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Microanalytics
Analytical Service
Summary Report
Presented to:
**Missouri Department of Natural
Resources**

CONFIDENTIAL

Submitted to:
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Microanalytics is pleased to present the following final summary report for analytical services to **Leanne Tippett-Mosby, Missouri Department of Natural Resources.**

This report summarizes the results of the preliminary odor profile survey study with regard to the combined Carthage Bottoms Area downwind odor assessments and sample collections which were carried out during the approximate time period bounded by Sunday, October 28, 2007 @ 1500 hrs and Thursday, November 01, 2007 @ 1300 hr. It summarizes my initial impressions regarding the most significant odorants impacting at-distance downwind from the combined Carthage Bottoms Area industrial park.

If, after reviewing this report, you have any questions or comments please feel free to contact Don Wright at 512-750-1047 (cell).

Donald Wright
Consultant

on behalf of
Microanalytics (a MOCON Company)

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FINAL SUMMARY REPORT

I. Objective:

Preliminary evaluation of the odor compositional profile based upon the following on-site composite odor and SPME collected odorant sample series:

Session #1 – October 31, 2007 downwind at Vine X Eldorado:

1. Sample #1 – 15 minute collection – fiber # 226 beginning @ 1410 hrs
2. Sample #2 – 20 minute collection – fiber # 222 beginning @ 1411 hrs
3. Sample #3 – 30 minute collection – fiber # 215 beginning @ 1412 hrs
4. Sample #4 – 39 minute collection – fiber # 216 beginning @ 1413 hrs
5. Sample #5 – 32 minute collection – fiber # 228 beginning @ 1428 hrs
6. Sample #6 – 05 minute collection – fiber # 218 beginning @ 1505 hrs

Session #2 – October 31, 2007 upwind reference at Java Street Tower:

7. Sample #7 – 16 minute collection – fiber # 213 beginning @ 1544 hrs
8. Sample #8 – 30 minute collection – fiber # 217 beginning @ 1545 hrs

Session #3 – November 01, 2007 downwind site #1 at Garrison X Eldorado:

9. Sample #9 – 15 minute collection – fiber # 229 beginning @ 1048 hrs
10. Sample #10 – 15 minute collection – fiber # 212 beginning @ 1049 hrs
11. Sample #11 – 19 minute collection – fiber # 214 beginning @ 1049 hrs
12. Sample #12 – 25 minute collection – fiber # 227 beginning @ 1050 hrs
13. Sample #13 – 10 minute collection – fiber # 220 beginning @ 1118 hrs
14. Sample #14 – 15 minute collection – fiber # 221 beginning @ 1119 hrs
15. Sample #15 – 15 minute collection – fiber # 219 beginning @ 1121 hrs

Session #4 – November 01, 2007 downwind site #2 near Garrison X High Street:

16. Sample #16 – 10 minute collection – fiber # 224 beginning @ 1145 hrs

Session #5 – November 01, 2007 upwind reference at Vine X Eldorado:

17. Sample #17 – 25 minute collection – fiber # 211 beginning @ 1205 hrs

Control Samples: Preconditioned and transported but not exposed

18. Sample #18 – 0 minute collection – fiber # 209 analyzed on Sunday 11-04-2007
19. Sample #19 – 0 minute collection – fiber # 223 analyzed on Tuesday 11-04-2007

II. Procedure:

The following Parameters List presents a summary of the initial chromatographic parameters utilized for this MDGC-MS-Olfactometry survey work-up.

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Parameters List

Instrument: Agilent 6890 / 6975 GCMS system modified for multidimensional gas chromatography (MDGC) utilizing an AromaTrax™ integrated MDGC-MS-O odor profiling system from Microanalytics.

Sample Introduction: Manual injection utilizing Solid Phase Microextraction (i.e. SPME)
Injection Mode: Splitless

Sample: The at-distance and near-source headspace volatiles survey samples were collected by exposure of pre-conditioned SPME fibers at the designated sample points (i.e. generally downwind of the Carthage Bottoms Area combined source). SPME fiber loadings were varied by altering the length of time the fiber was exposed to the target environment. All sample collections were carried out under ambient conditions.

Chromatographic Conditions

Injection Temperature: 250°
Detector # 1 Flame ionization Temperature 250°C
Detector # 2 Mass Spectrometer Interface Temperature 260°C
Detector # 2 Mass Spectrometer Source Temperature 230°C
Column # 1: 12 meter x .53mmID BPX 5 - 1.0um film (pre-column)
Column # 2: 25 meter x .53mmID BP 20 - 1.0um film (analytical column)
Column Temperature Program
40°C initial, 3 min hold, 7°C/min., 220°C final, 20 minutes hold

MDGC separations were carried out with heart-cuts of the selected region of the pre-column effluent taken to the polar second column for additional separation followed by detection utilizing olfactory and mass spectrometric detection operating in parallel. Mass spectrometric data acquisition was carried out in either SIM mode (i.e. selected ion monitoring mode) for a suite of targeted specific suspect odorants or full SCAN mode (i.e. scanning the mass range of 40 amu to 400 amu).

III. Results:

Based upon this brief overview odor profile survey, the following odorous compounds appear to represent the most significant downwind odor impact relative to the combined Carthage Bottoms Area. An attempt has been made to list the prioritized odorants in an approximate descending order with respect to relative significance (i.e. as perceived by this investigator during this brief on-site assessment). Please note that all compound identifications should be considered as tentative pending follow-up efforts to confirm.

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Primary – Downwind Odor Impact

Odor Ranking	Retention Time (min)	Descriptor	Tentative Identification
1	13.8	'characteristic', 'burnt', 'sulfurous', 'papermill'	dimethyltrisulfide

Secondary – Odor Carriers

Odor Ranking	Retention Time (min)	Descriptor	Tentative Identification
	24.7	'barnyard', 'urinous'	p-cresol
	12.7	'earthy', 'mushroom'	1-octene-3-one
	12.9	'musty'	1-octene-3-ol
	18.1	'musty', 'vegetable'	isovaleric acid
	17.6	'vomitus', 'body odor'	butyric acid
	1.64	'fecal'	methyl mercaptan
	25.6	'animal', 'roadkill'	? methyl quinazoline
	21.6	'smoky', 'medicinal'	guaiacol
	23.3	'canned beet', 'earthy'	geosmin
	14.2	'vinegar'	acetic acid

Other Background Odor Carriers

Odor Ranking	Retention Time (min)	Descriptor	Tentative Identification
	15.8	'cardboard', 'musty'	nonanal
	15.1	'nutty', 'musty'	unknown
	15.6	'earthy'	2-ethyl hexanol
	7.5	'grassy', 'herbaceous'	hexanal
	22.2	'musty', 'moldy'	trichloroanisole
	4.3	'buttery'	diacetyl
	14.6	'potato'	methional
	26.6	'floral'	peach lactone (suspected contaminant)
	29.2	'musty', 'woody'	tribromoanisole (suspected contaminant)

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Downwind Composite Odor Characterizations				
Location	Date & Time	Location Coordinates	Elevation	Composite Descriptors
Java Street Tower	Tue, Oct 30 th @1500 hrs	37°11'33.80" N 94°18'22.72" W	973 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Java Street Trucking Co	Tue, Oct 30 th @1520 hrs	37°11'34.65" N 94°18'07.89" W	983 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Java Street Draw	Tue, Oct 30 th @1535 hrs	37°11'30.35" N 94°18'06.65" W	961 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Java Street Tower	Wed, Oct 31 st @0805 hrs	37°11'33.80" N 94°18'22.72" W	973 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Java Street roadway	Wed, Oct 31 st @0815 hrs	37°11'35.19" N 94°18'16.35" W	977 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Kellogg Lake berm	Wed, Oct 31 st @0920 hrs	37°11'22.90" N 94°17'38.26" W	947 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Radio Control Pk on Hwy 96	Wed, Oct 31 st @1030 hrs	37°10'55.13" N 94°18'01.87" W	945 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Canoe Shop on Hwy 96	Wed, Oct 31 st @1045 hrs	37°10'58.09" N 94°18'04.00" W	947 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Vine X Eldorado	Wed, Oct 31 st @1400 hrs	37°10'52.84" N 94°18'20.27" W	948 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Vine X Eldorado	Wed, Oct 31 st @1400 hrs	37°10'52.84" N 94°18'20.27" W	948 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Java Street Tower	Wed, Oct 31 st @1540 hrs	37°11'33.80" N 94°18'22.72" W	973 ft	faint, non-descript, slightly 'smoky' background odor
Lincoln X Central Ave	Wed, Oct 31 st @1845 hrs	37°10'41.90" N	990 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'

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94°18'29.71" W

Garrison X Eldorado	Thur, Nov 01 st @1045 hrs	37°10'57.44" N 94°18'49.23" W	968 ft	'poultry house' and 'landfill' / 'dumpster' primarily
Garrison X High Street	Thur, Nov 01 st @1145 hrs	37°11'04.27" N 94°18'50.21" W	991 ft	'characteristic', 'burnt', 'sulfurous', 'papermill'
Vine X Eldorado	Thur, Nov 01 st @1200 hrs	37°10'52.84" N 94°18'20.27" W	948 ft	faint, non-descript, slightly 'musty' background odor

IV. Observations and Conclusions:

The following are the most significant observations and conclusions with respect to this overview odor profile survey study of downwind odorous emissions from the combined Carthage Bottoms Area industrial center. An attempt has been made to list these observations and conclusions in an approximate descending order based upon relative significance, as perceived by this investigator.

1. Initial headspace odor profile results generated with the downwind samples revealed the expected complex suite of odorous compounds; with 25 to 35 discrete odor notes detectable for several of the individual volatiles collections. An initial prioritized odorant listing relative to this initial downwind odor survey is summarized in the previous section (i.e. primary, secondary and other background odorant carrier compound listings). These odorants appeared to be tracable to a variety of sources, including (1) industrial emissions from the Bottoms Area; (2) background odorants common to the surrounding general vicinity and (3) low level background contaminants associated with sampler storage / shipment.
2. Unfortunately, as a result of unstable wind conditions during the available sampling period, the value of the analytical results were considerably diluted relative to what would be expected under more favorable conditions. In this case, such stable conditions had been experienced during the first two days after our arrival but, unfortunately, this period coincided with an on-going operations shut-down situation with respect to two of the key industry players; Butterball and RES. Return to operation for one or both of these facilities roughly coincided with the arrival of a cold front on Wednesday morning and the resulting increased instability in the wind conditions. The gradual southerly to northerly shifting of the wind direction during the day on Wednesday resulted in a

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'moving target' situation and difficulty in achieving the ideal of an extended and relatively continuous sampling of the plume core. In concert, the increased wind speed and direction variability likely resulted in increased dilution of the odorant density in the plume, as sampled. With respect to the SPME sample collection process, the end result was a sampled volatiles / odorant density which was well below optimum for differentiation of odorants between the general area background and those from the targeted industrial emission. Simply stated, the unstable conditions dictated that, from an analytical standpoint, it was necessary to work just above the 'noise level' in terms of the odor profile assessment. As a result of this increased dilution, the complexity of the combined odorant suite and the trace levels of many of the key odorants it was not possible to develop tentative GC-MS identification or odor impact priority ranking for many of the perceived secondary priority odor contributors. To do so will require additional efforts utilizing modified sampling strategies and MDGC techniques to refine the separation and identification of these trace level, high impact odor carrier compounds.

3. In spite of the aforementioned limitations, it was possible to develop a limited, first-pass approximation of the odorant prioritization (i.e. as perceived by this investigator and during the period of this assessment) relative to the at-distance survey. This prioritization is summarized in the three tables (i.e. **primary**, **secondary** and **other** background odor carriers) presented above in the **Results**, Section III. It appears that dimethyltrisulfide (i.e. DMTS) may represent a (the) high impact priority relative to the downwind odor problem. This conclusion is based upon the following factors; (1) my past investigation of odor issues involving this odorant as a priority; (2) direct experience with its individual odor character under different conditions and from different source types; (3) personal encounters with the composite odor character, at-distance and downwind of the Carthage Bottoms Area during the final two days of our site visit; (4) feedback comments from a very limited number of local citizens regarding consistency with the historical problem and (5) MDGC-MS-Olfactometry analytical results which appear to support this impression. DMTS is an odorous sulfur compound which carries a particularly disagreeable individual odor which is alternately described as 'sulfurous', 'fecal', 'burnt' or 'papermill', among others.
4. It is noteworthy that the several brief, at-distance odor encounters during the period bounded approximately by Tuesday afternoon, October 30th and Wednesday evening, October 31st were marked by a consistent odor character which was strongly reminiscent of the odor character described above for DMTS alone. This consistent odor character was shown to hold from the earliest Java Street encounter on Tuesday afternoon through to the final encounter in the area of Lincoln Avenue and Central @ 1845 hrs on Wednesday evening, October 31st. In contrast, this 'characteristic' odor was not detectable in either the on-site composite or analytical assessments for the upwind reference sites (i.e. three each). Likewise, it was not detectable in either of the shipped

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but unexposed control samples. Among the various assessment sites, the one representing the greatest downwind separation from the Bottoms Area source was the Kellogg Lake northwest berm ; a distance of @ 0.92 miles.

5. As a result of the near 'noise level' limitation described above for this initial odor survey it is difficult to infer the secondary odorant priority ranking much beyond DMTS as the apparent single highest impact odorant. However, based upon the encounter with an easily distinguishable secondary odor event on Thursday, November 01st in the vicinity of Garrison and Eldorado, some initial impressions were made possible. This odor event was alternately described as 'poultry house' and 'landfill' / 'dumpster'. It is likely that follow-up testing under more favorable weather conditions will confirm secondary odor impact (i.e. over some, as yet undefined, distance) from p-cresol, methyl quinazoline and a number of other known priority odorants previously shown to be associated with various high density animal situations. As shown in the secondary odorant listing above, many of the secondary odorants have been previously indicted as high-impact for agricultural and animal waste sources. These have included swine and cattle CAFOs, poultry litter dust and bat colonies, etc. Of particular interest is p-cresol which has previously been indicted for primary impact relative to both cattle and swine and has an odor character (i.e. at trace concentration levels) which many individuals describe alternately as 'barnyard', 'urinous', medicinal' or 'floral'. These differences in perceived odor character are largely driven by the 'concentration dependent' nature of the olfactory response (i.e. common to many odorous compounds).
6. With respect to the two Garrison Avenue assessment sites (i.e Thursday morning, November 01st) there was a remarkably clear and definable differentiation of the odor character between the two. The more northward location near High Street clearly matching the 'sulfurous', 'papermill' and 'burnt' odor defined as 'characteristic' during the previous day's Java Street, Kellogg Lake, Vine X Eldorado and Lincoln X 3rd Street events. The more southward location at Eldorado was alternately describable as 'poultry house' and 'landfill' / 'dumpster' primarily; interspersed with very brief and very transient 'characteristic' events (i.e pointing out the continuing variable nature of the winds at the time of sampling). The clear and definable lateral odor stratification between these two locations (i.e separated by only @ 200 yards) was one of the most surprising observations encountered during the 3.5 day on-site Bottoms Area odor assessment.
7. During our 3.5 day area stay there were other examples of local transient odor events which, in composite, were clearly distinguishable from the above problematic 'characteristic', 'sulfurous', 'burnt' or 'papermill' odor. These included: (1) a strong 'industrial' / 'overheated breaklining' event on the evening of Monday, October 29th in the vicinity of Garrison and Mound Street and (2) a strong, standing 'wood smoke' odor in the Kendrick Place vicinity at the intersection of Garrison and Java Street. The former

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appeared to be a brief transient event only noted during one @ 45 minute period while the latter was relatively constant during that same period. One additional transient odor event of note was the very occasional and brief detections of a 'chlorine' or Chlorox'-like odor during the Vine X Eldorado sampling session of Wednesday, October 31st.

8. The 'plume chaser' challenge encountered during this site visit mirrors the challenge associated with being limited to sensory panelists for on-site response to citizen odor complaints. Better to rely on instruments performing targeted continuous downwind screening assessments at critical fixed downwind sample sites. Instruments could be configured in standby, performing occasional background assessments and upon remote activation by phone / internet signal; setting into motion frequent and rapid target odorant analyses.
9. The analytical odorant priority rankings presented above appear to be in good general agreement with my own perception of the composite odor character near and at-distance downwind relative to the Carthage Bottoms Area. Additional collaborative odor profile and odor matching correlation efforts involving myself, Missouri DNR personnel and possibly representative Carthage downwind citizens may be required to refine or correct these initial odorant priority assignments.

V. Recommendations:

1. As a result of the limitations imposed on the analytical results by the combined weather condition / operational timing situation, a follow-up site assessment and sample collection by this investigator should be considered. Re-sampling of the downwind sites under more favorable weather conditions and modified sampling procedures may be required to boost the electronic and odor responses further above the noise level; thereby achieving the higher concentration densities required to yield improved identification and refined impact prioritization. This follow-up visit, if opted, should be carried out with adjustments in experimental procedures as appropriate, based upon the experiences of this initial effort.
2. Additional odorant priority correlation work should be undertaken in an attempt to validate (or disprove) the initial, limited odorant priority ranking as presented in the previous sections. Special attention is warranted for DMTS (i.e. the suspected primary at-distance impact odorant) and p-cresol. This could possibly involve travel of selected DNR or Carthage citizen representatives and / or other representatives (i.e. as summarized above and as deemed appropriate) to the Round Rock facility of Microanalytics. Client representatives would be given the opportunity to personally assess target odor profile samples utilizing Microanalytics MDGC-MS-O instruments. This could also involve efforts to develop and evaluate a synthetic odor match

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formulation utilizing the smallest subset of suspect high-impact odorants as summarized in the primary and secondary listings above.

3. Additional analytical method development work should be considered which is aimed at chromatographic isolation and confirmation of the secondary, unidentified or tentative odorant identifications summarized above (i.e. those marked by lower levels of identification certainty).
4. Additional analytical method development work should be considered which targets the development of a quantitative method for the primary odorants as reflected in the above odor profile rankings.

VI. Exhibits:

Exhibit A - Carthage Bottoms Area Site Assessment - Daily Log Narrative

Figure 1. Carthage Bottoms Area Aerial Photograph

Figure 2. Carthage Bottoms Area USGS Topographical Map

Exhibit B – Aromagrams (representative)

Exhibit C – Chromatograms (representative)

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EXHIBIT A

Carthage Bottoms Area Site Assessment - Daily Log

November 07, 2007

Daily Log: October 27, 2007; Saturday

- Travel toward Carthage.

Daily Log: October 28, 2007; Sunday

- Arrive in Carthage @ 1500 hrs.
- Perform initial survey of the Carthage area: (1) surprised at the relatively low odor intensity on survey circuit (Central Ave to 96 N, east on Java Street to Garrison, south on Garrison back to Central and repeat); (2) odor events of note were (a) consistent wood smoke in the Kendricktown intersection and (b) an 'industrial burnt' odor note I described as 'overheated break lining' odor on Garrison street north of Central Ave intersection (Monday night probably); (3) I commented to Helen that I did not believe that this was the problem which we were here to investigate based upon the description and my own perception; (4) subsequent discussion on Tuesday with Brooks McNeil confirmed my suspicions as Brooks commented that this odor was known to he and Paul Vitzthum and, further, was known to originate from Leggett and Platt. The 'overheated breaklining' odor was shown to linger in the same area of Garrison for an extended period of time (at @ 1900 to 2000 hrs).

Daily Log: October 29, 2007; Monday

- Our arrival in Carthage followed on an extended period of stable, mild weather with winds generally from a southerly direction. This stable condition continued until Wednesday, October 31st and was broken with the arrival of a cold front and a gradual shifting of the winds from the north during the day on Wednesday.
- Monday was spent in familiarizing ourselves with the area and performing exploratory spot odor assessments; primarily in the 'perimeter circuit'. Beyond the Kendricktown 'smoke' and the Garrison at Central 'overheated breaklining' events nothing else of apparent significance was noted.
- Some time on Monday was spent at the Kellogg Lake park, setting up and checking out the weather station / sampler assemblies.
- Phone discussions with Mark Rader, Paul Vitzthum and Brooks McNeil regarding scheduling and planning for the project: (1) informed that both RES and Butterball had been shut down since the previous Thursday / Friday timeframe, RES as a result of a

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leaking pump flange and Butterball as a result of a leaking roof and under direction of the FDA (This was assumed by all, to account for the common observation of low [characteristic] odor impact in the community during Sunday and Monday timeframe) and (2) discussed plan to meet on Tuesday afternoon for face to face discussions at the DNR office on the square.

Daily Log: October 30, 2007; Tuesday

- Continued general area assessment on the 'perimeter circuit', the Jasmine loop and beyond. (1) located good sample sites along Java Street through a chance meeting with the owner of a portion of the land between Java Street and the river to the north of the Carthage Bottoms area. This gentleman gave us free run to set up for sampling anywhere on his properties; (2) these locations appear to be optimum for the situation of stable weather and southerly prevailing winds such as we had seen since our arrival in town and (3) confirmation of the latter on Tuesday with our first apparent detection of periodic, transient and mild odor events in these locations during the afternoon. Afternoon discussions with Paul and Brooks appeared to confirm that these events coincided with their indications that RES and Butterball were starting back into operation.
- My initial perceptions of the odor character were described as 'sulfurous', 'burnt' and 'papermill-like' and this description was generally agreed with by my associate (and wife) Helen. This assessment was consistent during these few brief and mild detection events but, at that time, it was not clear to us as to whether this odor character was consistent with the overriding odor issue as perceived by the community at-large.

Daily Log: October 31, 2007; Wednesday

- Continued general area assessment on the 'perimeter circuit', the Jasmine loop and beyond. (1) picked up the first significant odor event since arrival during an early morning drive around assessment @ 0815 hrs; (2) the location of the observed event was to the north of the Bottoms area on Java Street behind the Tower fence; (3) the odor character at the time of the event was consistent with the 'sulfurous', 'papermill' and 'burnt' descriptions as first noted the previous day; (4) it is noteworthy that at the time of the observed event the prevailing wind direction was generally southerly (as it had been since our arrival on Sunday); (5) as a result of the intensity of the event I took the opportunity to perform a walking assessment of the location; cross-sectioning the plume on the perpendicular relative to the direction of flow; (6) in pacing back and forth several times between the trucking company parking lot and the Tower (along the south side Java Street road edge) I was surprised at how narrow the detectable plume appeared to be; it was possible to go from relatively mild or negligible intensity into a region of high intensity and back out within just a few paces; (7) it is noteworthy that almost simultaneous with this early morning assessment the prevailing wind direction began a slow and steady clockwise rotation from generally southerly to generally northerly over

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the next @ 12 hours (coincident with increasing windspeed marking arrival of a cold front); (8) it is noteworthy that within a few minutes of having left the Java Street site and returning to the White Rose B&B near Kellogg Lake I received a call from Paul Vitzthum @ 0830 notifying me of a complaint which had just been received from a citizen (coincidentally from the Java Street location directly across the street from the location where I had just completed my walking assessment and apparently at approximately the same time) and (9) I carried out a follow-up on-site interview with the complainant citizen (located on East Java Street) and got the following feedback: (a) the odor event of Wednesday morning was consistent in character with that which reflects her perception of the historical downwind odor problem; (b) the intensity of this particular event was approximately of medium intensity relative to the worst excursions which have been seen historically and (c) received her assurance that she had been unaware of my odor assessment activities across the street at the time of her complaint call.

- Upon returning to the Java Street site within a few minutes of the complaint notification, it was observed that the wind direction had already begun its clockwise rotation (coincident with the shift of the detectable plume center to the Kellogg Lake area to the northeast of the Bottoms Area source). This rotation continued throughout the day with plume detection sites progressing from: (1) the Java Street tower site; (2) the Kellogg Lake western berm; (3) the highway 96 at River Street site (at radio control park gate) and (canoe rental store parking lot); (4) the Vine at Eldorado levee base location at mid afternoon and (5) downtown in the vicinity of the intersection of 3rd Street X Lincoln and back to Central Avenue X Lincoln @ 1845 hrs.
- One interesting aside with respect to the Java Street event was that in the short period (i.e. @ 45 minutes) between my first assessment of the event and our return to the Tower site, a short section of the Java Street roadsides had been freshly oiled / tared by a Carthage city utilities truck. The curiosity is that this did not appear to be an extensive area wide project but rather a spot application limited to Java Street in the region of and overlapping the Trucking Company to Tower assessment span. This could have been problematic if the winds had remained light and southerly and we had wanted to sample the air in this region. However, the coincidental shifting of wind direction from the east and north resulted in our moving away from the area for subsequent assessment east and south of source locations. It only became a possible consideration with our return to the Tower area for reference upwind sampling later that afternoon.
- The first downwind SPME sampling session since arrival was carried out coincident with the Vine at Eldorado levee base location at mid afternoon and this was followed up with an upwind reference series at the Java Street Tower location. The downwind session ran from approximately 1410 hrs to 1500 hrs and was characterized by transient bursts of the distinct to strong characteristic odor interspersed with periods of mild to imperceptible odor intensity. The latter case appeared to dominate during this sampling session and the winds were relatively strong @ 8 to 13 mph and quite variable; ranging approximately from WNW to NNW. Other associated weather data included: (1) temperature range @

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62 to 64 deg F; (2) dew point @ 50 deg F; (3) relative humidity @ 63% and (4) barometric pressure @ 30.1 inches. The upwind session ran from approximately 1544 hrs to 1615 hrs with weather conditions generally identical to that of the downwind session with the exception of wind direction beginning to range slightly more northerly. The more obvious difference between the upwind and downwind sampling sessions was the complete absence of the transient, characteristic odor bursts during the upwind session.

- We received a visit from Brooks McNeil while wrapping up the sampling session at the Vine X Eldorado downwind location. I took the opportunity to demonstrate the SPME sampling device, support assemblies and procedures to Brooks for the situation wherein on-site sampling by DNR contacts on my behalf might be indicated. This also afforded a good opportunity for continued discussions between Brooks, Helen and myself relating to the targeted odor character perceptions. One interesting comment from Brooks related to a 'chlorine' or 'swimming pool' odor which would be emitted by [RES] ^{sic} during certain conditions of operation. In fact, Helen and I had both previously detected brief bursts of this odor event and the comment had been made likening it to 'chlorine' or 'Chlorox'. Brooks comment served as valuable confirmation that we had, in fact, witnessed a known, significant secondary odor event.
- The balance of the day was spent in tracking the odor plume by a combination of truck movement and on-foot. A decision was made to conserve the limited number of remaining prepared SPME fibers for a period of more stable wind direction and corresponding stationary odor impact zone (i.e. less of an attempt to sample what, up to that time, appeared to be a relatively small and moving target). The final observation of the moving odor event was @ 1845 at the uptown location centered on the intersection of 3rd and Lincoln and ranging down Lincoln to at least Central Avenue. This appeared to be a relatively strong, characteristic and lingering event but no attempt was made to sample at that time; opting to wait for expected increasing weather stability which was predicted for Thursday (i.e. both in terms of an extended period of generally easterly wind direction as well as reduced windspeed).
- As a result of the 'plume chaser' characteristic of our activities on Wednesday a number of adjustments were made relative to our approach to the sampling process, including: (1) the requirement for quick adjustment to the shifting plume forced us to abandon the use of the small data logging weather station since it required a bit of extra time and effort in take-down and set-up (i.e. with the frequent shifts in 'sighting' location); (2) as a result we opted to utilize a small wind strip device (i.e. the 'Lomax strip' device based upon suggestions from Dr. Ken Lomax of U of Delaware) which quickly attaches to the top of the pole of the sampler support stand; (3) these devices could be quickly deployed and with the aid of a small compass give a good general running indication of the relative wind direction and speed; (4) although data logged weather monitoring would certainly be preferable during periods of relative stability of weather and plume movement (or for extended routine specific site monitoring) it is not believed to be critical for the purpose of this initial qualitative odor survey relative to the combined Carthage Bottoms Area.

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Daily Log: November 1, 2007; Thursday

- Continued general area assessment on the 'perimeter circuit', the Jasmine loop and beyond.
- As predicted the wind direction had shifted from a generally easterly direction overnight placing the first encountered odor plume on Garrison Street, in the region bounded approximately by its intersections with Eldorado and High streets. As a result, a sampling session was carried out at the Garrison X Eldorado downwind site during the approximate timeframe of 1048 hrs to 1136 hrs. A subsequent single SPME fiber collection was carried out slightly further northward approaching the Garrison X High Street intersection (i.e. in a parking lot adjacent to the Schoolhouse Apartments). This second downwind collection was carried out during the approximate timeframe 1121 hrs to 1136 hrs. The weather conditions during these sampling sessions were approximately as follows: (1) wind @ 9 to 12 mph and quite variable; ranging approximately from ENE to ESE. Other associated weather data included: (2) temperature range @ 51 to 55 deg F; (2) dew point @ 27 deg F; (3) relative humidity @ 37% and (4) barometric pressure @ 30.4 inches.
- It is noteworthy, with respect to these two downwind locations, that there was a relatively clear and definable differentiation of the odor character detectable between the two during the sampling timeframe. The more northward location near High Street clearly matching the 'sulfurous', 'papermill' and 'burnt' odor defined as 'characteristic' during the previous day's Java Street, Kellogg Lake, Vine X Eldorado and Lincoln X 3rd Street events. The more southward location at Eldorado was alternately describable as 'poultry house' and 'landfill' / 'Dumpster' primarily; interspersed with very brief and very transient 'characteristic' events (i.e pointing out the continuing variable nature of the winds at the time of sampling). The clear and definable lateral odor stratification between these two locations (i.e separated by only @ 200 yards) was one of the most surprising observations encountered during the 3.5 day on-site Bottoms Area odor assessment phase.
- At the completion of these two downwind sampling sessions, an upwind reference collection was carried out at the same Vine X Eldorado location which was used for the previous day's downwind series. This session was a single SPME collection made in the approximate timeframe of 1205 hrs to 1230 hrs. The weather conditions during this sampling session were approximately as follows: (1) wind @ 9 mph and still variable; ranging approximately from E to ESE. Other associated weather data included: (2) temperature range @ 55 to 56 deg F; (2) dew point @ 24 deg F; (3) relative humidity @ 33% and (4) barometric pressure @ 30.3 inches. The most obvious difference between the upwind and downwind sampling sessions was the complete absence of either the transient, 'characteristic' odor noted for the Garrison X High Street location or the 'poultry house' and 'landfill' / 'Dumpster' character noted for the Garrison X Eldorado location in the preceding upwind sessions. It is noteworthy that slightly to the ENE of

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this upwind reference site is a commercial facility which shells walnuts and stores / processes shell residue. Given the prevailing wind direction during this upwind sampling session it is expected that this further upwind emission source might contribute a 'musty' and 'woody' odor character expected of such operations. Although sporadically and faintly detectable, the odor character of this potential upwind competing source is not likely to be mistaken for the odor character observed at and previously described for the two Garrison Avenue sampling sites. Completion of this session essentially completed the on-site assessment phase of the Carthage Bottoms Area project and initiated our shut-down and return home to begin the analytical phase of the project.

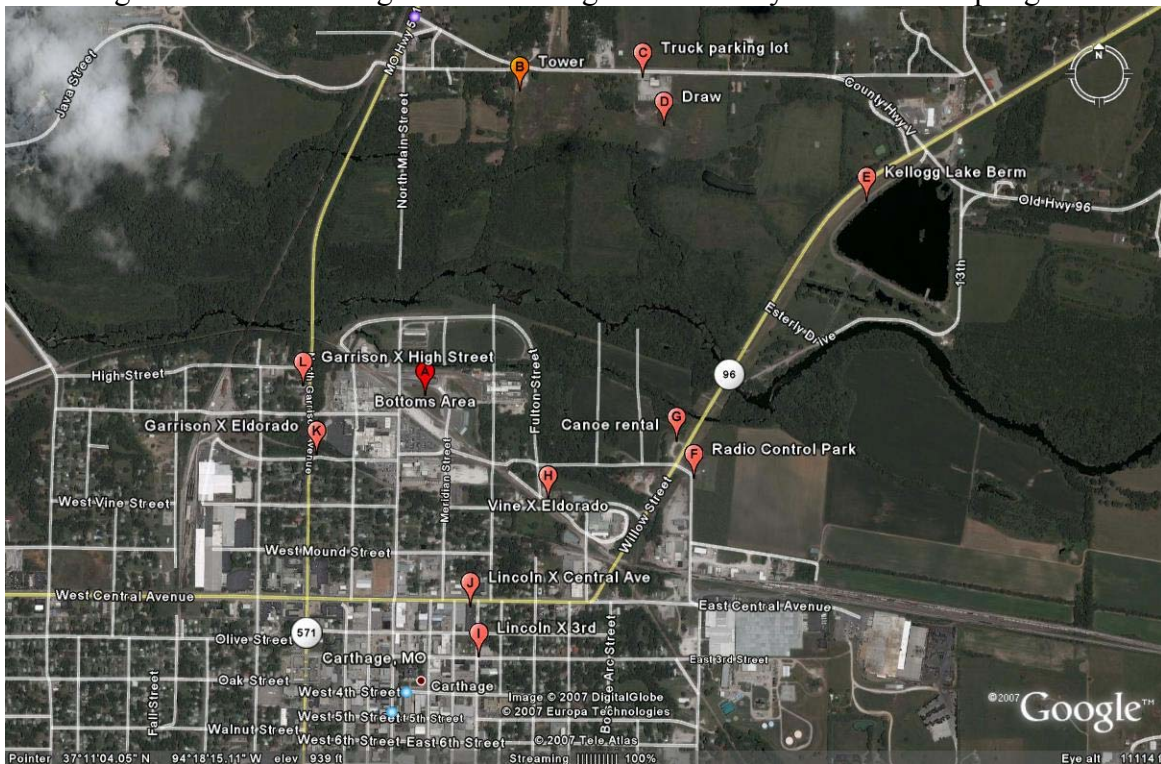
Regards

Donald Wright
Consultant / Manager
Don Wright & Associates, LLC
on behalf of
Microanalytics (a MOCON Company)

Figure 1

**Carthage Bottoms Area Phase I Odorant Prioritization Study - RFS (revised)
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Google Earth Aerial Image of the Carthage Odor Survey Area and Sampling Sites



Location Key

- | | |
|----------------------------------|--------------------------------------|
| A - Carthage Bottoms Area Center | G - Canoe Rental Shop Parking Lot |
| B - Tower Area on Java Street | H - Vine X Eldorado |
| C - Trucking Company Parking Lot | I - Lincoln X 3 rd Street |
| D - Draw Behind Trucking Company | J - Lincoln X Central Avenue |
| E - Kellogg Lake Berm | K - Garrison X Eldorado |
| F - Radio Control Park Gate | L - Garrison X High Street |

Figure 2

Carthage Bottoms Area Phase I Odorant Prioritization Study - RFS (revised)
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Topographical map of the Carthage Odor Survey Area and Sampling Sites

<http://www.topozone.com/map.asp?lat=37.19706&lon=94.31058&datum=nad83&size=1&s=100>

EXHIBIT B

Reference Aromagrams

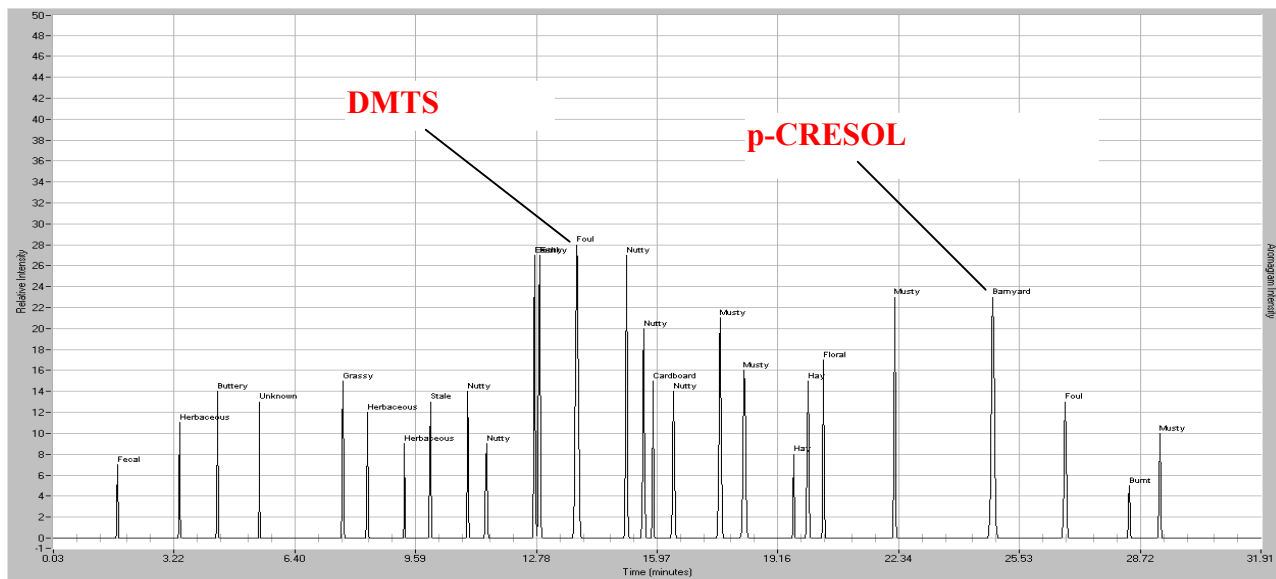
Aromagram # 1	Downwind; Vine X Eldorado; Wednesday, October 31 st ; 32 min collect; (file # car005)	Olfactory
Aromagram # 2	Upwind reference; Java Street Tower; Wednesday, October 31 st ; 30 min collect; (file # car010)	Olfactory
Aromagram # 3	Downwind; Garrison X Eldorado; Thursday, November 01 st ; 25 min collect; (file # car003)	Olfactory
Aromagram # 4	Upwind Reference; Vine X Eldorado; Thursday, November 01 st ; 25 min collect; (file # car015)	Olfactory
Aromagram # 5	Control; Shipped but not exposed; (file # car012)	Olfactory

EXHIBIT C

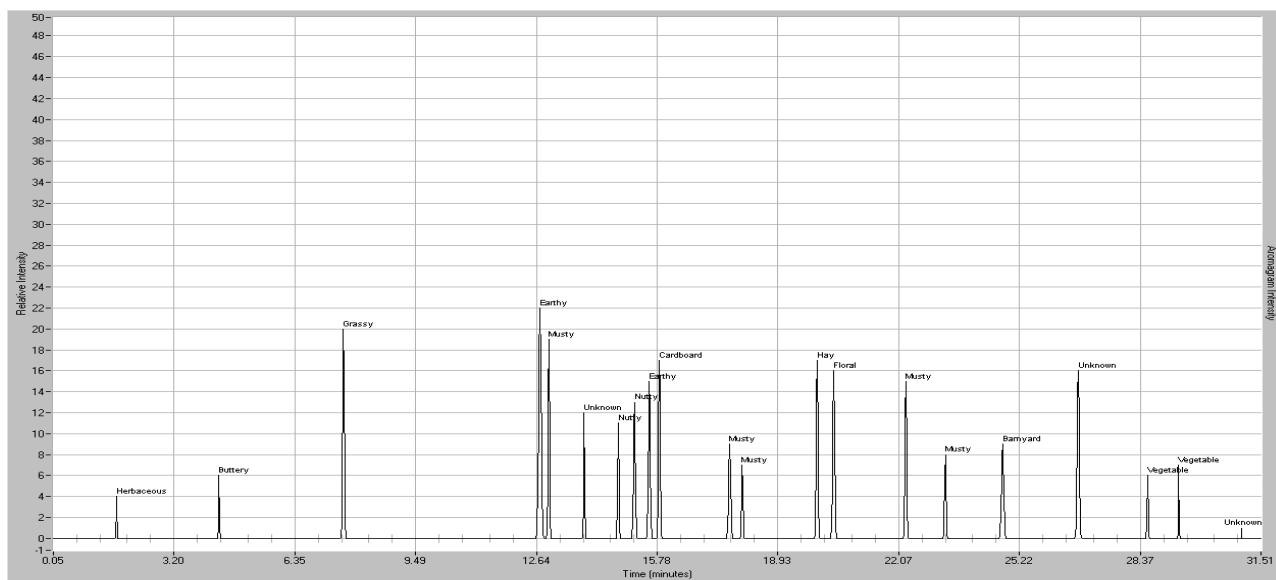
Reference Chromatograms

Chromatogram # 1	Downwind; Vine X Eldorado; Wednesday, October 31 st ; 32 min collect; (file #car005); DMTS focus, ion 126 amu	MSD SIM
Chromatogram # 2	Downwind; Vine X Eldorado; Thursday, November 01 st ; 25 min collect; (file # car015); DMTS focus, ion 126 amu	MSD SIM

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EXHIBIT B
Representative Aromagrams

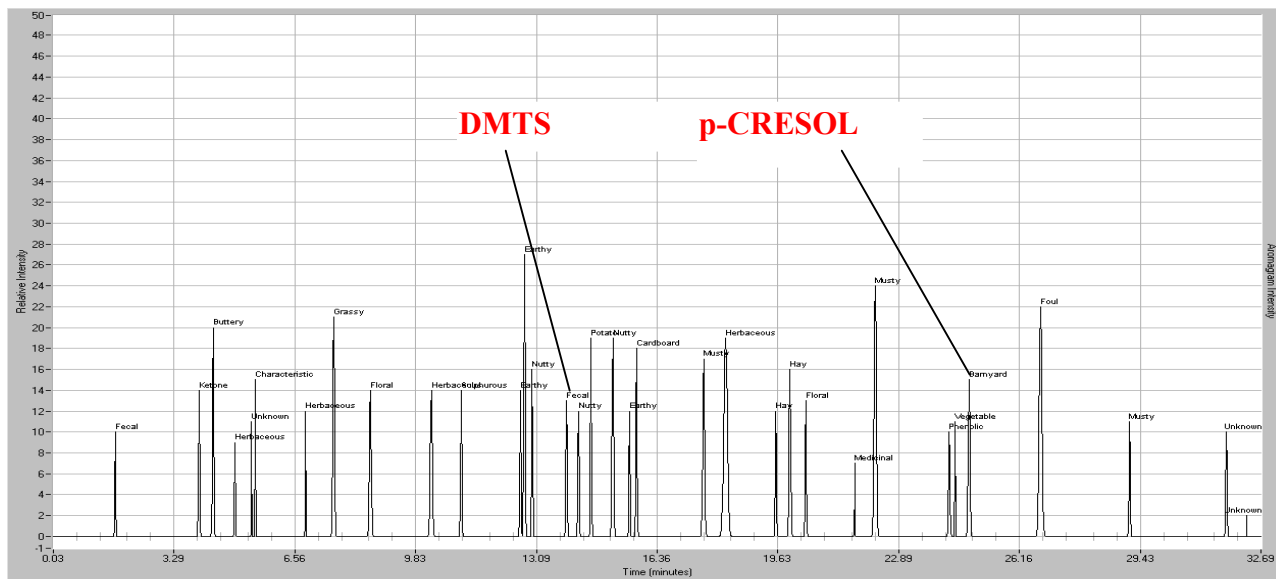


Aromagram #1 – Downwind; Vine X Eldorado; Wednesday, October 31st; 32 min collect; (file # car005)

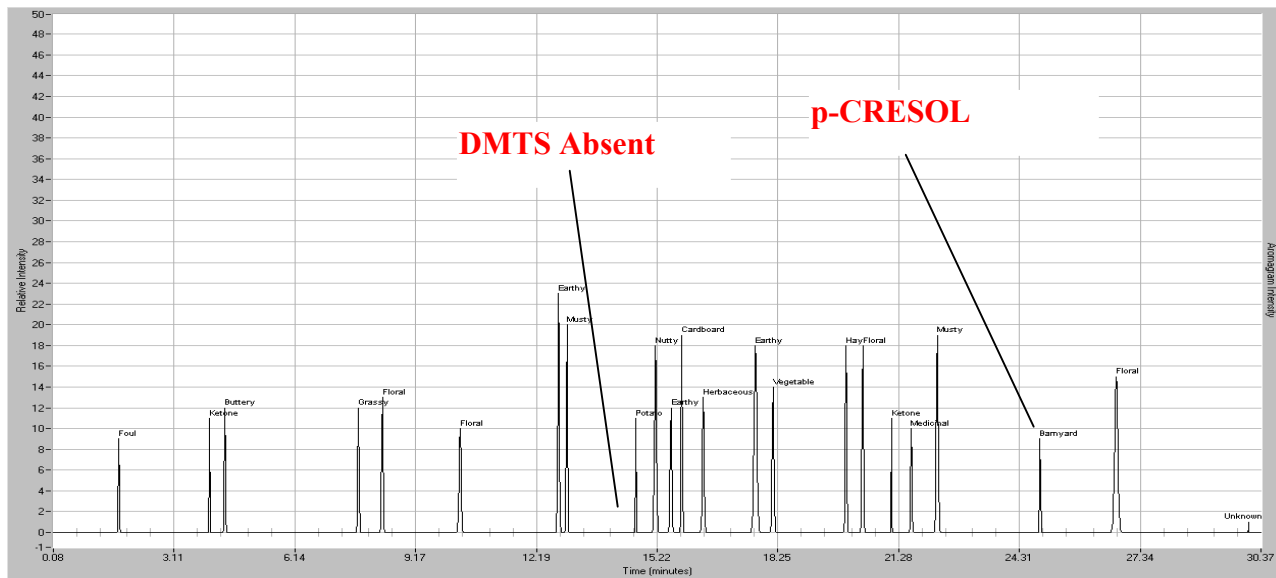


Aromagram #2 – Upwind reference; Java Street Tower; Wednesday, October 31st; 30 min collect; (file # car010)

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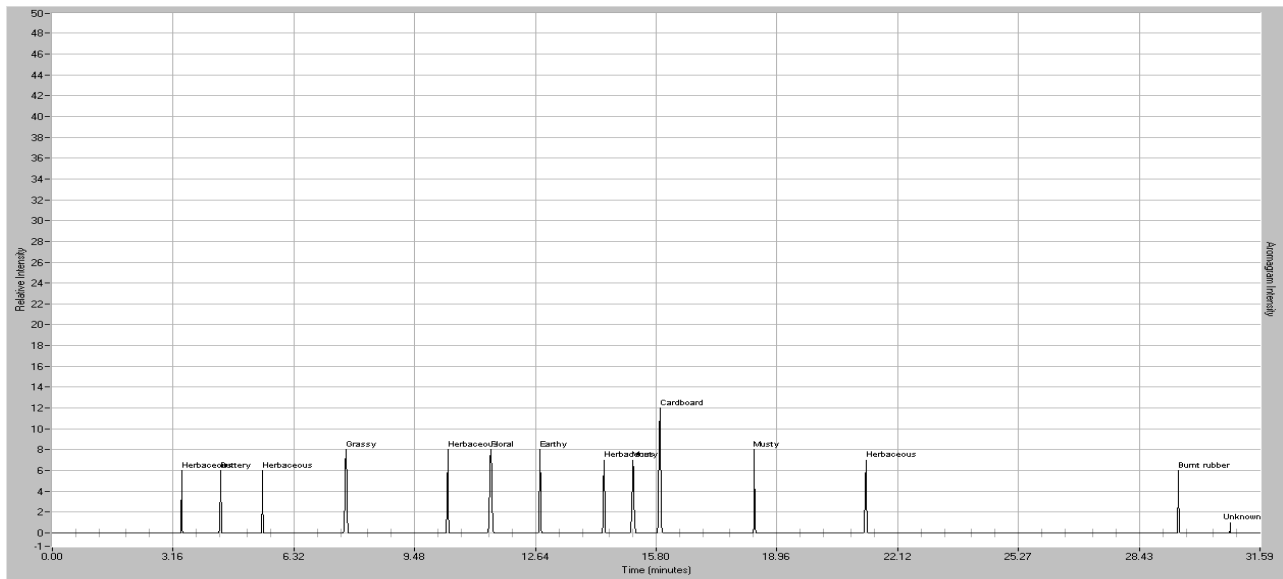


Aromagram #3 – Downwind; Garrison X Eldorado; Thursday, November 01st; 25 min collect; (file # car003)



Aromagram #4 – Upwind Reference; Vine X Eldorado; Thursday, November 01st; 25 min collect; (file # car015)

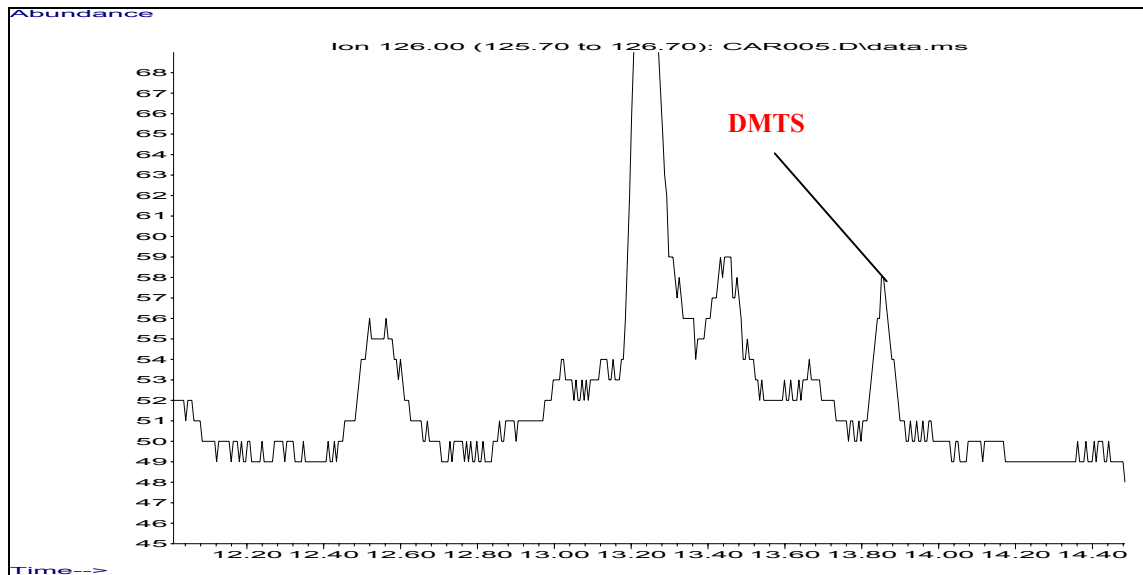
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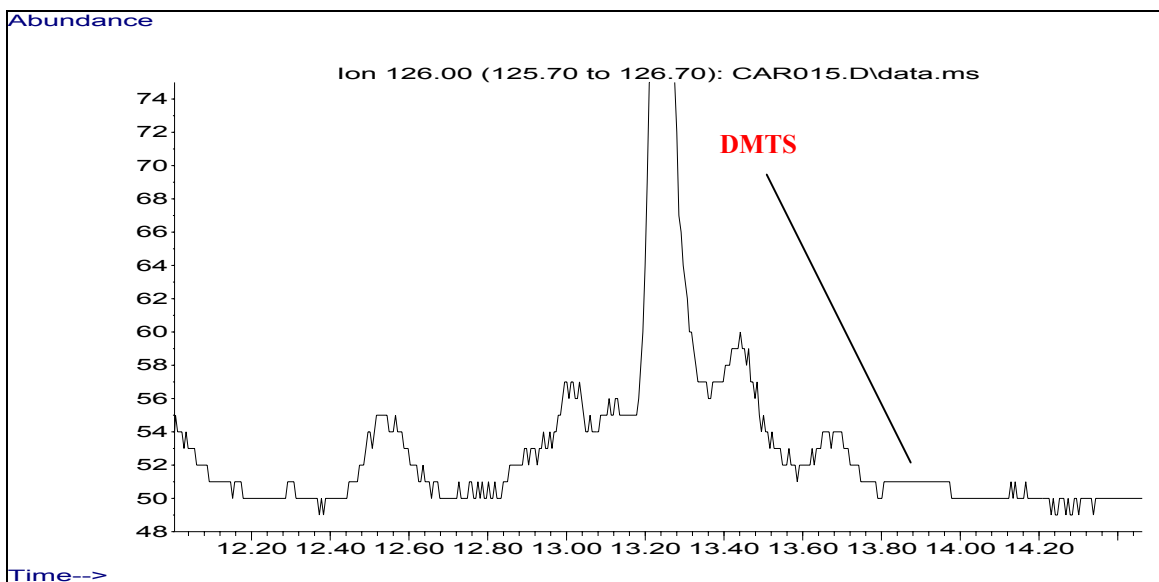
Aromagram #5 – Control; Shipped but not exposed; (file # car012)

Carthage Bottoms Area Phase I Odorant Prioritization Study - RFS (revised)
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EXHIBIT C
Representative Chromatograms



Chromatogram #1 – Downwind; Vine X Eldorado; Wednesday, October 31st; 32 min collect; (file # car005)



Chromatogram #2 – Downwind; Vine X Eldorado; Thursday, November 01st; 25 min collect; (file # car015)