V. C. Summer Nuclear Station
WSS	West Shore Services

1.0 EXECUTIVE SUMMARY

The scope of this project includes an acoustical analysis of the plume exposure Emergency Planning Zone (EPZ) for V. C. Summer Nuclear Station (VCSNS). This study includes the original EPZ for Unit 1 as well as the expanded EPZ for Units 2 and 3 (Map 1).

The expanded EPZ was necessary to account for construction of Units 2 and 3. These new units created a shift in the geographic center of the EPZ, and as a result of this shift, the EPZ was expanded to incorporate them. The expanded EPZ includes the original EPZ that centers on Unit 1 as well as the new EPZ that centers on Units 2 and 3.

The 2010 Census identifies a permanent population in the VCSNS EPZ of approximately 14,000 people and population densities of less than 2,000 persons per square mile. This information was confirmed to establish a minimum threshold of 60 dBc of coverage throughout both the current and expanded EPZs, which meets the currently accepted Federal Emergency Management Agency (FEMA) guidelines in place at the time of this study.[1] The only area likely to attract large numbers of temporary public assembly is Lake Monticello, which was identified as the only significant recreational (public assembly) area within the existing or expanded EPZ.

Baseline testing of Federal Signal 2001-SRNB and Federal Signal 2001-130 sirens models, which are the two types of sirens utilized by the VCSNS facility, were undertaken to assure that accurate performance of the existing system would be introduced into the acoustical model.

Acoustical tests were conducted at 14 individual locations throughout the EPZ including two areas within the expanded EPZ. Once the baseline testing and field testing were completed, the results were used to verify the coverage predicted by the SoundPLAN acoustic modeling of the existing and expanded EPZs.

[1] The current FEMA guidelines referenced in this document refer to the currently accepted guidelines and do not take into consideration any changes that have been proposed and not accepted at the time of the acoustic study. The latest version of the FEMA guidelines was out for comment at the time of this publication; comments were still being accepted through October 29, 2013.

2.0 PROJECT OVERVIEW

On December 12, 2012, representatives from West Shore Services (WSS) met with representatives of the VCSNS facility to review and confirm the scope of work for this project. During the meeting, information and documentation related to individual site inspections as well as the acoustical study was reviewed; this information was critical to WSS being able to move forward.

As a result of the meeting, the following scope of work was identified:

- Complete a thorough individual site inspection of each of the 106 sites. This review is for plant information only and is unrelated to the acoustical study.
- Complete baseline testing of the two existing types of sirens that comprise the Early Warning Siren System (EWSS): Federal Signal 2001-SRNB and Federal Signal 2001-130.
- Develop test sites throughout the existing EPZ to confirm coverage meets current Nuclear Regulations (NUREG) and FEMA Guidelines.
- Develop recommendations for additional siren sites if necessary to assume 60 dBc coverage in the existing EPZ based on test results.
- Review the expanded EPZ for Units 2 and 3 and recommend additional coverage if necessary based on test results.
- Utilize WSS site test data to generate a SoundPLAN software based model that represents the total dB coverage provided within the existing and expanded EPZ areas.
- Submit a final acoustic report and coverage map identifying and documenting VCSNS compliance with NUREG-0654 and FEMA-REP-1 and FEMA-REP-10 coverage guidelines in the existing and expanded EPZs.

It was confirmed that the balance of the EPZ was to be designed to meet the minimum 60 dBc requirements per the NUREG and FEMA guidelines based on 2010 Census data.

2.1 EWSS Location Description

VCSNS is located in Fairfield County, South Carolina, approximately 26 miles northwest of Columbia, South Carolina. The plume exposure pathway EPZ is an area surrounding the VCSNS site with Unit 1 at the center and a radius of about ten miles. It includes the following counties:

- Fairfield County
- Lexington County
- Newberry County
- Richland County

The EPZ is primarily rural in nature, with occasional residential interfaces throughout. The broad topographical makeup is characterized by heavily forested areas, open fields, light tree growth, and significant differences in elevation.

2.2 Current Warning Site Locations

Prior to beginning the review of the acoustic coverage for the VCSNS facility, WSS staff visited each of the 106 EWSS siren locations. Global Positioning System (GPS) coordinates for each location were verified to ensure a correct database for the acoustical study (Attachment 1).

3.0 SOUND REQUIREMENTS BASED ON POPULATION

3.1 Siren System Sound Level Compliance Discussion

The FEMA-REP-10 guidelines for EWSS acoustic coverage specify a sound pressure level that will generally be greater than 70 dB 'C' where population density exceeds 2,000 persons per square mile and 60 dB 'C' in other inhabited areas, or the expected siren sound pressure level will generally exceed 10 dB above the average measured summer daytime ambient levels in areas with less than 2,000 people per square mile.

VCSNS has a population density in the existing and expanded EPZ of less than 2,000 persons per square mile according to the most recent 2010 Census. Based on this population density, the existing and expanded EPZ were reviewed to ensure that VCSNS meets the minimum requirement of 60 dB for the less than 2,000 persons per square mile population density.

4.0 PHYSICS OF SOUND

In order to understand the acoustical analysis of the VCSNS EPZ, the following subsections include basic information on sound propagation and attenuation.

4.1 Atmospheric Conditions Effect on Siren Range

In a calm daytime atmosphere, temperature decreases with increasing height above the ground and is known as a temperature lapse. The speed of sound through a medium is proportional to its density. The speed of sound through the air has been found to be proportional to the square root of air temperature.

Therefore, sound velocity decreases with height above the ground and, as a result, sound waves have a tendency to bend upward under calm conditions with the sun high in the sky and warming the ground, which is typical for summer daytime conditions.

A further result is that an acoustic shadow is formed at the ground level, an area where the sound reaching a listener is greatly reduced because the sound wave is being bent upwards and away from the listener. Under extreme conditions, such acoustic shadows can form very close to the source in the upwind direction. Acoustic shadow zone formation due to temperature lapse is illustrated in Figure 1.

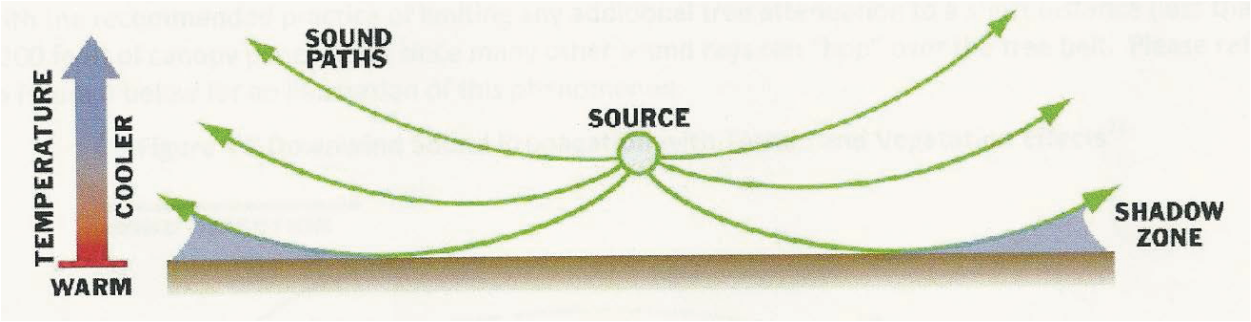


Figure 1 - Sound Transmission in Temperature Lapse Conditions

The opposite effect occurs in a temperature inversion (i.e., in those instances when the temperature decreases the closer one is to the ground). Because of the ground's capacity to retain heat absorbed during daylight hours, temperature inversions typically occur at night when this heat is being released, and is a contributing factor as to why the same sound source usually sounds louder at night than in the daytime.

This effect is illustrated in Figure 2.

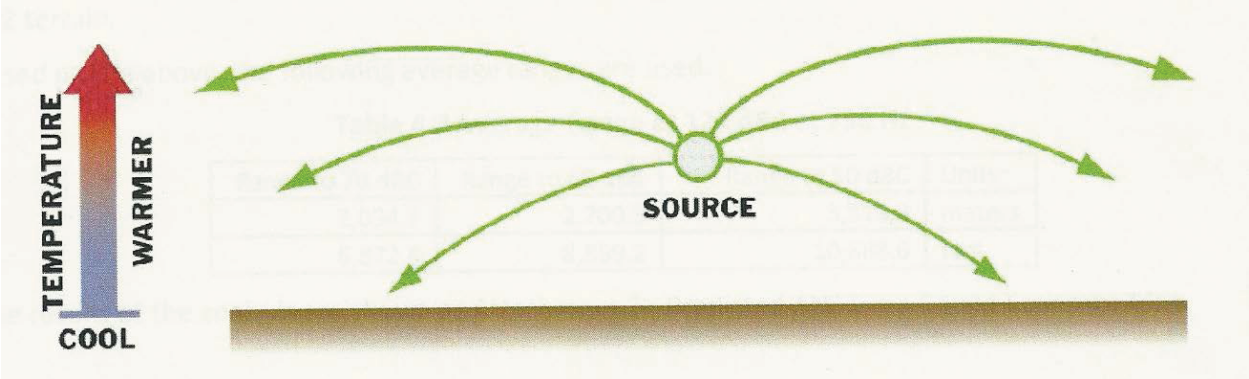


Figure 2 - Sound Transmission in Temperature Inversion Conditions

4.2 Ground Effects on Sound Absorption and Attenuation

Differences in attenuation between ground with and without large amounts of trees affect siren frequencies (500 Hz octave band) if the ground is modeled as soft (assuming the 0.25 soft-medium conservative ground factor used for our evaluation).

Much of the VCSNS EPZ consists of wooded land, with other parts cleared and used for residential, agricultural, and other purposes. Modeling large areas of forest is consistent with the recommended practice of limiting tree attenuation. In areas of the EPZ where tree coverage is limited to a short distance (<200') of canopy penetration, sound rays can “hop” over the tree belt.

An illustration of this phenomenon is shown in Figure 3.

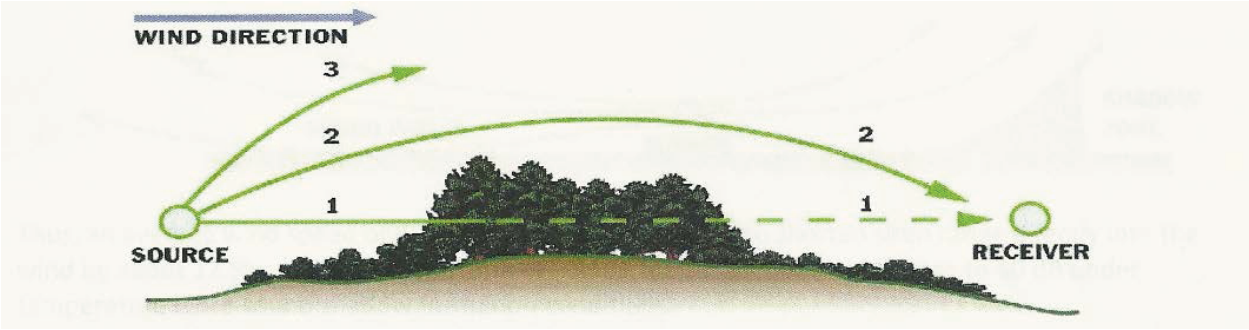


Figure 3 - Downwind Sound Propagation and Vegetation Effects for Short Distances (<200')

The assumption of soft ground inherent in the model is consistent with the VCSNS EPZ terrain.

4.3 Topographical and Barrier Effects

Diverse terrain (i.e., ridge, hills) or a large structure (i.e., building, water tower) will create a partial barrier to sound propagation. Barriers can provide a moderate amount of sound reduction within its shadow zone. The attenuation from a barrier is estimated by the SoundPLAN Acoustic Modeling Software. The model determines the effective barrier height above the line-of-sight from the siren (source) to the receiver (human reconnection) location. The other two essential dimensions are the distance from the siren to the barrier and from the barrier to the receiver.

Topographical data from United States Geological Service (USGS) maps is used to calculate the sound attenuation due to barrier effects caused by the high elevations generating acoustic shadow zones behind ridges and hills. SoundPLAN computer model uses topographical data that is obtained through direct readings of land elevation from USGS maps covering the siren propagation area.

4.4 Wind Shadow Effect in the Upwind Direction

While the acoustic model used in this report considers wind speed as a factor in atmospheric stability corrections to predicted average range, which includes upwind, downwind and crosswind directions, it does not consider the additional effect of the vector addition of wind effects and temperature lapse effects directly in the upwind direction.

Wind velocity adds or subtracts from sound velocity depending on whether the sound is moving upwind or downwind. In addition, wind velocity typically increases with increasing height, thus further augmenting the refraction of sound away from the ground.

The acoustic shadow will form in the upwind direction even closer to the sound source than under calm conditions, with the shadow's proximity to the source increasing with the speed of the wind; on the other hand, a downwind position will decrease or—given strong enough winds—totally eliminate the acoustic shadow.

As a rule of thumb, summer daytime wind shadow effect is roughly proportional to the square of the wind speed up to about 10 mph. Thus, in the upwind direction, 10 mph wind speed will result in a further siren range reduction of approximately 30%; 5 mph will result in a siren range reduction of approximately 8%, 2 mph will result in a range reduction of approximately 2%.

For normal wind speeds, downwind effects are typically small and are usually not considered in sound prediction models.

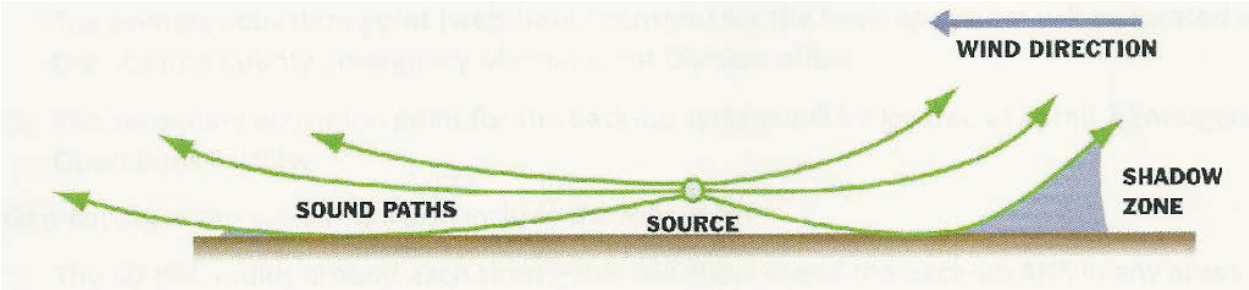


Figure 4 - Upwind Sound Propagation plus Temperature Lapse Shadow Formation

For sirens that are within the interior portions of the EPZ, there are several adjacent sirens that will sound downwind or crosswind into a given siren upwind sounding direction. Thus, sound from adjacent sirens will either be enhanced or unaffected by the wind, particularly for the VCSNS siren system, which has a dense siren configuration.

The upwind effect is accounted for by placing sirens close enough to the EPZ perimeter and close enough to adjacent sirens that will sound in a cross-wind direction such that the expected range shortening does not reduce the coverage area to inside the EPZ perimeter in any area that is populated.

5.0 EXISTING SIREN TYPES AND OUTPUT

VCSNS uses Federal Signal model 2001 series sirens to meet the alerting needs of the plant. All sirens located within the EPZ are model 2001-SRNB, factory rated at 128 dB(C) at 100 feet, with the exception of Site 5 which is a model 2001-130, rated at 130 dB(C) at 100 feet.

The Federal Signal 2001-SRNB siren is an electro-mechanical, DC, rotating siren that is capable of producing high intensity warning signals over a large area. A highly efficient design enables the siren to produce a high sound level while making moderate demands on the power source.

The 2001-SRNB siren is a single tone siren capable of producing a 128 dB sound level at 100 feet for a minimum of 15 minutes. It uses the 2001DCB Control Unit/Battery Box with fully charged, standard, deep-cycle, marine batteries.

Two motors are used to create the siren signals. The first motor rotates the siren assembly while the second motor produces the sound energy. The second motor is attached to a stator with a rotor mounted on the motor shaft concentric to the stator.

The rotor and stator each contain one row of ports. As the motor rotates the rotor, air is drawn into the rotor and passes through the rotor and stator ports in pulses. These pulses are produced when the rotor alternately opens and closes the stator ports. The pulses of air produce sound at a frequency, or pitch, that is dependent upon the rotational speed of the motor and the number of ports in the rotor-stator combination.

6.0 TEST METHODOLOGY

Collection locations were chosen based on existing siren locations and analysis of the typical sound coverage area of the Federal Signal sirens.

Each siren interacts with neighboring sirens to create a sound coverage area that includes both the sound energy from the local siren as well as the sound energy from surrounding sirens. Analysis of the existing siren locations coupled with the geographic data of VCSNS coverage identified areas most likely to have low coverage. These potentially low coverage areas were selected as test sites to verify whether the EPZ was adequately covered by warning sirens.

In addition to the potentially low coverage areas, areas identified as most likely to have adequate coverage were also selected as test sites. Including these areas in analysis and testing allowed coverage to be measured to verify that the acoustic model and study covered the EPZ as expected.

6.1 Sound Monitoring

A digital record of the sound levels was obtained at each of the collection, or acoustical measurement, locations.

Before and during the test interval, a data sheet was populated to document information on location, instrumentation used, and any general comments about the test location. The wind speed, wind direction, temperature, humidity, barometric pressure, and weather conditions were also documented at each site. Weather data was collected at each location utilizing an AcuRite portable weather station/anemometer. Data was collected during the two minute ambient and the two minute test sequences, for a total of four minutes.

Two minute ambient Equivalent Continuous Sound Levels (LEQ) and MAX measurements were recorded on both the ‘A’ and ‘C’ scale utilizing two separate measuring devices as identified on each acoustic survey form. Maximum slow average Siren Sound Pressure (SPL) measurements and a minimum two minute LEQ and MAX measurements were taken during the siren sounding. The maximum levels recorded using slow average SPL are considered most significant when measuring rotating sirens since the sound source is constantly moving.

6.2 Sound Monitoring Objectives

Test locations were selected based on the following objectives:

- Verify the existing EPZ EWSS warning system remains in compliance with NUREG and FEMA guidelines.
- Evaluate expanding EPZ for coverage compliant with NUREG and FEMA guidelines
- Verify adequate acoustic coverage based on year 2010 Census data – 60dB 'C' minimum sound level.
- Collect acoustical data to compare and contrast result from SoundPLAN Acoustical Modeling Software.

During EWSS test operations, several locations (Attachment 2) were used to measure the sound pressure levels generated by EWSS. The EWSS sound pressure levels and test sites background ambient sound pressure levels were measured on both the 'C' and 'A' weighting networks to allow for similar comparisons with modeled sound contours presented in the sound analysis documents. 'C' weighting and 'A' weighting differ in their sensitivity to different frequency ranges and environmental distortion.

Background ambient noise levels were measured at all locations. The background noise level is defined as the noise level in the acoustic environment excluding the noise source of interest.

At each location, two background noise level measurements were taken simultaneously using two separate Sound Level Meters (SLM) – maximum (peak) background noise was recorded for all locations. One SLM was set to measure the test site's LEQ on the 'A' weighted network while the other was set to measure the test site's LEQ on the 'C' weighted network. This was done to obtain the decibel difference between the 'A' and 'C' weighted networks at each location.

Weather observations used were collected at each site using an AcuRite portable weather station/anemometer.

6.3 Sound Measuring Equipment

Sound equipment used to measure on the 'A' weighting network:

- Soundtek model ST-107S ANSI Type 2 Measuring Device – Calibration date (manufacturer 3/03/13): units were field calibrated utilizing a SPER SCIENTIFIC 2 point acoustical calibrator prior to conducting each group test.

Sound equipment used to measure on the 'C' weighting network:

- Bruel & Kjaer model 2236 ANSI Type 1 Measuring Device – Calibration date (independent lab 3/08/13): units were field calibrated utilizing a SPER SCIENTIFIC 2 point acoustical calibrator prior to conducting each group test.

Each measurement system consisted of a sound level meter with windscreen and a calibration source.

6.4 Weather Monitoring Equipment

Weather conditions were determined utilizing an AcuRite portable weather station/anemometer. The wind speed, wind direction, temperature, humidity, barometric pressure, and general weather conditions were documented at each location. Data was collected during the two minute ambient and the two minute test sequences, for a total of four minutes.

7.0 BASELINE AND ACOUSTIC TESTING

Baseline testing was completed to verify field output on the two existing types of sirens used for the VCSNS EWSS.

Once baseline testing was completed, acoustical measurements were taken at 14 siren locations throughout the existing and expanded EPZ. Test locations are identified in Attachment 2.

7.1 Existing Siren Baseline Testing

Upon arrival at VCSNS and after the orientation meeting, the first task was to perform baseline testing of the two types of sirens used in the EWSS.

The first siren baseline test included Siren 5, which is a Federal Signal 2001-130 (130 dB) unit. This is the only 2001-130 unit in the VCSNS EWSS. This siren was updated due to a motor vehicle accident at the site. The baseline acoustical survey form is included in Attachment 5.

The second unit tested was Siren 40, a Federal Signal 2001-SRNB (128 dB) unit which represents the balance of the warning sirens used in the VCSNS EWSS. The baseline report is included in Attachment 6.

The results of the baseline testing were introduced into the Acoustic SoundPLAN Model to represent actual field output of the remote siren sites utilized in the system.

7.2 Baseline Test Results

The following table compares overall predicted values with actual measured values. The far left column lists each test location, with predicted and measured values listed in the adjacent columns. The far right column lists the resulting differences, which were obtained by subtracting measured values from predicted values.

Group Test	Test Location	Predicted A	Predicted C	Measured A	Measured C	Difference A	Difference C
Baseline[2]	1	70 – 75	70 – 75	68.4	73.5	1.6	0
Baseline[3]	2	70 – 75	70 – 75	52.3	68.6	17.3	1.6
1	3	60 – 65	60 – 65	51.1	59	8.9	1
2	4	65 – 70	65 – 70	54.3	74.9	10.7	(4.9) high
3	5	60 – 65	60 – 65	45.5	72.4	14.5	(7.4) high
4	6	65 – 70	65 – 70	50.2	71.6	14.8	(1.6) high
5	7	65 – 70	65 – 70	53.7	61.9	11.3	3.1
6	8	70 – 75	70 – 75	58.9	66.1	11.1	3.9
7	9	80 – 85	80 – 85	77.5	83.8	2.5	0
8	10	70 – 75	70 – 75	66.8	74.7	3.2	0
9	11	65 – 70	65 – 70	63.6	78	2.4	(8.0) high
10	12	65 – 70	65 – 70	58.3	64.2	6.7	0.8
11	13	75 – 80	75 – 80	50.3	76	24.7	0
12	14	45 – 50	45 – 50	55.7	77	(5.7) high	(27) high
13	15	60 – 65	60 – 65	51.3	56.7	8.7	3.3
14	16	60 – 65	60 – 65	51.7	81.3	8.3	(16.3) high

Table 1 Differences of Predicted and Measured Values by Test Location

[2] Baseline Test for Federal Model 2001-130.
[3] Baseline Test for Federal Model 2001-SRNB.

7.2.1 Location 1 - Siren 5 Baseline Test

This test site, shown in Figure 1 as Siren 5 Baseline Test Point, is located on Strother Road at the GPS coordinates listed below.

On 3/14/2013, measurements were taken in the center of the gravel road adjacent to the drive, which is slightly uphill. The road was bordered on each side with trees averaging 75 feet in height; it lies to the south of the Broad River Water Fowl Area. At 9:39 A.M., siren 5 was sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 1 Siren 5 Baseline Test Point

Test Data
Location 1 Siren 5 Baseline

Air temperature: 43°F

Relative humidity: 40%

Pressure: 30.09 inHg

Winds: calm at site, no wind

Siren 5 @ 4,774 feet (1,455 meters)

Location 1	Siren 5	
LOC	N 34.3895 lat W 81.3775 long	
Weighting	'A'	'C'
Background Noise LEQ (dB)	43.8	45
Run Time (min)	2	2
Projected (dB) MAX	70 - 75	70 - 75
Observed (dB) MAX	68.4	73.5

7.2.2 Location 2 - Siren 40 Baseline Test

This test site, shown in Figure 2 as Siren 40 Baseline Test Point, is located just off Dawkins Rd. / State Rd. S-20-651 at the GPS coordinates listed below.

On 3/14/2013, measurements were taken in the center of the gravel road, which is slightly uphill. The road was bordered on each side with trees averaging 60 feet in height. At 10:32 A.M., siren 40 was sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 2 Siren 40 Baseline Test Point

Test Data
Location 2 Siren 40 Baseline

Air temperature: 44°F

Relative humidity: 37%

Pressure: 30.15 inHg

Winds: 4 mph from W

Siren 40 @ 5,260 feet (1,603 meters)

Location 2	Siren 40	
LOC	N 34.3555 W 81.3648	
Weighting	'A'	'C'
Background Noise LEQ (dB)	42.4	50.4
Run Time (min)	2	2
Projected (dB) MAX	70 - 75	70 - 75
Observed (dB) MAX	52.3	68.6

7.3 Acoustic Group Testing

Fourteen acoustical measurement locations were selected for verification testing.

Sound pressure levels of activated EWSS and background ambient sound pressure levels were taken at each of the 14 specific group sample locations, within the VCSNS EPZ on 03/14/2013, 3/15/2013, 4/17/2013, and 4/18/2013.

The sound study in this document also includes the installation of three new 2001-130 siren locations, which are identified on the attached maps as Sites 9, 108, and 109. Site 9 in the existing EPZ was established to provide additional coverage in the surrounding area to meet current FEMA guidelines. Sites 108 and 109 were established in the new EPZ to provide coverage to meet current FEMA guidelines.

The 16 measurement locations are identified in the table titled “V.C. Summer EWSS Field Test Locations” (Attachment 2). Further information on the test locations is included in the table titled “V.C. Summer EWSS Group Testing Results” (Attachment 7).

The complete Acoustical Field Survey Forms can be found in Attachment 8.

7.4 Acoustic Group Testing Results

Location 3: Group 1 Test

This test site, shown in Figure 3 as Group 1 Test Point, is located off Native Drive at the GPS coordinates listed below.

On 3/14/2013, measurements were taken in the center of the gravel road. The road was bordered on each side with trees averaging 40-60 feet in height. At 11:30 A.M., sirens 40, 25, 21, 5, 6, 8, and 10 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 3 Group 1 Test Point

Location 3:
Group 1 Test Point Data

Air temperature: 50°F

Relative humidity: 30%

Pressure: 30.15 inHg

Winds: 2 mph from W

Location 3	Group test 1	
LOC	N 34.37773 W 81.36002	
Weighting	'A'	'C'
Background Noise LEQ (dB)	36	46.5
Run Time (min)	2	2
Projected (dB) MAX	60 - 65	60 - 65
Observed (dB) MAX	51.1	59

Note: Site-specific comments and observations are located in Attachment 8, Page 1.

Location 4: Group 2 Test

This test site, shown in Figure 4 as Group 2 Test Point, is located S20-205 at the GPS coordinates listed below.

On 3/14/2013, measurements were taken on the north side of a two-lane paved road. At 12:35 P.M., sirens 15, 16,18,61,41, and 13 were sounded. Two cars went by during the ambient test. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 4 Group 2 Test Point

Location 4:
Group 2 Test Point Data

Air temperature: 52°F

Relative humidity: 25%

Pressure: 30.03 inHg

Winds: 2 mph from S

Location 4	Group test 2	
LOC	N 34.393484 W 81.245504	
Weighting	'A'	'C'
Background Noise LEQ (dB)	60.4	62.5
Run Time (min)	2	2
Projected (dB) MAX	65 - 70	65 - 70
Observed (dB) MAX	54.3	74.9

Note: Site-specific comments and observations are located in Attachment 8, Page 2.

Location 5: Group 3 Test

This test site, shown in Figure 5 as Group 3 Test Point, is located in a Y area between Liston Road, S-20-225, and S-20-205 at the GPS coordinates listed below.

On 3/14/2013, measurements were taken in a Y grassy area between the three paved roads. At 1:30 P.M., sirens 18, 61,41,13,16, and 15 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 5 Group 3 Test Point

Location 5:
Group 3 Test Point Data

Air temperature: 56°F

Relative humidity: 25%

Pressure: 30.03 inHg

Winds: 5 mph from NW

Location 5	Group test 3	
LOC	N 34.382619 W 81.26144	
Weighting	'A'	'C'
Background Noise LEQ (dB)	41	51.6
Run Time (min)	2	2
Projected (dB) MAX	60 - 65	60 - 65
Observed (dB) MAX	45.5	72.4

Note: Site-specific comments and observations are located in Attachment 8, Page 3.

Location 6: Group 4 Test

This test site, shown in Figure 6 as Group 4 Test Point, is located at an intersection on Old Airport Road at the GPS coordinates listed below.

On 3/14/2013, measurements were taken on the north side of a gravel road. The road was bordered on each side with trees averaging 40 feet in height; it lies approximately 50 feet east of a paved road. At 2:15 P.M., sirens 58, 17, 18, and 57 were sounded. Siren sound pressure levels were measured two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

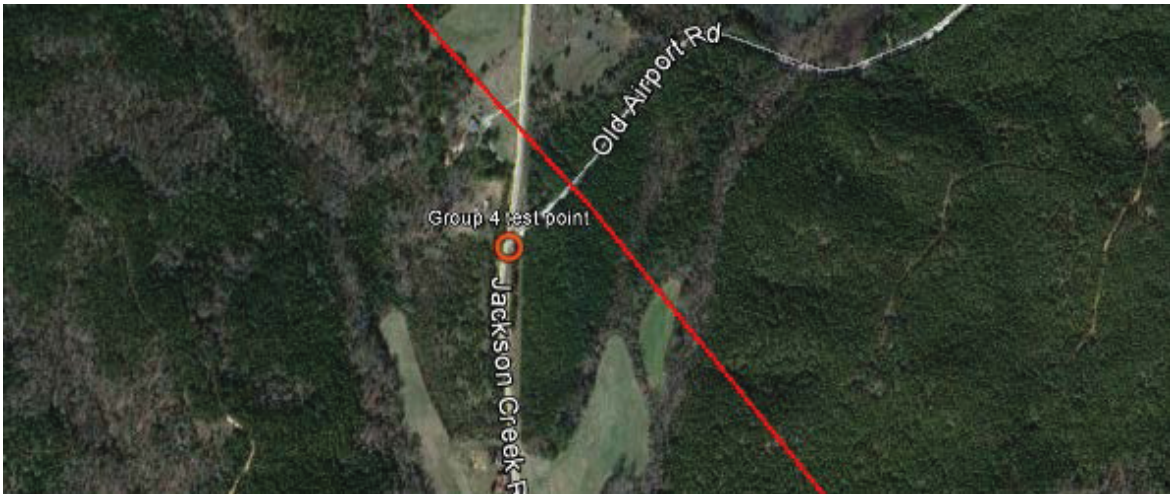


Figure 6 Group 4 Test Point

Location 6:
Group 4 Test Point Data

Air temperature: 54°F

Relative humidity: 26%

Pressure: 30.06 inHg

Winds: 7 mph from E

Location 6	Group test 4	
LOC	N34.380641 W81.192235	
Weighting	'A'	'C'
Background Noise LEQ (dB)	42	61.1
Run Time (min)	2	2
Projected (dB) MAX	65 - 70	65 - 70
Observed (dB) MAX	50.2	71.6

Note: Site-specific comments and observations are located in Attachment 8, Page 4.

Location 7: Group 5 Test

This test site, shown in Figure 7 as Group 5 Test Point, is located on Old Reservoir Road at the GPS coordinates listed below.

On 3/14/2013, measurements were taken on a gravel road adjacent to the driveway at 1093 Mill Creek Shores, which is on top of a hill. The road was bordered on each side with trees averaging 40 feet in height. At 3:00 P.M., sirens 58, 57, 59, and 63 were sounded. Siren sound pressure levels were measured for two minutes the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 7 Group 5 Test Point

Location 7:
Group 5 Test Point Data

Air temperature: 57°F

Relative humidity: 24%

Pressure: 29.89 inHg

Winds: 4 mph from W

Location 7	Group test 5	
LOC	N 34.341021 W 81.149513	
Weighting	'A'	'C'
Background Noise LEQ (dB)	39.5	53.2
Run Time (min)	2	2
Projected (dB) MAX	65 - 70	65 - 70
Observed (dB) MAX	53.7	61.9

Note: Site-specific comments and observations are located in Attachment 8, Page 5.

Location 8: Group 6 Test

This test site, shown in Figure 8 as Group 6 Test Point, is located on Brooks Drive at the GPS coordinates listed below.

On 3/14/2013, measurements were taken on a rugged two track trail; the closest address was 497 Brooks Drive in Blair, South Carolina. The road was bordered on each side with trees averaging 50 feet in height. At 4:00 P.M., sirens 47, 46, 45, 54, and 55 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 8 Group 6 Test Point

Location 8:
Group 6 Test Point Data

Air temperature: 63 °F

Relative humidity: 20%

Pressure: 29.93 inHg

Winds: 2 mph from S/SW

Location 8	Group test 6	
LOC	N34.3444 W81.2748	
Weighting	'A'	'C'
Background Noise LEQ (dB)	35.6	49.7
Run Time (min)	2	2
Projected (dB) MAX	70 - 75	70 - 75
Observed (dB) MAX	58.9	66.1

Note: Site-specific comments and observations are located in Attachment 8, Page 6.

Location 9: Group 7 Test

This test site, shown in Figure 9 as Group 7 Test Point, is located on St. Barnabus Church Road at the GPS coordinates listed below.

On 3/14/2013, measurements were taken in the middle of a paved road. The test point is fairly open with a field at its southern border; no trees lie within a several hundred foot radius of the test point. At 4:56 P.M., sirens 43, 89, 49, 50, and 51were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 9 Group 7 Test Point

Location 9:
Group 7 Test Point Data

Air temperature: 61°F

Relative humidity: 23%

Pressure: 29.92 inHg

Winds: 5 mph from W/NW

Location 9	Group test 7	
LOC	N 34.276318 W 81.280414	
Weighting	'A'	'C'
Background Noise LEQ (dB)	40.9	58.6
Run Time (min)	2	2
Projected (dB) MAX	80 - 85	80 - 85
Observed (dB) MAX	77.5	83.8

Note: Site-specific comments and observations are located in Attachment 8, Page 7.

Location 10: Group 8 Test

This test site, shown in Figure 10 as Group 8 Test Point, is located on Mann Road at the GPS coordinates listed below.

On 3/15/2013, measurements were taken in the center of a paved road. The road was bordered on each side with trees averaging 30 feet in height. At 9:38 A.M., sirens 68, 69, 102, and 103 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 10 Group 8 Test Point

Location 10:
Group 8 Test Point Data

Air temperature: 45°F

Relative humidity: 46%

Pressure: 29.95 inHg

Winds: 1 to 2 mph from W

Location 10	Group test 8	
LOC	N 34.26567 W 81.16158	
Weighting	'A'	'C'
Background Noise LEQ (dB)	39.8	49.6
Run Time (min)	2	2
Projected (dB) MAX	70 -75	70 -75
Observed (dB) MAX	66.8	74.7

Note: Site-specific comments and observations are located in Attachment 8, Page 8.

Location 11: Group 9 Test

This test site, shown in Figure 11 as Group 9 Test Point, is located on Hughey Ferry Road at the GPS coordinates listed below.

On 4/18/2013, measurements were taken on a dirt road at the entry of a farm field. The road was bordered on each side with trees averaging 80-100 feet in height. At 12:47 P.M., sirens 27, 31, 32, and 33 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 11 Group 9 Test Point

Location 11:
Group 9 Test Point Data

Air temperature: 59°F

Relative humidity: 29%

Pressure: 29.95 inHg

Winds: 3 to 6 mph from SW

Location 11	Group test 9	
LOC	N 34.30209 W 81.40774	
Weighting	'A'	'C'
Background Noise LEQ (dB)	38.6	60.2
Run Time (min)	2	2
Projected (dB) MAX	65 - 70	65 - 70
Observed (dB) MAX	63.6	78

Note: Site-specific comments and observations are located in Attachment 8, Page 9.

Location 12: Group 10 Test

This test site, shown in Figure 12 as Group 10 Test Point, is located on S99 at the GPS coordinates listed below.

On 4/17/2013, measurements were taken on the side of a paved road about four feet from the edge of the pavement. The area is sparsely wooded with trees averaging 80-100 feet in height; foliage is at 40% growth. At 2:08 P.M., sirens 4, 7, and 6 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 12 Group 10 Test Point

Location 12:
Group 10 Test Point Data

Air temperature: 82°F

Relative humidity: 52%

Pressure: 30.30 inHg

Winds: 2 mph from S

Location 12	Group test 10	
LOC	N 34.43065 W 81.37376	
Weighting	'A'	'C'
Background Noise LEQ (dB)	38	43.4
Run Time (min)	2	2
Projected (dB) MAX	65 - 70	65 - 70
Observed (dB) MAX	58.3	64.2

Note: Site-specific comments and observations are located in Attachment 8, Page 10.

Location 13: Group 11 Test

This test site, shown in Figure 13 as Group 11 Test Point, is located on an unmarked road at the GPS coordinates listed below.

On 4/17/2013, measurements were taken in a clearing about 15 feet from the center of a gravel road. This area is not heavily wooded; it is mostly comprised of pine trees and small undergrowth with foliage at about 40% growth. At 2:30 P.M., sirens 11, 12, and 106 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 13 Group 11 Test Point

Location 13:
Group 11 Test Point Data

Air temperature: 88°F

Relative humidity: 42%

Pressure: 30.30 inHg

Winds: 2 mph from S

Location 13	Group test 11	
LOC	N 34.43307 W 81.31365	
Weighting	'A'	'C'
Background Noise LEQ (dB)	34.3	51.5
Run Time (min)	2	2
Projected (dB) MAX	75 - 80	75 - 80
Observed (dB) MAX	50.3	76

Note: Site-specific comments and observations are located in Attachment 8, Page 11.

Location 14: Group 12 Test

This test site, shown in Figure 14 as Group 12 Test Point, is located at the corner of S36/236 and an unmarked side road at the GPS coordinates listed below.

On 4/17/2013, measurements were taken approximately 30 feet off a paved road. The road was sparsely bordered on each side with trees averaging 60-100 feet in height; however, there are some open fields past the tree line. At 11:10 A.M., sirens 71 and 72 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 14 Group 12 Test Point

Location 14:
Group 12 Test Point Data

Air temperature: 74°F

Relative humidity: 63%

Pressure: 30.27 inHg

Winds: 3 mph from N/W

Location 14	Group test 12	
LOC	N34.22036 W-81.49699	
Weighting	'A'	'C'
Background Noise LEQ (dB)	51.3	68.6
Run Time (min)	2	2
Projected (dB) MAX	45 - 50	45 - 50
Observed (dB) MAX	55.7	77

Note: Site-specific comments and observations are located in Attachment 8, Page 12.

Location 15: Group 13 Test

This test site, shown in Figure 15 as Group 13 Test Point, is located near 621 Sand Bar Road at the GPS coordinates shown below.

On 4/18/2013, measurements were taken in a gravel area that is approximately one foot off the paved road and 100 feet away from backwater. The closest trees to the test point are approximately 50 feet away and average 50-80 feet in height; foliage growth is only at 80%. At 2:20 P.M., sirens 95 and 104. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

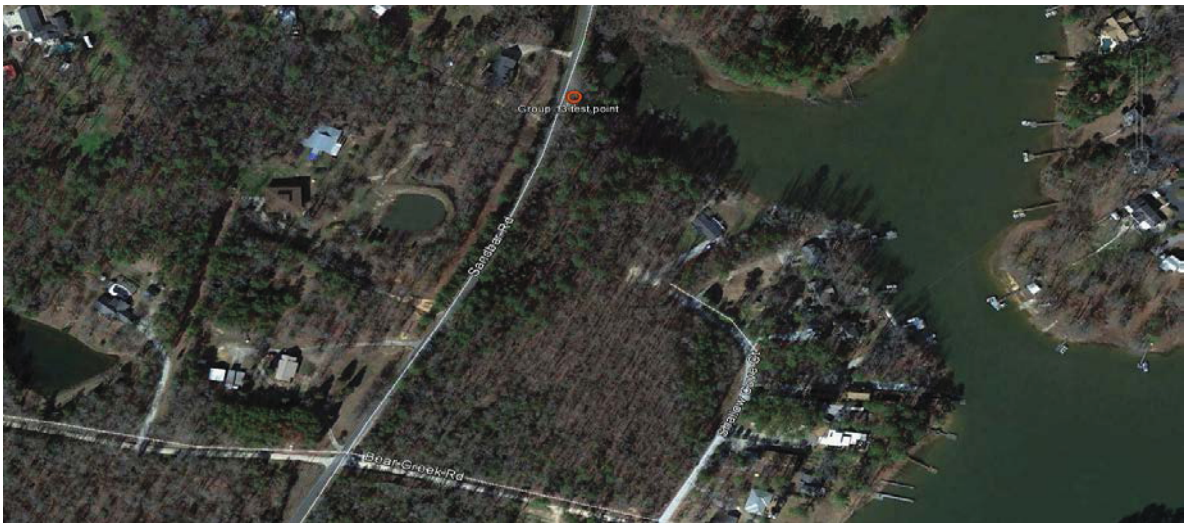


Figure 15 Group 13 Test Point

Location 15:
Group 13 Test Point Data

Air temperature: 75°F

Relative humidity: 78%

Pressure: 30.30 inHg

Winds: 2 mph from E/NE

Location 15	Group test 13	
LOC	N34.14372 W81.36107	
Weighting	'A'	'C'
Background Noise LEQ (dB)	44.1	54.1
Run Time (min)	2	2
Projected (dB) MAX	60 - 65	60 - 65
Observed (dB) MAX	51.3	56.7

Note: Site-specific comments and observations are located in Attachment 8, Page 13.

Location 16: Group 14 Test

This test site, shown in Figure 16 as Group 14 Test Point, is located on the corner of Westwoods Drive and Twin Pine Drive at the GPS coordinates shown below.

On 4/18/2013, measurements were taken on a small paved area approximately 20 feet off the edge of Westwoods Drive. The area was relatively open with only a few trees averaging 30-70 feet in height. At 2:31 P.M., sirens 79 and 80 were sounded. Siren sound pressure levels were measured for two minutes during the activation. Background sound pressure levels were taken at the same location with actual run times of two minutes for 'C' weighting and two minutes for 'A' weighting.

Figure 16 Group 14 Test Point

Location 16:
Group 14 Test Point Data

Air temperature: 78°F

Relative humidity: 69%

Pressure: 30.24 inHg

Winds: 7 to 8 mph from S/SE

Location 16	Group test 14	
LOC	N34.15581 W81.39981	
Weighting	'A'	'C'
Background Noise LEQ (dB)	41.3	65.3
Run Time (min)	2	2
Projected (dB) MAX	70 - 75	70 - 75
Observed (dB) MAX	51.7	81.3

Note: Site-specific comments and observations are located in Attachment 8, Page 14.

8.0 SIREN ACOUSTIC COMPUTER MODEL ANALYSIS

8.1 Description of Calculations Used

The acoustic computer model analysis was done using SoundPlan acoustic modeling software. This software includes many industry standard acoustic modeling options. The modeling standard chosen for this analysis is the Conservation of Clean Air and Water in Europe (CONCAWE) modeling standard. The CONCAWE model was selected because includes additional environmental attenuation parameters based on Pasquill-Turner stability classes A-D in addition to air and ground absorption criteria.

CONCAWE was established in 1963 by a group of oil companies to research environmental issues relevant to the oil industry. In 1981, they published Report No. 4/81, *The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighboring Communities*, which has been extensively validated and utilized as the basis of a number of prediction models for a variety of noise sources.

The CONCAWE model calculates the sound pressure level at a remote point using the following formula: $Lp= Lw+D-\Sigma k$.

For the calculation of Lp, the directivity D from the source to the remote point was set to 0 because the 100' rating used was considered to be in the far field from the siren. Σk - is the sum of the individual attenuations due to the seven attenuation effects listed below:

- geometric spreading
- atmospheric absorption
- ground effects
- meteorological effects
- source height effects
- barriers
- in-plant screening

In addition to the aforementioned parameters, CONCAWE considers additional atmospheric and metrological conditions and effects using Pasquill-Turner environmental models A through D. The Pasquill-Turner scale measures the atmospheric turbulence effect due to incoming solar radiation, wind and cloud cover.

The strongest lapse condition (A) was used in the acoustic model to represent the most conservative sound propagation condition. Excess attenuation due to these effects that can cause shadow zones is included in the model.

The Siren Acoustic Computer Analysis Model utilized for the VCSNS includes the effects of temperature, humidity, barometric pressure, atmospheric absorption, ground absorption, siren height and frequency, terrain, and barriers in the sound path including buildings, trees, and other obstacles that might interfere with the path of sound from the source (siren horn) to the receivers (humans in the Emergency Protection Zone).

8.2 Assumptions Used

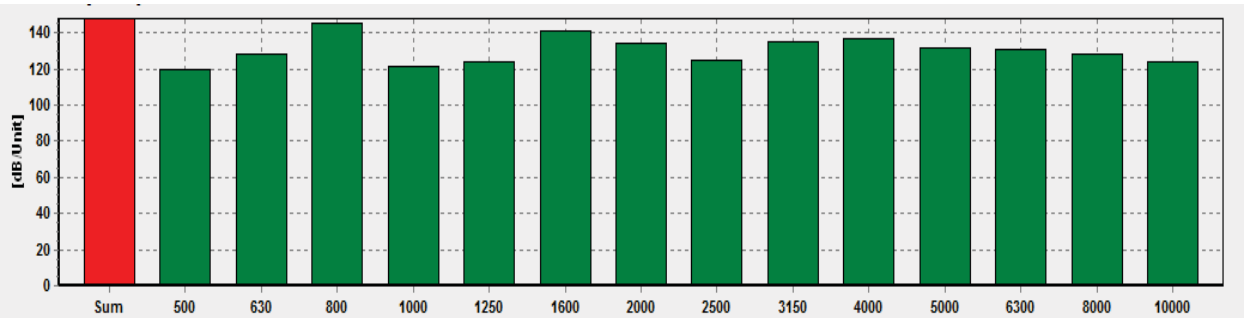
The acoustic model uses a ground classification of 0 for soft ground, 0.5 for medium ground, and 1 for hard ground. A average ground factor of 0.25 was used in the prediction model to account for ground absorption. The softer than average ground chosen provides additional attenuation compared thus a more conservative estimate.

Differences in the measured and modeled sound levels can be attributed to the fact that the model is based on averaged conditions throughout the coverage area. Measurements were taken to validate the model. As a result of testing, the measured values validate the general accuracy of the overall model and allow predictions in the total area to be evaluated without taking measurements at every location in the coverage area.

Temperatures and wind speeds vary considerably over diverse terrain; for modeling purposes, the average observed daytime temperature, pressure, and humidity were used and wind speed was set to zero. These average summertime environmental parameters represent the worst case environment for sound propagation. As a result of using these parameters, the coverage maps show a conservative estimate of the sound propagation. Average summertime temperature, air pressure, and humidity values were calculated using the data supplied. These averages (for the months of June 2012, July 2012, and August 2012) were calculated to be Temperature: 81.29 ° F / 27.38 °C, Pressure: 29.98 Inches of Mercury / 1015 mbar, and Humidity: 67.14% and Pasquill-Turner Class A.

All sirens were set to a height of 13.716 meters (45 feet).

Each of the sirens in the acoustic model was modeled using SPL and 1/3 octave frequency analysis obtained from Federal Signal anechoic chamber test data as shown in the following figure.



Frequency spectrum of Federal Signal 2001 Siren

The reference levels used in the acoustic model were input based on this data. The Sound level at 100 ft. reference for the Federal Signal 2001-130 sirens was set to and equivalent 124 dbL for the acoustic model, and the sound level for the Federal Signal 2001-SRN sirens was set to 122 dBL at 100 ft.

8.3 Coverage Maps

Field acoustical coverage tests of select sirens and locations were performed in the VCSNS EPZ to confirm that the actual coverage area matched the sound coverage calculations to ensure that the sound propagation map was an accurate representation of the siren acoustical coverage in the EPZ. The overall coverage map (Map 2) details the 14 test locations in relation to the existing sirens located in the EPZ.

In order to verify the accuracy of the SoundPLAN Acoustical Coverage Predictions (Map 2) actual on site test measurements were compared with the predicted values. The results of the actual versus predicted values are presented in Section 7.2 Table 1 of this report.

The test results generally matched the predicted calculations. Each of the test locations was evaluated and a conclusion with recommendations is included with this report.

A review of the final coverage map (Map 3) provides an overview of VCSNS's current sound coverage for both the current and expanded EPZ as determined from individual site testing and acoustic modeling. Map 3 also portrays the coverage for the additional 2001-130 sirens to be installed at Sites 9, 108, and 109.

9.0 SUMMARY/CONCLUSIONS

All testing was performed between 9:30 A.M. and 5:00 P.M. with the majority of the testing taking place in the mid-morning to mid-afternoon timeframe during peak sun and in most cases with little or no cloud cover and light wind conditions. This particular test scenario provides a worst case temperature gradient for acoustic shadows hence the most conservative results.

A ground factor of 0.25 has been used in the SoundPLAN Acoustic Model to provide a conservative estimate. Efforts were taken to observe and correct for events, which caused the data to be skewed at individual test sites. Events such as vehicle traffic, wind gusts, gun shots, logging operations, and other noise inducing anomalies were taken into consideration as individual site data was reviewed.

Measured SPL levels taken during the group tests generally correlate with the acoustical contours on the coverage map over the various types of terrain, elevations, and 2001-SRNB 128 dB siren types predominant through the VCSNS EWSS. Testing and acoustic modeling shows the VCSNS area of concern (existing and expanded EPZ) meets standards which state the EPZ must be generally covered by an alert and notification system which reaches a sound level of at least 60 dB where the population is below 2,000 people per square mile as required by NUREG-0654/FEMA-REP-1 and the guidelines set forth in FEMA-REP-10.

The results assume the installation of additional warning siren sites at locations identified as Sites 9, 108, and 109. Site 9 provided additional coverage to an area that was weak in the existing EPZ. Sites 108 and 109 were required additions in the expanded EPZ.

SCANA Acoustical Study For V.C. Summer Nuclear Plant

Submitted by: West Shore Services Inc.|6620 Lake Michigan Dr. | Allendale, MI 49401 | PH: 616-895-4347

Install Site #	RTU ID #	Coordinates (Latitude (N))	Coordinates (Longitude (W))	Site Address	City	County	State
1	1	34.39600	-081.42168	856 Mt Pleasant Rd. (Rt. 28)	Pomaria	Newberry	SC
2	2	34.39429	-081.44311	2198 Mt Pleasant Rd. (Rt. 900)	Pomaria	Newberry	SC
3	3	34.38148	-081.42704	1505 Deerfield Dr.	Pomaria	Newberry	SC
4	4	34.41835	-081.40103	165 SC -S-20-12 Spur (Granite Rd)	Blair	Fairfield	SC
5	5	34.39458	-081.39219	20435 SC -34 W (Newberry Rd.)	Blair	Fairfield	SC
6	6	34.40889	-081.37334	Rocky 2 Rd. (Rt 104)	Blair	Fairfield	SC
7	7	34.41618	-081.35921	Blair Volunteer Fire Dept.	Blair	Fairfield	SC
8	8	34.38044	-081.31802	169 Meadowlake Rd.	Blair	Fairfield	SC
9[4]	9	34.21409	-081.47845	213 Cy Shumpert Rd.	-	Newberry	SC
10	10	34.42496	-081.33228	Newberry Rd. (Hwy 34)	Blair	Fairfield	SC
11	11	34.42363	-081.32285	Newberry Rd. (Hwy 34)	Blair	Fairfield	SC
12	12	34.41861	-081.30171	Newberry Rd. (Hwy 34)	Blair	Fairfield	SC
13	13	34.39361	-081.29190	Highway 215	-	Fairfield	SC
14	14	34.42051	-081.28455	Hopewell Church Rd.	Blair	Fairfield	SC
15	15	34.41544	-081.25053	Newberry Rd. (Hwy 34)	Winnsboro	Fairfield	SC
16	16	34.40278	-081.22119	Newberry Rd. (Hwy 34)	Winnsboro	Fairfield	SC

[4] Site 9 is a new site in the existing EPZ, required to provide coverage to meet the current FEMA guidelines.

Install Site #	RTU ID #	Coordinates (Latitude (N))	Coordinates (Longitude (W))	Site Address	City	County	State
17	17	34.40071	-081.19941	Jackson Creek Rd.	Winnsboro	Fairfield	SC
18	18	34.37656	-081.22304	1930 Old Harden Rd.	Winnsboro	Fairfield	SC
19	19	34.36976	-081.44817	Consolidated Fire Dept. (Hwy 34)	Pomaria	Newberry	SC
20	20	34.25676	-081.39213	4553 Hwy 176	Pomaria	Newberry	SC
21	21	34.37046	-081.40648	10313 Old Broad River Rd. (Rt. 28)	Pomaria	Newberry	SC
22	22	34.35857	-081.42884	2271 Suber Rd. (Rt. 351)	Pomaria	Newberry	SC
23	23	34.34719	-081.46959	1978 Livingston Rd. (Rt. 572)	Pomaria	Newberry	SC
24	24	34.34275	-081.43238	350 Frances Rd.	Pomaria	Newberry	SC
25	25	34.34444	-081.39014	8302 Old Broad River Rd. (Rt. 28)	Pomaria	Newberry	SC
26	26	34.32663	-081.40444	2155 Leitzsey Rd. (Rt. 494)	Pomaria	Newberry	SC
27	27	34.31022	-081.43169	New Hope Rd.	Pomaria	Newberry	SC
28	28	34.32167	-081.44556	1609 Griffin Rd.	Pomaria	Newberry	SC
29	29	34.31821	-081.47583	11248 Hwy 176	Pomaria	Newberry	SC
30	30	34.29074	-081.47676	1640 Road 219	Prosperity	Newberry	SC
31	31	34.28755	-081.44658	9 Bonner Rd.	Pomaria	Newberry	SC
32	32	34.29942	-081.38348	1003 Hughey Ferry Rd.	Pomaria	Newberry	SC
33	33	34.27674	-081.38677	1441Peak Rd.	Pomaria	Newberry	SC
34	34	34.26414	-081.41537	Pomaria Fire Station	Pomaria	Newberry	SC
35	35	34.25639	-081.44240	3309 HWY 773	Pomaria	Newberry	SC
36	36	34.25819	-081.46468	12 Boinest Rd.	Prosperity	Newberry	SC
37	37	34.26080	-081.48325	3276 Old Jolly Street	Prosperity	Newberry	SC

Install Site #	RTU ID #	Coordinates (Latitude (N))	Coordinates (Longitude (W))	Site Address	City	County	State
38	38	34.26254	-081.35476	2273 Broad River Rd.	Pomaria	Newberry	SC
39	39	34.29261	-081.36121	48 Magnolia Ln	Pomaria	Newberry	SC
40	40	34.35055	-081.34854	352 Dave Cole Rd.	Blair	Fairfield	SC
41	41	34.33698	-081.33894	1995 Cole Trestle	Blair	Fairfield	SC
42	42	34.26310	-081.30704	Hwy 213 at NND	-	Fairfield	SC
43	43	34.27425	-081.28873	Hwy 213 & Hwy 215	Jenkinsville	Fairfield	SC
44	44	34.30507	-081.28728	8410 Hwy 215		Fairfield	SC
45	45	34.32437	-081.28661	Overlook Park on Hwy 215	Jenkinsville	Fairfield	SC
46	46	34.35828	-081.29848	4589 S Hwy 215	-	Fairfield	SC
47	47	34.36356	-081.27537	355 Twisted Lane	Blair	Fairfield	SC
48	48	34.31327	-081.26955	12621 Hwy 213	Jenkinsville	Fairfield	SC
49	49	34.29652	-081.26620	3708 St. Barnabas Church Rd.	-	Fairfield	SC
50	50	34.28893	-081.25755	3177 St. Barnabas Church Rd.	-	Fairfield	SC
51	51	34.25809	-081.26437	12634 Hwy 215 S	-	Fairfield	SC
52	52	34.27817	-081.23457	2066 Koon Store Rd.	Winnsboro	Fairfield	SC
53	53	34.31250	-081.23424	6668 Landis Rd (County Rd. 48)	Winnsboro	Fairfield	SC
54	54	34.33036	-081.23731	130 Anderson Quarry Rd	Winnsboro	Fairfield	SC
55	55	34.33810	-081.23038	Hwy 213	Winnsboro	Fairfield	SC
56	56	34.34236	-081.21066	Hwy 213	Winnsboro	Fairfield	SC
57	57	34.35009	-081.19819	196 Old Hill Crest School Dr.	-	Fairfield	SC
58	58	34.35626	-081.17653	Hwy 213 at Jackson Creek Rd.	Winnsboro	Fairfield	SC

Install Site #	RTU ID #	Coordinates (Latitude (N))	Coordinates (Longitude (W))	Site Address	City	County	State
59	59	34.32496	-081.17719	Jackson Creek	Winnsboro	Fairfield	SC
60	60	34.31520	-081.20152	6167 Reservoir Rd.	Winnsboro	Fairfield	SC
61	61	34.37116	-081.23038	130 Old Harden Rd.	Winnsboro	Fairfield	SC
62	62	34.31237	-081.16428	Chappell Town Rd.	Winnsboro	Fairfield	SC
63	63	34.32312	-081.15242	2534 Reservoir Rd.	Winnsboro	Fairfield	SC
64	64	34.30186	-081.15211	4 Fleming Ln.	Winnsboro	Fairfield	SC
65	65	34.28385	-081.20100	2250 Glenn's Bridge Rd.	Winnsboro	Fairfield	SC
66	66	34.26838	-081.21529	1883 Glenn's Bridge Rd.	Winnsboro	Fairfield	SC
67	67	34.25034	-081.21112	3298 Estes Ln.	Winnsboro	Fairfield	SC
68	68	34.26879	-081.17856	2207 Landis Rd. (County Rd 48)	Winnsboro	Fairfield	SC
69	69	34.27974	-081.15763	6537 Jackson Creek Rd.	Winnsboro	Fairfield	SC
70	70	34.25858	-081.15204	Hwy 269	Winnsboro	Fairfield	SC
71	71	34.23529	-081.45109	3184 Kibler's Bridge Rd.	Prosperity	Newberry	SC
72	72	34.20903	-081.44359	1174 Kibler's Bridge Rd.	Prosperity	Newberry	SC
73	73	34.22681	-081.42282	287 Central School Rd.	Pomaria	Newberry	SC
74	74	34.24224	-081.41471	117 Koon Trestle Rd	Pomaria	Newberry	SC
75	75	34.22658	-081.38519	2247 Parr Rd.	Little Mountain	Newberry	SC
76	76	34.21439	-081.41331	1338 Hwy 202	Little Mountain	Newberry	SC
77	77	34.22043	-081.40385	508 Four Oaks Rd.	Little Mountain	Newberry	SC

Install Site #	RTU ID #	Coordinates (Latitude (N))	Coordinates (Longitude (W))	Site Address	City	County	State
78	78	34.23387	-081.40549	390 Harris Rd.	Pomaria	Newberry	SC
79	79	34.19682	-081.41446	Little Mountain Fire Dept.	Little Mountain	Newberry	SC
80	80	34.17476	-081.38635	555 Lazy Brook Dr.	Little Mountain	Lexington	SC
81	81	34.20281	-081.38481	2358 Holy Trinity Church Rd.	-	Newberry	SC
82	82	34.18764	-081.37161	1032 Sam Koon Rd.	Chapin	Newberry	SC
83	83	34.19952	-081.35078	211 Red Knoll Rd.	Chapin	Lexington	SC
84	84	34.22346	-081.35521	1426 US 176	Little Mountain	Newberry	SC
85	85	34.24397	-081.37204	28 Hope Station Rd.	Pomaria	Newberry	SC
86	86	34.23520	-081.32681	R Stoudemayer Rd.	Little Mountain	Newberry	SC
87	87	34.208494	-081.323722	Broad River Rd.	-	Richland	SC
88	88	34.22274	-081.31056	Mike Stuck Rd.	-	Richland	SC
89	89	34.20710	-081.28888	1550 Wash Lever Rd.	-	Richland	SC
90	90	34.20792	-081.26021	99 Desport Sites Rd.	Little Mountain	Richland	SC
91	91	34.22348	-081.24250	Wallaceville Rd.	Winnsboro	Richland	SC
92	92	34.18339	-081.25555	Freshly Mill Rd/Pet Sites Rd.	IRMO	Richland	SC
93	93	34.17985	-081.29094	11867 Broad River Rd.	Chapin	Richland	SC
94	94	34.17878	-081.32018	685 Columbia Ave (County Rd. 48)	Chapin	Lexington	SC
95	95	34.14939	-081.32730	145 Crooked Creek Rd.	Chapin	Lexington	SC

Install Site #	RTU ID #	Coordinates (Latitude (N))	Coordinates (Longitude (W))	Site Address	City	County	State
96	96	34.16005	-081.28243	993 Three Dog Rd.	Chapin	Richland	SC
97	97	34.16939	-081.25159	Kennerly Rd/Uldeen Sites Rd.	IRMO	Richland	SC
98	98	34.18487	-081.22900	Freshly Mill Rd/Page Derrick Rd.	IRMO	Richland	SC
99	99	34.24625	-081.24914	13928 State Hwy 215 S	-	Fairfield	SC
100	100	34.22563	-081.22164	16079 State Hwy 215 S	-	Fairfield	SC
101	101	34.20839	-081.19588	Hwy 215/Browns Bridge Rd.	Winnsboro	Fairfield	SC
102	102	34.23523	-081.16548	289 Louden Cir.	Winnsboro	Fairfield	SC
103	103	34.24640	-081.17997	1004 Estes Ln.	Winnsboro	Fairfield	SC
104	104	34.16740	-081.34943	Chapin Fire Dept.	Chapin	Lexington	SC
105	105	34.26366	-081.33109	Parr Hydro	Jenkinsville	Fairfield	SC
106	106	34.44176	-081.30008	Hwy 215/Cooper Holmes Rd.	-	Fairfield	SC
107	107	34.31188	-081.11893	Kelly Miller Rd.	Blair	Fairfield	SC
108[5]	108	34.14732	-081.35598	179 Farrs Lake Ct.	Chapin	Lexington	SC
109[6]	109	34.155910	-081.399775	836 Westwood Dr.	Chapin	Lexington	SC

[5] Site 108 is a new site in expanded EPZ, required to provide coverage to meet the current FEMA guidelines.
[6] Site 109 is a new site in expanded EPZ, required to provide coverage to meet the current FEMA guidelines.

V.C. Summer EWSS Field Test Locations (16)		
Loc 1 Siren 5 Reference Baseline[7]		**Sirens To Sound**
Zone: 17		5
465299 m E	Latitude: 34.3895	
3805409 m N	Longitude: 81.3775	
Loc 2 Siren 40 Reference Baseline[8]		**Sirens To Sound**
Zone: 17		40
466452 m E	Latitude: 34.3555	
3801635 m N	Longitude: 81.3648	
Loc 3 Group 1 Test		**Sirens To Sound**
Zone: 17		40,25,21,5,6,8,10
467343 m E	Latitude: 34.37773	
3803916 m N	Longitude: 81.36002	
Loc 4 Group 2		**Sirens To Sound**
Zone: 17		15,16,18,61,41,13
477433 m E	Latitude: 34.393484	
3805813 m N	Longitude: 81.245504	
Loc 5 Group 3		**Sirens To Sound**
Zone: 17		18,61,41,13,16,15
475965 m E	Latitude: 34.382619	
3804612 m N	Longitude: 81.26144	
Loc 6 Group 4		**Sirens To Sound**
Zone: 17		58,17,18,57
482327 m E	Latitude: 34.380641	
3804379 m N	Longitude: 81.192235	
Loc 7 Group 5		**Sirens To Sound**
Zone: 17		58,57,59,63
486248 m E	Latitude: 34.341021	
3799979 m N	Longitude: 81.149513	

[7] Baseline Test for Federal Model 2001-130.
[8] Baseline Test for Federal Model 2001-SRNB.

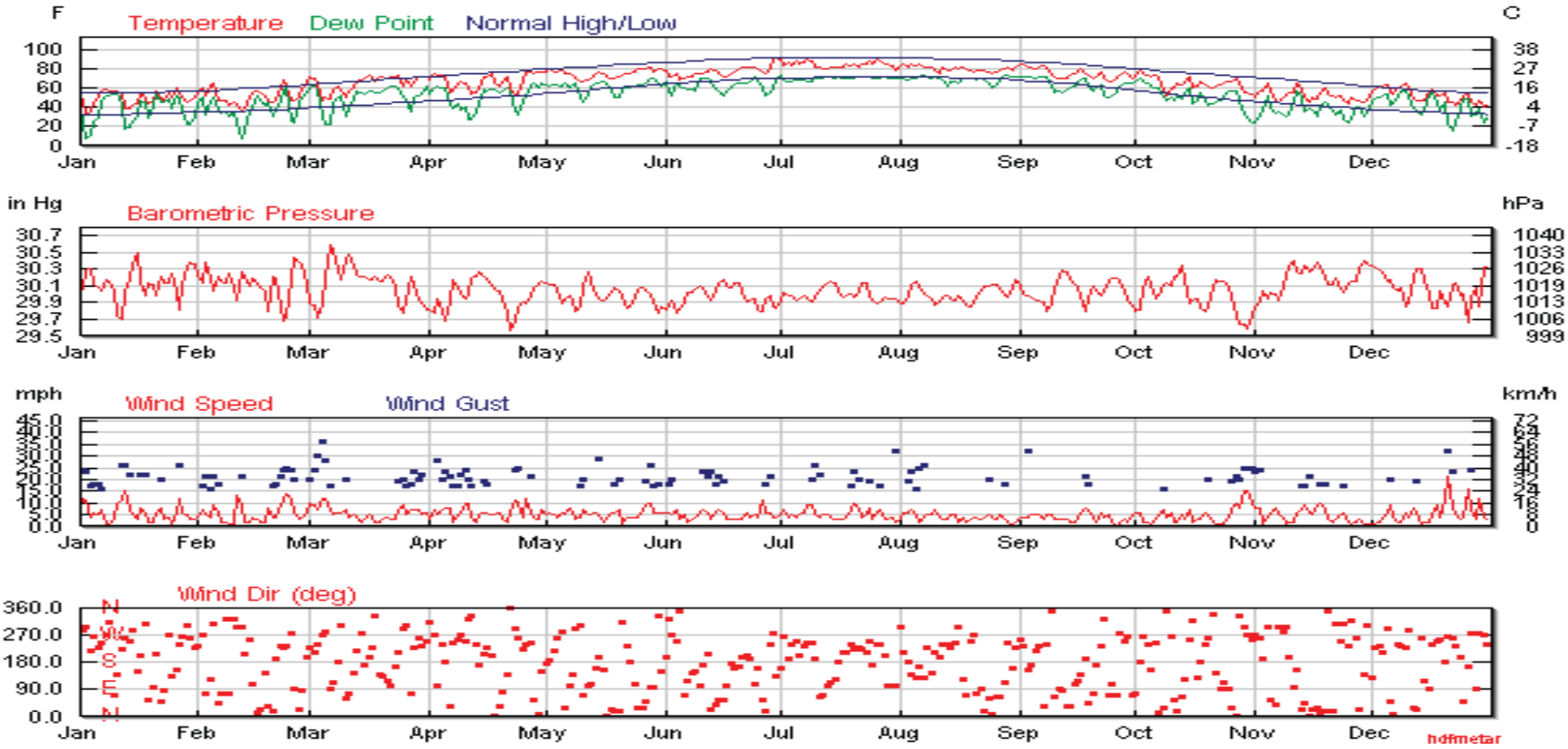
Loc 8 Group 6		**Sirens To Sound**
Zone: 17		47,46,45,54,55
475042 m E	Latitude: 34.34445	
3801044 m N	Longitude: 81.24484	
Loc 9 Group 7		**Sirens To Sound**
Zone: 17		43,89,49,50,51
474188 m E	Latitude: 34.276318	
3792830 m N	Longitude: 81.280414	
Loc 10 Group 8		**Sirens To Sound**
Zone: 17		68,69,102,103
486129 m E	Latitude: 34.26567	
3791134 m N	Longitude: 81.16158	
Loc 11 Group 9	**GPS**	**Sirens To Sound**
Zone: 17		27,31,32,33
462479 m E	Latitude: 34.30209	
3795727 m N	Longitude: 81.40774	
Loc 12 Group 10	**GPS**	**Sirens To Sound**
Zone: 17		4, 6, 7
465659 m E	Latitude: 34.43065	
3089970 m N	Longitude: 81.37376	
Loc 13 Group 11	**GPS**	**Sirens To Sound**
Zone: 17		11, 12, 106
471182 m E	Latitude: 34.43307	
3810220 m N	Longitude: 81.31365	
Loc 14 Group 12	**GPS**	**Sirens To Sound**
Zone: 17		**71, 72**
454222 m E	Latitude: 34.322036	
3786701 m N	Longitude: 81.49699	
Loc 15 Group 13	**GPS**	**Sirens To Sound**
Zone: 17		95, 104
466712 m E	Latitude: 34.14372	
3778150 m N	Longitude: 81.36107	

Loc 16 Group 14	GPS	Sirens To Sound
Zone: 17		79, 80
463145 m E	Latitude: 34.15581	
3779504 m N	Longitude: 81.39981	

Weather History for Columbia, SC
January 1, 2012 through December 31, 2012

January 1 2012 - TO - December 31 2012 Go

	Max	Avg	Min	Sum
Temperature				
Max Temperature	**109** °F	**78** °F	**40** °F	
Mean Temperature	**92** °F	**67** °F	**33** °F	
Min Temperature	**79** °F	**55** °F	**19** °F	
Degree Days				
Heating Degree Days (base 65)	32	5	0	1858
Cooling Degree Days (base 65)	27	7	0	2507
Growing Degree Days (base 50)	42	17	0	6281
Dew Point				
Dew Point	**79** °F	**53** °F	**2** °F	
Precipitation				
Precipitation	**2.88** in	**0.13** in	**0.00** in	**41.73** in
Snowdepth	-	-	-	-
Wind				
Wind	**43** mph	**5** mph	**0** mph	
Gust Wind	**130** mph	**21** mph	**16** mph	
Sea Level Pressure				
Sea Level Pressure	**30.64** in	**30.05** in	**29.50** in	


F
Temperature
Dew Point
Normal High/Low
C
100
80
60
40
20
0
38
27
16
4
-7
-18
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
in Hg
Barometric Pressure
hPa
30.7
30.5
30.3
30.1
29.9
29.7
29.5
1040
1033
1026
1019
1013
1006
999
mph
Wind Speed
Wind Gust
km/h
Wind Dir (deg)
360.0
270.0
180.0
90.0
0.0
N
W
S
E
N
hdfmetar

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Jan	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	73	53	32	55	43	30	92	73	53	30.19	30.09	29.97	10	7	2	24	8	32	0	
2	57	46	34	36	20	8	82	51	19	30.14	30.06	29.99	10	10	10	24	12	30	0	
3	40	33	25	13	8	5	55	40	25	30.38	30.28	30.16	10	10	10	23	11	29	0	
4	50	35	19	17	11	5	84	50	15	30.43	30.3	30.16	10	10	8	14	4	18	0	
5	62	46	30	32	25	13	76	52	27	30.17	30.12	30.08	10	10	8	15	6	18	0	
6	69	50	31	33	29	27	85	54	22	30.16	30.08	30.03	10	9	6	15	5	18	0	
7	73	58	43	52	45	33	86	66	46	30.12	30.05	30	10	10	8	18	7	22	T	
8	73	59	45	57	52	43	93	71	49	30.22	30.18	30.1	10	7	1	9	1	13	0.05	Rain
9	62	57	51	56	53	51	100	89	78	30.2	30.15	30.09	10	3	0	9	1	10	0.01	Fog, Rain
10	61	57	53	56	54	52	100	92	84	30.1	30.04	29.97	8	2	0	10	3	12	T	Fog, Rain
11	65	58	51	61	55	41	100	80	59	29.96	29.74	29.56	10	4	0	22	10	29	0.4	Fog, Rain
12	65	55	44	48	43	26	82	63	44	29.79	29.69	29.62	10	10	10	38	11	46	T	Rain
13	46	39	31	20	18	14	59	45	31	30.14	30.03	29.86	10	10	10	36	15	44	0	
14	51	39	26	25	19	14	75	49	22	30.29	30.2	30.16	10	10	10	23	7	29	0	
15	54	42	30	29	25	21	85	57	29	30.53	30.37	30.15	10	10	9	15	5	20	0	
16	59	44	28	35	30	24	92	63	33	30.6	30.49	30.37	10	10	6	14	3	20	0	
17	69	55	41	56	48	36	92	74	55	30.35	30.16	30	10	9	3	23	8	31	0.17	Rain
18	61	49	37	58	46	32	93	67	40	30.09	29.99	29.89	10	10	6	18	6	23	0.1	Rain
19	54	44	33	35	29	23	89	65	41	30.24	30.14	30.07	10	10	9	9	2	16	0	
20	58	45	32	52	40	29	93	75	57	30.17	30.12	30.04	10	9	2	12	2	7	0.11	Rain
21	62	58	54	58	54	47	100	80	60	30.07	29.99	29.9	10	6	0	18	6	24	0.75	Fog, Rain, Thunderstorm
22	57	49	41	55	45	38	100	88	76	30.31	30.21	30.08	10	5	0	16	8	23	0.02	Fog, Rain
23	55	48	41	54	46	39	100	96	92	30.27	30.13	30.04	1	1	0	12	3	15	0.06	Fog, Rain
24	71	56	41	54	49	42	100	69	37	30.23	30.14	30.04	10	6	0	12	4	15	0	Fog
25	67	51	35	46	39	34	100	67	34	30.32	30.24	30.17	10	7	0	10	1	12	0	Fog
26	75	61	46	61	53	43	100	79	57	30.17	30.02	29.78	10	8	0	15	6	21	0	Fog
27	68	55	42	63	50	38	90	66	42	30.05	29.82	29.68	10	10	2	29	12	38	0.09	Rain
28	67	51	35	40	35	28	92	59	26	30.22	30.11	30.04	10	10	10	17	6	22	0	
29	59	45	31	32	22	12	78	48	17	30.41	30.33	30.24	10	10	10	14	5	18	0	
30	65	47	29	31	23	16	78	47	15	30.47	30.39	30.34	10	10	10	10	3	13	0	
31	68	51	34	36	29	23	79	49	19	30.44	30.37	30.3	10	10	9	13	3	16	0	

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Feb	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	73	56	38	55	45	33	85	62	38	30.32	30.21	30.1	10	8	6	12	4	18	0.01	Rain
2	74	61	48	58	51	32	93	64	34	30.29	30.13	30.06	10	9	6	17	7	22	T	Rain
3	64	52	40	36	32	29	70	49	27	30.46	30.39	30.3	10	10	10	17	5	21	0	
4	74	62	49	53	46	34	86	66	46	30.35	30.2	30.04	10	10	10	16	4	20	0	
5	78	65	51	57	51	42	90	63	36	30.19	30.04	29.96	10	10	8	21	9	28	T	
6	51	48	45	40	37	36	76	69	61	30.27	30.21	30.17	10	10	9	14	6	18	0	
7	60	47	34	40	34	28	92	62	31	30.2	30.16	30.13	10	9	6	8	2	15	0	
8	64	48	32	39	35	29	92	64	36	30.19	30.14	30.07	10	9	6	13	2	21	T	Rain
9	54	42	30	35	30	27	92	65	38	30.32	30.24	30.19	10	9	6	12	1	15	0	
10	60	45	30	42	36	28	92	71	49	30.22	30.08	29.91	9	7	4	7	1	10	0	
11	53	42	30	44	24	2	93	57	21	30.2	29.93	29.81	10	10	6	26	13	38	T	
12	47	37	26	15	7	3	58	39	19	30.35	30.27	30.22	10	10	10	22	9	30	0	
13	57	39	20	23	15	9	77	46	15	30.32	30.22	30.14	10	10	10	12	2	17	0	
14	58	50	42	43	35	24	71	56	41	30.15	30.1	30.03	10	10	6	9	2	12	T	Rain
15	68	55	42	48	40	37	83	58	32	30.25	30.2	30.12	10	9	5	10	4	15	0	
16	64	57	49	61	53	46	97	87	77	30.22	30.12	30.01	10	5	1	10	3	14	0.12	Rain
17	66	55	43	53	47	41	93	71	48	30.14	30.08	30.04	10	10	6	9	2	12	0	
18	68	53	38	51	42	33	93	61	29	30.11	30.04	29.94	10	8	4	10	2	14	0.19	Rain
19	57	48	39	54	46	33	100	92	83	29.96	29.79	29.64	10	6	1	16	8	23	0.9	Rain
20	56	46	36	35	31	25	89	60	30	30.32	30.21	30	10	10	10	15	4	22	0	
21	64	48	31	44	37	30	89	68	46	30.32	30.2	30.06	10	9	6	17	4	22	0	
22	75	61	46	54	47	41	93	62	31	30.05	29.86	29.65	10	10	6	20	9	25	0	
23	81	69	57	63	57	50	93	65	36	29.74	29.68	29.63	10	9	2	23	11	33	0.16	Rain
24	73	62	51	66	60	29	93	74	54	29.95	29.71	29.64	10	7	0	30	14	41	0.86	Fog , Rain , Thunderstorm
25	57	48	38	31	25	19	70	47	23	30.32	30.17	29.99	10	10	10	29	11	33	0	
26	60	48	36	30	24	19	76	50	23	30.51	30.43	30.34	10	10	10	14	6	20	0	
27	56	51	45	52	46	32	93	70	46	30.43	30.39	30.32	10	6	1	7	3	10	0.16	Rain
28	71	61	50	52	49	43	100	70	39	30.41	30.35	30.28	10	5	0	13	4	15	T	Fog , Rain
29	75	65	54	64	56	46	90	75	60	30.27	30.11	29.91	10	9	6	17	6	25	0.06	Rain

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Mar	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	81	73	65	63	61	55	87	65	42	29.94	29.88	29.82	10	10	10	18	10	25	T	Rain
2	80	70	59	64	62	59	100	76	52	29.95	29.87	29.74	10	8	1	25	9	31	0.19	Rain , Thunderstorm
3	72	64	56	63	59	53	93	81	68	29.76	29.72	29.65	10	9	2	43	7	48	0.32	Rain , Thunderstorm
4	57	48	39	52	31	15	93	58	22	30.1	29.88	29.72	10	10	4	37	12	47	0.31	Rain
5	64	51	37	29	22	13	59	37	14	30.5	30.2	30.02	10	10	10	33	12	45	0	
6	62	49	35	37	22	16	61	39	17	30.64	30.59	30.51	10	10	10	15	7	20	0	
7	72	59	46	49	44	38	76	59	41	30.61	30.53	30.43	10	10	10	15	5	23	0	
8	77	62	47	58	51	44	96	66	36	30.43	30.29	30.14	10	9	6	16	6	20	0	
9	67	57	46	61	53	37	87	65	42	30.3	30.17	30.11	10	9	6	16	6	21	T	Rain
10	65	51	37	36	30	22	85	54	22	30.48	30.41	30.31	10	10	10	20	7	25	0	
11	70	57	43	47	39	33	76	55	34	30.56	30.47	30.4	10	10	10	10	4	21	0	
12	75	61	47	53	49	45	89	64	38	30.42	30.35	30.27	10	10	8	14	5	17	0	
13	77	68	58	63	57	53	90	74	57	30.28	30.23	30.16	10	10	6	14	4	17	0.13	Rain
14	85	69	53	61	55	45	97	62	26	30.27	30.21	30.16	10	5	0	9	2	14	0	Fog
15	88	71	54	60	54	46	93	59	25	30.28	30.22	30.16	10	9	6	13	3	17	0	Fog
16	87	74	60	61	57	49	90	60	29	30.24	30.18	30.1	10	10	9	14	5	18	0	Fog
17	85	72	58	61	57	55	93	65	37	30.24	30.18	30.11	10	10	9	20	4	26	T	Rain , Thunderstorm
18	81	68	55	59	56	52	93	66	39	30.3	30.22	30.18	10	9	4	13	2	18	T	
19	88	72	56	59	56	51	93	61	29	30.22	30.16	30.08	10	9	4	9	2	16	0	
20	85	72	58	61	58	54	90	64	37	30.23	30.16	30.1	10	10	6	13	3	16	0	
21	83	71	58	64	60	55	100	70	40	30.29	30.23	30.16	10	6	0	25	4	29	0	Fog
22	83	73	63	65	62	57	93	68	43	30.27	30.21	30.13	10	7	0	15	3	20	0.05	Fog
23	82	72	61	66	62	59	100	73	46	30.16	30.09	29.98	10	6	0	21	3	28	0.04	Fog , Rain
24	82	74	65	64	61	56	93	69	45	29.98	29.85	29.74	10	8	0	22	7	28	0.02	Rain , Thunderstorm
25	71	62	52	60	51	48	93	71	49	29.84	29.78	29.72	10	10	8	20	9	33	0.02	Rain
26	83	70	56	53	48	38	86	54	21	30.04	29.93	29.84	10	10	10	14	5	20	0	
27	72	63	53	50	35	28	77	50	22	30.32	30.22	30.06	10	10	10	18	7	23	0	
28	82	68	53	59	51	43	77	57	37	30.25	30.12	29.97	10	9	4	22	7	29	0	
29	87	73	58	57	53	51	75	53	30	29.98	29.93	29.86	10	10	6	18	7	24	0	
30	86	72	58	62	54	49	80	55	29	29.98	29.91	29.85	10	9	6	29	5	38	0.01	Rain
31	79	72	65	65	62	53	93	73	52	29.91	29.82	29.76	10	9	3	17	6	22	0.09	Rain

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Apr	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	84	69	54	60	54	45	93	60	26	29.89	29.82	29.77	10	10	6	15	3	21	0.02	Fog
2	91	76	61	65	60	55	90	61	32	29.9	29.78	29.73	10	10	8	26	7	39	0.04	
3	82	73	64	66	62	57	87	71	54	30.01	29.94	29.88	10	8	2	21	5	28	0.27	Rain , Thunderstorm
4	87	74	61	63	61	58	100	70	40	29.92	29.79	29.66	10	9	5	16	7	24	0.01	
5	85	72	58	64	61	52	87	66	44	29.75	29.68	29.6	10	9	6	21	8	28	0	
6	66	56	46	52	44	37	89	62	34	30.09	29.9	29.74	10	9	3	21	8	28	T	Rain
7	74	57	39	46	39	30	89	56	23	30.28	30.18	30.11	10	10	10	13	2	17	0	
8	82	66	50	49	44	39	83	53	23	30.17	30.08	29.99	10	10	10	16	5	21	0	
9	80	68	56	50	37	27	72	43	14	30.12	30.01	29.91	10	10	6	18	6	24	0	
10	82	65	47	49	40	31	71	45	18	30.04	29.94	29.86	10	10	10	31	10	39	T	Rain
11	68	60	51	42	27	19	48	32	16	30.14	30	29.88	10	10	10	20	10	26	0	
12	67	54	41	37	27	21	82	51	20	30.26	30.19	30.13	10	10	10	15	4	23	0	
13	75	56	37	44	36	28	85	52	19	30.27	30.21	30.16	10	10	10	12	2	17	0	
14	80	61	42	58	44	38	89	59	28	30.35	30.26	30.18	10	10	10	18	5	29	0	
15	82	72	61	61	59	56	90	68	45	30.24	30.21	30.17	10	10	9	18	6	25	0	
16	87	73	59	59	57	55	87	62	37	30.23	30.18	30.12	10	10	10	15	6	20	0	
17	88	75	62	63	59	56	87	62	36	30.18	30.12	30.03	10	10	10	13	5	17	0	
18	73	66	59	63	59	56	90	74	57	30.09	30.06	30.02	10	9	6	17	5	20	0.02	Rain
19	67	63	58	56	55	55	93	81	68	30.08	30.04	30	10	8	5	10	6	14	0	
20	72	67	61	60	57	55	87	77	66	30.02	29.95	29.86	10	8	4	9	3	12	T	Rain
21	83	73	62	64	60	56	93	68	42	29.88	29.78	29.67	10	7	0	15	2	17	0.04	Fog
22	69	61	52	64	58	47	93	80	67	29.67	29.57	29.5	10	8	2	28	6	35	1.76	Rain , Thunderstorm
23	63	53	42	46	35	28	83	56	29	29.81	29.68	29.62	10	10	10	24	11	32	0	
24	70	54	38	37	32	28	76	49	22	29.88	29.83	29.79	10	10	10	28	10	35	0	
25	83	68	52	57	48	40	71	53	34	29.97	29.91	29.85	10	10	10	15	4	22	0	
26	89	78	67	66	53	48	78	52	26	29.97	29.89	29.83	10	10	9	28	12	37	0.12	Rain , Thunderstorm
27	88	77	65	69	62	58	100	72	43	30.04	29.97	29.89	10	10	8	15	6	21	T	
28	84	75	66	69	66	62	100	79	58	30.12	30.08	30.02	8	4	0	15	4	22	0	Fog
29	89	77	64	65	61	56	87	61	34	30.18	30.12	30.07	10	8	4	9	3	13	0	
30	88	77	66	67	65	61	93	68	43	30.21	30.15	30.08	10	9	5	16	7	22	0	

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
May	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	90	78	66	66	64	60	90	65	40	30.2	30.13	30.06	10	10	7	14	5	21	0	
2	91	81	70	66	63	55	90	62	34	30.17	30.11	30.06	10	10	10	15	6	20	0	
3	88	77	66	66	64	60	93	67	40	30.18	30.12	30.06	10	10	7	12	5	15	0	
4	87	78	69	67	64	62	84	64	43	30.09	30.04	29.96	10	10	10	13	4	20	0	
5	95	81	66	69	63	59	93	63	32	29.95	29.88	29.79	10	9	2	21	6	31	0.19	Rain , Thunderstorm
6	84	76	67	71	65	62	100	77	54	29.99	29.94	29.88	10	10	4	17	5	20	0.05	Rain
7	85	76	67	67	61	56	93	65	37	30.03	29.98	29.91	10	10	6	20	8	24	0	
8	83	74	65	67	64	63	100	77	54	29.98	29.93	29.85	10	8	1	17	6	21	T	
9	76	70	64	69	66	60	97	86	74	29.9	29.79	29.69	10	6	0	25	3	32	0.95	Rain , Thunderstorm
10	79	67	54	59	50	42	93	61	28	29.95	29.85	29.78	10	9	6	14	4	21	0	
11	80	68	56	53	46	36	86	57	28	30.21	30.1	29.96	10	10	10	18	7	24	0	
12	80	69	57	59	53	47	86	59	32	30.33	30.26	30.22	10	10	9	13	5	18	0	
13	76	70	63	68	63	56	93	77	60	30.24	30.16	30.09	10	7	3	17	5	21	0.17	Rain
14	83	75	66	72	66	62	100	79	58	30.08	29.99	29.89	10	8	1	20	6	23	0.23	Rain
15	89	78	66	70	65	61	97	69	40	30	29.95	29.89	10	7	1	29	5	35	0.82	Rain , Thunderstorm
16	84	75	65	70	67	63	100	78	55	29.98	29.93	29.88	10	8	2	18	2	23	0.3	Rain , Thunderstorm
17	81	73	64	70	64	61	100	79	58	30	29.95	29.91	10	7	2	23	4	32	0.83	Rain , Thunderstorm
18	76	70	63	63	59	52	93	71	49	30.09	30.03	29.98	10	9	5	16	6	22	0.05	Rain
19	80	71	61	55	51	47	78	56	33	30.13	30.08	30.03	10	10	10	16	6	21	0	
20	86	73	60	58	51	47	72	50	28	30.1	30.05	29.99	10	10	10	17	7	30	0	
21	87	74	61	64	59	57	90	64	37	30.04	29.96	29.87	10	10	10	10	1	16	0	
22	87	75	63	68	61	57	97	69	40	29.89	29.84	29.77	10	10	5	18	4	22	0.04	Rain , Thunderstorm
23	88	76	64	67	61	53	93	62	31	29.91	29.85	29.81	10	9	6	15	4	18	0	
24	90	78	65	68	63	57	100	67	34	30.02	29.96	29.9	10	7	0	12	4	16	0	Fog
25	93	80	66	68	64	60	93	65	36	30.12	30.06	30.01	10	9	6	12	4	15	0	
26	93	80	66	68	64	59	87	62	36	30.12	30.07	30.01	10	9	6	18	7	26	0	
27	90	81	72	70	66	63	79	62	44	30.1	30.05	29.99	10	10	10	17	9	22	0	
28	90	82	74	72	70	67	93	70	47	30.04	30	29.95	10	9	1	30	10	37	T	Rain , Thunderstorm
29	85	78	71	73	71	67	93	76	59	29.97	29.91	29.81	10	7	1	16	6	23	0.84	Rain , Thunderstorm
30	91	80	69	69	66	57	90	62	34	29.84	29.77	29.71	10	9	4	17	6	22	0.24	Rain
31	93	80	66	68	63	54	90	59	28	29.9	29.85	29.8	10	10	6	15	6	18	0	

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Jun	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	88	79	69	71	68	64	93	73	53	29.89	29.82	29.73	10	7	1	29	6	45	0.77	Rain , Thunderstorm
2	82	73	63	68	56	48	90	61	31	29.93	29.85	29.79	10	10	10	15	6	22	0	
3	88	73	57	61	53	49	86	56	26	30	29.92	29.86	10	10	10	20	5	23	0	
4	84	76	68	69	66	60	93	74	55	29.85	29.77	29.71	10	9	3	20	7	23	0.21	Rain , Thunderstorm
5	74	69	64	65	62	60	93	79	64	29.87	29.81	29.71	10	7	2	16	3	21	0.6	Rain
6	78	71	63	63	60	55	93	69	45	30	29.9	29.84	10	9	6	15	5	18	T	Rain
7	83	72	60	63	59	57	93	69	45	30.06	30.02	29.99	10	10	10	10	2	14	0	
8	86	73	60	64	59	55	93	65	37	30.07	30.03	29.98	10	10	7	12	3	14	0	
9	89	76	62	63	58	52	90	60	29	30.1	30.06	30.01	10	10	6	13	4	21	0	
10	80	75	70	73	70	62	94	81	68	30.14	30.1	30.04	10	8	0	17	6	22	1.25	Fog , Rain
11	80	76	72	73	71	68	93	86	79	30.11	30.08	30.03	10	8	1	18	7	24	1.04	Rain
12	85	78	71	72	70	68	93	79	65	30.06	29.96	29.87	10	9	2	18	6	23	0.31	Rain , Thunderstorm
13	91	81	70	70	68	66	90	70	50	29.97	29.92	29.88	10	10	10	22	3	26	0	
14	86	79	71	69	59	50	90	62	34	30.12	30.05	29.97	10	10	10	14	6	20	0	
15	86	76	66	63	57	50	78	55	31	30.19	30.14	30.1	10	10	10	17	7	23	0	
16	85	73	61	59	52	45	84	56	28	30.25	30.18	30.11	10	10	10	16	6	23	0	
17	86	72	58	62	58	55	90	65	40	30.18	30.1	30.01	10	10	10	10	3	13	0	
18	88	76	63	64	61	58	87	65	42	30.12	30.07	30.04	10	10	7	12	3	16	0	
19	89	78	66	66	64	61	87	65	42	30.19	30.14	30.11	10	10	7	12	3	16	0	
20	91	80	69	68	66	64	84	64	44	30.19	30.13	30.07	10	10	8	14	3	16	0	
21	93	82	70	68	66	64	84	63	41	30.1	30.02	29.92	10	10	10	12	3	16	0	
22	94	82	69	68	65	61	84	59	33	29.97	29.91	29.85	10	10	10	13	6	15	0	
23	95	83	71	72	68	63	90	63	36	29.99	29.93	29.9	10	10	10	14	4	21	T	
24	89	82	74	76	72	68	87	69	50	30	29.95	29.88	10	10	6	18	5	22	T	Rain
25	90	81	71	71	69	67	93	70	47	29.91	29.81	29.71	10	10	10	12	4	16	0	
26	85	78	70	72	60	51	87	61	34	29.86	29.79	29.72	10	10	9	23	11	32	0	
27	89	76	62	57	52	48	72	48	24	29.99	29.94	29.86	10	10	10	16	6	21	0	
28	100	81	61	62	56	49	78	48	18	30.05	29.98	29.92	10	10	10	14	6	21	0	
29	109	90	71	68	60	51	73	45	16	29.9	29.85	29.78	10	10	7	12	4	15	0	
30	109	92	75	78	68	63	79	52	24	29.88	29.84	29.8	10	9	6	12	4	16	0	

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Jul	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	106	90	73	79	74	68	91	62	32	30.13	29.93	29.87	10	5	0	18	5	44	1.3	Rain , Thunderstorm
2	95	84	72	72	69	65	84	65	46	30.13	30.02	29.95	10	10	10	12	7	17	0	
3	100	87	73	73	68	63	87	59	31	30.02	29.98	29.91	10	10	10	23	4	30	0	
4	99	84	68	72	67	59	93	65	36	30.04	29.98	29.91	10	10	7	10	5	-	0	
5	102	89	76	72	69	63	82	56	29	29.97	29.93	29.86	10	9	6	20	4	22	0	
6	98	86	74	73	69	66	82	59	35	29.99	29.95	29.91	10	10	9	12	5	18	0	
7	100	88	75	72	69	66	82	58	33	30.04	29.99	29.93	10	10	9	13	6	15	0	
8	102	91	79	71	68	63	74	52	29	30.01	29.95	29.85	10	10	9	20	9	24	0	
9	103	89	74	73	68	61	67	46	25	29.95	29.9	29.81	10	9	1	26	9	52	2.88	Rain , Thunderstorm
10	93	83	72	74	72	69	94	75	56	30.06	29.96	29.9	10	7	2	28	5	35	1.26	Rain , Thunderstorm
11	91	82	72	73	70	68	94	71	47	30.11	30.04	29.99	10	9	2	17	4	22	0.29	Rain
12	89	81	73	73	71	70	93	73	52	30.15	30.09	30.05	10	9	4	21	5	25	T	Rain
13	87	81	74	75	72	70	100	87	74	30.17	30.14	30.09	10	6	0	15	5	18	0.26	Fog, Rain, Thunderstorm
14	92	83	74	75	73	69	100	75	49	30.21	30.16	30.1	10	6	0	21	4	26	0.03	Fog
15	93	83	73	73	70	65	94	68	41	30.2	30.14	30.06	10	10	10	15	3	20	0	
16	93	83	73	75	72	69	93	71	49	30.1	30.03	29.96	10	10	7	13	3	17	0.08	Rain
17	94	83	72	74	71	67	94	68	41	30	29.96	29.9	10	10	10	10	3	15	0	
18	95	85	75	72	71	69	87	67	46	30.03	29.98	29.92	10	10	5	24	4	31	0.02	
19	95	84	73	73	71	69	88	67	46	30.06	30.01	29.95	10	10	7	18	7	23	0.2	Rain , Thunderstorm
20	94	85	75	74	71	68	87	67	46	30	29.96	29.91	10	10	10	21	10	25	T	
21	89	83	76	75	73	69	85	72	59	30.1	30.03	29.97	10	10	7	17	8	21	0.11	Rain , Thunderstorm
22	97	86	75	76	72	68	87	65	42	30.17	30.13	30.08	10	10	10	21	4	25	0.02	Thunderstorm
23	94	86	77	76	73	66	88	69	49	30.19	30.13	30.05	10	10	2	23	5	30	0.16	Rain , Thunderstorm
24	99	89	78	74	72	68	85	62	38	30.06	29.97	29.88	10	10	10	24	8	30	0.01	Rain
25	94	85	76	74	71	68	94	69	44	29.98	29.93	29.9	10	10	10	13	3	17	T	
26	101	90	78	76	71	63	91	60	29	29.92	29.88	29.82	10	9	6	18	6	23	0	
27	100	89	78	75	71	68	74	56	38	29.95	29.9	29.86	10	10	4	20	7	26	0.04	Rain , Thunderstorm
28	97	86	75	76	73	68	87	68	49	30.01	29.96	29.89	10	10	10	15	3	21	0	
29	95	85	74	74	71	67	94	68	41	29.99	29.95	29.89	10	9	0	16	3	20	0.03	Fog , Rain , Thunderstorm
30	95	84	73	72	70	66	93	67	41	29.99	29.95	29.88	10	8	2	26	4	37	0	
31	88	79	69	73	70	66	94	75	55	29.98	29.94	29.91	10	7	1	25	2	32	0.27	Fog , Rain

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Aug	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	94	84	73	73	70	65	94	68	41	29.94	29.89	29.84	10	7	1	12	3	16	0	Fog
2	97	86	74	72	70	66	93	66	38	29.95	29.89	29.83	10	9	6	23	6	29	T	Rain , Thunderstorm
3	95	83	71	74	69	66	84	63	41	30.05	29.98	29.94	10	10	9	18	6	29	0	
4	95	86	76	73	71	68	94	69	44	30.19	30.11	30.05	10	10	7	20	7	24	0	
5	93	84	74	75	71	68	88	68	47	30.21	30.16	30.11	10	10	10	23	5	28	0	
6	94	85	75	74	73	69	94	72	49	30.15	30.09	30.02	10	7	0	24	2	28	2.12	Fog , Rain , Thunderstorm
7	90	82	74	75	74	71	94	75	56	30.06	30.01	29.96	10	6	1	25	4	33	1.09	Rain , Thunderstorm
8	91	82	73	73	72	69	94	73	52	30.03	29.99	29.92	10	9	2	21	5	26	0.19	Fog , Rain
9	92	82	71	74	71	68	93	71	49	30.02	29.94	29.85	10	9	0	29	5	40	2.24	Fog , Rain , Thunderstorm
10	84	79	73	74	72	69	93	77	61	29.9	29.87	29.83	10	9	5	15	7	20	0.02	Rain
11	80	76	72	74	71	69	94	84	74	29.95	29.91	29.88	10	9	4	17	4	23	0.34	Rain , Thunderstorm
12	91	82	72	72	69	59	93	64	34	30.01	29.97	29.93	10	9	2	10	3	14	0	
13	91	79	66	67	62	55	93	62	30	30.05	29.99	29.95	10	10	6	12	3	15	0	Fog
14	89	79	68	71	67	63	87	69	51	29.98	29.94	29.88	10	10	9	16	5	22	T	
15	92	82	72	72	68	64	93	69	44	29.97	29.93	29.9	10	10	6	20	5	24	0	
16	92	81	69	69	65	58	90	61	32	30.04	29.99	29.93	10	10	7	10	2	16	0	
17	92	82	71	73	70	67	90	67	44	29.99	29.9	29.82	10	9	3	20	4	26	0.06	Rain , Thunderstorm
18	90	81	72	73	70	66	93	70	47	29.91	29.87	29.81	10	9	6	9	2	13	T	
19	84	79	73	73	71	69	93	79	65	29.91	29.86	29.83	10	7	1	16	3	21	0.89	Rain
20	85	78	70	73	70	67	94	75	55	29.96	29.89	29.83	10	9	3	12	4	18	0.35	Rain
21	86	79	71	73	69	66	93	74	55	30.04	29.99	29.94	10	10	9	13	4	20	0.04	
22	86	79	71	73	70	66	93	72	51	30.09	30.05	30.01	10	9	6	12	3	16	0.08	
23	87	79	70	72	69	64	93	72	51	30.12	30.09	30.05	10	9	0	23	4	29	1.96	Fog , Rain , Thunderstorm
24	87	78	68	70	65	56	93	64	35	30.13	30.09	30.05	10	10	6	15	5	22	0	
25	88	76	63	65	60	54	93	64	35	30.15	30.11	30.07	10	10	7	12	4	22	0	
26	90	77	63	68	64	61	93	67	40	30.17	30.11	30.06	10	9	6	13	3	16	0	
27	90	79	68	74	69	64	88	70	52	30.11	30.06	29.99	10	10	7	23	5	30	T	Fog
28	85	80	75	76	74	72	94	82	70	30.02	29.99	29.95	10	7	0	14	3	18	0.36	Fog , Rain
29	88	82	75	75	74	73	94	81	68	30.02	29.97	29.94	10	6	0	13	2	21	0.07	Fog , Rain , Thunderstorm
30	84	79	74	74	73	72	94	82	69	30.16	30.08	29.99	10	9	6	7	1	8	T	Rain
31	93	83	73	74	72	69	100	73	46	30.23	30.17	30.11	10	6	0	10	2	13	0	Fog

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Sep	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	96	85	73	75	72	69	93	68	42	30.15	30.09	30.02	10	10	6	13	4	16	0	
2	95	85	75	75	73	70	94	70	46	30.05	30	29.93	10	9	2	23	4	29	0.2	Rain , Thunderstorm
3	90	83	75	75	73	71	94	79	63	30.01	29.98	29.95	10	9	2	25	4	32	0.11	Rain , Thunderstorm
4	91	83	74	73	72	72	94	75	56	30	29.96	29.91	10	10	9	18	5	22	T	Rain
5	89	81	73	72	71	69	93	74	55	29.99	29.93	29.88	10	10	5	14	5	21	0	
6	89	82	74	75	72	70	87	72	56	29.99	29.93	29.88	10	10	9	13	5	18	0	
7	93	84	74	74	72	69	94	72	49	29.96	29.9	29.85	10	9	6	13	3	25	T	
8	92	83	74	73	72	70	93	71	49	29.85	29.8	29.73	10	9	2	20	5	26	0.38	Rain
9	83	74	64	72	63	57	93	68	43	29.99	29.88	29.79	10	10	4	13	5	20	0.02	Rain
10	84	72	59	61	56	51	93	64	34	30.14	30.07	29.99	10	10	10	13	3	22	0	
11	83	71	59	60	58	55	93	67	40	30.29	30.22	30.14	10	10	6	10	3	14	0	
12	83	71	58	59	56	52	93	65	37	30.34	30.28	30.24	10	10	8	13	3	21	0	
13	82	70	58	62	59	56	87	67	47	30.32	30.26	30.21	10	10	6	13	3	16	0	
14	87	74	61	64	61	57	90	65	40	30.24	30.18	30.13	10	10	10	10	2	14	0	
15	88	75	62	65	62	59	93	66	39	30.18	30.12	30.07	10	10	10	10	2	14	0	
16	87	77	66	68	65	61	93	68	42	30.13	30.08	30.02	10	10	10	9	3	12	T	
17	88	80	71	72	69	64	93	70	46	30.06	29.99	29.91	10	9	1	26	6	32	0.12	Rain
18	80	76	72	73	71	68	94	83	71	29.89	29.79	29.73	10	8	1	18	8	23	0.69	Rain
19	81	74	66	70	63	57	93	71	48	30.11	29.97	29.84	10	10	6	15	7	20	0.01	Rain
20	81	71	61	63	58	55	87	66	45	30.14	30.09	30.04	10	10	10	12	4	15	0	
21	85	73	60	65	61	58	93	69	44	30.09	30.05	29.99	10	10	6	10	2	13	0	
22	88	77	65	67	64	62	93	68	43	30.04	29.99	29.93	10	10	4	16	6	16	0	
23	83	71	59	66	53	43	84	54	24	30.11	30.05	29.97	10	10	9	13	4	17	0	
24	79	68	56	55	50	43	87	62	36	30.2	30.15	30.08	10	10	10	14	5	18	0	
25	82	67	52	56	53	50	89	64	39	30.24	30.2	30.17	10	10	2	9	2	15	0	Fog
26	86	71	55	60	55	50	86	58	30	30.23	30.19	30.14	10	10	10	8	0	12	0	Fog
27	88	74	59	70	63	57	93	65	37	30.22	30.16	30.08	10	8	1	9	2	14	0	
28	89	77	64	68	65	59	93	66	39	30.11	30.05	29.98	10	9	5	10	3	15	0	
29	84	76	68	68	66	64	84	70	55	30	29.93	29.85	10	9	1	8	2	10	0.21	Rain
30	72	70	67	68	65	63	93	86	78	29.91	29.87	29.84	10	6	2	10	5	130	0.1	Rain

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Oct	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	76	72	67	72	68	65	100	91	82	29.85	29.8	29.75	7	3	0	12	6	15	0.23	Fog , Rain
2	87	81	74	75	71	65	100	76	51	29.96	29.82	29.74	10	8	2	15	6	24	0.03	Rain
3	81	76	71	71	68	64	93	76	58	30.2	30.08	29.97	10	10	10	8	2	18	0.01	Rain
4	82	74	65	68	66	63	93	74	54	30.26	30.21	30.16	10	8	1	8	2	13	0.41	Fog , Rain
5	81	72	62	65	62	59	93	71	49	30.18	30.11	30.03	10	8	4	8	1	12	0	Fog
6	88	74	60	65	60	57	97	67	36	30.03	29.95	29.87	10	8	3	13	3	20	0	
7	82	71	60	65	61	51	93	74	55	30.1	29.99	29.92	10	9	6	15	5	20	0	
8	60	57	53	54	50	47	86	74	62	30.16	30.12	30.06	10	9	1	16	7	22	0.44	Rain
9	58	53	47	49	48	46	93	83	72	30.18	30.14	30.11	10	9	4	9	4	13	T	
10	77	61	44	56	50	42	93	68	43	30.14	30.09	30.02	10	10	6	20	6	26	0	
11	74	61	47	52	47	42	93	66	38	30.3	30.22	30.14	10	10	10	17	2	24	0	Fog
12	81	66	50	56	52	47	89	63	36	30.27	30.21	30.15	10	10	9	9	2	12	0	Fog
13	75	64	53	55	49	46	89	65	41	30.42	30.34	30.27	10	10	10	14	5	20	0	
14	81	66	50	66	56	48	90	70	49	30.29	30.18	30.04	10	10	10	14	3	15	0.01	
15	81	72	63	67	60	44	93	69	45	30.04	29.88	29.76	10	10	8	21	7	26	T	Rain
16	74	60	45	49	44	39	93	61	29	29.99	29.92	29.88	10	10	10	14	2	17	0	
17	75	62	49	50	47	44	93	64	35	30.01	29.94	29.9	10	10	6	13	3	17	0	Fog
18	82	68	53	63	56	48	93	68	42	29.89	29.83	29.77	10	10	9	14	3	22	0.06	
19	79	64	49	65	47	30	93	56	18	29.84	29.79	29.74	10	9	3	17	6	23	0.23	Rain
20	77	62	47	50	43	40	83	56	28	29.95	29.85	29.81	10	10	10	16	5	21	0	
21	74	60	45	50	44	37	89	61	33	30.15	30.08	29.96	10	10	10	13	2	17	0	
22	79	62	44	52	46	41	93	62	31	30.25	30.18	30.13	10	10	10	7	1	8	0	
23	81	64	46	53	47	43	93	61	28	30.22	30.15	30.1	10	10	9	7	1	10	0	
24	83	66	49	60	52	46	100	66	31	30.21	30.15	30.08	10	7	0	7	1	10	0	Fog
25	84	68	52	62	57	50	93	67	40	30.12	30.08	30.03	10	10	6	15	4	21	0	
26	79	68	56	61	57	52	93	68	42	30.05	29.97	29.87	10	10	6	17	7	25	0	Fog
27	75	70	65	60	57	50	84	67	50	29.85	29.73	29.65	10	10	9	20	10	28	0	
28	77	66	55	52	48	38	69	51	33	29.69	29.65	29.59	10	10	10	22	8	29	0	
29	64	56	47	39	33	28	61	46	30	29.69	29.64	29.56	10	10	10	26	15	37	0	
30	61	55	48	32	29	27	54	42	29	29.71	29.58	29.52	10	10	10	24	15	32	0	
31	68	54	40	29	24	15	55	35	15	29.82	29.75	29.71	10	10	10	28	10	31	0	

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Nov	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	67	50	32	30	24	18	75	46	16	29.94	29.86	29.81	10	10	10	24	8	30	0	
2	77	57	36	43	33	26	70	47	23	29.97	29.91	29.83	10	10	10	25	8	31	0	
3	77	58	39	44	37	31	85	52	19	30.12	30.04	29.99	10	10	9	9	1	12	0	
4	79	65	50	59	52	44	89	66	42	30	29.95	29.88	10	9	3	14	4	21	0.19	Rain , Thunderstorm
5	66	57	47	48	39	32	77	56	34	30.08	30.02	29.96	10	10	10	13	5	16	0	
6	54	47	40	39	34	30	71	58	44	30.06	30	29.95	10	10	10	16	8	23	0	
7	53	46	38	39	35	32	92	71	50	29.98	29.93	29.87	10	9	5	13	5	15	0	
8	67	51	35	43	33	25	92	56	20	30.16	30.08	29.99	10	8	4	15	4	22	0	
9	72	52	31	38	31	26	89	54	19	30.29	30.23	30.16	10	10	9	8	1	10	0	
10	76	55	34	39	33	28	89	54	18	30.38	30.32	30.26	10	9	7	9	2	13	0	
11	75	56	37	56	45	34	85	65	44	30.46	30.4	30.36	10	9	6	13	2	15	0	
12	76	65	53	61	58	52	93	77	60	30.37	30.27	30.16	10	8	2	22	6	25	T	Rain
13	66	59	52	61	50	41	93	79	64	30.35	30.25	30.16	10	9	5	15	7	21	T	Rain
14	54	50	45	41	35	32	76	61	45	30.42	30.35	30.29	10	10	10	17	9	22	0	
15	50	46	42	41	39	34	89	71	52	30.32	30.27	30.24	10	7	2	17	6	25	1.36	Rain , Thunderstorm
16	62	51	40	41	38	36	86	64	42	30.34	30.28	30.24	10	10	9	12	5	17	0	
17	59	49	39	36	30	22	79	52	24	30.43	30.38	30.34	10	10	9	17	9	25	0	
18	62	56	49	48	41	34	83	62	41	30.39	30.33	30.27	10	10	10	17	10	23	T	
19	69	61	52	49	46	43	83	66	49	30.28	30.22	30.17	10	10	10	16	7	23	0	
20	65	54	42	46	43	38	89	69	48	30.18	30.12	30.06	10	10	10	9	3	14	0	
21	67	52	36	44	37	33	92	62	32	30.17	30.12	30.08	10	10	6	12	2	16	0	
22	67	50	32	38	32	28	92	58	24	30.27	30.2	30.16	10	10	9	13	3	21	0	
23	71	52	32	47	37	28	89	59	29	30.17	30.06	29.94	10	10	6	18	5	24	0	
24	61	47	32	38	27	12	76	48	19	30.13	30.03	29.95	10	10	10	16	6	20	0	
25	60	44	27	28	24	19	85	53	21	30.22	30.14	30.07	10	10	9	13	2	16	0	
26	72	51	30	33	27	21	85	50	15	30.22	30.16	30.12	10	10	9	7	1	8	0	
27	57	48	38	50	41	27	89	64	38	30.2	30.16	30.1	10	8	5	9	2	12	0.07	Rain
28	59	47	34	48	40	32	92	68	43	30.39	30.3	30.19	10	8	4	12	3	16	0	
29	60	45	29	36	30	26	92	61	29	30.48	30.41	30.37	10	8	5	8	1	10	0	
30	66	48	30	44	36	27	92	64	36	30.42	30.36	30.3	10	9	6	6	1	8	0	

2012	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Dec	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
1	70	57	43	49	45	42	92	68	44	30.4	30.34	30.32	10	9	6	9	1	14	0	
2	74	59	44	55	49	42	93	71	49	30.39	30.32	30.26	10	9	6	12	1	13	0	
3	76	62	47	58	50	45	100	69	38	30.34	30.29	30.24	10	6	0	12	2	15	0	Fog
4	75	62	48	58	52	45	89	68	46	30.35	30.27	30.22	10	10	6	13	3	22	0	
5	76	64	51	57	54	50	93	70	46	30.21	30.16	30.09	10	10	7	17	6	23	0	
6	61	56	50	50	43	36	77	64	50	30.23	30.18	30.15	10	10	10	16	9	20	T	
7	57	54	50	52	44	36	100	77	54	30.16	30.08	30.01	10	8	0	9	4	13	T	Fog
8	72	61	49	54	51	48	100	77	53	30.09	30.05	30	10	6	0	9	2	15	0	Fog
9	71	62	52	61	57	50	100	87	73	30.13	30.07	29.98	10	6	0	10	2	17	0	Fog
10	74	65	56	60	57	55	100	77	53	29.97	29.85	29.75	10	8	1	18	6	23	T	Rain
11	66	60	54	57	50	41	100	74	48	30.09	29.9	29.75	10	8	0	10	4	12	0	Fog
12	56	49	42	43	39	35	92	71	50	30.31	30.19	30.09	10	8	2	16	8	22	0.66	Rain
13	55	47	38	39	38	35	89	72	55	30.36	30.31	30.2	10	8	2	21	6	29	0.22	Rain
14	61	47	32	39	33	29	89	63	36	30.4	30.31	30.23	10	10	7	6	1	10	0	Fog
15	61	48	35	47	38	33	92	65	37	30.26	30.18	30.1	10	9	7	8	2	12	0	
16	64	58	52	58	54	46	93	85	77	30.07	30	29.87	10	7	2	7	2	9	0.03	Rain
17	61	59	56	58	56	54	93	89	84	29.91	29.83	29.73	10	8	2	20	5	23	0.44	Rain
18	64	52	40	56	46	33	93	65	36	29.99	29.83	29.73	10	10	10	23	9	30	0	
19	72	53	34	43	37	31	86	58	29	30.12	30.05	29.99	10	10	10	15	4	20	0	
20	72	55	38	61	46	31	92	71	49	30.1	29.88	29.62	10	10	2	39	11	51	0.19	Rain
21	51	46	40	28	23	18	53	42	31	29.97	29.85	29.77	10	10	10	35	21	47	0	
22	59	45	31	26	16	7	64	39	13	30.16	30.1	29.98	10	10	10	21	8	26	0	
23	60	43	26	30	24	20	75	49	23	30.21	30.13	30.07	10	10	10	12	5	15	0	
24	54	47	40	49	39	30	93	67	41	30.07	29.99	29.91	10	9	3	16	3	23	0.43	Rain
25	54	52	50	51	49	48	96	90	83	30.08	30	29.93	10	8	2	10	4	13	0.16	Rain
26	67	54	40	61	49	30	93	70	46	29.92	29.67	29.51	10	7	2	32	16	44	0.69	Rain , Thunderstorm
27	57	46	35	35	31	29	85	62	38	30.06	29.96	29.82	10	10	9	21	7	26	0	
28	52	42	32	37	32	29	89	68	46	30.17	30.08	29.94	10	10	7	8	3	10	0	
29	56	48	39	45	39	28	96	74	51	30.07	29.86	29.74	10	8	2	28	12	36	0.69	Rain
30	51	40	28	27	24	19	78	53	28	30.43	30.32	30.09	10	10	7	15	4	26	0	
31	59	43	26	42	29	23	85	57	28	30.43	30.32	30.17	10	9	2	14	3	22	0	

Average Summertime Environmental Parameters

Date	Temperature		Humidity (%)	Pressure	
	F	C		in HG	mbar
6/1/2012	79	26.11111111	73	29.82	1009.817
6/2/2012	73	22.77777778	61	29.85	1010.833
6/3/2012	73	22.77777778	56	29.92	1013.203
6/4/2012	76	24.44444444	74	29.77	1008.124
6/5/2012	69	20.55555556	79	29.81	1009.478
6/6/2012	71	21.66666667	69	29.9	1012.526
6/7/2012	72	22.22222222	69	30.02	1016.59
6/8/2012	73	22.77777778	65	30.03	1016.928
6/9/2012	76	24.44444444	60	30.06	1017.944
6/10/2012	75	23.88888889	81	30.1	1019.299
6/11/2012	76	24.44444444	86	30.08	1018.622
6/12/2012	78	25.55555556	79	29.96	1014.558
6/13/2012	81	27.22222222	70	29.92	1013.203
6/14/2012	79	26.11111111	62	30.05	1017.606
6/15/2012	76	24.44444444	55	30.14	1020.654
6/16/2012	73	22.77777778	56	30.18	1022.008
6/17/2012	72	22.22222222	65	30.1	1019.299
6/18/2012	76	24.44444444	65	30.07	1018.283
6/19/2012	78	25.55555556	65	30.14	1020.654
6/20/2012	80	26.66666667	64	30.13	1020.315
6/21/2012	82	27.77777778	63	30.02	1016.59
6/22/2012	82	27.77777778	59	29.91	1012.865
6/23/2012	83	28.33333333	63	29.93	1013.542
6/24/2012	82	27.77777778	69	29.95	1014.219
6/25/2012	81	27.22222222	70	29.81	1009.478
6/26/2012	78	25.55555556	61	29.79	1008.801
6/27/2012	76	24.44444444	48	29.94	1013.881
6/28/2012	81	27.22222222	48	29.98	1015.235
6/29/2012	90	32.22222222	45	29.85	1010.833
6/30/2012	92	33.33333333	52	29.84	1010.494
7/1/2012	90	32.22222222	62	29.93	1013.542
7/2/2012	84	28.88888889	65	30.02	1016.59
7/3/2012	87	30.55555556	59	29.98	1015.235
7/4/2012	84	28.88888889	65	29.98	1015.235

Date	Temperature		Humidity (%)	Pressure	
	F	C		in HG	mbar
7/5/2012	89	31.66666667	56	29.93	1013.542
7/6/2012	86	30	59	29.95	1014.219
7/7/2012	88	31.11111111	58	29.99	1015.574
7/8/2012	91	32.77777778	52	29.95	1014.219
7/9/2012	89	31.66666667	46	29.9	1012.526
7/10/2012	83	28.33333333	75	29.96	1014.558
7/11/2012	82	27.77777778	71	30.04	1017.267
7/12/2012	81	27.22222222	73	30.09	1018.96
7/13/2012	81	27.22222222	87	30.14	1020.654
7/14/2012	83	28.33333333	75	30.16	1021.331
7/15/2012	83	28.33333333	68	30.14	1020.654
7/16/2012	83	28.33333333	71	30.03	1016.928
7/17/2012	83	28.33333333	68	29.96	1014.558
7/18/2012	85	29.44444444	67	29.98	1015.235
7/19/2012	84	28.88888889	67	30.01	1016.251
7/20/2012	85	29.44444444	67	29.96	1014.558
7/21/2012	83	28.33333333	72	30.03	1016.928
7/22/2012	86	30	65	30.13	1020.315
7/23/2012	86	30	69	30.13	1020.315
7/24/2012	89	31.66666667	62	29.97	1014.897
7/25/2012	85	29.44444444	69	29.93	1013.542
7/26/2012	90	32.22222222	60	29.88	1011.849
7/27/2012	89	31.66666667	56	29.9	1012.526
7/28/2012	86	30	68	29.96	1014.558
7/29/2012	85	29.44444444	68	29.95	1014.219
7/30/2012	84	28.88888889	67	29.95	1014.219
7/31/2012	79	26.11111111	75	29.94	1013.881
8/1/2012	84	28.88888889	68	29.89	1012.188
8/2/2012	86	30	66	29.89	1012.188
8/3/2012	83	28.33333333	63	29.98	1015.235
8/4/2012	86	30	69	30.11	1019.638
8/5/2012	84	28.88888889	68	30.16	1021.331
8/6/2012	85	29.44444444	72	30.09	1018.96
8/7/2012	82	27.77777778	75	30.01	1016.251
8/8/2012	82	27.77777778	73	29.99	1015.574
8/9/2012	82	27.77777778	71	29.94	1013.881

Date	Temperature		Humidity (%)	Pressure	
	F	C		in HG	mbar
8/10/2012	79	26.11111111	77	29.87	1011.51
8/11/2012	76	24.44444444	84	29.91	1012.865
8/12/2012	82	27.77777778	64	29.97	1014.897
8/13/2012	79	26.11111111	62	29.99	1015.574
8/14/2012	79	26.11111111	69	29.94	1013.881
8/15/2012	82	27.77777778	69	29.93	1013.542
8/16/2012	81	27.22222222	61	29.99	1015.574
8/17/2012	82	27.77777778	67	29.9	1012.526
8/18/2012	81	27.22222222	70	29.87	1011.51
8/19/2012	79	26.11111111	79	29.86	1011.172
8/20/2012	78	25.55555556	75	29.89	1012.188
8/21/2012	79	26.11111111	74	29.99	1015.574
8/22/2012	79	26.11111111	72	30.05	1017.606
8/23/2012	79	26.11111111	72	30.09	1018.96
8/24/2012	78	25.55555556	64	30.09	1018.96
8/25/2012	76	24.44444444	64	30.11	1019.638
8/26/2012	77	25	67	30.11	1019.638
8/27/2012	79	26.11111111	70	30.06	1017.944
8/28/2012	80	26.66666667	82	29.99	1015.574
8/29/2012	82	27.77777778	81	29.97	1014.897
8/30/2012	79	26.11111111	82	30.08	1018.622
8/31/2012	83	28.33333333	73	30.17	1021.669
	81.29348	27.3852657	67.14130435	29.98728	1015.482

Siren 5 Reference Baseline

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 9:39 A.M.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	N/A – Calibration before test
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Siren 5 Reference Baseline 2001-130 dB(C)
Loc. Coordinates:	N34.3895 W81.3775
Loc. Elevation:	439

Weather:	
Description:	See below
Temperature:	43 degrees
Humidity:	40% BP: 30.09
Wind Speed:	Calm
Wind Direction:	N/A

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	43.8	N/A	48.9		45	N/A	48.3

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	65.2	N/A	68.4		63.2	N/A	73.5

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 5

Weather: Clear, sunny day, no clouds.

This location is slightly uphill on a gravel road. Testers were in the center of the road adjacent to the drive that exists to the south of the Broad River Water Fowl area. There are trees to the north approximately 25' away. The tree height averages about 75'. To the south lies a small clearing then trees at the same height, approximately 45' away in all directions. The test site is on a slight uphill slope and the tree line along the road is similar all the way in both directions.

Siren 40 Reference Baseline

Project:	V.C. SUMMER
Date:	3/14/2013 time 10:32 A.M.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 93.2 ST 94.0
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Siren 40 Reference Baseline 2001-SRNB 128 dB(C)
Loc. Coordinates:	N34.3555 W081.3648
Loc. Elevation:	296

Weather:	
Description:	See below
Temperature:	44 degrees
Humidity:	37% BP: 30.15
Wind Speed:	4 mph
Wind Direction:	West

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	42.4	N/A	53.		50.4	N/A	59.5

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	42.9	N/A	52.3		58.5	N/A	68.6

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 40

Weather: Clear, sunny day, no clouds.

This location is slightly uphill on a gravel road. The test site is in the center of the road. The trees are approximately 15’ away on either side of the road. It is a fairly thin stand of pines. The trees are averaging about 60’ tall.

GROUP TEST	LOCATION	AREA TESTED INSIDE EPZ	AREA TESTED IN EXPANDED EPZ	POP DENS <2,000/SQMI	MODEL	SOUND LEVEL (MAX dBC SPL) AMBIENT	SOUND LEVEL (MAX dBC SPL) SIREN	SIREN AUDIBILITY (HIGH, MED, LOW, NONE)
1	3	YES	/	YES	2001SRNB	62.6	59	LOW
2	4	YES	/	YES	2001SRNB	79	74.9	MED
3	5	YES	/	YES	2001SRNB	64.8	72.4	MED
4	6	YES	/	YES	2001SRNB	72	71.6	LOW
5	7	YES	/	YES	2001SRNB	67.2	61.9	LOW
6	8	YES	/	YES	2001SRNB	61.6	66.1	MED
7	9	YES	/	YES	2001SRNB	73.8	83.8	HIGH
8	10	YES	/	YES	2001SRNB	61.3	74.7	HIGH
9	11	YES	/	YES	2001SRNB	70.8	78	MED
10	12	YES	/	YES	2001SRNB	50.7	64.2	MED
11	13	YES	/	YES	2001SRNB	67.3	76	MED
12[9]	14	YES	/	YES	2001SRNB	73.4	77	NONE
13[10]	15	/	YES	YES	2001SRNB	58.5	56.7	NONE
14[11]	16	/	YES	YES	2001SRNB	77.1	81.3	NONE

[9] New Site #9 to provide coverage to eliminate the coverage deficiency noted.
[10] New Site #108 to provide coverage to eliminate the coverage deficiency noted.
[11] New Site #109 to provide coverage to eliminate the coverage deficiency noted.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 11:30 a.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 93 ST 94
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group 1 Test Native Drive
Loc. Coordinates:	Location changed N34.37773 W081.36002
Loc. Elevation:	493

Weather	
Description:	See below
Temperature:	50 degrees
Humidity:	30% BP 30.15
Wind Speed:	2 mph
Wind Direction:	West

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	36	N/A	54.2		46.5	N/A	62.6

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	43.9	N/A	51.1		50.9	N/A	59

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 40, 25, 21, 5, 6, 8, 10

Weather: Sunny day, no clouds.

We set up in the center of a gravel road. The road was bordered on each side with trees averaging 40-60' in height. We changed the GPS on this site to stay out on the main road as opposed to a little two track out in the field.

Observation: Siren Audibility – Low

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 12:35 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92.8 ST 93.8
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group 2 Test
Loc. Coordinates:	N34.393484 W081.245504
Loc. Elevation:	287

Weather	
Description:	See below
Temperature:	52 degrees
Humidity:	25% BP 30.03
Wind Speed:	2 mph
Wind Direction:	South

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	60.4	N/A	61.3		62.5	N/A	79.0

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	49	N/A	54.3		60.2	N/A	74.9

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 15, 16, 18, 61, 41, 13

Weather: Sunny day, no clouds.

We set up on the north side of a two lane paved road. There are no significant trees blocking this site. We are open all the way around for approximately 100'. The closest trees after that are about 70' tall and there is no foliage on the trees at this point.

Observation: Siren Audibility – Medium; Note: Two cars that went by during the test skewed the ambient test results.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 1:30 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92.9 ST 93.5
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 3
Loc. Coordinates:	N34.382619 W081.26144
Loc. Elevation:	411

Weather	
Description:	See below
Temperature:	56 degrees
Humidity:	25% BP 30.03
Wind Speed:	5 mph
Wind Direction:	Northwest

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	41.0	N/A	54.5		51.6	N/A	64.80

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	45.0	N/A	45.5		61.2	N/A	72.4

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 18, 61, 41, 13, 16, 15

Weather: Sunny day, no clouds.

This is a wide open site in the Y between three paved roads. We are in a grassy area of approximately 1200 square feet where Liston Road, S-20-225, and S-20-205 meet. The closest trees are approximately 60’ away in all directions and are not dense. To the south, the trees are only about 40’ tall and to the north, they are approaching 65’ tall.

Observation: Siren Audibility - Medium; Note: While this site technically shows a failure due to the fact that the siren sound is not 10dB above ambient, the higher ambient noise level was due to natural (not manmade) background noise, which we experienced in several other locations during field testing.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 2:15 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92.5 ST 93.1
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 4
Loc. Coordinates:	N34.380641 W081.192235
Loc. Elevation:	355

Weather	
Description:	See below
Temperature:	54 degrees
Humidity:	26% BP 30.06
Wind Speed:	7 mph
Wind Direction:	East

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	42.0	N/A	56.7		61.1	N/A	72.00

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	46.5	N/A	50.2		60.6	N/A	71.6

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 17, 18, 57, 58

Weather: Sunny day, no clouds.

Intersection at Old Airport Road. We are approximately 50’ east of a paved road on the north side of a gravel road. The closest trees are approximately 30’ away. Trees west of the site are approximately 100’ away. There are no real dense trees in the area and the closest trees south of our location have height of approximately 40’.

Observation: Siren Audibility – Very low; Note: Ambient background noise was high in this area.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 3:00 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92.6 ST 92.8
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 5
Loc. Coordinates:	N34.341021 W81.149513
Loc. Elevation:	474

Weather	
Description:	See below
Temperature:	57 degrees
Humidity:	24% BP 29.89
Wind Speed:	4 mph
Wind Direction:	West

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	39.50	N/A	55.3		53.2	N/A	67.2

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	48.9	N/A	53.7		54.3	N/A	61.9

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 58, 57, 59, 63

Weather: Sunny day, no clouds.

This site is located on Reservoir Road adjacent to the driveway at 1093 Mill Creek Shores at the top of the hill on Reservoir Road, which is gravel. We tested 100' away from trees, which average 40' in height. The terrain drops to the west down about 100'.

Observation: Siren Audibility – Very low; Note: Ambient background noise was high in this area.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 4:00 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92.5 ST 92.9
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 6
Loc. Coordinates:	Location changed N34.34445 W-81.27484
Loc. Elevation:	378

Weather	
Description:	See below
Temperature:	63 degrees
Humidity:	20% BP 29.93
Wind Speed:	2 mph
Wind Direction:	South/Southwest

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	35.6	N/A	51.5		49.7	N/A	61.6

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	55.9	N/A	58.9		58.1	N/A	66.1

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 47, 46, 45, 54, 55

Weather: Sunny day, no clouds.

We set up on Brooks Drive. The closest address is 497 Brooks Drive in Blair, South Carolina. This is a real rugged two track trail. There are trees around us within 10' of the center line of the road. Most of these trees are averaging in height of about 50'. Not real dense forest.

Observation: Siren Audibility – Medium; Note: Gun shots in background during ambient test resulted in a high ambient max reading for the SPLDC ambient.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/14/2013 Time: 4:56 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92.5 ST 93.0
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 7
Loc. Coordinates:	N34.276318 W81.280414
Loc. Elevation:	452

Weather	
Description:	See below
Temperature:	1 degrees
Humidity:	23% BP 29.92
Wind Speed:	5 mph
Wind Direction:	West/Northwest

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	40.9	N/A	52.4		58.6	N/A	73.8

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	72.4	N/A	77.5		73.3	N/A	83.8

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 43, 89, 49, 50, 51

Weather: The sky is partially overcast.

We set up in the middle of an asphalt street. There are no trees around of any consequence for several hundred feet in all directions of the test point with open field facing to the south. In addition, St. Barnabus Church Road that runs through this site points almost immediately down around a couple of curves towards siren site 43. Site 13 is directly to the west.

Observation: Siren Audibility - High

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	3/15/2013 Time: 9:38 a.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 93.1 ST 93.1
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 8
Loc. Coordinates:	New location: N34.26567 W81.16158
Loc. Elevation:	425

Weather	
Description:	See below
Temperature:	45 degrees
Humidity:	46% BP 29.95
Wind Speed:	1-2 mph
Wind Direction:	West

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	39.8	N/A	54.3		49.6	N/A	61.3

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	65.6	N/A	66.8		65.6	N/A	74.7

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 68, 69, 102, 103

Weather: Clear, sunny day, no clouds.

We set up in the center of a paved road (there are new coordinates). It is on Mann Road. The closest address is 1245 Mann Road. The closest trees of any consequence are a quarter of a mile away. We do have some short tree growth (40' or less), not dense, starting about 30' away from the test site.

Observation: Siren Audibility – High; Note: Logging operation approximately 3/8 of a mile away added 10 dB to ambient test.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	4/18/2013 Time: 12:47PM
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 91.9 ST 92
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer/independent lab.
Location Name:	Group Test #9 (Retest) 2511 Hughey Ferry Road
Loc. Coordinates:	N34.30209 W-81.40774
Loc. Elevation:	406

Weather	
Description:	See below
Temperature:	82 degrees
Humidity:	54% BP 30.30
Wind Speed:	8 mph 4-10 mph
Wind Direction:	SE/S

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	38.6	N/A	51.8		60.2	N/A	70.8

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	51.4	N/A	63.6		67.0	N/A	78.00

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 27, 31, 32, 33

Weather: Partly sunny, 50% sun, 50% clouds

This retest is near test point 11 but closer to the main road; the original test was closer to a farmer's field.

We set up on gravel about 6' off the edge of a 20' wide paved road. Most of the area is open; about 50' away is a sparsely wooded area with trees averaging 40–50' in height. The rest of the area, for about 0.25 miles, is clear of any vegetation taller than 25'. The winds averaged between 4-10 mph during the actual siren test, with a couple of wind gusts up to 10 mph. There was also background noise from a tractor approximately 0.25 miles away during the test.

Observation: Siren Audibility – Medium; Note: There is a lot of background noise from birds at this site, which raised the ambient max level.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	4/17/2013 Time: 2:08 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test BK 93.1 ST 91.6
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 10 S20-99
Loc. Coordinates:	N34.43065 W81.37376
Loc. Elevation:	349

Weather	
Description:	See below
Temperature:	82 degrees
Humidity:	52%
Wind Speed:	2 mph
Wind Direction:	South

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	38.0	N/A	46.2		43.4	N/A	50.7

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	45.6	N/A	58.3		49.5	N/A	64.2

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 4, 7, 6

Weather: Clear, sunny day, patchy clouds.

We set up on the side of a paved road about 4' from the edge of the pavement. There are some large trees however, they are sparse, approximately 80' – 100' tall. There is foliage on the trees that is at about 40% of growth.

Observation: Siren Audibility – Medium

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	4/17/2013 Time: 2:30 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test BK 91.8 ST 90.3
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 11 Cooper Holmes Road
Loc. Coordinates:	N34.43307 W81.31365
Loc. Elevation:	648

Weather	
Description:	See below
Temperature:	88 degrees
Humidity:	42% BP 30.30
Wind Speed:	2 mph
Wind Direction:	South

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	34.3	N/A	51.1		51.5	N/A	67.3

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	48.2	N/A	50.3		63.3	N/A	76.0

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 11, 12, 106

Weather: Clear, sunny day, with few clouds.

We set up in a clearing about 15 feet off the center of a gravel road. The area is not heavily wooded. It is comprised mostly of pine trees with some small undergrowth; foliage is at 40% growth.

Observation: Siren Audibility – Medium; Note: There is a lot of background noise at this site.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	4/17/2013 Time 11:10 a.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92. 2 ST 90.8
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 12 S36/99 Silver Bullet Road
Loc. Coordinates:	N34.22036 W81.49699
Loc. Elevation:	498

Weather	
Description:	See below
Temperature:	74 degrees
Humidity:	63% BP 30.27
Wind Speed:	3 mph
Wind Direction:	N/W

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	51.3	N/A	55.1		68.6	N/A	73.4

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	55.0	N/A	55.7		69.8	N/A	77.0

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 71, 72

Weather: Clear, sunny day, no clouds in the sky.

We are set up about 30' off the edge of a paved road at the corner of S36/99 and Silver Bullet Road. There are some large trees, approximately 40' tall in all directions. They are some 60' – 100' tall, however, the woods are sparsely populated, and there are some open fields past the tree line.

Observation: Siren Audibility – None; Note: We could not hear the two sirens sounded in this location over ambient noise; 77.0 dBC max was ambient noise only.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	4/18/2013 Time: 2:20 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 92.0 ST 91.9
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 13 621 Sand Bar Road
Loc. Coordinates:	N34.14372 W81.36107
Loc. Elevation:	370

Weather	
Description:	See below
Temperature:	75 degrees
Humidity:	78% BP 30.30
Wind Speed:	2 mph
Wind Direction:	E/NE

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	44.1	N/A	59.9		54.1	N/A	58.5

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	43.1	N/A	51.3		53.6	N/A	56.7

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 95, 104

Weather: Partly sunny

This site is within the new EPZ, close to 621 Sand Bar Road. We tested in a little gravel area off about one foot off the edge of a paved road and about 100 feet away from backwater. This area is somewhat open. The closest trees to the test point are 50 feet away and average 50-80 feet in height; foliage is not very dense with 80% growth.

Observation: Siren Audibility – Very low to none; Note: No vehicles passed the site during the ambient test. We performed an ambient test, but significant rain dropped the temperature 10 degrees and raised the humidity 20% before the siren test was completed. We retested to ensure accurate test results based on the weather changes.

Acoustic Survey Form

Project:	V.C. SUMMER
Date:	4/18/2013 2:31 p.m.
Test Technician:	
Equipment Used:	BRUEL & KJAER TYPE 2236 AND SOUNDTEK ST-107S
Calibration Number(s):	Calibration before test – BK 91.9 ST 91.9
Calibration Date:	03/03/2013 AND 03/08/2013 by manufacturer or independent lab.
Location Name:	Group Test 14 Twin Pines Dr./Westwood Dr.
Loc. Coordinates:	N34.15581 W81.39981
Loc. Elevation:	442

Weather	
Description:	See below
Temperature:	78 degrees
Humidity:	69% BP 30.24
Wind Speed:	6 mph – 7 mph
Wind Direction:	S/SE

SPL(dBA) (Ambient)	LEQ	SEL	MAX	SPL(dBC) (Ambient)	LEQ	SEL	MAX
	41.3	N/A	49.3		65.3	N/A	77.1

SPL(dBA) (Siren)	LEQ	SEL	MAX	SPL(dBC) (Siren)	LEQ	SEL	MAX
	47.1	N/A	51.7		67.9	N/A	81.3

Notes: Readings include at least a two-minute sampling of data.

Site Comments:

Sirens sounded: 79, 80

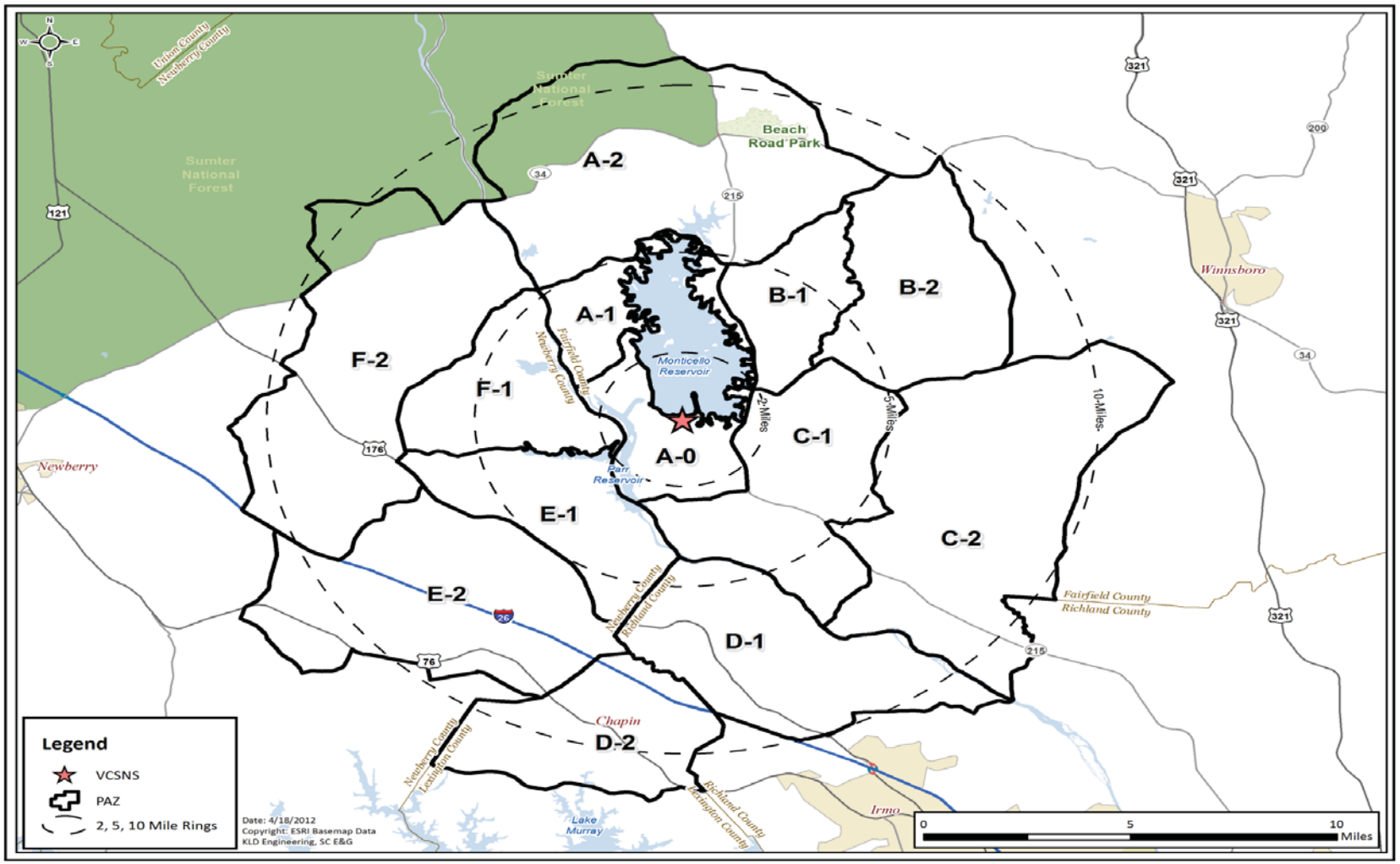
Weather: Partly sunny

This is on the corner of Westwoods Drive and Twin Pine Drive. We set up on a small paved area approximately 20' off the edge of Westwoods Drive. This area is mostly open fields with a few residential trees averaging 30–70 feet in height.

Observation: Siren Audibility – None; Note: Ambient noise in this location is extremely high; the 81.3 max dBC ambient noise level listed for the siren actually represents ambient noise for this area. Both max measurements are artificially high due to excessive background noise from barking dogs, firing guns, and passing cars.

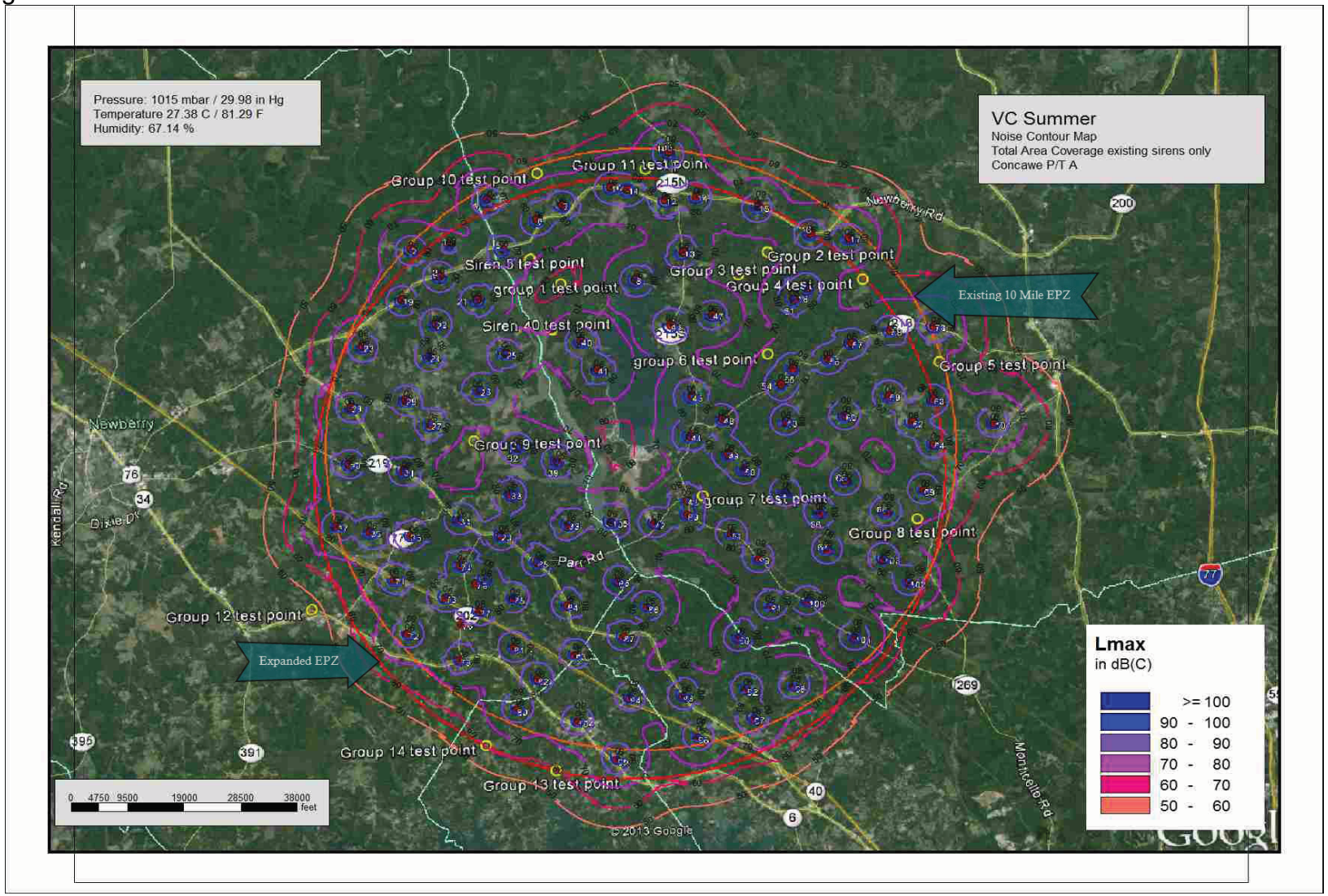
MAP 1

VCSNS 10-Mile Emergency Planning Zone

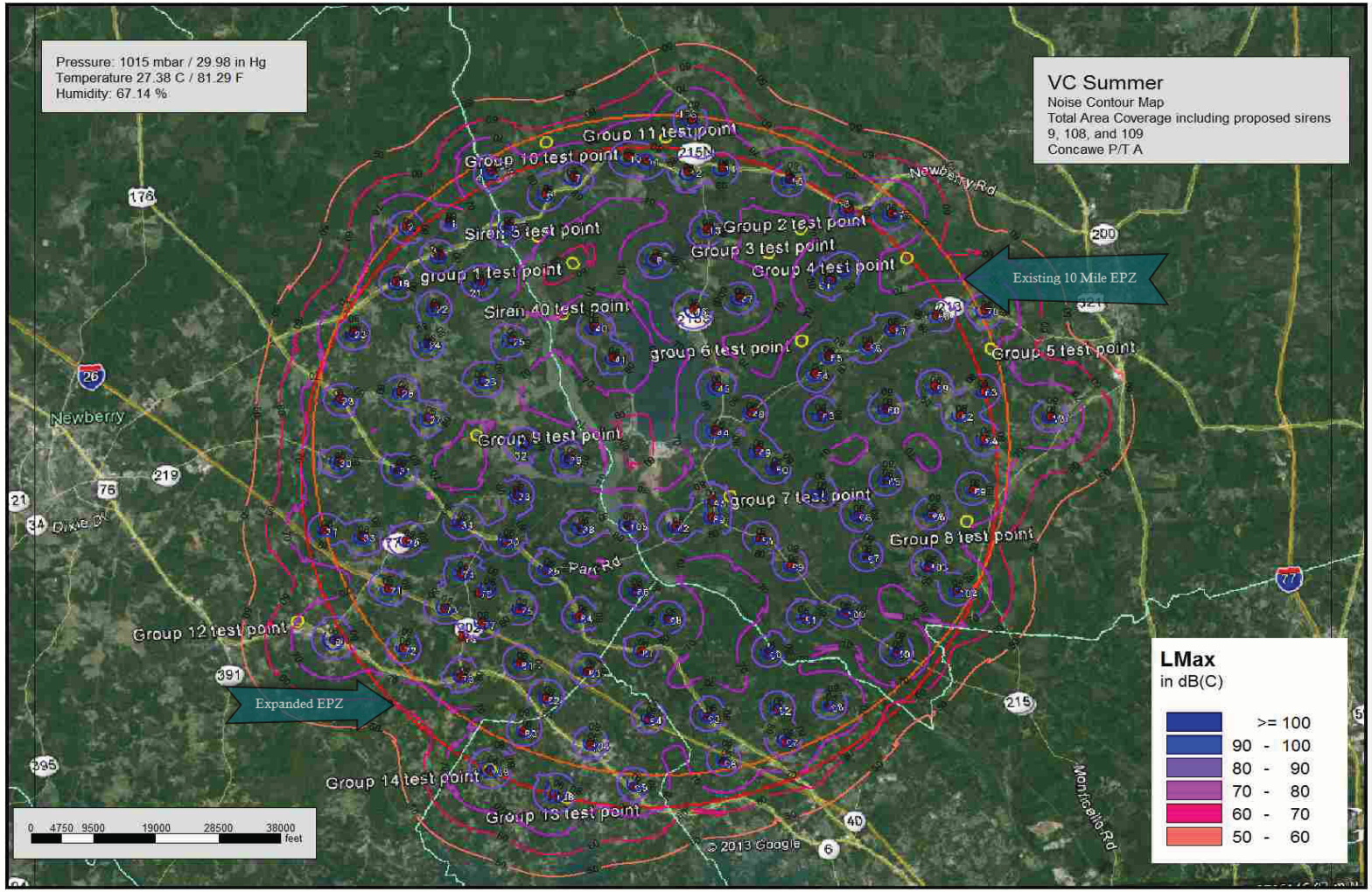


MAP 2

Existing Sirens



Proposed Sirens



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