Investigation of Citizens Complaints of Air Pollution from the Essex Group Magnet Wire Manufacturing Facility in Franklin, Tennessee

Tennessee Department of Environment and Conservation
Division of Air Pollution Control
December 2010

Executive Summary

The Essex Group (also known as Superior Essex) operates a magnet wire manufacturing operation in Franklin, Tennessee. Magnet wire can be made of copper or aluminum and is used in electrical motors and electrical coils. As part of the manufacture of magnet wire, phenol and cresol based coatings are applied to the wire and cured in ovens to electrically insulate the wire. Phenol can have an antiseptic or medicinal type odor. Cresols can have a distinct odor similar to the ink solvents found in permanent magic markers. The odor threshold for phenol and cresols is very low, meaning that it can be detected in very small quantities by the human sense of smell.

During the public participation portion of the evaluation of Essex Group's major source operating permit renewal application, TDEC's Division of Air Pollution Control received considerable public comment expressing concern about air emissions and odors from the facility. In response to those comments, the Division of Air Pollution Control extensively evaluated the facility to answer two broad-based questions:

1. Does the facility comply with existing air pollution control requirements, and

2. If the facility does comply with the existing air pollution control requirements, should those requirements be made more stringent?

To address these questions, the Division conducted an extensive source survey of the Essex facility to accurately characterize the emissions from the facility. In addition, ambient air monitoring for phenol and cresols was conducted at three locations surrounding the Essex facility.

Based on the results of the source survey, the Division has concluded that the Essex facility is currently demonstrating compliance with all applicable air pollution control requirements. A summary of the report of the source survey is included as Appendix A to this report. A discussion of the operation of the Essex facility during this survey is included as Appendix B to this report.

Based on the results of the ambient air monitoring, the Division has concluded that the measured ambient concentrations of phenol and cresols were well below any recommended exposure limit values. A summary of this ambient air data is included as Appendix C to this report. A summary of an area surveillance conducted simultaneously with the ambient monitoring is included as Appendix D to this report.

Based on these studies, TDEC's Air Pollution Control Division has concluded that the facility does comply with the existing air pollution control requirements and that under the authority of the Tennessee Air Quality Act and its implementing regulations, there is no current justification for the agency to impose more stringent requirements on the Essex facility.

It should be noted that under federal regulations for the control of hazardous air pollutants for which a maximum achievable control technology standard is set, a residual risk assessment is performed approximately eight years after the compliance deadline for *the source category as a whole* to determine if the technology based standards were sufficient. TDEC's Division of Air Pollution Control will send this report to the United States Environmental Protection Agency as information for them to consider in performing the residual risk evaluation.

Table of Contents

Report Findings

Essex Group Inc., also known as Superior Essex, operates a magnet wire manufacturing operation at 120 Southeast Parkway in Franklin, Tennessee. In its manufacturing process, copper or aluminum rod is drawn through sizing dies to the desired wire diameter and then coated with an electrically insulating material that allows the wire to be wound to make electrical coils for use in electric motor windings or other electrical applications. The finished wire is coated with a wax-based coating called Dri-Lube to make the wire more "slippery" for winding purposes.

The insulating coating is applied as a liquid and contains among other substances, cresols and phenol. Cresols are solids below about 52-95˚F, depending upon the isomer of the substance, and phenol is a solid below about 109˚F. Both chemicals have a distinct odor and can be pungent in higher concentrations. As with all substances, these chemicals can be injurious to human health in sufficiently high concentrations. The coating is applied as a heated liquid and cured/dried in ovens that are heated either by gas burners or electric resistance heat. As the coating vapors evolve during the curing/drying process, they are combusted either in the burners of gas-fired ovens or in a catalytic oxidation bed of the electrically heated ovens.

While a number of air pollution control regulations apply to the Superior Essex facility, the focus of this investigative report is on the coating and curing emissions at the plant – specifically, the emission of volatile organic compounds and the hazardous air pollutants, phenol and cresols. It is the belief of the Division of Air Pollution Control that the latter two pollutants are the likely basis for the citizen complaints that have been registered with the Division. It should be noted that phenol and cresols are considered to be volatile organic compounds, and that there are other volatile organic compounds used at the Superior Essex facility.

Emission limits for volatile organic compounds, based upon coating content, were set as part of a reasonably available control technology determination for the Middle Tennessee State Implementation Plan revisions to address nonattainment of the one-hour ozone national ambient air quality standard. (This state implementation plan was subsequently revised to address attainment of the 1997 8-hour ozone standard, but the revised plan did not result in a change of the volatile organic compound emission standards that were previously set for Superior Essex.) These standards are set forth in the Tennessee Air Pollution Control Regulations as Rule 1200-03-18-.19. The rule, which specifically addresses the coating of magnet wire, is based upon a published federal guidance document known as Control Technology Guidelines (EPA Publication: EPA-450/2-77-033). In addition, special requirements relating to the Dri-Lube application were implemented through Board Order No. 94-14, which was adopted by the Tennessee Air Pollution Control Board on April 13, 1994. The aforementioned requirements were incorporated into the facility operating permits. Subsequent permit modifications to add or reconfigure the existing operations resulted in more stringent volatile organic compound limits being set on the current Title V operating permit (# 556509, issued on February 5, 2010). In addition, this permit also sets forth a maximum amount of total volatile organic compound emissions that can be released into the air on an annual basis.

Emission limits for hazardous air pollutants are also applicable to the Superior Essex facility. The Superior Essex facility is subject to the portion of 40 CFR 63, Subpart MMMM that pertains to magnet wire operations. By the authority of Division Rule 1200-03-31-.04, those standards are imposed as a permit condition in the Superior Essex Title V operating permit. Under these rules, emission limits are set for new and existing facilities that produce magnet wire. For existing magnet wire coating machines, like those at the Superior Essex plant, the rules provide that the machines must be kept under negative pressure and that the organic hazardous air pollutants within the oven must be combusted to provide an emission rate of no more than 1.0 pound of hazardous air pollutants per gallon of coating solids.

Compliance with these standards is demonstrated through an emissions performance test that measures the magnet wire coating machine emission rate with a simultaneous measurement of post-combustion temperature and proof that the magnet wire coating machine is under negative pressure during the test. Once testing establishes that the magnet wire coating machine can meet the stack emission allowable rate, continuous measurements and records of temperature are kept when the magnet wire coating machine is operating, and periodic tests are done to verify that the machine is being kept under negative pressure when it is operating. Superior Essex conducts periodic monitoring by measuring the electrical resistance for each magnet wire coating machine oven heater (for machines having catalytic incinerators) to ensure that the destruction efficiency values measured during the performance testing remain valid. Periodic reports of monitoring data are submitted to the Division for assurance of compliance.

During the public participation portion of the renewal application review, several citizens commented that the facility emissions and odor had not been objectionable until the last two years of operation. The facility has been in operation at its current location for approximately twenty-seven years. As such, the Division of Air Pollution Control also focused its efforts on what might have changed at the facility during those last two years.

The following theories have been proposed, evaluated, and conclusions have been reached:

Theory: *There have been increased volatile organic compound emissions from the Superior Essex facility in the past few years.*

Conclusion: While certain wire coating machines have been replaced with newer machines, the reported overall volatile organic compound emissions from the Superior Essex facility have actually decreased since 2005, due to the ducting of dry lube emissions back into a number of magnet wire coating machines for incineration in the machine ovens. A table showing the actual facility volatile organic compound emissions, as reported to the Division, follows this section of the report as Attachment 1.

Issues have been raised concerning the increased emissions reported for certain compounds from the Superior Essex facility, per the Toxic Release Inventory System (TRIS). TRIS is a federal program with penalties for the under-reporting of emissions, but no penalties for the over-reporting of emissions. The Superior Essex facility staff were requested to provide an explanation for the TRIS-reported increases. Superior Essex responded that the emission reports posted were the result of an error on its part in preparing the report, and that the actual corrected TRIS emission rate shows an emissions increase, but not as significant as the previously reported TRIS values. Superior Essex filed an amended report with EPA to correct the data. Attachment 2, which follows this section of the report, shows the destruction efficiency values upon which the calculated values shown in both the TRIS reports and Attachment 1 were determined.

During the course of the study of the actual emissions from the Superior Essex facility, the Division requested the submittal of data showing the year-to-year changes in the use of total volatile organic compounds at the facility, and the year-to-year changes in the use of phenol and cresols at the facility. Attachment 3, which contains this data, follows this section of the report.

This attachment displays the usage rates of VOC, phenol, and cresols, relative to the base year of 2001, for each material. Please note that the usage rates are not proportional to each other, as phenol and cresols are a subset of VOC. The graph may be used to observe the trends in usage rates for each individual compound on a year-to-year basis. It indicates that the actual usage of cresols by the facility has increased during the time frame of the recent odor complaints.

Here it should be noted that most of the increase in the reported phenol and cresol emissions for 2007 and later years (see Attachment 1) exaggerates the magnitude of the actual emission increases due to the use of the updated destruction efficiency values shown in Attachment 2. This is shown by the recalculation of the reported phenol and cresol emissions for calendar year 2006, using the later destruction efficiency values presented in Attachment 4, which follows this section of the report. In Attachment 1, the total volatile organic compound emission rates show decreases due to the increased control of Dri-Lube emissions.

Theory: *Changes in coating formulation may be causing the complaints.*

Conclusion: Some members of the public have suggested that a review of material invoices and formulation data would provide a basis for understanding any changes, which have occurred at the facility. Given both the number of different materials in use and the varying usage rates of these compounds over recent years, it was felt that a compound-by-compound review of formulations and usage rates would not necessarily provide the information needed to assess the production rate at the facility. Because the process is basically the same in all magnet wire coating machine ovens, the Division considers that the annual usage data for VOC, phenol and cresols presented in Attachment 3 presents a more meaningful picture of production, and therefore, emission changes, at the Superior Essex facility than would any analysis of coating formulations change.

Theory: *Noncompliance attributed to not having covers on the liquid coating feed tanks as required by 40 CFR 63 Subpart MMMM for magnet wire operations may have caused objectionable emissions or odors.*

Conclusion: While the work practice requirement of having lids on the tanks is a hazardous air pollutant regulation, the amount of emission reduction from having such lids is not believed to be enough to have caused citizen complaints. Lids were installed in the Fall of 2009 to bring the facility into compliance, and citizen complaints continued after the installation of the lids. A civil penalty assessment of $31,489 was issued on March 31, 2010, and Superior Essex paid the full amount on April 30, 2010, in response to the assessment.

Theory: "*After-bake" emissions from hot, smoldering wire insulation leaving the ovens to the take-up spools may be causing the complaints.*

Conclusion: There does not appear to be any correlation between visible after-bake emissions and measured volatile organic compound emission rates.

Division personnel periodically observed visible emissions emanating from the hot, coated wire as it exited from certain magnet wire coating machines – a phenomenon labeled "after-bake". A number of the wire coating machines have an exterior cooling chamber that cools the wire as it exits the oven. At these machines, visible emissions were significantly reduced. In addition, since these exterior cooling chambers have separate exhaust stacks, it was possible to quantify emissions through stack testing from the hot wire as it exited the wire coating machine.

The results of this stack testing indicated no significant emissions from the exterior cooling chambers. The cooling chambers are not connected to the oven, so there is no incineration of the cooling emissions. The logical conclusion is that there would be no technical justification to retrofit those ovens that lack cooling chambers.

A device called a "pressure box" is used to capture emissions from certain magnet wire coating machines. The pressure box creates an air curtain to pull air in the vicinity of the hot wire back into the oven for incineration. The oven is kept under negative pressure, so that the pressure box creates a "pull" type of air movement toward the oven wire exit orifices. While there is not a dedicated stack to serve these operations, there is a general area roof vent in close proximity to them. Testing of those vents did not indicate any significant emission differences from machines not having pressure boxes. However, in the General Process Description section of this report, it is stated that "(t)he roof vent emissions do not seem to vary considerably from different areas based on whether or not the magnet wire coating machines in those areas have pressure boxes. However, this does not necessarily mean that these devices are ineffective, because the emissions from various magnet wire coating machines are presumably intermixed at the upper level of the plant interior before exiting through the roof vents."

Theory: *When magnet wire coating machine enclosures are opened up for servicing to change the type of wire or type of coating, the temporary loss of capture efficiency may account for increased citizen complaints.*

Conclusion: Superior Essex reported that it can experience a loss of capture efficiency of up to fifty percent during intermittent periods of time when the machines are open to change types of wire or types of coating. It was discovered that recently, the machines have had to be opened more than in the past for this servicing due to customer-directed production runs, and the switch to aluminum wire for certain applications.

The Division's understanding is that Superior Essex has developed voluntary procedures to minimize coating emissions during these periods of having the magnet wire coating machines opened. These procedures include reducing the amount of time that the machines are opened, and using less solvent to prepare the machines for the new production run.

Division personnel requested that Superior Essex perform an experiment of opening several of the magnet wire coating machines to see if there was an increase in emissions from the roof vents. There was not a notable increase measured. The lack of a measured increase in emissions from the magnet wire coating machines when they were opened leads the Division to conclude that any increased emissions, from time periods when the magnet wire coating machines are opened, would be negligible. This is borne out by members of the test team, who noted that the magnet wire coating machine fans, which continued to operate when the magnet wire coating machines were opened, continued to draw fumes back into the machine.

Theory: *Some of the magnet wire coating machines were modified about two years ago to incinerate the previously un-incinerated Dri-Lube solvent, heptane, and to allow for the addition of six replacement magnet wire coating machines, while remaining below the major New Source Review threshold. It was postulated that the additional heptane solvent might overwhelm the oven burners, resulting in incomplete combustion.*

Conclusion: Stack testing shows no significant differences in volatile organic compound emissions from the same magnet wire coating machine during time periods when Dri-Lube solvent was being incinerated as compared to time periods when the Dri-Lube capture system was disabled, allowing all of the emissions from the Dri-Lube process to be emitted directly into the air.

Theory: *Since both the compliance testing required by Rule 1200-3-18-.19 of the Regulations and the compliance testing required by 40 CFR 63, Subpart MMMM (the MACT regulations) only required testing of representative magnet wire coating machines, could magnet wire coating machines that were not tested have much higher emissions than those reported for tested machines?*

Conclusion: Based upon the results of the source survey of all magnet wire coating machines, no high emitting machines were found.

General Observation

During the source testing of the Superior Essex facility, each magnet wire coating machine was operating normally during the actual test period. In order to obtain an estimate of facility-wide emissions, all machine oven exhausts, cooler exhausts, and roof vent stacks were tested. When roof vents were tested, the majority of the machines in the area of the roof vent being tested were operating. This ensured that the emissions results obtained were representative of normal facility operation.

Based upon the results of the testing program, the Division considers that the Superior Essex facility is demonstrating compliance with all applicable air pollution control emission limits.

Ambient Monitoring

Ambient air testing and surveillance patrols have been conducted as part of the agency investigation of citizen complaints. The ambient testing for phenol and cresols revealed extremely low levels that are expressed as nanograms (billionths or 10^{-9} of a gram) per cubic meter.

The ambient measurements were taken as twenty-four hour composite samples. The reason that a twenty-four hour sample procedure was chosen is that the scientific literature on exposures to air toxics is expressed in twenty-four hour average exposures. This facilitates an “apples to apples” comparison of ambient concentrations and recommended exposure concentration limits. The results of the ambient testing were forwarded to the Tennessee Department of Health and the United States Environmental Protection Agency for scientific peer review, as to the interpretation of the testing results. In a letter dated October 1, 2010, the United States Environmental Protection Agency agreed that the ambient concentrations measured during this study were significantly below the recommended exposure limits for the pollutants involved. A copy of this letter follows this section of the report as Attachment 5.

The ambient air sampling for this investigation was conducted over two time periods. The first period was at Moore Elementary School and used two monitors that were co-located to verify that the sampling and analysis procedures for phenol and cresols were producing valid, repeatable data. The co-located results at Moore Elementary School were acceptable. To maximize the resources allocated to the investigation, the second sampling period had one monitor at Winstead Elementary School, while the other monitor was placed at a location in the Sullivan Farms subdivision that was chosen in consultation with concerned members of the homeowners association.

The surveillance patrols were used primarily during the second ambient air-sampling period (at Winstead Elementary School and the Sullivan Farms subdivision). The patrol routes had pre-selected points where agency personnel would stop, sniff the air and make notations of observations. The points included the monitoring site areas and street addresses where citizen complainants resided. Most of the observations made by Division staff were categorized as “no odor detected.” On a few occasions, an odor was detected. A Division staff member residing in Franklin was on call to investigate when citizens reported detecting an odor. As shown in the patrol reports and summaries incorporated as an appendix of this report, response time from the citizen report to being on the scene was approximately 15-20 minutes. A graphic that plots the spatial distribution of the locations where inspections of the general neighborhood is included in Appendix D.

Odor

By definition odor involves one's olfactory perception, which can vary from person to person. For example, cigar smoke may be pleasant to some and offensive to others. For this reason the Tennessee Air Pollution Control Board has not elected to regulate odor as a form of air pollution. Instead, the Board has elected to regulate air pollution as air emission concentrations that focus on the protection of public health and public welfare. If a person is aggrieved by odors, then the person may wish to pursue a private action.

Attachment 1. Reported Emissions of Phenol Cresols, and VOC, Annual Basis

Year	Phenol (pounds released)	Cresols (pounds released)	VOC, (tons released)
2004	9,186	2336	155.7
2005	9,036	2217	175.5
2006	8,295	2054	141.2
2007	15,117	2766	131.3
2008	20,838	5077	138.1
2009	19,931	9273	91.48

Note that Phenol and Cresols are both VOC
There are three isomers (types) of cresol

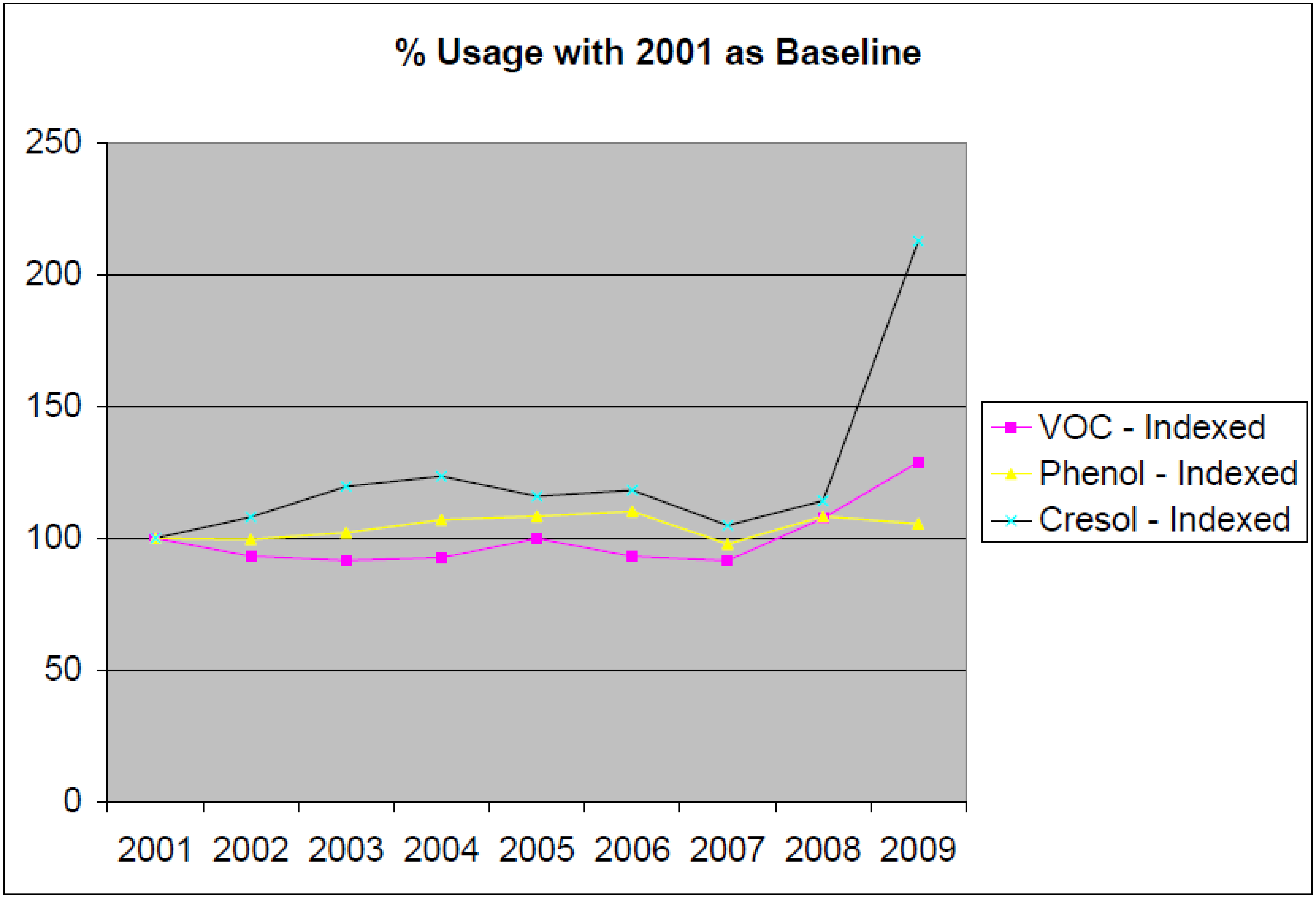
Source: Data reported to APC.

Attachment 2. Destruction Efficiencies used for calculations, by Oven Set

		Pre-2007		**2007-2009**		**2010-present**		
Oven Numbers	**Model**	**Destruction Efficiency**	**Reference**	**Destruction Efficiency**	**Reference**	**Oven sets**	**Destruction Efficiency**	**Reference**
201-212	SX-525	99.3	Stack test @ plant, 3/24/1994	99.4	Stack test @ plant, 11/2006	**201-206, 208-212**	99.4	Stack test @ plant, 11/2006
213-216	V-22	99.99	Stack test on a comparable unit @ Vincennes, 12/12/1995	98.6	Stack test @ plant, 11/2006	**207, 213-216**	98.6	Stack test @ plant, 11/2006
301-312	SICME 2NEMG	97.3	Stack test @ plant, 3/24/1994	94.9	Stack test @ plant, 11/2006	**301-306**	94.9	Stack test @ plant, 11/2006
313-316	SICME SEL 575	98.5	Mfr.'s data per 8/5/1997 Title V application	99.8	Stack test @ plant, 11/2006	**313-316**	99.8	Stack test @ plant, 11/2006
317	DEA TECH	98.5	Mfr.'s data per 8/5/1997 Title V application	99.4	Stack test @ plant, 11/2006	**317**	99.4	Stack test @ plant, Nov. 2006
217-220	V-22	NA	NA	98.6	Used stack test results from 213-216	**217-220**	98.6	Used stack test results from 213-216
601-602	V-14	NA	NA	99.9	Stack test on a comparable unit @ Vincennes, Sept. 2004	**601-602**	99.9	Stack test on a comparable unit @ Vincennes, Sept. 2004

When 209 is replaced it will use same destruction efficiency number as 213-216

Attachment 3. Relative Usage Rates of VOC, Phenol, and Cresols



Attachment 4. Comparison of HAP Emissions Based on Revised Destruction Efficiencies

Essex Group, Inc. - 94-0072

Speciated HAPS - 2006 as reported

Month	Phenol	Cresols	Xylene	Ethyl Benzene	Cumene	Methanol	Total
Jan	767	186	182	49	1	0	**1185**
Feb	742	164	156	43	1	0	**1108**
Mar	816	206	226	61	1	1	**1312**
April	878	235	265	74	3	0	**1456**
May	620	139	181	51	2	1	**993**
June	907	253	313	87	1	1	**1561**
July	710	180	356	102	4	0	**1353**
August	621	165	274	76	3	2	**1140**
September	603	147	214	60	2	2	**1028**
October	638	146	242	68	2	2	**1098**
November	513	111	57	14	1	2	**698**
December	429	111	230	65	2	2	**840**
Totals	**8243**	**2043**	**2697**	**751**	**23**	**14**	**13771**

Speciated HAPS - 2006 - using 2007 destruction efficiencies

Month	Phenol	Cresols	Xylene	Ethyl Benzene	Cumene	Methanol	Total
Jan	1447	355	239	62	1	4	**2107**
Feb	1396	318	201	54	2	4	**1974**
Mar	1578	420	299	79	2	5	**2383**
April	1771	489	340	92	4	4	**2700**
May	1170	277	213	59	2	5	**1725**
June	1641	465	391	106	3	5	**2610**
July	1297	355	423	117	5	3	**2201**
August	1236	324	321	87	4	7	**1978**
September	1282	331	273	75	4	7	**1972**
October	1188	285	280	76	3	6	**1837**
November	1022	248	103	25	2	5	**1404**
December	756	211	271	75	2	6	**1320**
Totals	**15783**	**4076**	**3353**	**905**	**34**	**60**	**24212**

All values in pounds, after controls

Attachment 5. EPA Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

2010 OCT -7 AM 11: 47

OCT 0 1 2010

Barry R. Stephens, Director
Division of Air Pollution Control
Department of Environment and Conservation
401 Church Street
Nashville, TN 37243-1531

RE: Review of Essex Group (Ref. 94-0072) Magnet Wire Production

Dear Mr. Stephens,

We have received and reviewed the document entitled "Review of Essex Group (Ref. 94-0072) Magnet Wire Production" which describes processes associated with the manufacture of magnet wire. The document also contains ambient monitoring results obtained from a short-term study conducted by the Tennessee Department of Environment and Conservation (TDEC) to assess the levels of phenols and cresols in nearby communities. This short term study mirrored the Environmental Protection Agency's School Air Toxic monitoring protocol. The results include comparisons to risk levels and odor thresholds. Based on our review of the monitoring results for these two pollutants, there does not appear to be an unacceptable potential health risk. We look forward to receiving a copy of the final report.

If you have further questions or require additional information, please contact me at, (404-562-9097) or either Dr. Solomon Pollard (404-562-9180) or Donnette Sturdivant (404-562-9431) of the Air Toxics Assessment and Implementation Section.

Sincerely,

Douglas Neeley

R. Douglas Neeley, Chief
Air Toxics and Monitoring Branch

Appendix A Sampling Survey

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF AIR POLLUTION CONTROL
9th Floor, L & C Annex
401 Church Street
Nashville, Tennessee 37243-1531

SAMPLING SURVEY

FOR THE

MAGNET WIRE COATING MACHINE OVEN EXHAUST STACKS, COOLER EXHAUST DUCTS AND ROOF VENTS

AT

ESSEX GROUP, INC.

94-0072

Introduction

Essex Group, Inc. (also known as Superior Essex) owns and operates a magnet wire manufacturing facility located at 120 SE Parkway in Franklin, Tennessee. The emissions of volatile organic compounds and hazardous air pollutants from the Essex facility are limited by several state and federal regulations, which are set forth in the recently issued Title V permit (#556509) for the facility. Specifics of these regulations are as follows:

(1) Condition E3-2 of the permit limits the emissions of volatile organic compounds from the entire facility to 235.0 tons per any consecutive twelve-month time period.
(2) Condition E3-5 of the permit requires control of volatile organic compound emissions consistent with the requirements of the federal control technology guidance document for magnet wire coating (Division Rule 1200-3-18-.19).
(3) Condition E3-6 of the permit requires control of hazardous air pollutants consistent with the requirements of the federal National Emission Standards for Hazardous Air Pollutants for Surface Coating of Miscellaneous Metal Parts and Products, which specifically apply to magnet wire coating operations (40 CFR 63-Subpart MMMM).
(4) Condition E3-10 of the permit requires that Reasonably Available Control Technology be utilized for the application of wire lubricant to certain coating machines (Tennessee Air Pollution Control Board Order 94-14 adopted on April 13, 1994.

The primary objective of this testing program was to perform an audit of each magnet wire coating machine oven exhaust, cooler exhaust and each building vent exhaust above the wire machines. An air sample was taken by a Tedlar bag sample train from each exhaust and vent as per Method 18 and analyzed by flame ionization detection (fid). During this analysis total volatile organic compounds (VOC) was measured by fid and methane gas was measured by passing the sample gas through a carbon trap prior to the same fid. Total non-methane VOC's (measured as propane) was calculated by the subtraction of methane (measured as propane) from the total VOC (measured as propane). In concurrence with this sampling, flow, temperature, and representative moisture measurements were documented. All of the 90 emission points were audited and an additional seven operating scenarios were audited.

For the Division of Air Pollution Control, Alvin Pratt, Bryan Parker, Steve Morgan, Erin Tays, and Jonathan Bradley performed the testing. Greg Forte and Younes Aleali monitored and documented the process operations. Jeff Twaddle of ERM consultants and Bob Distler of Essex Corporation, coordinated process operations and testing schedules and facilitated testing requirements. Alvin Pratt prepared this report under the review of Jeryl Stewart.

A detailed discussion of the operation of the Superior Essex facility during the testing period (General Process Description) was prepared for inclusion in the overall Division report addressing the current situation with respect to the Superior Essex facility and is not included as a part of this report.

Test Conditions and Technical Approach

The following sections describe the methods and techniques that were used to complete the audit testing on the wire machine exhaust stacks and vent outlets

Test Conditions

The Superior Essex magnet wire coating machines were operated at the normal production rate during the audit testing period. During specific audit testing scenarios such as cleaning or wire changeovers etc., the operating conditions were agreed upon prior to testing. The audit test matrix that was utilized during the testing program is summarized in the following table.

Sampling Location	Volumetric Flow Rate	Moisture Content	VOC Analysis
Oven Exhaust	Method 2	Method 4	Method 18/25A
Cooler Exhaust	Hot Wire Anemometer	Wet Bulb/Dry Bulb	Method 18/25A
Vent Exhaust	Hot Wire Anemometer	Wet Bulb/Dry Bulb	Method 18/25A

Prior to sampling, the probe and sample line was purged through the three-way valve. For conducting sampling for volatile organic compound emissions from the source exhaust gas stream, an integrated gas sample was collected at a sampling rate of approximately 0.4 liter per minute for a specified period of time (20 minutes) for a total sample volume of approximately 8 liters.

The sample gas was collected in 10 liter Tedlar Bags. The Tedlar bag samples were analyzed utilizing a TECO flame ionization detector (fid). The sample was delivered to a fid measuring total VOC content as propane. After obtaining the total VOC content reading the sample was sent though a charcoal trap prior to analysis by the same fid. The charcoal trap removes most organic compounds other than methane thereby measuring methane content as propane. Other organic compounds not absorbed by charcoal are not expected in this gas stream. The non-methane VOC content (as propane) will be calculated by subtracting the methane (measured as propane) from the total VOC content (measured as propane).

Prior to analysis the fid's were calibrated according to procedures outlined in EPA Method 25A. Stack temperature, moisture content, and volumetric flow rate were measured during the test period. Wet bulb/ dry bulb measurements were utilized when applicable and EPA Method 4 when necessary. Volumetric flow rates were measured utilizing a hot-wire anemometer on sources with lower stack temperatures and EPA method 2 when temperatures were higher.

Alternate Operating Conditions

In addition to collecting samples during normal facility operation, samples were collected and analyzed during certain specific operating conditions to determine if there were any changes in emissions associated with these specific operational conditions. The operational conditions addressed are as follows:

(1) The cleaning of a magnet wire coating machine during a changeover from one gauge of wire to another. This is designated as **Changeover** in the following emissions summary tables.
(2) As originally constructed the solvent loss from the application of lubricant to the coated magnet wire was completely uncontrolled. Currently a number of the magnet wire coating machines control the emissions from the lubricant application by ducting it back into the magnet wire

coating machine for incineration in the oven. To determine the effect of the lubricant incineration on emissions on three magnet wire coating machines where the lubricant application is controlled were sampled with the lubricant application emissions capture system temporarily disconnected to simulate a magnet wire coating machine with no lubricant emissions controls. This is designated as **DL open** in the following emissions summary tables. Where this occurred at a magnet wire coating machine processing aluminum wire it is designated **DL open, Al wire** in the following emissions tables.

(3) Since phenol has a melting point of about 109 degrees F, a sample run was conducted with a filter in the sampling probe to determine if any of the volatile organic compounds being emitted were in a solid form. This is designated **Filtered** in the following emission tables.

(4) All of the magnet wire coating machines have service doors that are closed during normal operation. Comparison sampling of the adjacent roof vents was conducted for two pairs of machines both with the access doors closed and with them open for comparison. This is designated **Doors open** in the following emissions tables.

After evaluating the emissions data obtained, it is the conclusion of the Division that none of the alternate operating scenarios evaluated resulted in any appreciable change in the emissions from the facility.

SAMPLING METHODS

The sampling and analytical procedures used during this test program were those established by the US EPA and TDEC-APCD. For this sampling audit some of the testing was abbreviated to expedite the sampling program. Testing was conducted during normal operating conditions.

SAMPLING AND ANALYTICAL PROCEDURES

The sampling and analytical program for measuring the gas stream concentration for Volatile Organic Compounds (VOC's) concentration was conducted based on procedures described in the EPA Method 18.

Method 25A

Volatile Organic Compound emissions were measured utilizing EPA Method 25A as outlined in the Code of Federal Regulations, Volume 40, Part 60 Appendix A. The gas sample was drawn from the Tedlar bag where it was delivered to the analyzer. The analyzer output was manually input to a computer where the data was recorded on a pre-designed Excel spreadsheet and saved.

The Volatile Organic Compound Analyzer utilized was the Thermo Environmental Instruments Model 51HT. The microprocessor-based 51HT flame ionization detector analyzer measures VOC concentration based on the constituents of the calibration gases. All gases utilized in the operation of this analyzer were propane in nitrogen. The analyzer was fueled with zero air and a 40% hydrogen, 60% helium gas mixture.

Quality Control

Prior to analysis the fid's were calibrated according to procedures outlined in EPA Method 25A. All gases utilized for calibration were Scott EPA certified protocol gases

To insure that no carryover from previous testing was occurring, sample bags were periodically analyzed then evacuated and filled with zero gas and reanalyzed. A sample bag was correlated with a direct heated sample line measurement to insure that no losses were occurring in the Tedlar bag sample. Duplicate samples were taken sporadically to insure reproducibility.

Results

Testing was completed on March 10, 2010 at the Superior Essex facility located in Franklin, Tennessee. The results of this emissions audit determined that all volatile organic compound emissions from the Superior Essex facility have a very low concentration with no high emission deviations noted from any of the emission points sampled. It was noted that the over 95% of the reported emissions came from the roof vents. The total VOC emissions (assuming 100% phenol) from the plant, during the testing, period was measured at 24.44 pounds per hour. This calculates to 107 ton per year of VOC for the facility (assuming wire coating machines are operating 100% of the time). This is significantly less than the 235 ton per year allowed by Condition E3-2. of permit #556509. The results from the testing closely correlates previous testing conducted with the portable fid/pid (flame ionization detection/photoionization detection).

Conclusions

Visible inspection of this facility along with the testing results contained in this report indicate that the facility is operating in compliance with the requirements set forth in Title V Permit #556509 including the Code of Federal Regulations, Title 40 Part 63 (40 CFR 63), Subpart MMMM, "National Emission Standards for Hazardous Air Pollutants (NESHAPS), Standard for the Surface Coating of Miscellaneous Metal Parts and Products. The air pollution control devices associated with the magnet wire coating machine ovens are extremely efficient and emissions from the oven exhausts were extremely low. The major source of the VOC emissions are the roof vents and these emissions may represent a variety of compounds at low levels. Housekeeping (keeping all doors on oven closed at all times and the prevention and immediate cleanup of all spills) could be improved and should be monitored. Failure to eliminate leaks and contain spills will result in the need to enclose problem areas.

DETERMINATION OF GASEOUS POLLUTANT EMISSIONS
Example Calculations

Run No. 315W Source: Oven Exhaust

PPM= 0.400 Measured concentration of Non-Methane Volatile Organic Compounds (NMVOC), as Carbon, dry basis, at standard conditions (ppmv)

$Q_{s(std)}$ = 58 dscfm, volumetric flow rate of gas stream, corrected to dry standard conditions.

Nomenclature and Equations for Emissions Calculations

K_3 = 2.590E-09 Mass to volume conversion factor at standard conditions (2.59×10^{-9} M lb/ dscf per ppm)

M_i = 12.0 Molecular weight of Carbon (lb/lb-mole)

C_i = 1.24E-08 Mass per volume NMVOC, dry basis, at standard conditions (lb/dscf).
$PPM*K_3*M$

PMR_c= 0.00004 Pollutant mass rate of NMVOC, as Carbon (lb/hr)
$C_i * Q_{s(std)}$ * (60 min/hr)

PMR_{Phenol}= 0.000057 Pollutant mass rate of NMVOC, as Phenol (lb/hr)
PMR_C * (VOC to Carbon Weight Ratio)

Oven Exhaust						
Source	NMVOC	$Q_{s(std)}$	M_i	C_i	PMR_C	PMR_{Phenol}
	(ppm)	(dscfm)	(lb/lb-mole)	(lb/dscf)	(lb/hr)	(lb/hr)
315W	0.4	58	12.0	1.24E-08	0.00004	0.00006
315E	0.3	60	12.0	9.32E-09	0.00003	0.00004
314W	0.5	60	12.0	1.55E-08	0.00006	0.00007
314E	0.4	50	12.0	1.24E-08	0.00004	0.00005
317W	4.3	48	12.0	1.34E-07	0.00038	0.00050
317E	8.1	70	12.0	2.52E-07	0.00106	0.00138
316E	0.8	48	12.0	2.49E-08	0.00007	0.00009
316W	0.6	48	12.0	1.86E-08	0.00005	0.00007
218E	2.3	635	12.0	7.15E-08	0.00272	0.00356
218W	3.4	645	12.0	1.06E-07	0.00409	0.00534
219E	0.7	646	12.0	2.18E-08	0.00084	0.00110
219W	2.3	527	12.0	7.15E-08	0.00226	0.00295

Mass Emission Rates as NMVOC , Phenol
Essex Corporation

Oven Exhaust						
Source	NMVOC	$Q_{s(std)}$	M_i	C_i	PMR_C	PMR_{Phenol}
	(ppm)	(dscfm)	(lb/lb-mole)	(lb/dscf)	(lb/hr)	(lb/hr)
220W	1.0	482	12.0	3.11E-08	0.00090	0.0012
220W (Changeover)	***1.2***	***496***	***12.0***	***3.73E-08***	***0.00111***	***0.0015***
217E	0.9	421	12.0	2.80E-08	0.00071	0.0009
217W	0.7	560	12.0	2.18E-08	0.00073	0.0010
217W (DL open)	***1.4***	***558***	***12.0***	***4.35E-08***	***0.00146***	***0.0019***
220E	0.3	651	12.0	9.32E-09	0.00036	0.0005
602W	2.3	535	12.0	7.15E-08	0.00229	0.0030
301	5.2	2168	12.0	1.62E-07	0.02102	0.0275
302	4.6	2387	12.0	1.43E-07	0.02048	0.0268
303	3.9	2899	12.0	1.21E-07	0.02108	0.0276
601W	0.9	571	12.0	2.80E-08	0.00096	0.0013
601W (DL open)	***0.9***	***566***	***12.0***	***2.80E-08***	***0.00095***	***0.0012***
601W (Filtered)	***0.9***	***566***	***12.0***	***2.80E-08***	***0.00095***	***0.0012***
602E	5.6	510	12.0	2.80E-08	0.00086	0.0011
601E	1.9	587	12.0	2.80E-08	0.00099	0.0013
304	17.4	2535	12.0	1.74E-07	0.02647	0.0346
305	6.4	2327	12.0	5.91E-08	0.00824	0.0108
306	3.9	2809	12.0	5.41E-07	0.09115	0.1191
313E	1.4	214	12.0	1.99E-07	0.00255	0.0033
313W	0.9	42	12.0	1.21E-07	0.00031	0.0004
201-204	1.7	4397	12.0	4.35E-08	0.01148	0.0150
205	2.3	982	12.0	2.80E-08	0.00165	0.0022
207W	1.1	617	12.0	3.42E-08	0.00044	0.0006
207E	0.4	494	12.0	1.24E-08	0.00003	0.0000
208	2.6	638	12.0	8.08E-08	0.02132	0.0279
209	3.8	902	12.0	1.18E-07	0.00696	0.0091
210	3.9	850	12.0	1.21E-07	0.00449	0.0059
211	2.5	795	12.0	7.77E-08	0.00230	0.0030
212	1.0	685	12.0	3.11E-08	0.00119	0.0016
216E	3.1	488	12.0	9.63E-08	0.00521	0.0068
216W	3.0	468	12.0	9.32E-08	0.00476	0.0062
214W	6.8	470	12.0	2.11E-07	0.01008	0.0132
214E	3.0	504	12.0	9.32E-08	0.00383	0.0050
213W	2.9	427	12.0	9.01E-08	0.00264	0.0034
213E	4.6	451	12.0	1.43E-07	0.00401	0.0052
212 (DL open, Al wire)	***1.8***	***767***	***12.0***	***5.59E-08***	***0.00158***	***0.0021***
206 (Changeover)	***0.9***	***1264***	***12.0***	***2.80E-08***	***0.00085***	***0.0011***
206	1.0	1282	12.0	3.11E-08	0.00080	0.0010
215E	5.0	472	12.0	1.55E-07	0.00421	0.0055
215W	2.0	488	12.0	6.22E-08	0.00286	0.0037

Duplicate samples were not included in totals.

Total Oven Emissions 0.391

Mass Emission Rates as NMVOC , Phenol

Essex Corporation

Roof Vents						
Source	NMVOC	$Q_{s(std)}$	M_i	C_i	PMR_C	PMR_{Phenol}
	(ppm)	(dscfm)	(lb/lb-mole)	(lb/dscf)	(lb/hr)	(lb/hr)
315E	14.2	20828	44.1	1.62E-06	2.027	2.65
220W (Changeover)	6.5	18721	44.1	7.42E-07	0.834	1.09
#4(RV 45)	9.0	25336	44.1	1.03E-06	1.563	2.04
#5 (RV46)	7.6	18612	44.1	8.68E-07	0.969	1.27
202	9.2	22951	44.1	1.05E-06	1.447	1.89
201	6.3	32372	44.1	7.20E-07	1.398	1.83
203	9.7	26122	44.1	1.11E-06	1.736	2.27
204	12.0	31854	44.1	1.37E-06	2.620	3.42
205	3.7	28244	44.1	4.23E-07	0.716	0.94
207	2.0	31437	44.1	2.28E-07	0.431	0.56
208	1.9	32696	44.1	2.17E-07	0.426	0.56
209	2.0	27350	44.1	2.28E-07	0.375	0.49
210	1.8	25505	44.1	2.06E-07	0.315	0.41
211	2.5	6858	44.1	2.86E-07	0.117	0.15
212	2.4	19206	44.1	2.74E-07	0.316	0.41
216E	1.4	16012	44.1	1.60E-07	0.154	0.20
216W	1.5	18709	44.1	1.71E-07	0.192	0.25
214	2.0	20289	44.1	2.28E-07	0.278	0.36
213	1.7	19283	44.1	1.94E-07	0.225	0.29
215	1.3	16993	44.1	1.48E-07	0.151	0.20
206 (Changeover)	***3.6***	***30092***	***44.1***	***4.11E-07***	***0.742***	***0.97***
206	3.2	28003	44.1	3.66E-07	0.614	0.80
212 (DL open)	***2.9***	***17166***	***44.1***	***3.31E-07***	***0.341***	***0.45***
601-602	5.9	19604	44.1	6.74E-07	0.793	1.04
217-218	2.0	16141	44.1	2.28E-07	0.221	0.29
601-602 (Doors open)	***6.5***	***18731***	***44.1***	***7.42E-07***	***0.834***	***1.09***
217-218 (Doors open)	***2.2***	***21215***	***44.1***	***2.51E-07***	***0.320***	***0.42***

Duplicate samples were not included in totals.

Total 23.42

Cooler Exhausts						
Source	NMVOC	$Q_{s(std)}$	M_i	C_i	PMR_C	PMR_{Phenol}
	(ppm)	(dscfm)	(lb/lb-mole)	(lb/dscf)	(lb/hr)	(lb/hr)
315W	12.6	297	44.1	1.44E-06	0.026	0.034
314W	7.8	604	44.1	8.91E-07	0.032	0.042
317W	6.3	517	44.1	7.20E-07	0.022	0.029
317E	5.8	536	44.1	6.62E-07	0.021	0.028
316E	6.2	1581	44.1	7.08E-07	0.067	0.088
316W	6.8	1630	44.1	7.77E-07	0.076	0.099
218E	1.0	1174	44.1	1.14E-07	0.008	0.011
218W	0.3	1088	44.1	3.43E-08	0.002	0.003
219E	7.9	193	44.1	9.02E-07	0.010	0.014
219W	1.7	145	44.1	1.94E-07	0.002	0.002
220W	2.8	1201	44.1	3.20E-07	0.023	0.030
220W (Changeover)	2.5	1448	44.1	2.86E-07	0.025	0.032
217E	4.0	1203	44.1	4.57E-07	0.033	0.043
217W	2.6	1251	44.1	2.97E-07	0.022	0.029
217W (DL open)	2.4	1311	44.1	2.74E-07	0.022	0.028
220E	3.6	1056	44.1	4.11E-07	0.026	0.034
602W	2.2	115	44.1	2.51E-07	0.002	0.002
601W	2.4	1580	44.1	2.74E-07	0.026	0.034
601W (DL open)	3.1	1580	44.1	3.54E-07	0.034	0.044
601W (Filtered)	2.8	1556	44.1	3.20E-07	0.030	0.039
602E	2.5	1409	44.1	2.86E-07	0.024	0.032
601E	2.1	1543	44.1	2.40E-07	0.022	0.029
313E	8.3	236	44.1	9.48E-07	0.013	0.018
313W	8.6	439	44.1	9.82E-07	0.026	0.034
				Total		0.63

Total Plant VOC Emissions 24.44

Volatile Organic Compound Sampling Survey

Essex Corporation, Franklin, TN

Oven Exhausts									
Wire Coating	Concentration (ppm) as					Barometric	Volume H_2O	Meter	Moisture
Machine No.	VOC	Methane	NMVOC	Carbon	Phenol	Pressure	Collected	Temp	Content
315W	0.8	0.4	0.4	1.2	0.2	29.25	1.7	58	0.009
315E	0.9	0.6	0.3	0.9	0.2	29.15	3.6	55	0.02
314W	0.7	0.2	0.5	1.5	0.3	29.35	2.6	38.8	0.014
314E	0.8	0.4	0.4	1.2	0.2	29.35			0.02
317W	4.4	0.1	4.3	12.9	2.2	29.58	1.2	47.8	0.006
317E	9.7	1.6	8.1	24.3	4.1	29.35			0.006
316E	0.9	0.1	0.8	2.4	0.4	29.46			0.02
316W	1.6	1.0	0.6	1.8	0.3	29.45			0.02
218E	2.5	0.2	2.3	6.9	1.2	29.45	5.8	88	0.035
218W	3.8	0.4	3.4	10.2	1.7	29.7			0.035
219E	1.4	0.7	0.7	2.1	0.4	29.8			0.035
219W	5.8	3.5	2.3	6.9	1.2	29.8			0.035
220W	1.6	0.6	1.0	3.0	0.5	29.8			0.035
220W (Changeover)	1.5	0.3	1.2	3.6	0.6	29.8			0.035
217E	1.4	0.5	0.9	2.7	0.5	29.66			0.035
217W	1.5	0.8	0.7	2.1	0.4	29.66			0.035
217W (DL open)	2.7	1.3	1.4	4.2	0.7	29.66			0.035
220E	3.2	2.9	0.3	0.9	0.2	29.7			0.035
602W	3.1	0.8	2.3	6.9	1.2	29.7			0.035
301	8.9	3.7	5.2	15.6	2.6	29.7	2	54	0.012
302	9.5	4.9	4.6	13.8	2.3	29.7			0.012
303	21.8	17.9	3.9	11.7	2.0	29.7			0.012
601W	1.7	0.8	0.9	2.7	0.5	29.4			0.035
601W (DL open)	1.7	0.8	0.9	2.7	0.5	29.4			0.035
601W (Filtered)	1.8	0.9	0.9	2.7	0.5	29.4			0.035
602E	13.5	7.9	5.6	16.8	2.8	29.4			0.035
601E	4.8	2.9	1.9	5.7	1.0	29.4			0.035
304	44.9	27.5	17.4	52.2	8.7	29.5			0.012
305	39.3	32.9	6.4	19.2	3.2	29.5			0.012
306	9.6	5.7	3.9	11.7	2.0	29.5			0.012
313E	2	0.6	1.4	4.2	0.7	29.5			0.02
313W	1.5	0.6	0.9	2.7	0.5	29.5			0.02
201-204	4.3	2.6	1.7	5.1	0.9	29.8	5.9	56.4	0.032
205	3.2	0.9	2.3	6.9	1.2	29.8			0.018
207W	2.2	1.1	1.1	3.3	0.6	29.8			0.018
207E	1.3	0.9	0.4	1.2	0.2	29.8			0.018
208	7.2	4.6	2.6	7.8	1.3	29.8			0.02
209	4.8	1	3.8	11.4	1.9	29.8			0.02
210	4.6	0.7	3.9	11.7	2.0	29.8			0.02
211	3.1	0.6	2.5	7.5	1.3	29.8			0.02
212	1.1	0.1	1	3.0	0.5	29.8			0.02
216E	5.5	2.4	3.1	9.3	1.6	29.46	3.8	76	0.028
216W	5.1	2.1	3	9.0	1.5	29.46			0.028
214W	10.5	3.7	6.8	20.4	3.4	29.46			0.028
214E	5.7	2.7	3	9.0	1.5	29.46			0.028
213W	5.6	2.7	2.9	8.7	1.5	29.46			0.028
213E	9.6	5	4.6	13.8	2.3	29.46			0.028
212 (DL open, Al wire)	2.8	1	1.8	5.4	0.9	29.36			0.02
206 (Changeover)	1.6	0.7	0.9	2.7	0.5	29.36			0.018
206	1.9	0.9	1	3.0	0.5	29.36	3	81	0.018
215E	8.6	3.6	5	15.0	2.5	29.36			0.028
215W	3.8	1.8	2	6.0	1.0	29.36			0.028

Volatile Organic Compound Sampling Survey

Essex Corporation, Franklin, TN

Roof Vents										
Wire Coating	Concentration (ppm) as					Barometric	Wet	Dry	Static	Moisture
Machine No.	VOC	Methane	NMVOC	Carbon	Phenol	Pressure	Bulb	Bulb	Pres.	Content
315E	30.9	16.7	14.2	42.6	7.1	29.15	71	91	0.00	0.021
220W (Changeover)	19.6	13.1	6.5	19.5	3.3	29.80	65	95	0.00	0.013
#4(RV 45)	29.5	20.5	9.0	27.0	4.5	29.50	71	98	0.01	0.019
#5 (RV46)	23.5	15.9	7.6	22.8	3.8	29.50	71	95	0.01	0.020
202	17.1	7.9	9.2	27.6	4.6	29.80	72	106	0.01	0.018
201	13	6.7	6.3	18.9	3.2	29.80	74	101	0.01	0.021
203	21.4	11.7	9.7	29.1	4.9	29.80	74	108	0.01	0.020
204	13.8	1.8	12.0	36.0	6.0	29.80	66	103	0.01	0.012
205	15.4	11.7	3.7	11.1	1.9	29.80	66	102	0.01	0.012
207	35.8	33.8	2.0	6.0	1.0	29.86	66	88	0.01	0.016
208	18.7	16.8	1.9	5.7	0.9	29.86	67	95	0.01	0.015
209	13.3	11.3	2.0	6.0	1.0	29.86	62	94	0.01	0.010
210	9.7	7.9	1.8	5.4	0.9	29.86	67	102	0.01	0.013
211	8.8	6.3	2.5	7.5	1.3	29.86	68	105	0.01	0.013
212	12.3	9.9	2.4	7.2	1.2	29.86	71	109	0.01	0.016
216E	4	2.6	1.4	4.2	0.7	29.46	76	106	0.01	0.023
216W	4	2.5	1.5	4.5	0.8	29.46	75	101	0.01	0.023
214	4.7	2.7	2.0	6.0	1.0	29.46	76	102	0.01	0.024
213	4.9	3.2	1.7	5.1	0.9	29.46	74	96	0.01	0.023
215	4.3	3	1.3	3.9	0.7	29.36	84	105	0.01	0.035
206 (Changeover)	15.7	12.1	3.6	10.8	1.8	29.36	75	91	0.01	0.026
206	17.1	13.9	3.2	9.6	1.6	29.36	77	93	0.01	0.028
212 (DL open)	10.6	7.7	2.9	8.7	1.5	29.36	75	104	0.01	0.022
601-602	20.5	14.6	5.9	17.7	3.0	29.36	75	101	0.01	0.023
217-218	11.4	9.4	2.0	6.0	1.0	29.36	75	102	0.01	0.023
601-602 (Doors open)	20.9	14.4	6.5	19.5	3.3	29.36	81	100	0.01	0.032
217-218 (Doors open)	11.8	9.6	2.2	6.6	1.1	29.36	81	102	0.01	0.031

Cooler Exhausts										
Wire Coating	Concentration (ppm) as					Barometric	Wet	Dry	Static	Moisture
Machine No.	VOC	Methane	NMVOC	Carbon	Phenol	Pressure	Bulb	Bulb	Pres.	Content
315W	15.5	2.9	12.6	37.8	6.3	29.15	85.0	104.0	-0.01	0.0369
314W	10.3	2.5	7.8	23.4	3.9	29.35	72.0	111.0	-0.01	0.0168
317W	8.5	2.2	6.3	18.9	3.2	29.35	77.0	117.0	0.03	0.0214
317E	8.0	2.2	5.8	17.4	2.9	29.35	72.0	98.0	0.03	0.0202
316E	8.4	2.2	6.2	18.6	3.1	29.46	74.0	114.0	-0.01	0.0183
316W	9.6	2.8	6.8	20.4	3.4	29.41	76.0	117.0	0.01	0.0200
218E	9.9	8.9	1.0	3.0	0.5	29.45	62.0	83.0	-1.20	0.0137
218W	5.9	5.6	0.3	0.9	0.2	29.7	62.0	75.0	-1.20	0.0157
219E	8.0	0.1	7.9	23.7	4.0	29.8	65.0	98.0	-0.05	0.0123
219W	3.1	1.4	1.7	5.1	0.9	29.8	70.0	95.0	-0.03	0.0184
220W	7.2	4.4	2.8	8.4	1.4	29.8	68.0	105.0	-1.80	0.0136
220W (Changeover)	7.3	4.8	2.5	7.5	1.3	29.8	71.0	2.0	-1.20	0.0446
217E	12.7	8.7	4.0	12.0	2.0	29.66	70.0	91.0	-1.40	0.0196
217W	6.6	4.0	2.6	7.8	1.3	29.66	61.0	72.0	-1.30	0.0156
217W (DL open)	6.9	4.5	2.4	7.2	1.2	29.66	62.0	73.0	-1.10	0.0162
220E	9.7	6.1	3.6	10.8	1.8	29.7	64.0	92.0	-1.00	0.0130
602W	3.8	1.6	2.2	6.6	1.1	29.7	61.0	64.0	0.05	0.0176
601W	6.2	3.8	2.4	7.2	1.2	29.4	60.8	64	-2.00	0.0177
601W (DL open)	6.7	3.6	3.1	9.3	1.6	29.4	61	64	-2.00	0.0179
601W (Filtered)	6.3	3.5	2.8	8.4	1.4	29.4	60	74	-2.00	0.0143
602E	6.6	4.1	2.5	7.5	1.3	29.4	64	71	-2.00	0.0189
601E	5.9	3.8	2.1	6.3	1.1	29.4	64	77	-2.00	0.0173
313E	12.8	4.5	8.3	24.9	4.2	29.5	80	105	0.44	0.0285
313W	13.4	4.8	8.6	25.8	4.3	29.5	80	104	0.44	0.0288

Volumetric Flow Rate Measurements
Essex Corporation

Oven Exhaust					
Wire Coating	Dia.	A_s	Sqrt.	Velocity	Volumetric Flow
Machine No.	in.	ft^2	Delta P	ft/min	Rate (dscfm)
315W	5.5	0.16	0.164	862	58
315E	5.5	0.16	0.167	858	60
314W	5.5	0.16	0.167	861	60
314E	5.5	0.16	0.141	728	50
317W	7.5	0.31	0.071	364	48
317E	7.5	0.31	0.091	410	70
316E	5.5	0.16	0.130	654	48
316W	5.5	0.16	0.133	677	48
218E	12	0.79	0.437	2630	635
218W	12	0.79	0.441	2623	645
219E	12	0.79	0.447	2669	646
219W	12	0.79	0.348	2022	527
220W	12	0.79	0.330	1942	482
220W (Changeover)	12	0.79	0.336	1976	496
217E	12	0.79	0.286	1715	421
217W	12	0.79	0.387	2299	560
217W (DL open)	12	0.79	0.385	2291	558
220E	12	0.79	0.451	2683	651
602W	12	0.79	0.368	2181	535
301	24	3.14	0.231	870	2168
302	24	3.14	N/A	1100*	2387
303	24	3.14	0.314	1201	2899
601W	12	0.79	0.395	2356	571
601W (DL open)	12	0.79	0.391	2326	566
601W (Filtered)	12	0.79	0.391	2326	566
602E	12	0.79	0.351	2103	510
601E	12	0.79	0.384	2165	587
304	24	3.14	0.291	1176	2535
305	24	3.14	N/A	1100*	2327
306	24	3.14	N/A	1100*	2809
313E	10.5	0.60	0.164	841	214
313W	5.5	0.16	0.119	600	42
201-204	30	4.91	0.382	2481	4397
205	16	1.40	0.320	2234	982
207W	12	0.79	0.342	2293	617
207E	12	0.79	0.278	1891	494
208	16	1.40	0.204	1388	638
209	16	1.40	0.293	2034	902
210	16	1.40	0.274	1890	850
211	16	1.40	0.251	1693	795
212	16	1.40	0.218	1487	685
216E	13	0.92	0.279	1612	488
216W	13	0.92	0.254	1387	468
214W	13	0.92	0.27	1569	470
214E	13	0.92	0.288	1661	504
213W	13	0.92	0.243	1428	427
213E	13	0.92	0.258	1499	451
212 (DL open, Al wire)	16	1.40	0.246	1692	767
206	12.5	0.85	0.815	4946	1264
206	12.5	0.85	0.821	5009	1282
215E	13	0.92	0.267	1526	472
215W	13	0.92	0.279	1611	488

*Average flow rate from similar sources, actual flows not obtainable.

Volumetric Flow Rate Measurements
Essex Corporation

Roof Vent				
Wire Coating	Dia.	A_s	Velocity	Volumetric Flow
Machine No.	in.	ft^2	ft/min	Rate (dscfm)
315E	4096	28.44	801	20828
220W (Changeover)	4096	28.44	704	18721
#4(RV 45)	4096	28.44	973	25336
#5 (RV46)	4096	28.44	712	18612
202	4096	28.44	884	22951
201	4096	28.44	1241	32372
203	4096	28.44	1012	26122
204	4096	28.44	1214	31854
205	4096	28.44	1074	28244
207	4096	28.44	1168	31437
208	4096	28.44	1229	32696
209	4096	28.44	1022	27350
210	4096	28.44	969	25505
211	4096	28.44	262	6858
212	4096	28.44	741	19206
216E	4096	28.44	627	16012
216W	4096	28.44	727	18709
214	4096	28.44	790	20289
213	4096	28.44	742	19283
215	4096	28.44	675	16993
206 (Changeover)	4096	28.44	1155	30092
206	4096	28.44	1081	28003
212(DL open)	4096	28.44	672	17166
601-602	4096	28.44	764	19604
217-218	4096	28.44	630	16141
601-602(Doors Open)	4096	28.44	735	18731
217-218(Doors Open)	4096	28.44	835	21215

Cooler Exhaust				
Wire Coating	Dia.	A_s	Velocity	Volumetric Flow
Machine No.	in.	ft^2	ft/min	Rate (dscfm)
315W	11.7	0.75	450	297
314W	11.8	0.75	900	604
317W	12.0	0.79	750	517
317E	12.0	0.79	750	536
316E	11.8	0.75	2362	1581
316W	11.8	0.75	2456	1630
218E	9.7	0.51	2456	1174
218W	9.5	0.49	2300	1088
219E	9.8	0.52	400	193
219W	9.8	0.52	300	145
220W	9.8	0.52	2535	1201
220W (Changeover)	9.8	0.52	2575	1448
217E	9.8	0.52	2500	1203
217W	9.8	0.52	2500	1251
217W (DL open)	9.8	0.52	2625	1311
220E	9.8	0.52	2180	1056
602W	9.8	0.52	225	115
601W	9.75	0.52	3150	1580
601W (DL open)	9.75	0.52	3150	1580
601W (Filtered)	9.75	0.52	3150	1556
602E	9.75	0.52	2850	1409
601E	9.75	0.52	3150	1543
313E	11.75	0.75	350	236
313W	11.75	0.75	650	439

Appendix B General Process Description

Report on VOC Testing at Essex Group, Inc. Facility, Ref. No. 94-0072

General Process Description

Testing for Volatile Organic Compound (VOC) emissions was conducted at Essex Group, Inc. (also known as Superior Essex) in Franklin from February 22 through March 10, 2010. The purpose of the testing was to determine the quantities and relative proportions of VOC emissions from emission points at the facility, and also to determine compliance with applicable regulatory requirements. The testing was conducted by the Compliance Validation Program of the Tennessee Division of Air Pollution Control, with staff from the Permit Section observing the manufacturing process during testing. For the purposes of this report, the term "numbered oven" is sometimes used. Some magnet wire coating machine ovens may have East and West sections, such as 216 East and 216 West, but are designated as one "numbered" oven, both being considered as a part of Oven 216.

The process is basically the same in all magnet wire coating machines; bare wire, which may be copper or aluminum, is coated with enamel and is then heated in an oven to cure the enamel. In the oven, the volatile organic compounds (VOC) present in the solvent carrier for the enamel coating are evaporated and combusted. The heat generated from the combustion of the VOC materials is partially used to help cure the enamel coating on the wire. The hot enamel coating on the wire must be cooled after leaving the oven; this may be accomplished in the open air of the interior of the plant building, or the wire may enter an enclosure known as a cooler, where air will be forced across the wire. All ovens use heat to destroy the volatile organic compounds released from the enamel coating. Some ovens use natural gas to aid the combustion process; others may use electrical heat with a catalyst for this purpose.

The current Title V permit for this facility, No. 556509, specifies minimum temperatures for different categories of magnet wire coating machine ovens. During the test, all magnet wire coating machine ovens were meeting the minimum temperature requirements. Replacement machines, # 207 and # 209, are regulated by a minor permit modification that was issued on November 23, 2010. Machine # 207 has been installed, and Machine # 209 is expected to be in place in December 2010. Each magnet wire coating machine may process one wire or numerous wires, and each wire will have one or more coats. For each coating layer, the wire must leave the oven for cooling purposes before it can be returned for another coating. When hot wire leaves an oven, some of the enamel coating may volatilize to form a brief visible plume. These emissions, which occur after the wire leaves the oven, have been referred to as "afterbake" or "cool-down" emissions. These "afterbake" emissions may result from volatilized enamel condensing into a solid. In some cases, afterbake emissions were seen coming from the hot wire after it exited the ovens. Some ovens have enclosures known as "pressure boxes" that should capture some (or most) of the "afterbake" emissions over a certain distance, as wire leaves the ovens. During the test, and as of July 2010, eleven of thirty-three "numbered" magnet wire coating machines have pressure box enclosures for wire.

VOC (and/or aerosol) emissions from the wire after it leaves the oven may be captured in an enclosure known as a "cooler", which may have a separate exhaust to the atmosphere. Some coolers exhaust to the interior of the plant with those emissions ultimately being exhausted through the roof vents. During the testing process, all operational ovens, coolers, and roof vents were tested. In the final phase of processing, after the last coating has been applied and cured, the wire is coated with a lubricant (Dri-Lube) to facilitate the winding process. The VOC emissions from the lubricant, primarily heptane, are captured and conveyed to the ovens to be combusted at some units. Those emissions are uncontrolled in other units, and ultimately exhaust to the roof vents. At the time of the testing, eighteen ovens had Dri-Lube enclosure control. As of late November, twenty of thirty-three "numbered" magnet wire coating machine ovens had control of lubricant (Dri-Lube) emissions, and at least two more numbered magnet wire coating machine ovens are scheduled to be fitted with this type of control later this year.

There are two types of magnet wire coating machines at this facility, and a representative of each type of machine was tested prior to the February/March 2010 VOC testing effort, in order to certify that each type of machine could comply with the applicable regulatory requirements.

The two basic magnet wire coating machine types at the plant are horizontal alignment and vertical alignment. All magnet wire coating machine ovens exhaust to the atmosphere, but under different configurations. Some machine ovens have a separate exhaust stack; in one case, four machine oven exhausts are combined into one stack. If there is a cooler associated with a machine oven, it may have an individual stack which exhausts to the interior or the exterior of the building, or the cooler exhaust may be combined with the oven exhaust. If there is no cooler, any volatile or airborne cooler emissions will exhaust through the roof vents, which pull air out of the general interior of the plant.

It should be noted that the majority of adjacent magnet wire coating machines were running during the testing of roof vents, which ensured a representative concentration of emissions in the roof vent exhaust stream. Some machines were tested under different operating scenarios, for a comparison of resultant emission concentrations. Tests were conducted with lubricant exhaust to the machine ovens (controlled) and with the lubricant exhaust collection features sealed off (uncontrolled). Tests were conducted during "changeover" conditions as described below. Tests were also conducted on some machines while processing aluminum wire and on others while processing copper wire.

The process known as a "changeover" refers to the changing over of a magnet wire coating machine from one wire type to another. This often, but not always, involves the cleaning of the machines prior to the introduction of a new wire. Since this involves using open containers of solvent for cleaning purposes, there was a presumption that this activity would cause higher emission levels. Testing was conducted during changeover conditions when solvent was used to clean equipment. During this procedure, Superior Essex estimates that about half of the emissions from the solvent are ducted through the machine oven exhaust, and the remainder are exhausted through nearby roof vents. Based upon the emissions data from "changeover" testing, as compared with testing during standard operations, it appears that "changeovers" do not cause any appreciable change in emissions from roof vents or machine ovens.

Two roof vents were tested simultaneously with the enamel application sections of a magnet wire coating machine closed (during one test) or opened (during an immediately subsequent test) to compare the effect of exposure of this large amount of applicator surface area to the plant interior. It appears that this action did not cause any significant change in emissions from roof vents. The roof vent emissions do not seem to vary considerably from different areas based on whether or not the ovens in those areas have pressure boxes. However, this does not necessarily mean that these devices are ineffective, because the emissions from various ovens are presumably intermixed at the upper level of the plant interior before exiting through the roof vents. The Superior Essex facility includes solvent cleaning emissions with their MACT compliance calculations, using the allocation of emissions as specified previously. It is assumed that 100% of the solvents are emitted during any cleaning operations that are not conducted at the machines.

Rule Applicability

This facility is subject to the Maximum Achievable Control Technology (MACT) Rule "40 CFR 63 Subpart MMMM—National Emission Standards for Hazardous Air Pollutants for Surface Coating of Miscellaneous Metal Parts and Products." The term Hazardous Air Pollutant (HAP) means any air pollutant listed in or pursuant to section 112(b) of the Clean Air Act (42 U.S.C. 7401 et seq., as amended by Pub. L. 101–549, 104 Stat. 2399).

The limitation for HAP emitted from magnet wire ovens is found at 63.3890(b)(3), and reads as follows: "For each existing magnet wire coating affected source, limit organic HAP emissions to no more than 0.12 kg (1.0 lb) organic HAP per liter (gal) coating solids used during each 12-month compliance period."

This requirement is found at condition E3-6 of Title V permit 556509. Although the rule only addresses total HAP emissions, the highest reported HAP emissions for individual compounds from the Superior Essex facility are for phenol and cresols.

Additionally, the facility must comply with the provisions of 1200-3-18-.19(3)(a) “Coating of Magnet Wire,” which specifies a limit of 1.7 pounds of volatile organic compound (VOC) emissions per gallon of coating, excluding water and/or exempt compounds, as applied. This requirement is found at condition E3-5 of Title V permit 556509. The permittee has elected to comply with 1200-3-18-.19(5), which states that “The overall emission reduction needed is the lesser of the value calculated according to the procedure in this chapter or 95 percent.”

Condition E3-2 of Permit 556509 states that the allowable 12-month VOC emission rate is 235.0 tons. If it is assumed that the molecular weight of the emissions, based on measured carbon, is approximately equal to the weight of phenol (although that is probably not the principal constituent), then the hourly VOC emission rate of 24.4 pounds per hour would be equal to 107.0 tons per 12-month period, which is well within the 235 ton limit.

Condition E3-3 of permit 556509 states that compliance with the minimum incinerator (afterburner) temperatures specified in that same condition may be used to demonstrate compliance with the applicable requirements from 1200-3-18-.19(3)(a) “Coating of Magnet Wire” and 40 CFR 63 Subpart MMMM—“MACT” for Surface Coating of Miscellaneous Metal Parts and Products, as long as all applicable requirements for the system are met. Compliance with the requirements of 1200-03-18-.19 must be demonstrated on a daily basis, while compliance with the organic HAP per gallon of coating solids limit is demonstrated over a 12-month period. Please note that the “total enclosure for 100 percent VOC capture efficiency” (also known as permanent total enclosure or PTE) requirements are in effect for both the state rule 1200-03-18-.19 and the MACT rule.

The MACT report submitted by Superior Essex, which covers the February through March, 2010 testing period, indicates a ratio of 0.30 pounds of organic HAP emissions per gallon of coating solids used (for the 12-month compliance period of July 1, 2009 through June 30, 2010).

The Superior Essex facility has been tested in the past and was found to be in compliance with both of the above-specified rules. The “overall control efficiency” values specified in condition E3-3 of Permit 556509 are assumed to be attained, as long as the facility is maintaining the specified minimum magnet wire coating machine oven temperature (as determined from previous testing), and keeping each magnet wire coating machine oven under “negative pressure” so that surrounding air will be drawn into the ovens, thereby preventing the escape of any organic compounds from coatings. The oven/incinerator temperatures are recorded on a continuous basis, and the requirements to maintain the oven under “negative pressure” are checked at least once every six months. “Negative pressure” tests were conducted by the Superior Essex facility on the “300” series ovens on June 28, 2010, and for ovens 201-220 and 601-602 on November 8, 2010.

The Superior Essex facility conducts periodic monitoring by measuring the electrical resistance for the heaters for each machine that uses a catalyst to ensure that the destruction efficiency values measured during the performance test remain valid.

The Division notes that the MACT rule exempts magnet wire coating machines from the requirement for an annual inspection of the catalyst bed for situations where the catalyst bed is not accessible without disassembling the machine. This exemption applies to all of the magnet wire coating machines with catalyst beds located at the Superior Essex facility.

Consideration of Emissions Not Originating in Ovens for MACT Purposes

As written, the MACT rule addresses only emissions from the magnet wire coating machine ovens. There is no reference to the emissions which occur after the wire leaves the oven (such as emissions from coolers and "afterbake" or "cool-down" emissions). Please note that section 2.1 of Appendix A to Subpart MMMM reads as follows:

- *"If the capture system is a permanent total enclosure as described in §63.3965(a), then its capture efficiency may be assumed to be 100 percent."*

Additionally, the January 2, 2004 Federal Register (the date when the Subpart MMMM final rule was published), includes the following commentary, which would seem to indicate that the "afterbake" emissions are not required to be included in compliance calculations.

Page 137 (under the category "E. What are the Testing and Initial Compliance Requirements?")

- *"If you have a permanent total enclosure and all materials are applied and dried within the enclosure and you route all exhaust gases from the enclosure to a control device, you assume 100 percent capture."*

Page 152 (under the category "L. Compliance Requirements for Magnet Wire Sources")

- *"If the capture system for a magnet wire coating machine meets the definition of a permanent total enclosure, then you may assume capture efficiency is 100 percent and no measure of capture efficiency is needed."*

However, in order to verify this interpretation of the rule, an inquiry was made to the contact person for this MACT rule at EPA on July 29, 2010. As of the date of this report, the Division has not received a response.

Note that emissions from coolers are included in roof vent emissions if the coolers exhaust to the interior of the structure, but are not included in roof vent emissions if they have separate stacks exhausting to the exterior of the building.

Review of Plant Wide Emissions

The amount of uncontrolled volatile organic compounds (VOC) emissions, as calculated from source emissions testing, are provided for each magnet wire coating machine in Table 1, which follows this section of the report. There is a significant variation in the amount of pre-control VOC emissions, as determined from material usage for the (numbered) magnet wire coating machines, ranging from about 1.2 to 48 pounds per hour. The higher values of pre-control emissions are typically found for the coating of larger diameter wires. Note that the oven stack emission concentrations (as non-methane carbon) are always below 20 ppm (almost all are below 10 ppm), indicating that the oven/incinerator/oxidizers are very efficient at destruction of VOC. Although the cooler stack and roof vent (uncontrolled) VOC "ppm" concentrations are generally in the same range as the (controlled) oven emissions, the roof vent emissions make up about 95% of the total weight hourly VOC emissions (assuming that all compounds have approximately the same molecular weight). This is because the total exhaust air flow from all roof vent exhaust stacks is so much higher than the total exhaust air flow from all combined oven and cooler exhausts.

It is possible to make a rough estimate of the origin of VOC emissions from the roof vents, if some assumptions are made. If it is assumed that all VOC compounds from the roof vents have approximately the same molecular weight (similar to heptane, phenol and cresols), and that the plant generally operates in the same way, then perhaps 50% or more of the roof vent emissions could be from the Dri-Lube (heptanes) material. The balance of the emissions may be from solvent cleaning operations in the plant and/or compounds related to the "afterbake" emissions. Division testing did not classify the roof vent emissions as HAP or non-HAP.

Superior Essex has indicated that production levels during the test period were higher than normal, and that the emissions were presumably also higher. The weather was unusually cold during testing, and the building was tightly sealed, so that any interior plant emissions should have been pulled through the oven stacks, coolers, or roof vents. Therefore, the combined roof vent emissions, which constitute the largest category of emissions, are also assumed to be higher than normal.

A description of the magnet wire coating machine ovens and associated operating parameters during testing follows this section of the report (Table 1).

Based on the information presented in this report, the Division considers that the Superior Essex facility is demonstrating compliance with all applicable air pollution control emission limits.

Table 1 - Oven Testing Description at Essex Group, Inc. Franklin, TN Facility, February 22 – March 10, 2010

Oven Type & I.D.	Type of Control & Minimum Temperature Requirement	Type of Wire	Pre-control Coating VOC Emissions, pounds per hour	Dry-Lube Emissions, pounds per hour (without control)	Pressure Box? Dry – lube Control? (these features will be stated below if present)	Comment
201-204 Vertical	Thermal Incinerator 1,326°F.	Copper	58.74	4.47	---------- ----------	One outlet stack for all four numbered ovens and associated coolers
205 Vertical	Thermal Incinerator 1,326°F.	Aluminum	33.96	1.11	---------- Dry- Lube Control	
206 Vertical	Thermal Incinerator 1,326°F.	Aluminum	14.25	0.57	---------- Dry-lube Control	West oven operating, changeover for East unit , also Roof Vent test during changeover
206 Vertical	Thermal Incinerator 1,326°F.	Aluminum	13.02	0.86	---------- Dry-lube Control	West oven shut down 11 minutes into test
207 West Vertical	Thermal Incinerator 1,354°F	Aluminum	21.45	0.57	Pressure Box Dry- Lube Control	
207 East Vertical	Thermal Incinerator 1,354°F	Aluminum	24.87	0.57	Pressure Box Dry- Lube Control	Simultaneous roof vent test
208 Vertical	Thermal Incinerator 1,326°F	Aluminum	33.51	1.11	---------- Dry- Lube Control	Simultaneous roof vent test
209 Vertical	Thermal Incinerator 1,326°F	Aluminum	34.23	1.11	---------- Dry- Lube Control	Simultaneous roof vent test

Oven Type & I.D.	Type of Control & Minimum Temperature Requirement	Type of Wire	Pre-control Coating VOC Emissions, pounds per hour	Dry-Lube Emissions, pounds per hour (without control)	Pressure Box? Dry – lube Control? (these features will be stated below if present)	Comment
210 Vertical	Thermal Incinerator 1,326°F	Aluminum	36.45	1.11	---------- Dry- Lube Control	Simultaneous roof vent test
211 Vertical	Thermal Incinerator 1,326°F	Aluminum	39.54	1.11	---------- Dry- Lube Control	Simultaneous roof vent test (vent partially closed)
212 Vertical	Thermal Incinerator 1,326°F	Aluminum	46.50	1.11	---------- Dry- Lube Control	Simultaneous roof vent test
212 Vertical	Thermal Incinerator 1,326°F	Aluminum	48.72	1.11	---------- Dry- Lube Control disabled for this test	Simultaneous roof vent test
213East Vertical	Thermal Incinerator 1,354°F	Aluminum	18.0	0.57	Pressure Box Dry- Lube Control	Simultaneous roof vent test
213 West Vertical	Thermal Incinerator 1,354°F	Aluminum	4.24	0.57	Pressure Box Dry- Lube Control	
214 West Vertical	Thermal Incinerator 1,354°F	Aluminum	21.84	0.57	Pressure Box Dry- Lube Control	
214 East Vertical	Thermal Incinerator 1,354°F	Aluminum	19.0	0.57	Pressure Box Dry- Lube Control	Simultaneous roof vent test
215 East Vertical	Thermal Incinerator 1,354°F	Aluminum	17.46	0.57	Pressure Box Dry- Lube Control	Simultaneous roof vent test (see entry below, this is the same roof vent test) (cooler exhausting inside)
215 West Vertical	Thermal Incinerator 1,354°F	Aluminum	9.9	0.57	Pressure Box Dry- Lube Control	Simultaneous roof vent (cooler exhausting inside)

Oven Type & I.D.	Type of Control & Minimum Temperature Requirement	Type of Wire	Pre-control Coating VOC Emissions, pounds per hour	Dry-Lube Emissions, pounds per hour (without control)	Pressure Box? Dry – lube Control? (these features will be stated below if present)	Comment
216 East Vertical	Thermal Incinerator 1,354°F	Aluminum	32.10	0.57	Pressure Box Dry- Lube Control	Simultaneous roof vent test (cooler exhausting inside)
216 West Vertical	Thermal Incinerator 1,354°F	Aluminum	23.34	0.57	Pressure Box Dry- Lube Control	Simultaneous roof vent test (cooler exhausting inside)
217 East Vertical	Thermal Incinerator 1,354°F	Copper	3.9	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
217 West Vertical	Thermal Incinerator 1,354°F	Copper	3.78	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
217 West Vertical	Thermal Incinerator 1,354°F	Copper	3.78	0.57	Pressure Box Dry- Lube Control disabled for test	
218 East Vertical	Thermal Incinerator 1,354°F	Copper	2.31	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
218 West, Vertical	Thermal Incinerator 1,354°F	Copper	1.56	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
219 East Vertical	Thermal Incinerator 1,354°F	Copper	2.40	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
219 West Vertical	Thermal Incinerator 1,354°F	Copper	3.39	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
220 East Vertical	Thermal Incinerator 1,354°F	Copper	17.31	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test

Oven Type & I.D.	Type of Control & Minimum Temperature Requirement	Type of Wire	Pre-control Coating VOC Emissions, pounds per hour	Dry-Lube Emissions, pounds per hour (without control)	Pressure Box? Dry – lube Control? (these features will be stated below if present)	Comment
220 West Vertical	Thermal Incinerator 1,354°F	Copper	10.80	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
601 East Vertical	Thermal Incinerator 1,350°F	Copper	4.68	0.54	Pressure Box Dry- Lube Control	
601 West Vertical	Thermal Incinerator 1,350°F	Copper	1.26	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler (VOC emissions for this test estimated to be same as for other tests of 601 West for same wire production)
601 West Vertical	Thermal Incinerator 1,350°F	Copper	1.26	0.57	Pressure Box Dry- Lube Control disabled for this test	Simultaneous cooler with dry-lube open
601 West Vertical	Thermal Incinerator 1,350°F	Copper	1.26	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test with particulate filter on cooler (filter on cooler or on oven or both)
602 East Vertical	Thermal Incinerator 1,350°F	Copper	5.76	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
602 West Vertical	Thermal Incinerator 1,350°F	Copper	2.94	0.57	Pressure Box Dry- Lube Control	Simultaneous cooler test
306 Horizontal	Thermal Incinerator 1,350°F	Copper	4.68	0.60	---------- ----------	---------- ----------
305 Horizontal	Thermal Incinerator 1,350°F	Copper	11.40	0.57	---------- ----------	---------- ----------

Oven Type & I.D.	Type of Control & Minimum Temperature Requirement	Type of Wire	Pre-control Coating VOC Emissions, pounds per hour	Dry-Lube Emissions, pounds per hour (without control)	Pressure Box? Dry – lube Control? (these features will be stated below if present)	Comment
304 Horizontal	Thermal Incinerator 1,350°F	Copper	5.1	0.54	---------- ----------	---------- ----------
303 Horizontal	Thermal Incinerator 1,350°F	Copper	6.3	0.57	---------- ----------	---------- ----------
302 Horizontal	Thermal Incinerator 1,350°F	Copper	9.00	0.57	---------- ----------	Combined Stack - Simultaneous cooler test
301 Horizontal	Thermal Incinerator 1,350°F	Copper	5.94	0.57	---------- ----------	Combined Stack - Simultaneous cooler test
313 East Horizontal	Catalyst - Incinerator 1,260 °F	Copper	0.35	0.27	---------- ----------	Simultaneous cooler test
313 West Horizontal	Catalyst - Incinerator 1,260 °F	Copper	0.90	0.27	---------- ----------	Simultaneous cooler test
314 East Horizontal	Catalyst - Incinerator 1,260 °F	Copper	0.81	0.27	---------- ----------	Oven
314 West, Horizontal	Catalyst - Incinerator 1,260 °F	Copper	0.69	0.27	---------- ----------	Simultaneous cooler test
315 East, Horizontal	Catalyst - Incinerator 1,260 °F	Copper	1.02	0.27	---------- ----------	Simultaneous roof vent test
315 West Horizontal	Catalyst - Incinerator 1,260 °F	Copper	0.84	0.27	---------- ----------	VOC rate from earlier test in day used here

Oven Type & I.D.	Type of Control & Minimum Temperature Requirement	Type of Wire	Pre-control Coating VOC Emissions, pounds per hour	Dry-Lube Emissions, pounds per hour (without control)	Pressure Box? Dry – lube Control? (these features will be stated below if present)	Comment
316 East Horizontal	Catalyst - Incinerator 1,260 °F	Copper	0.51	0.18	---------- ----------	Simultaneous cooler test
316 West, Horizontal	Catalyst - Incinerator 1,260 °F	Copper	1.11	0.36	---------- ----------	Simultaneous cooler test
317 East Horizontal	Catalyst - Incinerator 950 °F	Copper	2.34	0.27	---------- ----------	Simultaneous cooler test
317 West Horizontal	Catalyst - Incinerator 950 °F	Copper	5.70	0.27	---------- ----------	Simultaneous cooler test

The above table provides a review of the following items:

Oven I.D, Type of Oven: This specifies the oven identification and indicates whether the oven has a vertical or horizontal orientation

Type of Control & Minimum Temperature Requirement: This specifies the type of control equipment (Catalyst-Incinerator or Thermal Incinerator) and the lowest temperature at which the oven may operate as specified by condition E3-3. The oven temperature is continuously monitored

Type of Wire: This indicates whether the wire consists of one of two materials, aluminum or copper

Pre-control Coating VOC Emissions, pounds per hour: This is the weight of VOC emissions released by the coated wire before the VOC's are combusted. Please be aware that these values do not represent VOC emissions to the atmosphere, but are included for general information purposes.

Dry-Lube Emissions, pounds per hour (without control): This is the weight of VOC emissions from Dry-Lube; please be aware that these emissions may or may not be ducted to the associated oven for destruction.

Pressure Box? Dry – lube Control? (these features will be stated below if present): This states whether or not a Pressure Box (an enclosure to capture emissions immediately after the hot wire leaves the oven to direct these emissions back to the oven for combustion) is present and if there is Dry Lube Control (this means that there is an enclosure to capture Dry-Lube emissions for conveyance to the oven for combustion) If these devices are present, the terms Pressure Box and Dry Lube will be included; if not, these terms will not be listed.

Comments: This includes information which may be relevant to the testing, such as simultaneous roof vent testing or special operating conditions during the test.

Appendix C Ambient Data

Figure 1. Moore Elementary School sampling results with comparisons to various levels of concern.

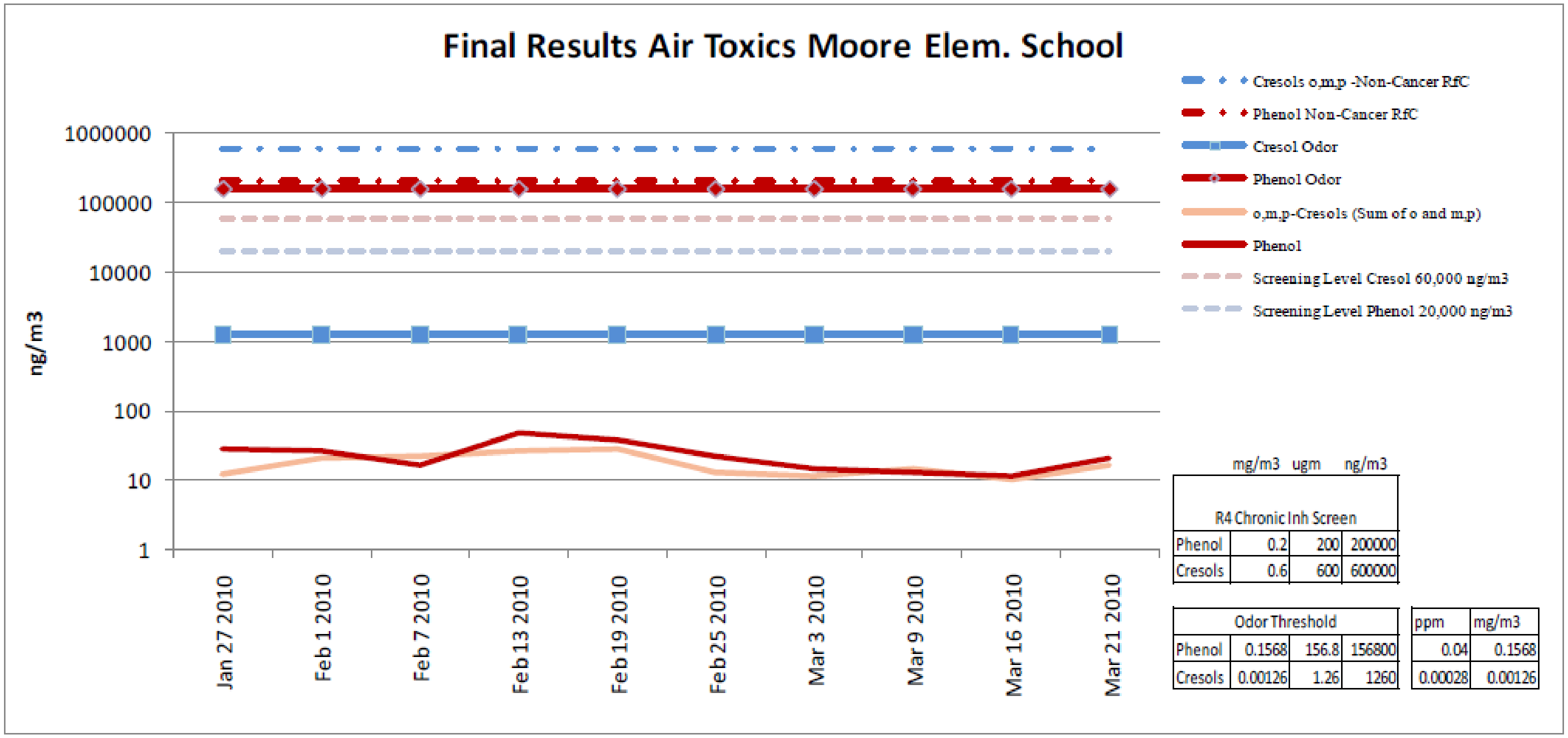


Table 1. Moore Elementary School sampling results with statistical summary data.

Final Results Air Toxics Moore Elem. School Site

ANALYTE	1/27/2010	2/1/2010	2/7/2010	2/13/2010	2/19/2010	2/25/2010	3/3/2010	3/9/2010	3/16/2010	3/21/2010	Max ng/m3	Min ng/m3	Avg ng/m3
Phenol	28.5	25.7	16.8	46.7	37.8	21.7	14.2	13.1	11.3	20.3	46.7	11.3	23.6
o,m,p-Cresols (Sum of o and m,p)	12.0	20.5	22.2	27.1	27.5	13.1	11.2	14.7	10.1	16.0	27.5	10.1	17.4

Figure 2. Winstead Elementary School sampling results with comparisons to various levels of concern.

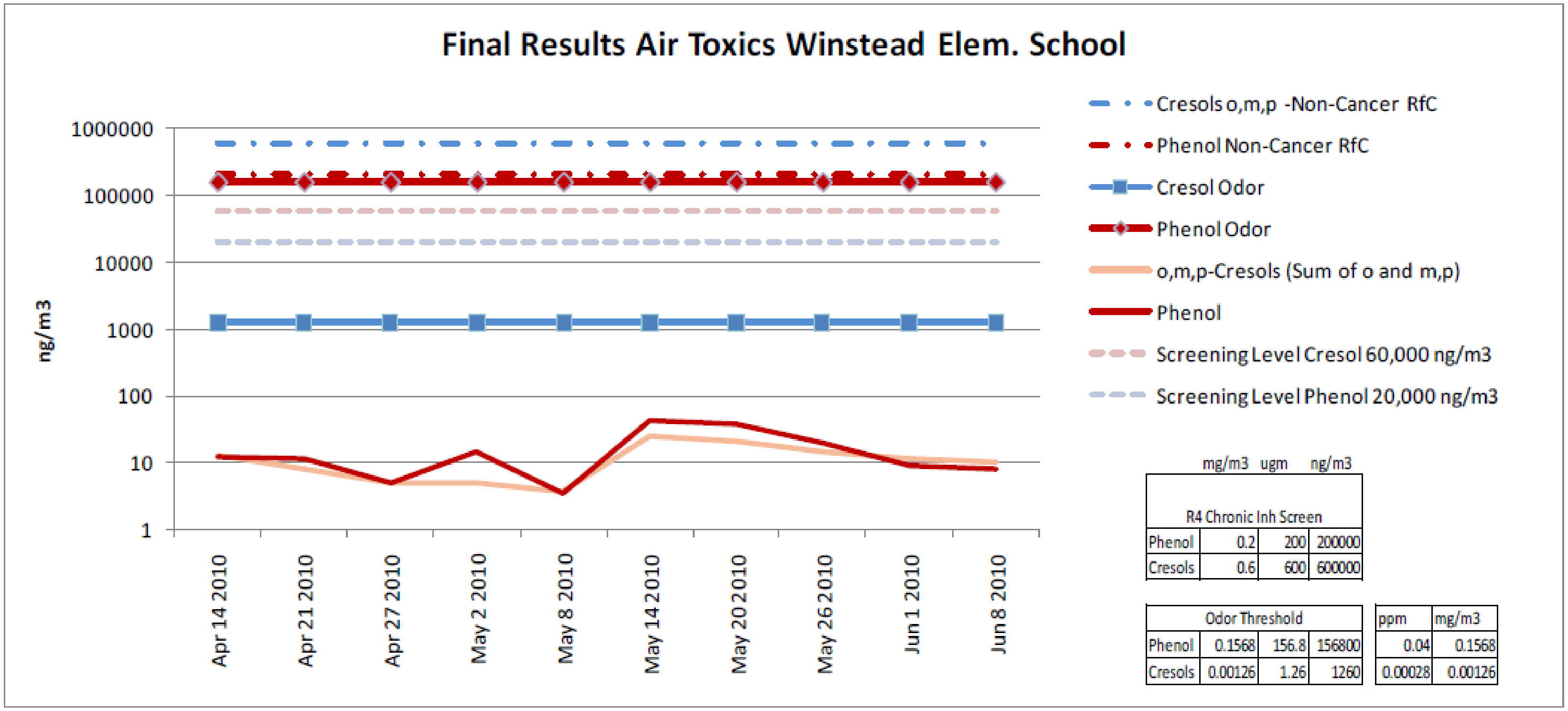


Table 2. Winstead Elementary School sampling results with statistical summary data.

Final Results Air Toxics Winstead Elem. School Site

ANALYTE	4/14/2010	4/21/2010	4/27/2010	5/2/2010	5/8/2010	5/14/2010	5/20/2010	5/26/2010	6/1/2010	6/8/2010	Max ng/m3	Min ng/m3	Avg ng/m3
Phenol	12.2	11.3	4.97	14.7	3.54	41.7	37	19.9	9.23	8.12	41.7	3.5	16.3
o,m,p-Cresols (Sum of o and m,p)	12.6	8.3	4.9	4.9	3.8	24.8	21.2	14.2	11.7	10.0	24.76	3.8	11.6

Figure 3. Sullivan Farms HOA site sampling results with comparisons to various levels of concern.

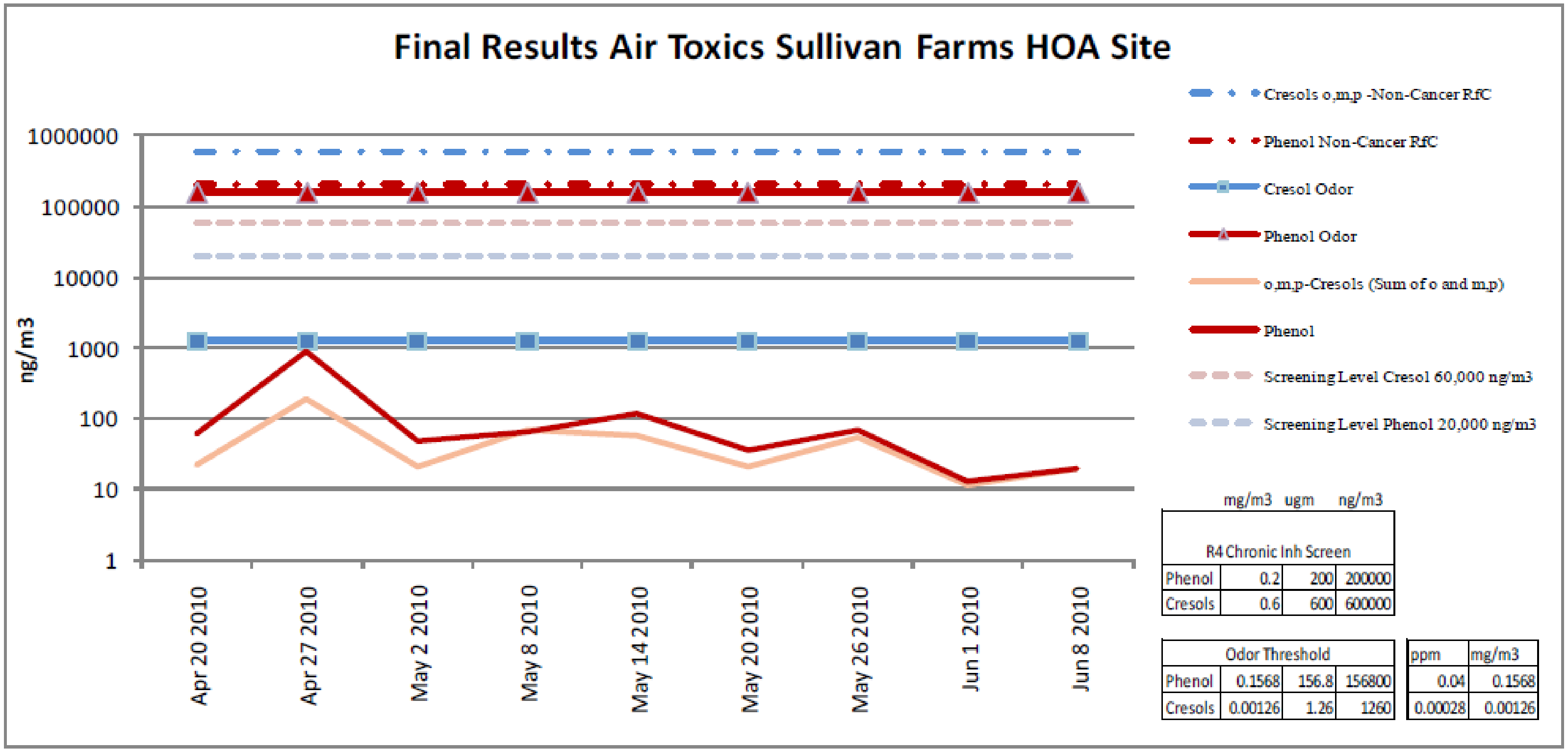


Table 3. Sullivan Farms HOA site sampling results with statistical summary data.

Final Results Air Toxics Sullivan Farms HOA Site

ANALYTE	4/20/2010	4/27/2010	5/2/2010	5/8/2010	5/14/2010	5/20/2010	5/26/2010	6/1/2010	6/8/2010	Max ng/m3	Min ng/m3	Avg ng/m3
Phenol	62	886	47.1	65	115	35.2	69.8	12.9	19.4	886	12.9	145.8
o,m,p-Cresols (Sum of o and m,p)	21.9	190.0	21.0	67.0	57.2	20.8	54.9	11.2	19.4	190	11.2	51.5

Area Surveillance of the Superior Essex Facility in Franklin, Tennessee

On April 5, 2010, the Nashville field office began making visits to six residential locations each morning to record odor observations and weather conditions. These site locations were chosen from a number of addresses which the Nashville field office had received the most complaints of odor and, based upon that information, would be locations where the likelihood of detecting odor might be greater. On April 15, 2010, in response to a citizen's request to have someone available for after hours contact, the Nashville field office began having a person on call from 5:00p.m. to 8:00p.m., Monday through Friday.

The six locations designated for the morning observation route are as follows:

224 Stillcreek Drive
204 Wynbrook Court
409 William Wallace Drive
219 Wysteria Drive
109 Sontag Drive
1513 Sunset Court

The 224 Stillcreek Drive, 204 Wynbrook Court, 409 William Wallace Drive, and 219 Wysteria Drive locations are south, or southeast of the Superior Essex facility. 109 Sontag Drive is located northeast of the Superior Essex facility, and 1513, Sunset Court is located north of the facility.

Additionally, observations were made at the two ambient air monitoring locations of Winstead Elementary School and 248 Stonehaven Circle starting April 20, 2010. The odor observations for these two locations were made only on the days these monitors collected data. These observations continued from April 5, 2010, until June 25, 2010, at which time it had been determined that the ambient air monitors that were operated as part of this project had completed the collection of data. There were a total of 359 observations made during this period including the morning observations at the designated residential locations previously listed, the observations made at ambient air monitor sites, and observations made in response to after-hours calls. From the 359 observations made, 20 of those observations documented that odor was detected at a slight level. This shows that odor was detected 5.6% of the time based upon this information. There were 7 after-hours calls made and all were responded to within 30 minutes. Most were responded to within 20 minutes. All but one of these resulted in the documentation of a slight odor. There was one instance in which no odor was detected upon Ray's arrival to that location.

April 5, 2010:
At 6:30am on April 5, 2010, odor was detected at 109 Sontag Drive and 1513 Sunset Drive. The wind was from the south at 5-10 mph. No odor was detected at the designated locations south of the Superior Essex facility. Ray Stubblefield made site visit to the Superior Essex facility and met with the Superior Essex plant engineer, Dan Jones, the morning of April 5 after making the positive odor observations. All control ovens except 4 were operating at or greater than the minimum temperature allowed. These values were established by emissions stack testing conducted for these control devices. The ovens that were down were down due to product changeover, a broken fan, and a wire tangle in one production line.

From April 6 through April 12:
The daily observations showed no odor was detected.

From April 13 through April 20:
On April 19, 2010, a slight odor was detected at the 219 Wysteria Drive location during the morning observations. The wind was from the north at about 2 mph under cloudy skies and 47 degrees F. 219 Wysteria Drive is located 270 yards southeast of the Essex facility. Also on April 19, 2010, Ray received a call from 409 William Wallace Drive reporting odor. A site visit to that address at 5:45 p.m. documented that a slight odor was detected. The wind was from the north at

10-15 mph under cloudy skies and 70 degrees F. 409 William Wallace Drive is located just under one-half mile southeast of the Essex facility. On April 20, 2010, Ray made site visits to the ambient air monitors located on Winstead Elementary School and 248 Stonehaven Circle and did not detect any odor at that time. Aside from these observations, there was no other odor detected during the period of April 13 through April 20.

From April 21 through April 30:
On April 27, 2010, a slight odor was detected at 219 Wysteria Drive at 7:34am. The wind was from the west at 10-12 mph under cloudy skies and 52 degrees F. Again, the 219 Wysteria Drive location is 270 yards southeast of the Essex facility. At 5:40pm on April 27, 2010, Ray received a call from 204 Wynbrook Court reporting odor at Mac Hatcher and Donaldson Creek Parkway at a moderate level. This location is 300 yards southeast of the Essex facility and is very close to the ambient air monitor site of 248 Stonehaven Circle. Ray made his observation there at 6:00pm and did not detect any odor. There was no odor detected during the site visits to the ambient air monitors on April 27. On April 30, 2010, a slight odor was detected at 1513 Sunset Court at 7:37am. The wind was from the south at 10-12 mph under clear skies and 63 degrees F. 1513 Sunset Court is located one mile north of the Essex facility. Aside from these observations, no other odor was detected during the period of April 21 through April 30.

May 3 through May 7:
No odor was detected that week and no after hours calls were received. Weather conditions were calm winds and clear skies. The ambient air monitors ran on Sunday, May 2, 2010.

May 10 through May 14:
A slight odor was detected at 1513 Sunset Court on the morning of May 11. The wind was from the south at 10-12 mph under cloudy skies. 1513 Sunset Court is located one mile north of the Essex facility. On the morning of May 13 a slight odor was again detected at 1513 Sunset Court. Again, the wind was from the south at 3-5 mph under cloudy skies. The ambient air monitors ran on Friday, May 14, 2010. No odor was detected at the ambient air monitor sites on Friday, May 14. Aside from these instances, no other odor was detected during the period of May 10 through May 14 and no after-hours calls were received.

May 17 through May 21:
No odor was detected during the morning observations. On the afternoon of May 19, 2010, an after-hours call was received at 4:40 p.m. from 219 Wysteria Drive. At 5:05 p.m. ARS detected a slight odor at this location. Another call was received on May 19, 2010, from 230 Wysteria Drive at 6:04 p.m. At 6:16 p.m. Ray Stubblefield detected a slight odor at this location. 219 Wysteria Drive and 230 Wysteria Drive are located 270 yards and 310 yards respectively, southeast of the Essex facility. The wind was from the northwest at 5-7 mph during his observations at these locations. The ambient air monitors ran on Thursday, May 20, 2010. No odor was detected at these monitor sites during the site visits on Thursday, May 20.

May 24 through May 28:
On the afternoon of May 26, 2010, two after-hours calls were received. A call was received at 6:34 p.m. from 204 Wynbrook and at 6:35 p.m. from 613 Wildflower Court. ARS detected no odor at 204 Wynbrook upon his arrival there at 6:49 p.m. The wind was calm at the time. ARS detected a slight odor at 613 Wildflower Court upon his arrival there at 7:10 p.m. The wind was from the northeast at 3-5 mph at the time. 613 Wildflower Court is located just over one-quarter mile southeast of the Essex facility and 204 Wynbrook is located just over one-half mile southeast of the Essex facility. On May 28, 2010, a slight odor was detected at the 219 Wysteria Drive during the morning observations. The wind was from the northwest at 3-5 mph under cloudy skies. 219 Wysteria Drive is located 270 yards southeast of the Essex facility. Aside from these instances, no other odor was detected during the observations for the period of May 24 through May 28.

June 1 through June 4, 2010:
On June 1, 2010, a slight odor was detected at 1513 Sunset Court during the morning observation period. The wind was calm at the time. Again, 1513 Sunset Court is located one mile north of the Essex facility. The ambient air monitors ran on June 1. No odor was detected at these monitor sites during the site visits on June 1. Aside from this observation, no other odor was detected during the period of June 1 through June 4 and no after-hours calls were received.

June 7 through June 11, 2010:

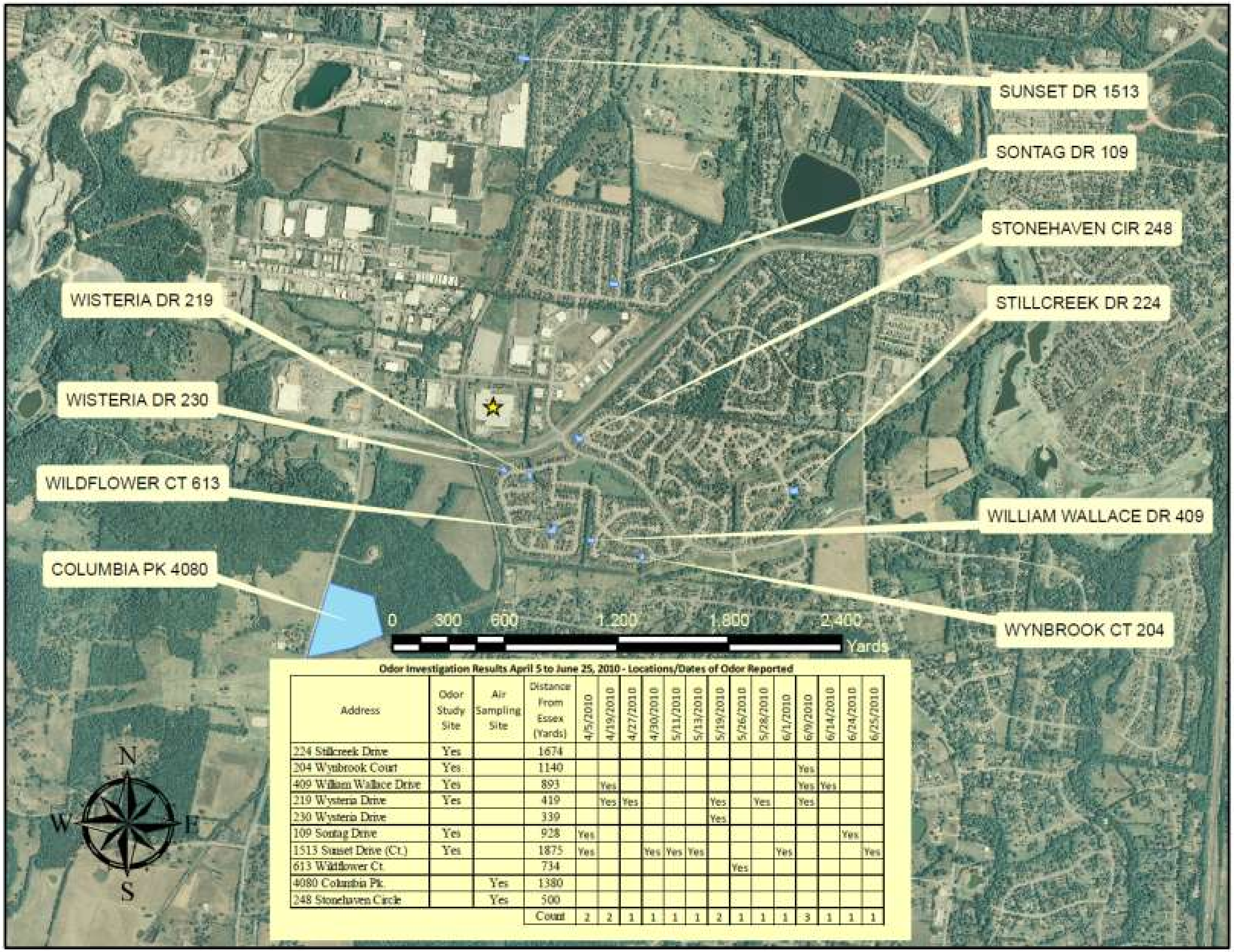
A slight odor was detected on the morning of June 9, 2010, at 204 Wynbrook Court, 409 William Wallace Drive, and 219 Wysteria Drive, during the morning observations. The wind was from the northwest at 5-7 mph and it was raining. These three sites where odor was detected are located southeast of the Essex facility ranging from just over one quarter mile to just under one-half mile away from the Essex facility. The ambient air monitors ran on June 8, 2010, and no odor was detected during the observations made at those monitor sites on June 8. Aside from these instances, no other odor was detected during the period of June 7 through June 11 and no after hours calls were received.

June 14 through June 18, 2010:
No odor was detected at any of the designated locations during the morning observations. There was an after-hours call received on the evening of June 14 at 6:25 p.m. from 409 William Wallace Drive. ARS detected a slight odor at this location at 7:25 p.m. on June 14. The wind was from the north at 1-2 mph under clear skies at the time. 409 William Wallace Drive is located just under one-half mile southeast of the Essex facility.

June 21 through June 25, 2010:
On the morning of June 24, a slight odor was detected at 109 Sontag Drive. The wind was from the southeast at 2-3 mph at the time. 109 Sontag Drive is located 800 yards northeast of the Essex facility. On the morning of June 25, a slight odor was detected at 1513 Sunset Court. 1513 Sunset Court is located one mile north of the Essex facility. There was no wind at the time of this observation. Aside from these instances, no other odor was detected and no after-hours calls were received during the period of June 21 through June 25.

Again, 359 observations were made between April 5, 2010, and June 25, 2010. These include the morning observations at the residential locations, the ambient air monitor sites, and the after-hours calls. Of the 20 instances where odor was detected during these observations, the odor was detected downwind from the Essex facility in all but four instances. On the afternoon of May 26, 2010, Ray observed a slight odor at 613 Wildflower Court, which is located southeast of the Essex facility, with the wind from the northeast at 3-5 mph. On June 1, 2010, Ray detected a slight odor one mile north of the Essex facility at 1513 Sunset Court with no wind. On June 24, a slight odor was detected at 109 Sontag Drive which is located about one-half mile northeast of the Essex facility. The wind was from the southeast at 2-3 mph at the time. On June 25, a slight odor was detected at 1513 Sunset Court and there was no wind at the time.

Most of the time odor was detected (80%), the odor was detected downwind from the Essex facility, but as the examples above show, this is not always the case with 20% of the time the odor was detected in a location that was not downwind from the facility.



Odor Investigation Results April 5 to June 25, 2010 - Locations/Dates of Odor Reported

Address	Odor Study Site	Air Sampling Site	Distance From Essex (Yards)	4/5/2010	4/19/2010	4/27/2010	4/30/2010	5/11/2010	5/13/2010	5/19/2010	5/26/2010	5/28/2010	6/1/2010	6/9/2010	6/14/2010	6/24/2010	6/25/2010
224 Stillcreek Drive	Yes		1674														
204 Wynbrook Court	Yes		1140											Yes			
409 William Wallace Drive	Yes		893		Yes									Yes	Yes		
219 Wysteria Drive	Yes		419		Yes	Yes				Yes		Yes		Yes			
230 Wysteria Drive			339							Yes							
109 Sontag Drive	Yes		928	Yes												Yes	
1513 Sunset Drive (Ct.)	Yes		1875	Yes			Yes	Yes	Yes				Yes				Yes
613 Wildflower Ct.			734								Yes						
4080 Columbia Pk.		Yes	1380														
248 Stonehaven Circle		Yes	500														
			Count	2	2	1	1	1	1	2	1	1	1	3	1	1	1