quinn emanuel **trial lawyers | chicago**
500 W. Madison Street, Suite 2450, Chicago, Illinois 60661-2510 | TEL (312) 705-7400 | FAX (312) 705-7401

WRITER'S DIRECT DIAL NO.
(312) 705-7488

WRITER'S INTERNET ADDRESS
stephenswedlow@quinnemanuel.com

September 26, 2014

VIA HAND DELIVERY

Commissioner Bechara Choucair, M.D.
Chicago Department of Health
333 South State Street, Room 200
Chicago, IL 60604

Re: KCBX Terminals Company's Response to the Natural Resources Defense Council, et al.'s Comments on its Petition for Variance

Dear Commissioner Choucair:

KCBX Terminals Company ("KCBX") appreciates this opportunity to respond to the comments submitted by the Natural Resources Defense Council, et al. ("NRDC"), and to correct the factual and legal inaccuracies perpetuated therein.

KCBX has demonstrated sincerity and good faith in its efforts to comply with the City of Chicago Department of Public Health Rules and Regulations for the Handling and Storage of Bulk Material Piles ("Regulations").[1] Contrary to the NRDC's comments, KCBX has requested limited variances and only from those few requirements that are practically impossible for KCBX to achieve as it attempts to continue its operations in Chicago at its North Terminal, while making major investments in enclosure at its South Terminal.

The NRDC, on the other hand, is a well-funded political activist group that has been attacking KCBX and its affiliates falsely on these issues for over a year. Its false attacks continue in its comments, which reveal its true agenda—to force KCBX out of business. That is *not*, however, the intent of the Regulations that the City enacted.

---

[1] The Regulations are available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/DoHRRegCntrlEmiHdlingStrgeBulkMaterPiles7142014.pdf.

In its comments, the NRDC demonstrates both a lack of knowledge of, and indifference to, the scientific evidence relied upon by KCBX in its Petition for Variance. Specifically, the NRDC largely ignores the sampling data that have been collected and submitted to regulatory agencies over the past year demonstrating that KCBX is not adversely impacting the neighborhoods surrounding its facility. Soil and wipe samples obtained from various locations in the neighborhoods show no indication of pet coke or coal in neighborhood soil or on neighborhood surfaces. Air monitors installed by KCBX and approved by the United States Environmental Protection Agency ("EPA") demonstrate that dust concentration levels in the air surrounding KCBX's facility meet public health standards. Most recently, furnace filters obtained from neighborhood residences and analyzed by both KCBX and the EPA contained no evidence of either pet coke or coal. Rather than addressing the actual test results, the NRDC mischaracterizes KCBX's obligations under the variance process. The reality is that KCBX has invested over $10 million on its dust suppression system since acquiring the KCBX South site in late 2012. Since the dust suppression system became operational, there has been no evidence of any impacts upon residents in the neighborhoods surrounding the facility. The existence of meritless lawsuits cannot (and should not) be a basis to deny the legitimate and narrowly-tailored variance requests submitted by KCBX.

The City's Regulations made many changes to the existing law under which KCBX had operated for decades. As explained in its Petition for Variance, KCBX has devoted significant resources and made changes to its operations to meet the requirements of the newly enacted Regulations. The Regulations envision, however, that given their complexity and untried nature, businesses impacted by the Regulations may need variances from some of the new requirements. Therefore, the Regulations specifically set forth procedures under which to seek those variances. KCBX, in compliance with those procedures, submitted its limited variance requests so that KCBX could continue to operate in Chicago without compromising the safeguards that protect against the potential for fugitive dust. KCBX respectfully requests that the Commissioner grant the discrete variances sought for the reasons outlined in its Petition.

I. The Commissioner Should Grant KCBX's Requested Variances

A. The City's Regulations Outline the Criteria for Reviewing Variance Applications

The City's Regulations expressly provide for the availability of variances, specifically setting forth requirements for the content of variance applications as well as the criteria that the Commissioner must consider in determining whether to grant a variance request. § 8.0. Notwithstanding the plain language of the Regulations, the NRDC attempts to effectively ban variances, by reading requirements into the Regulations that are not there, to the detriment of applicants like KCBX.

Contrary to the NRDC's claims, KCBX's Petition for Variance meets the requirements set forth in Section 8.0 of the Regulations:

> a) A statement identifying the regulation or requirement from which the variance is requested;
>
> b) A description of the process or activity for which the variance is requested, including pertinent data on location, size, and the population and geographic area affected by, or potentially affected by, the process or activity;
>
> c) The quantity and types of materials used in the process or activity in connection with which the variance is requested, as appropriate;
>
> d) A demonstration that issuance of the variance will not create a public nuisance or adversely impact the surrounding area, surrounding environment, or surrounding property uses;
>
> e) A statement explaining
>
> > i. Why compliance with the regulations imposes an arbitrary or unreasonable hardship;
> >
> > ii. Why compliance cannot be accomplished during the required timeframe due to events beyond the Facility Owner or Operator's control such as permitting delays or natural disasters; or

> iii. Why the proposed alternative measure is preferable.
>
> f) A description of the proposed methods to achieve compliance with the regulations and a timetable for achieving that compliance, if applicable;
>
> g) A discussion of alternate methods of compliance and of the factors influencing the choice of applying for a variance;
>
> h) A statement regarding the person's current status as related to the subject matter of the variance request;
>
> i) For any request for a variance from the enclosure deadline set forth in 6.0(5), the applicant must submit all of the information required in sections 8.0(2)(a) through (h) above and shall also submit 1) fugitive dust monitoring reports for the four months prior to the date of the variance application and 2) in the event that the variance is granted, monthly fugitive dust monitoring reports for the duration of the variance which shall be due fourteen (14) days following the end of the month which the report covers. The monthly fugitive dust monitoring reports required by this section shall be submitted in an electronic format as specified in the Variance.

§ 8.0(2).

Also, contrary to the NRDC's assertions, the Regulations do not allow for their provisions to apply differently to some companies as opposed to others. *See* NRDC's Comments on KCBX's Petition for Variance ("Comments")[2], at 2-3 (stating that the Commissioner should apply a "ten-fold" stringency test to assessing KCBX's request for a variance). KCBX is not, and cannot be, held to a different standard. Instead, KCBX's Petition for Variance must be reviewed with the same level of scrutiny with which other applicants' requests are reviewed pursuant to Section 8.0(3). KCBX has submitted an application that meets the requirements of Section 8.0(2), and its requested variances should be granted.

---

[2] The NRDC's Comments on KCBX's Petition for Variance are available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/PetCoke_Public_Comments/PubComNRDCetalComonKCBXVarianceReqst922014.pdf.

B. KCBX has Demonstrated that its Requested Variances Will Not Adversely Impact the Area Surrounding its Facility

The Regulations require a variance request to demonstrate that the "issuance of the variance will not create a public nuisance or adversely impact the surrounding area, surrounding environment, or surrounding property uses." § 8.0(2)(d). KCBX's Petition for Variance satisfies this standard. KCBX has presented overwhelming evidence that its operations at its North and South Terminals do not adversely impact the areas surrounding the sites. The NRDC's claims to the contrary are inconsistent with established facts. For example:

- In an October 2013 report, the Congressional Research Service evaluated comprehensive toxicity analyses from the EPA, and found that pet coke has a "low health hazard potential in humans, with no observed carcinogenic, reproductive, or developmental effects" and a "low potential to cause adverse effect on aquatic or terrestrial environments." Ex. 1, at 9.

- A toxicity assessment by the Michigan Department of Environmental Quality, published in February 2014, concluded that it is not necessary to establish specific screening levels for pet coke air emissions because "[t]here is no evidence indicating that PM from petcoke is more potent than other forms of PM" and "petcoke dust does not pose a significant carcinogenicity risk." Ex. 2, at 1.

- Soil and surface sampling reveal that no evidence exists of pet coke or coal on the surface or in the soil of the East Side and South Deering neighborhoods. KCBX's Petition for Variance ("Petition")[3], at Exs. 1-2.

- Air monitoring data and modeling show that KCBX's operations are consistent with off-site levels that meet standards designed to protect public health. Petition, at Ex. 3.

- Furnace filter samples show that there is no evidence of pet coke in homes near KCBX's Terminals. Ex. 3, at 1; EPA Lab Analysis of Furnace Filters.[4]

---

[3] KCBX's Petition for Variance is available at: http://www.cityofchicago.org/content/dam/city/depts/cdph/environmental_health_and_food/VarReqKCBXTerCo3259E100th10730SBurleyAve.pdf.

[4] Since the time of filing KCBX's Petition for Variance, the EPA tested "used furnace filters from two residents who live in the Southeast Chicago neighborhood, near the KCBX properties," and the "preliminary analysis of the furnace filter sample results does not confirm (footnote continued)

The NRDC ignores these facts in order to deliver a message to the Commissioner that it wants KCBX out of business; there is, however, no legal or factual basis for the NRDC's demand. The soil and surface sampling, air monitoring data and modeling, and furnace filter samples demonstrate that KCBX's dust suppression systems are working. KCBX acquired the South Terminal in December 2012. Prior to KCBX's acquisition, the facility had been handling pet coke and coal. KCBX was not content to rely on its predecessor's dust suppression system, which, to KCBX's knowledge, had never been previously challenged. Instead, upon acquiring the site, KCBX *immediately* and *voluntarily* began upgrading the facility. While the NRDC may "take exception with KCBX's repeated references to its investments in the South Terminal," Comments at 3, the fact is that KCBX invested $10 million in building and putting into service a state-of-the-art dust suppression system at that Site. The hallmark of that system is 42 automated water cannons oscillating on 60-foot-high poles with overlapping coverage areas, capable of applying up to 1,800 gallons of water per minute to the material piles. The NRDC casually discounts KCBX's substantial investments, based solely on its view that KCBX should have enclosed the material piles at the South Terminal. Comments, at 3-4. But according to the National Association of Manufacturers, 87 percent of transfer facilities stage pet coke in uncovered, outdoor piles. Ex. 4, at 2. Further, the NRDC does not account for the fact that it took less than one year from the time KCBX acquired the site for KCBX to implement its water cannon system, while enclosure would have taken multiple years. Finally, the NRDC continues to ignore the considerable evidence that KCBX's dust suppression systems are effective. The

---

the presence of pet coke." The EPA's Lab Analysis of Furnace Filters is available at: http://www2.epa.gov/petroleum-coke-chicago/lab-analysis-furnace-filters.

NRDC's scare tactics are just that; KCBX's dust suppression systems are working, and its requested variances will not adversely impact the surrounding communities.

1. The Data Underlying the Experts' Analyses are Available to the City

The NRDC's argument that KCBX failed to provide the data underlying its experts' analyses to the City is inaccurate and misleading. Comments, at 16. KCBX provided the underlying data for the soil and surface sampling conducted in November and December 2013 to the City on February 11, 2014. KCBX also provided the underlying data for additional sampling conducted in April 2014 to the City on June 11, 2014. Further, KCBX makes its fence line air monitoring data, which underlie the air modeling, available to the public and government every week.[5]

Notably, the NRDC omits any criticisms of testing conducted by both the EPA and KCBX's expert, Dr. MacIntosh, on furnace filter samples from heating, ventilating and air conditioning ("HVAC") systems from homes in the South Deering and East Side neighborhoods. *See* Comments. Both the EPA and Dr. MacIntosh concluded that chemical analyses of those samples showed no evidence of pet coke from KCBX's facility. Ex. 3, at 1; EPA Lab Analysis of Furnace Filters.[6] Indeed, the furnace filter samples were consistent with indoor and outdoor air, settled house dust, and soil reported from Chicago and other urban areas in the United States, demonstrating that pet coke dust does not get into homes in the East Side and South Deering neighborhoods. Ex. 3, at 1.

2. The NRDC's Reliance on the EPA's Notice of Violation is Misplaced

---

[5] KCBX's Fenceline Air Monitoring Data is available at: http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data; http://aboutpetcoke.com/environmental-reporting/.

[6] http://www2.epa.gov/petroleum-coke-chicago/lab-analysis-furnace-filters.

The statements in the EPA's Notice of Violation do not contradict the information submitted to the City by KCBX. The NRDC relies on KCBX's fence line monitoring data, showing that on April 12, 2014, a PM10 monitor at the North Terminal recorded a 24 hour average of 155 µg/m3, and that on May 8, 2014, a PM monitor at each site recorded 24 hour averages of 156 µg/m3. NOV, at ¶ 18[7]; KCBX's Fenceline Air Monitoring Data.[8] However, pursuant to the EPA's regulations, the PM10 monitors at KCBX's terminals are source monitors, located within the terminals' fence lines and adjacent to the material piles, and thus should not be directly compared to ambient air quality standards. Unlike these source monitors, the EPA's criteria for air monitors indicates that NAAQS monitors should be sited so as to gather data at scales that capture public exposure to PM10—primarily at the "middle scale" and "neighborhood scale" rather than "microscale" sites such as "fence line stationary source monitoring locations":

> Although microscale monitoring may be appropriate in some circumstances, the most important spatial scales to effectively characterize the emissions of PM10 from both mobile and stationary sources are the middle scales and neighborhood scales. . . . Neighborhood scale PM10 sites provide information about trends and compliance with standards because they often represent conditions in areas where people commonly live and work for extended periods.

40 C.F.R. Part 58, Appendix D, § 4.6(b). This section further directs that where "fence line stationary source monitoring locations" are utilized for microscale monitoring, they should "be located near inhabited buildings or locations where the general public can be expected to be exposed to the concentration measured." *Id.* at § 4.6(b)(1). Because the fence line monitors at

---

[7] The EPA Notice of Violation is available at: http://www2.epa.gov/sites/production/files/2014-06/documents/kcbx-nov-20140603.pdf.

[8] http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data.

the North and South Terminals are *not* located in places where the general public can be expected to be, the monitors are inappropriate for determining NAAQS compliance.

In any event, the majority of PM10 measured on the referenced days originated from sources other than KCBX. The readings referenced were recorded at only one of the nine source monitors on April 12, 2014 and at two of the nine source monitors on May 8, 2014. NOV, at ¶ 18[9]; KCBX's Fenceline Air Monitoring Data.[10] Although the monitors were oriented downwind of the piles on both days, concurrent PM10 concentrations at all of the other KCBX monitors were similar. KCBX's Fenceline Air Monitoring Data.[11] The similarity of readings across all monitors, even monitors that would not have been affected by the piles on those days, clearly demonstrates the effect of off-site sources. Indeed, the net contributions to observed PM10 from KCBX's operations on April 12 and May 8, 2014—approximately 9 µg/m3 and 50 µg/m3 respectively—were small relative to offsite source contributions. Ex. 6, at 5, 8.

The data that the EPA relied upon in issuing the NOV simply do not support the EPA's conclusion that the Illinois State Implementation Plan ("SIP") was violated on the cited days. Further, that same data proves that KCBX's terminals do not impact the surrounding area and as such emissions during those events were not "air pollution" as EPA and now NRDC allege.

Data from KCBX's on-site PM10 air monitors show approximately 98% of days recording < 100 µg/m3, and 85% of days recording < 50 µg/m3. *See* KCBX's Fenceline Air Monitoring

---

[9] http://www2.epa.gov/sites/production/files/2014-06/documents/kcbx-nov-20140603.pdf.

[10] http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data.

[11] http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data.

Data.[12] The monitored average PM10 concentrations on all days (except the two cited by EPA in its NOV), were below the 150 μg/m3 24 hour average for PM10 used for National Ambient Air Quality Standards purposes. The average concentrations were lower still, with an average daily concentration of approximately 32 μg/m3 and a median concentration of 27 μg/m3. *See id.*

NRDC's assertion that a number of wipe samples exceeded the background vanadium to nickel ratio in Chicago's soil is based on the incorrect premise that the background vanadium to nickel ratio in Chicago is "about 1." EPA Notice of Violation ("NOV")[13], at ¶ 21. Data from the United States Geological Survey ("USGS") and the Illinois Tiered Corrective Action ("TACO") program indicate that the average vanadium to nickel background ratios for soil in the Chicago area range between 1.4 and 2.5. Petition, at Ex. 2. This is important because *all* of the vanadium to nickel ratios reported by the EPA in their wipe sampling (and all of the samples taken by Dr. MacIntosh) were within ranges representing background levels in urban areas of Chicago. *See* EPA Lab Analysis of Dust Wipe Samples[14]; Petition, at Exs. 1-2. Indeed, both the EPA and Dr. MacIntosh's data show average vanadium to nickel ratios between 1.2 and 1.3, well within normal ranges for any neighborhood in Chicago. *See id.* Moreover, these results are well below the vanadium to nickel ratios observed in the coal and pet coke samples from KCBX's facility, which range from 2.9 to 4.5, with an average of 3.5. Ex. 5, at 5. The EPA's NOV actually *confirms* that there is no evidence of pet coke or coal on the surfaces in the area surrounding KCBX.

---

[12] http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data.

[13] http://www2.epa.gov/sites/production/files/2014-06/documents/kcbx-nov-20140603.pdf.

[14] The EPA Lab Analysis of Dust Wipe Samples is available at: http://www2.epa.gov/petroleum-coke-chicago/lab-analysis-dust-wipe-samples.

The NRDC also asserts that vanadium to nickel ratios in the samples were "highest at the location closest to KCBX and decreased as distance of the sampling location from KCBX increased." Comments, at 17; NOV, at ¶ 23.[15] This, however, ignores the fact that several other samples collected near the facility did not detect both vanadium and nickel. In fact, both vanadium and nickel were detected in less than half (5 of 11) of the EPA's eleven samples. *See* EPA Lab Analysis of Dust Wipe Samples.[16] In addition, some sample locations closer to KCBX had lower concentrations of vanadium and nickel than sample locations farther away from the terminals. *See id.* Because of all this, no persuasive evidence exists of higher vanadium to nickel ratios closer to KCBX.

3. The Air Modeling Analysis Submitted by KCBX is Persuasive Evidence that No Adverse Impacts have Occurred

As with its criticisms of the soil and sampling analysis, the NRDC unsuccessfully attempts to undermine the air modeling analysis submitted by KCBX. First, the NRDC complains that KCBX has not provided the inputs and assumptions that went into the expert's model. Comments, at 18. KCBX did, however, offer to provide that very data to the City of Chicago, but the City declined KCBX's offer. In any event, KCBX provided this information to the EPA in June 2014. Since the EPA and the City are in close coordination, the City has access to this information.

Second, the NRDC objects that the model fails to consider PM2.5 levels. Comments, at 19. However, it is unnecessary for KCBX to conduct PM2.5 monitoring, which the EPA itself recognized when it required KCBX to install and operate PM10, but not PM2.5, monitors. This

---

[15] http://www2.epa.gov/sites/production/files/2014-06/documents/kcbx-nov-20140603.pdf.

[16] http://www2.epa.gov/petroleum-coke-chicago/lab-analysis-dust-wipe-samples.

is because pet coke is comprised of granules orders of magnitude larger than PM2.5. Ex. 1, at 15. PM2.5 monitoring is more appropriate for the measurement of smaller, inhalable particles such as combustion particles, including emissions from vehicles, smokestacks, or gasoline and diesel engines.

Next, the NRDC protests that the air monitoring model sample size of two days per facility is too small. Comments, at 19. But the model does not represent a random sample; rather, three of the four sample days were specifically selected from 61 days of data because those days had the highest 24 hour PM10 readings, and the fourth sample day was selected because of the wind direction that day. Petition, at Ex. 3. The model was designed to capture worst case scenarios, rendering modeling of other days unnecessary. Further, the model does not represent PM10 at the nearest residence, as the NRDC claims, but rather the nearest residence *in line with the wind* that day. *Id.*

Fourth, the NRDC argues that it is not clear whether the model accounts for emissions sources at the site aside from the material piles. Comments, at 19. The modeling is based on data from KCBX's fence line monitors—the monitors necessarily monitor dust from all sources at the site, including the piles, vehicles, conveyors, and loading and unloading structures, as well as upwind sources outside of KCBX.

Finally, the NRDC claims that the model should account for dust that leaves the facility and is subsequently re-emitted by activity on nearby roadways. Comments, at 19. The model is not intended, however, to account for off-site sources, nor does it need to. Instead, the EPA's ambient air monitor at George Washington High School, located less than a mile from KCBX's South Terminal, is capable of and would likely capture any dust allegedly leaving the facility and subsequently re-emitted by off-site activity. That monitor was evaluated for long-term trends from 2010 to 2013 and reported no instances when PM10 in ambient air exceeded EPA's PM10 NAAQS standard. 2012 Illinois Environmental Protection Agency Illinois Annual Air Quality Report.[17] Indeed, a 2012 Illinois Air Quality Report issued by the Illinois EPA concludes that "[t]here were no exceedances of the 24-hour primary standard of 150 μg/m3" for PM10 at any site, including the George Washington High School Monitor. *Id*, at 10. Moreover, KCBX employs several mechanisms to ensure that dust is not on the nearby roadways, including routine street sweeping, rumble strips and truck washes. Because KCBX has demonstrated that its current operations do not adversely impact the air, surfaces, and soil surrounding its terminals, the Commissioner should grant KCBX's variance requests.

4. The Soil and Sampling Analysis Submitted by KCBX is Persuasive Evidence that No Adverse Impacts have Occurred

Apart from the NOV, the NRDC attempts to discredit the soil and sampling analysis and air monitoring and modeling data by presenting a laundry list of critiques, none of which have merit. First, as it relates to the soil and sampling analysis, the NRDC argues that Dr. MacIntosh's analysis does not disclose the protocols that he employed. Comments, at 18. However, KCBX provided the City with the soil and wipe sampling protocols and supporting references, on or about June 11, 2014. Those protocols show that the samples were collected and tested in accordance with EPA, USGS, and American Society for Testing and Materials ("ASTM") standards. In addition, the general protocols that Dr. MacIntosh used were included both in his January 13, 2014 presentation and his April 21, 2014 presentation. Petition, at Exs. 1-2.

---

[17] The 2012 Illinois Environmental Protection Agency Illinois Annual Air Quality Report is available at: http://www.epa.state.il.us/air/air-quality-report/2012/air-quality-report-2012.pdf.

Second, the NRDC posits that by averaging the samples in his presentation of the vanadium to nickel ratios and PAH profiles in the collected samples, Dr. MacIntosh may be masking individual sample results. Comments, at 18. This argument is entirely unpersuasive, in light of the fact that KCBX provided the City Dr. MacIntosh's individual sample results from November and December 2013 as well as April 2014. But either way, the use of averages is appropriate for evaluating KCBX's overall impact on the area, and is consistent with the theories of wind-blown transport and neighborhood-wide impact posited by the regulatory agencies.

Next, the NRDC argues that Dr. MacIntosh may not have accounted for the potentially elevated levels of vanadium and nickel in Chicago's background soil. Comments, at 18. This argument misunderstands Dr. MacIntosh's analysis. Whether the background levels of vanadium and nickel throughout Chicago are elevated is wholly irrelevant—what matters is whether the levels observed in the samples from the East Side and South Deering neighborhoods that surround the KCBX facility are elevated *above* the background levels that have been found to occur elsewhere in Chicago. The EPA's and Dr. MacIntosh's data show that is not the case. *See* EPA Lab Analysis of Dust Wipe Samples[18]; Petition, at Exs. 1-2. Further, Dr. MacIntosh did consider the background levels of vanadium and nickel in Chicago's soil for comparative purposes. The Chicago-area background levels are derived from (1) independent government studies by the USGS and the State of Illinois's TACO program; and (2) a collection of samples from Chicago-area control neighborhoods surrounding the South Deering and East Side neighborhoods. Petition, at Exs. 1-2. When compared against the background, both Dr. MacIntosh's and the EPA's studies show that vanadium to nickel ratios in the East Side and

---

[18] http://www2.epa.gov/petroleum-coke-chicago/lab-analysis-dust-wipe-samples.

South Deering neighborhoods are similar to vanadium to nickel ratios throughout Chicago, and dissimilar to the same ratio in coal and pet coke. *See* EPA Lab Analysis of Dust Wipe Samples[19]; Petition, at Exs. 1-2.

Finally, the NRDC claims that Dr. MacIntosh's samples were not collected within close enough proximity to KCBX's terminals. Comments, at 18. Dr. MacIntosh collected samples from many locations near KCBX's facility, as well as other publicly accessible locations in the nearby neighborhoods. Petition, at Exs. 1-2. His approach of taking samples near the facility as well as in the surrounding communities was appropriate to address KCBX's overall impact on the area, and again, is consistent with the theories of wind-blown transport and neighborhood-wide impact posited by the regulatory agencies.

Notably, the EPA also collected samples from locations near KCBX's facility. *See* EPA Lab Analysis of Dust Wipe Samples.[20] All of the EPA's samples from near the terminals either did not detect the presence of both vanadium and nickel, or were well within the range for vanadium and nickel observed within Chicago-area soil. *See id.* In sum, the information collected by both Dr. MacIntosh and the EPA to date indicates that any chemical indicators of pet coke and coal on surfaces and in the soil of the surrounding neighborhoods are not related to proximity to the KCBX terminals.

C. The Commissioner Should Grant KCBX's Request for a Variance from Section 3.06(6) and 6.0(3)—Conveyors

KCBX's request for a variance from the requirements that it cover its conveyors within six months should be granted. Despite air monitoring results that overwhelmingly show that

---

[19] http://www2.epa.gov/petroleum-coke-chicago/lab-analysis-dust-wipe-samples.

[20] http://www2.epa.gov/petroleum-coke-chicago/lab-analysis-dust-wipe-samples.

KCBX's terminals do not adversely impact the surrounding area, the NRDC argues that KCBX's conveyors may contribute to "exceedingly high" PM10 levels, and thus, its variance request should be denied. Comments, at 20. The NRDC cites hourly PM10 levels at the North site on February 27, 2014 and April 12, 2014, and at the South site on April 12, 2014 and June 2, 2014. *Id.* at n.71. The NRDC's analysis is fundamentally flawed for several reasons. First, the NRDC's comparison of the hourly PM10 readings to the NAAQS is improper because the PM10 NAAQS is based on a 24 hour average, not an hourly average, and because the NAAQS apply to ambient PM10 air levels, but KCBX's fence line monitors are not ambient air monitors. Second, the air modeling that KCBX submitted in its variance petition shows that PM10 levels at the residences nearby the North Terminal on February 27, 2014 and April 12, 2014 remained consistent with public health standards on both days. Petition, at Ex. 3. This is because as PM10 disperses from KCBX's fence line to the nearest residence, PM10 concentrations decrease dramatically. *Id.* Even the NRDC concedes that "[g]enerally, fugitive dust emissions deposit relatively close to their source when compared with other air pollutants . . . ." Comments, at 18. Third, the 24 hour average PM10 readings at the South site did not exceed 150 µg/m3 on either April 12, 2014 or June 2, 2014. KCBX's Fenceline Air Monitoring Data.[21]

Additionally, the NRDC argues that KCBX's variance request should be denied because KCBX did not provide any analysis quantifying the difference in emissions between covered conveyors and uncovered conveyors with spray systems. Comments, at 21. However, such an analysis is not required by the Regulations, and therefore the absence of the analysis is not an appropriate basis for denial. *See* § 8.0. Further, KCBX has already demonstrated that its current

---

[21] http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data.

operations—which include the use of the uncovered conveyors—do not have an adverse impact on the surrounding area, rendering additional conveyor-specific analysis unnecessary.

Further, the NRDC objects to what it characterizes as KCBX's request to operate the uncovered conveyors at the North site indefinitely. Comments, at 21. KCBX requested to operate eight uncovered conveyors at the North Terminal until it transitions its operations from the North Terminal to the South Terminal. Petition, at 17. The NRDC demands a "date certain for completing the transfer of operations," but pinpointing the date of transfer is beyond KCBX's control, as it depends on external factors such as permitting. Comments, at 21. Even absent a "date certain," this argument is of minimal persuasiveness in light of the fact that KCBX plans to construct an enclosure at its South Terminal and not at its North Terminal, as evidenced by its Enclosure Plan. Without an enclosure at the North site, the City's regulations clearly preclude KCBX from operating the North Terminal indefinitely.

The NRDC also alleges that KCBX failed to provide installation information relative to throughput so that the City could determine how quickly installation could occur. Comments, at 21-22. However, such information is neither necessary nor helpful, because the estimated time to cover the conveyors depends on a number of factors not directly related to throughput, such as the time it will take to custom design and manufacture the covers and modify the conveyors prior to installation. Petition, at 20-21. The Regulations simply require "[a] statement explaining . . . [w]hy compliance cannot be accomplished during the required timeframe due to events beyond the Facility Owner or Operator's control . . ." § 8.0(2)(e)(ii). KCBX clearly states that it cannot install the covers within the six month time frame:

> The 26 conveyors at issue were not designed to have covers. Rather, KCBX would have to have the covers custom-designed and manufactured, as well as modify the conveyors in order to install supports for the covers. For safety purposes, once KCBX has received

> the covers at the Facility, it cannot install the covers while the conveyors are in operation. It is estimated that it would take approximately 10 to 12 weeks for installation of the custom covers from the time that the covers are ordered. If additional support or structural engineering is required for the conveyors that work would extend the time required to complete installation of the custom covers. To meet the obligations of KCBX's current contracts, all conveyors must be kept in service through October 31, 2014.

Petition, at 21.

Next, the NRDC argues that KCBX's explanation that it must keep all conveyors in service through October 31, 2014 to meet its current contractual obligations is not sufficient to show arbitrary or unreasonable hardship. Comments, at 22. Instead, the NRDC claims that KCBX must "provide [] information on its contracts showing that accommodation for compliance with the Rule would constitute a breach resulting in disastrous penalties." *Id.* The NRDC has no basis whatsoever for its contention that the Regulations require KCBX to disclose contractual information to show hardship, or that the standard for hardship is "disastrous penalties." The installation of the covers will require KCBX to take the conveyors out of service, which impacts KCBX's ability to transfer materials to and from its Terminals, and therefore its ability to meet its contractual obligations. Not allowing KCBX to minimize the impact on its business by installing the covers when business slows down is particularly arbitrary and unreasonable where KCBX has already shown that the operations at its site—including conveyance—do not adversely impact the surrounding area.

Finally, the NRDC argues that KCBX has failed to show that an extension over the winter will not adversely impact the surrounding areas. Comments, at 22. But KCBX has shown an absence of adverse impacts in general, based on data that includes information collected during winter months. For example, Dr. MacIntosh conducted the soil and sampling analysis in November and December (as well as April). Petition, at Exs. 1-2. Air monitoring data for the sites date back to winter as well—specifically, to February 18, 2014. KCBX's Fenceline Air Monitoring Data.[22] KCBX need not prove a decrease in activity levels during winter months to support an inference that any adverse impacts will decrease, because KCBX has already presented data confirming the absence of any adverse impacts.

D. The Commissioner Should Grant KCBX's Request for a Variance from Section 5.0(2)—Height Limit

With regard to KCBX's request to stage material in piles up to 45 feet in height, the NRDC complains that KCBX does not explain in detail how its customer obligations align with the volumes of materials it can store at different pile heights to prove the necessity of the requested variance. Comments, at 23. KCBX's Fugitive Dust Plan, submitted concurrent with its variance request, relays substantial detail. For example, KCBX represents that based on the 2.6 million square feet it has available to stage material, it can stage 2.1 million tons, 1.6 million tons, or 1.1 million tons at its South Terminal, at 60, 45, and 30-foot pile heights respectively. Similarly, it can stage 1.1 million tons, 0.9 million tons, or 0.6 million tons at its North Terminal, at 60, 45, and 30-foot pile heights respectively. KCBX also represents that based on its customer contracts, which include agreements to accept specific amounts of material, to segregate material, or to blend material, a third-party engineering firm engaged by KCBX determined that operating at a 30 foot pile height is not feasible. Petition, at 24-25. KCBX should not be required to state additional detail relating to its customer obligations.

The NRDC again asserts that KCBX's representation that it will be unable to meet its customer obligations absent the requested variance fails to state an arbitrary or unreasonable hardship. Comments, at 23. However, an explanatory statement is all that is required. §

---

[22] http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data.

8.0(2)(e)(i). KCBX explains in its petition that a 30 foot pile height would limit its capacity and threaten its existing customer obligations. Petition, at 27.

The NRDC also argues that KCBX has not demonstrated an absence of adverse impacts at a 45 foot pile height. Comments, at 23. This is incorrect, as air modeling of pet coke piles configured with heights of 30 feet and 45 feet shows that lowering the height from 45 feet to 30 feet has only a negligible impact on PM10 emissions and indeed, that a 30 foot pile height—as opposed to a 45 foot pile height—actually results in slightly higher PM10 emissions. Ex. 7, at 1. Moreover, KCBX's dust suppression systems are designed for pile heights in excess of 60 feet. Additionally, the soil and surface sampling as well as air monitoring and modeling data prove that KCBX is capable of operating with either 45 or 60 foot pile limitations. Given that the dust suppression controls that are currently in place effectively suppress dust at 60 feet, additional measures for controlling dust are not necessary.

E. The Commissioner Should Grant KCBX's Request for a Variance from Section 5.0(5)(B)—Dust Suppressant System

KCBX's request to continue operations when temperatures are under 25 degrees Fahrenheit without immediately applying water or surfactant to the materials should be granted. The NRDC cites air monitoring data at the North site on February 27, 2014, and at the South site on March 1, 2014, to support its claim that KCBX cannot effectively control dust during low temperatures. Comments, at 24. Again, the NRDC's analysis is flawed. First, air modeling of February 27, 2014 shows that PM10 levels at nearby residences were consistent with public health standards that day. Petition, at Ex. 3. Second, the 24 hour average PM10 readings at the South site did not exceed 150 μg/m3 on March 1, 2014. KCBX's Fenceline Air Monitoring

Data.[23] Third, KCBX's air monitoring results as a whole show that KCBX's operations do not adversely affect the surrounding area. *See supra*, at 11.

The NRDC again argues that KCBX has not shown an arbitrary or unreasonable hardship, by representing that if required to turn away all shipments when the temperatures fall below 25 degrees, KCBX would not be able to perform its contractual obligations. Comments, at 25. As stated previously, KCBX has met the requirements by providing an explanatory statement pursuant to Section 8.0(2)(e)(i).

F. The Commissioner Should Grant KCBX's Request for a Variance from Section 5.0(5)(C)—Dust Suppressant System

KCBX has made the requisite showing for a variance from the requirement that it suspend disturbance of material piles if part of its dust suppression system that controls dust from the piles is under maintenance or otherwise inoperable. First, the NRDC argues that permitting KCBX to employ a different control method that may not be approved by the City will not guarantee equivalent effectiveness in suppressing dust. Comments, at 26. However, any alternative that KCBX would employ would have already been approved by the City as part of KCBX's Fugitive Dust Plan. Further, KCBX's commitment to monitoring the activity at issue guarantees the effectiveness of the alternative control, because in the event that the control is not effective, KCBX would suspend the activity.

The NRDC's next claim, that KCBX failed to provide an objective standard as to when employing alternative measures or shutting down an activity may be necessary, is without merit. Comments, at 26. The NRDC suggests that KCBX link the standard of what is "necessary" to "compliance with the opacity limits that apply to the emission sources." *Id.* However, KCBX

---

[23] http://www2.epa.gov/petroleum-coke-chicago/kcbx-fenceline-air-monitoring-data.

need not affirmatively state such, as necessity is necessarily measured by compliance with all applicable laws and regulations.

Lastly, the NRDC argues that KCBX has not demonstrated an arbitrary or unreasonable hardship because it has not "attempt[ed] to quantify the impacted operations and translate that impact into effects on the business." Comments, at 26-27. KCBX is required to *explain* any impact on its business, and it has done so. § 8.0(2)(e)(i).

G. The Commissioner Should Grant KCBX's Request for a Variance from Section 5.0(6)(D)—Runoff Management, Grading

KCBX's request for a variance from the requirement that it prevent the pooling of water at its sites should be granted. The NRDC argues that pooled water may present air quality issues, to the extent that pooled water splashes on trucks and results in material being tracked out of the facility, or because when the water evaporates, coal and pet coke dust accumulates. Comments, at 27. The NRDC's arguments are not persuasive, particularly because the terminals' truck wheel washes are near the exits, which minimizes any tracking from the site, and because any accumulations of coal and pet coke will be removed from the sites as required.

The NRDC also claims that KCBX failed to propose alternatives to minimize the pooling of water on-site. Comments, at 27-28. The Regulations require "[a] discussion of alternate methods *of compliance*." § 8.0(2)(g) (emphasis added). KCBX concluded that the sole alternative method of complying with the Regulations would be to pave the terminals, and it included a discussion of such in its petition. Petition, at 41-42. But the NRDC posits that KCBX must also include a discussion of alternate methods of *minimizing* the pooling of water at its terminals. The runoff and grading Regulations require the complete prevention of pooling, §

5.0(6)(d)—thus, the Regulations do not require any discussion of efforts to minimize pooling, because such efforts are not methods of complying with the Regulations.

The Commissioner should grant the discrete variances requested by KCBX, for the reasons set forth above, as well as in its Petition.

II. The City Should Disregard the NRDC's Comments on KCBX's Enclosure and Fugitive Dust Plans

Despite recognizing that KCBX's Enclosure and Fugitive Dust plans "are not formally at issue during this comment period," Comments, at 1, the NRDC nonetheless urges the Chicago Department of Health to reject KCBX's Enclosure and Fugitive Dust plans. Comments, at 4-13. Because neither the Enclosure Plan or Fugitive Dust Plan is properly the subject of public comment, the Department of Health should disregard the NRDC's comments on the plans in their entirety.[24] The NRDC's comments were submitted to and received by the Department of Health pursuant to Section 8.0(5) of the City's Regulations, which state that "[t]he Commissioner will not grant any variance under this section until members of the public have had an opportunity to submit written comments *on the variance application*." § 8.0(5) (emphasis added). Section 8.0(5) expressly limits the scope of public comments to the variance application and does not encompass Enclosure or Fugitive Dust plans. In fact, there are no provisions in the Regulations that provide for public comment on Enclosure or Fugitive Dust plans—both plans are subject to review and approval by the Department of Health. §§ 3.0(3); 4.0(1). Because the

---

[24] Similarly, the City should disregard the NRDC's statement that the City "should revoke KCBX's certificates of operation." Comments, at 2. This statement is disingenuous at best as there is no basis or authority for the NRDC to request the City to shut down KCBX as a result of KCBX's lawfully filed Petition for Variance or otherwise. It only reveals the NRDC's motive to close the door of a business that has been contributing to the Chicago economy for many years.

NRDC has no legal basis to submit comments on KCBX's Enclosure and Fugitive Dust plans, its comments are improper and should not be considered by the Department. To the extent that the Department has or may have any questions relating to KCBX's Enclosure and Fugitive Dust Plans, KCBX is committed to addressing those questions with the City directly.

III. Conclusion

KCBX respectfully requests that the Commissioner grant the requested variances for the reasons outlined above and in its Petition.

Dated: September 26, 2014

/s/ Stephen A. Swedlow

Stephen Andrew Swedlow, #6234550
QUINN EMANUEL URQUHART & SULLIVAN, LLP
500 West Madison St., Suite 2450
Chicago, Illinois 60661
Tel. 312-705-7400
Fax. 312-705-7401
stephenswedlow@quinnemanuel.com

Counsel for KCBX Terminals Company

cc: Alderman Pope
Alderman Burke

Exhibit 1

Congressional Research Service
Informing the legislative debate since 1914

Petroleum Coke: Industry and Environmental Issues

Anthony Andrews
Specialist in Energy Policy

Richard K. Lattanzio
Analyst in Environmental Policy

October 29, 2013

Congressional Research Service
7-5700
www.crs.gov
R43263

Summary

In early 2013, media outlets around Detroit, Michigan began publishing stories about large piles of petroleum coke stored along the Detroit Riverfront. Petroleum coke (petcoke) is a black-colored solid composed primarily of carbon, and may contain limited amounts of elemental forms of sulfur, metals and non-volatile inorganic compounds. Petcoke is essentially chemically inert. Petcoke exposure is considered to pose few human health or environmental risks, but may present significant nuisance concerns. The material in Detroit was the byproduct of the nearby Marathon Refinery's processing of heavy crude oils derived, in part, from Canadian oil sands deposits. The situation gained national attention with the publication of an article in the *New York Times* ("A Black Mound of Canadian Oil Waste Is Rising over Detroit," *New York Times,* May 17, 2013). The piles of petcoke sparked local concerns over the potential impacts of the material on human health and the environment, and whether these concerns were adequately addressed by local, state, and federal regulations. As petroleum refining is a nationwide commercial industry, these concerns may arise in other regions.

Petcoke is a co-product of several distillation processes used in refining heavy crude oil. Nearly half of U.S. petroleum refineries (56 or more) use a coking process to convert heavy crude oils into refined petroleum products, and more refineries may follow suit to take advantage of the supply of heavy crude oils from Canada's oil sands projects. Although it is a refining co-product, petcoke has economic value as both a heating fuel and raw material in manufacturing. In 2012, the U.S. Energy Information Administration reported that U.S. refineries produced in excess of 56 million metric tons of petcoke, of which 80% was exported.

The U.S. Environmental Protection Agency has surveyed the potential human health and environmental impacts of petcoke through its High Production Volume (HPV) Challenge Program and found the material to be highly stable and non-reactive at ambient environmental conditions. Most toxicity analyses of petcoke find it has a low potential to cause adverse effects on aquatic or terrestrial environments as well as a low health hazard potential in humans, with no observed carcinogenic, reproductive, or developmental effects. Cases of repeated-dose and chronic inhalation of fugitive dust (as generated during petcoke handling and storage) in animal studies do appear associated with respiratory inflammation. Emissions from the combustion of petcoke, however, can have impacts on human health and the environment, including the release of common pollutants, hazardous substances, and high levels of the greenhouse gas, carbon dioxide.

While some federal statutes address certain environmental impacts of petcoke's life-cycle, most regulatory action and oversight has been undertaken at the state and local levels, generally through facility-specific permitting requirements. Federally, petcoke is exempted from classification as either a solid or hazardous waste under the Resource Conservation and Recovery Act (RCRA) and is not considered a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Petcoke facilities may be regulated under certain provisions of the National Pollutant Discharge Elimination System (NPDES) permit program, as authorized by the Clean Water Act (CWA), if it is determined that runoff from sites where it is stored has the potential to transport the substance to nearby surface waters. The handling of petcoke may also create instances of reduced air quality due to releases of fugitive dust into the atmosphere. Most of the impacts of fugitive dust are localized; and thus, much of the regulatory oversight is implemented at the local and state level. Whether such oversight is providing adequate protection is among the issues that have been raised.

Contents

Figures

Tables

Appendixes

Contacts

Background

Some Members of Congress have expressed concern about storage and management of petroleum coke (petcoke) in their districts. Despite a lack of data on observed health impacts, local concerns have included potential human health and environmental impacts of fugitive dusts and runoff into waterways. Broader concerns have also been raised about the carbon dioxide (greenhouse gas) emissions from petcoke combustion.

Petcoke is the co-product of several processes used in petroleum refining to upgrade "residuum" into gasoline and middle distillate-range fuels. Residuum (or resid) remains after refineries initially distill heavy crude oils. Petcoke is a black-colored solid composed primarily of carbon, and may contain limited amounts of elemental forms of sulfur, metals, and non-volatile inorganic compounds.

The petroleum industry and federal regulators characterize petcoke as a "co-product" because it may have some commercial value as a boiler fuel and as a raw material in manufacturing. Nearly half of U.S. petroleum refineries employ "coking" processes. Refineries also produce petcoke as a by-product of catalysis, which refineries later consume as a fuel.

In addition to the existing suite of coking refineries, other refineries may add coking processes to take advantage of increased supplies of heavy crude oils from Canada's oil sand projects. Meanwhile, newly available light crude oil from U.S. unconventional shale projects and the Texas Permian Basin is leading some coking refineries to cut back on coking. At present, it is uncertain whether petcoke production will increase, remain steady or even decline, given the changing slate of U.S. crude oil supplies. Nevertheless, the export and demand for U.S. petcoke has been rising recently.

Community stakeholders have grown concerned over the potential effects on public health and the environment related to the production, storage, transportation, and use of petcoke. Some of these impacts include concerns over air quality due to fugitive dust, water quality due to run-off, and the potential for toxic and other emissions (including greenhouse gas emissions) from its combustion as a fuel source. In light of these concerns, industry, regulators, and compliance officers may be interested in best practices related to the storing, containing, and managing of petcoke.

Petcoke Uses

Petcoke may be combusted as fuel in industrial and power generating plants. Cement plants and power plants are currently the two greatest consumers of petcoke. There is some limited use as space heating and in commercial brick kilns in Europe, and a small but emerging market as a metallurgical coal blending component for the steel industry. In the United States, the high sulfur content may limit the petcoke in a coal/petcoke blend in a plant designed for coal. However, more recently designed Circulating Fluidized Bed (CFB) boilers can accommodate 100% high sulfur coke.[1]

---

[1] Pet Coke Consulting LLC, http://www.petcokeconsulting.com/primer/index.html.

Fuel grade petcoke can substitute for "steam coal" in power plant boilers, having the advantage of a higher heating value (discussed below). Conventional coal-fired boilers can blend petcoke with steam coal, and newer boiler designs have replaced steam coal with petcoke entirely.[2] Cement plants consume fuel-grade petcoke in rotary kilns.

Anode grade calcined petcoke is the principal raw material used in manufacturing carbon anodes for use in aluminum smelting. The anodes act as conductors of electricity and as a source of carbon in the electrolytic cell that reduces alumina into aluminum metal. Carbon anode manufacturers, predominantly captive operations of aluminum smelting companies, purchase anode grade calcined petcoke, mix it with pitch binders, press the mixture into blocks, and then bake the mixture to form a finished, hardened carbon anode.

Petcoke Composition

Petcoke is composed primarily of carbon. The specific chemical composition of petcoke depends on the composition of the petroleum feedstock used in refining. Petcoke impurities (i.e., the non-elemental carbonaceous substances) include some residual hydrocarbons left over from processing (referred to as volatiles), as well as elemental forms of nitrogen, sulfur, nickel, vanadium, and other heavy metals. These impurities exist as a hardened residuum captured within coke's carbon matrix. **Table 1** provides an observed range of petcoke properties for green and calcined petcoke.

Table 1. Petcoke Elemental Composition

By Weight Percent

Composition	Green	Calcined
Carbon	89.58–91.80	98.40
Hydrogen	3.71–5.04	0.14
Oxygen	1.30–2.14	0.02
Nitrogen	0.95–1.20	0.22
Sulfur	1.29–3.42	1.20
Ash (including heavy metals such as nickel and vanadium)	0.19–0.35	0.35
Carbon-Hydrogen Ratio	18:1–24:1	910:1

Source: U.S. Environmental Protection Agency, Screening-Level Hazard Characterization, Petroleum Coke Category, June 2011; and H.W. Nelson, *Petroleum Coke Handling Problems*, 1970.

Notes: The process of "calcining" converts green coke to almost pure carbon, with a defined structure to produce carbon anodes for the aluminum industry.

---

[2] Thermal coal is sometimes called "steam coal" because it is used to fire boiler plants that produce steam for electricity generation and industrial uses.

Petcoke Compared to Metallurgical Coke and Coal

Petcoke has a significantly high heating value compared to metallurgical coke (metcoke) and bituminous coals (see **Table 2**). The higher heating value comes at the cost of higher sulfur and nitrogen content, however. Ash content is relatively low, compared to coal, but much of it is in the form of heavy metals. Due to the severe thermal environment in which petcoke forms, there is very little combustible volatile material. The low volatile content, in comparison to coal and other fossil fuels, makes petcoke more difficult to ignite and sustain combustion.[3]

Bituminous coal includes two subtypes: thermal and metallurgical.[4] Metallurgical coke is made from low ash, low sulfur bituminous coal, with special coking properties. To produce metcoke, special coke ovens heat metallurgical grade coal at temperatures of 1,000ºF to 2,000ºF to fuse fixed carbon and inherent ash, and drive off most of the volatile matter.[5] Approximately 1.5 tons of metallurgical coal will produce one ton of metcoke. The final product is a nearly pure carbon source with sizes ranging from basketballs (foundry coke) to a fine powder (coke breeze).

Table 2. Petcoke vs. Metcoke and Coal

Heating Value and Price

Fuel	Coal Rank	Btu / lb.	$/Short Ton
Petcoke	n.a.	14,200	See Note
Metcoke	Metallurgic	12,600	171.51
Steam Coal			
Pittsburgh #8	Bituminous	13,000	68.25
Illinois #6	Bituminous	11,000	45.40
Powder River Basin	Sub-bituminous	8,800	10.30

Source: MIT, The Future of Coal Appendices, P5, http://web.mit.edu/coal/The_Future_of_Coal_Appendices.pdf, and EIA, Coal News and markets, http://www.eia.gov/coal/news_markets/.

Notes: Steam Coal Prices as of July 19, 2013. Petcoke prices track steam coal prices, but at a discount that may range from 15% to 85%. Recent prices have been closer to 67% of steam coal prices.

Petcoke Grades

The coking processes described above produce "green coke," which then requires additional thermal processing to remove any residual hydrocarbons (volatile matter) to increase the percentage of elemental carbon. Thermal processing lowers the potential toxicity of the coke. Depending on the coking operation temperatures, length of coking-time, and quality of the crude oil feedstock, one of several grades of petcoke can be produced:

---

[3] Anthony Pavone, "Converting Petroleum Coke to Electricity," Proceedings from the 14th National Industrial Energy Technology Conference, Houston, TX, April 22-23, 1992, http://repository.tamu.edu/bitstream/handle/1969.1/92212/ESL-IE-92-04-47.pdf.

[4] Bituminous coals are mined throughout the eastern United States range but generally have higher sulfur and nitrogen contents than western coals.

[5] Oxbow, *Metallurgical Coke*, http://www.oxbow.com/Products_Industrial_Materials_Metallurgical_Coke.html. Also see Grande Cache Coal, *Met Coke 101*, http://www.gccoal.com/about-us/met-coal-101.html.

- *sponge coke*, the most common type of regular-grade petcoke, used as a solid fuel (see **Figure 1**);
- *needle coke,* a premium-grade coke made from special petroleum feedstock, used in the manufacture of high-quality graphite electrodes for the steel industry;
- *shot coke,* produced from heavy petroleum feedstock, used as fuel, but less desirable than sponge coke (see **Figure 2**);
- *purge coke*, produced by flexi-coking, used as a fuel in coke-burning boilers; or
- *catalyst coke,* carbon deposited on catalysts, used in various refining processes and burned off and used as a fuel in the refining process; not recoverable in a concentrated form.

Figure 1. Sponge Coke

Source: John D. Elliott, Shot Coke: Design & Operations, http://www.fwc.com/publications/tech_papers/oil_gas/shotcoke.pdf.

Figure 2. Shot Coke

Partially Crushed

Source: John D. Elliott, Shot Coke: Design & Operations, http://www.fwc.com/publications/tech_papers/oil_gas/shotcoke.pdf.

Coking Refineries and Outputs

The fleet of petroleum refineries operating throughout the United States has steadily declined in the past several decades as refining capacity has become concentrated in larger refineries. At present, some 115 refineries (and refinery complexes) produce over 17 million barrels per day of motor fuels and other petroleum products. Nearly half (56) have the coking capacity to convert heavy crude oils[6] (see the **Appendix** to this report).

---

[6] For further background on the refining industry, see CRS Report R41478, *The U.S. Oil Refining Industry: Background in Changing Markets and Fuel Policies*, by Anthony Andrews et al.

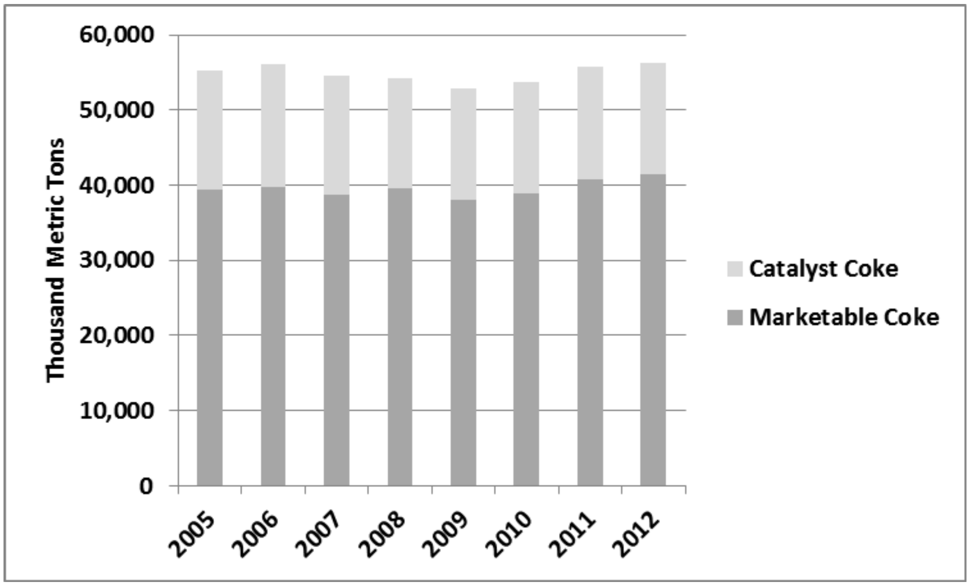
Coking capacity has been concentrated in refineries operating along the Gulf Coast, the historic refining center of the United States and primary destination for crude oil imports. However, to take advantage of the increasing supply of heavier crude oils from Canada's oil sands projects, several Midwest refineries have added coking conversion capacity.

U.S. refineries have the capacity to process 2.5 million barrels per day of petroleum resid. The Gulf Coast not only represents the greatest refining capacity (9.3 million barrels per day), it also represents also the greatest coking capacity (1.5 million barrels per day).

U.S. petcoke production has remained constant over the last decade for the reason that refining capacity has remained constant (see **Figure 3**). In 2012, the U.S. Energy Information Administration (EIA) reported that U.S. refineries produced 42 million metric tons of marketable petcoke and another 15 million metric tons of catalyst coke.[7] For the purpose of comparison, the United States produced 9.3 million tons of coke from metallurgical grade coal[8] and more than 1.2 billion tons of coal in 2012.[9]

Figure 3. U.S. Refinery Net Petcoke Production

Thousand Metric Tons per Year



Source: U.S. Energy Information Administration, U.S. Refinery Net Production, http://www.eia.gov/dnav/pet/pet_pnp_refp2_dc_nus_mbbl_a.htm.

Notes: Catalysts used in various refining processes (e.g., catalytic cracking) become deactivated from the buildup of carbon deposits, In order to reactivate the catalysts; the carbon is burned off and used as a fuel by the refinery. The carbon coke is not recoverable in a concentrated form.

---

[7] The U.S. Energy Information Administration reported that U.S. refinery net production of petroleum coke in 2012 was 310,481 thousand barrels (U.S. Refinery Net Production, http://www.eia.gov/dnav/pet/pet_pnp_refp2_dc_nus_mbbl_a.htm). 1 metric ton is the equivalent of 5.51 barrels.

[8] American Iron and Steel Institute, *Annual Statistical Report*, 2012, p.80. Production and Consumption of Coke.

[9] U.S. Energy Information Administration, *Monthly Energy Review*, Coal, June 2013, http://www.eia.gov/totalenergy/data/monthly/index.cfm#coal.

Overall, petcoke production reflects refinery capacity utilization rate, which represents the use of the refinery atmospheric crude oil distillation units. The rate is calculated by dividing the gross input to these units by the operable refining capacity of the units. The utilization rate has averaged from 82% to 88%.[10] U.S. refineries have been producing approximately 40 million metric tons of marketable petcoke annually over the period of 2007 through 2012. Refineries, however, need enough light-heavy price spread (LHS) between coker feedstock (heavy resid) and light products (gasoline, jet, and diesel) to run their coking units profitably. With the rising availability of U.S. produced light-sweet crude oil, however, some refineries may choose to cut back on coking, and thus produce less coke. These and other variables lend uncertainty to whether petcoke production will increase, remain steady or decline in the coming years.

Petcoke Storage Terminals

Refineries temporarily stockpile petcoke on their facilities, but because they generally lack sufficient storage space must transport it regularly to avoid production slowdowns. Typically, coker drums are mounted over railroad tracks so that coke can be discharged directly into open hopper or gondola cars. The rail cars then transport the petcoke to calcining plants or to temporary storage terminals.

A complete accounting of independent terminals that store petcoke exceeds the scope of this report. However, a CRS survey identified at least four companies with petroleum coke as a primary business line: SSM Petroleum Coke LLC, TCP Petroleum coke Corp, DTE Petroleum Coke, LLC, and Kinder Morgan Petroleum Coke Gp LC.[11] SSM Petroleum Coke is an affiliate of Oxbow Carbon LLC (Koch Industries, Inc.). Koch Carbon, LLC specialize in the global sourcing, supply, handling, and transportation of bulk commodities including, but not limited to, petcoke. TCP Petroleum Coke Corporation is a joint venture between CITGO Petroleum Corporation (CITGO) and RWE Power AG, offering a diversified marketing network to over 30 countries. DTE Petroleum Coke is a subsidiary of DTE Energy, a diversified energy company that includes electric/gas utilities. DTE Energy has reportedly removed the petcoke it stored at its Detroit Bulk Storage site along the Detroit River.[12] Kinder Morgan Petroleum Coke L.P. advertises that it is responsible for handling over 10 million tons of petcoke through several terminals located on the Texas Gulf Coast.

Petcoke Market and Exports

Petcoke competes with both coal and metcoke in the international market. Its comparatively higher heating values makes it an economic substitute for steam coal. However, its granular physical properties may add to the cost of material handling, which is reflected in a discounted price compared with coal in the United States. Petcoke prices track coal prices but at discounts in the range of 15% to 85%.[13] Recently U.S. petcoke price have ranged from 67% to 68% of coal prices.

---

[10] U.S. Energy Information Administration, Refinery Utilization and Capacity, http://www.eia.gov/dnav/pet/pet_pnp_unc_dcu_nus_a.htm.

[11] A search through http://www.Manta.com produced six U.S. companies matching "petroleum coke."

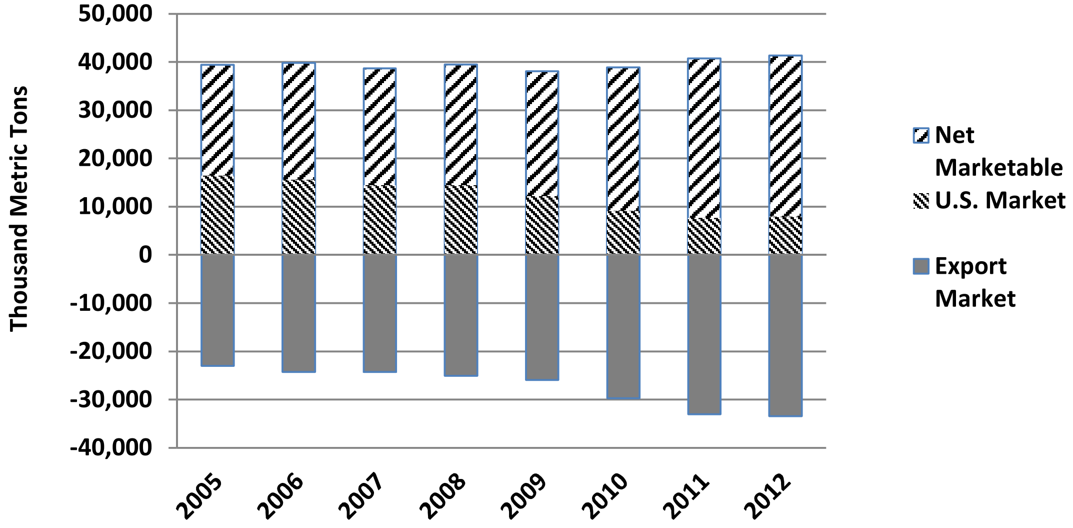
[12] "Pet Coke Piles Along Detroit River Clear Away," *CBS Detroit*, August 27, 2013, http://detroit.cbslocal.com/2013/08/27/pet-coke-piles-along-detriot-river-cleared-away/.

[13] Personal communication with Mike Stewart, Jacobs Consultancy/Petroleum Coke Quarterly.

U.S. petcoke exports have steadily increased over the last decade, as the U.S. market has given way to increased demand overseas (see **Figure 4**). In 2012, 80% of marketable (i.e., non-catalyst) petcoke was exported. The largest recipients of U.S. petcoke exports in 2012 were China (14%), followed by Japan (11%), Mexico (9%), and Turkey (7%). China's demand has steadily increased during the last decade.

Figure 4. Net Petcoke Production vs. Exports

Thousand Metric Tons per Year



	2005	2006	2007	2008	2009	2010	2011	2012
Net Marketable	39,474	39,818	38,694	39,529	38,105	38,895	40,749	41,376
U.S. Market	16,458	15,577	14,450	14,461	12,185	9,155	7,677	7,952
Export Market	-23,016	-24,241	-24,244	-25,068	-25,920	-29,740	-33,071	-33,424

Source: U.S. Energy Information Administration, U.S. Refinery Net Production, http://www.eia.gov/dnav/pet/pet_pnp_refp2_dc_nus_mbbl_a.htm, and Petroleum Coke Exports by Destination, http://www.eia.gov/dnav/pet/pet_move_expc_a_eppc_eex_mbbl_a.htm.

Potential Health and Environmental Impacts

The recent increase in coking capacity in the United States has raised concerns over the potential impacts of petcoke on both human health and the environment. Local concerns include air quality hazards, water quality hazards, and potential exposure to toxic substances. These impacts may arise during various stages of petcoke's life-cycle, including its production, handling, storage, transportation, combustion, and use. Broader concerns have been raised about the greenhouse gas (i.e., carbon dioxide) emissions from petcoke combustion. The focus of this report, however, is on the impacts of handling and storage, not on end-use combustion.

EPA's Hazard and Toxicity Characterizations

In recent years, the U.S. Environmental Protection Agency (EPA) has surveyed the potential human health and environmental impacts of petcoke through its High Production Volume (HPV) Challenge Program. The HPV Challenge Program, initiated jointly by EPA, Environmental Defense Fund (EDF), American Petroleum Institute (API), and American Chemistry Council (ACC), was instituted for several purposes, including

1. to collect health and environmental effects data on industrial chemicals produced in the United States in high volumes,
2. to provide the public with basic hazard information that would allow for active participation in environmental decision-making at all levels—local, state, and federal, and
3. to provide EPA with valuable hazard and toxicity information to support its mission of protecting human health and welfare.

Companies have sponsored research into more than 2,200 HPV chemicals, with approximately 1,400 administered directly through the HPV Challenge Program and the remainder administered indirectly through international efforts.[14] API sponsored a testing group for the petcoke category,[15] which produced an analysis in December 2007.[16] This analysis was supplemented by EPA, after stakeholder comments, and published in June 2011.[17]

The findings from EPA's hazard characterization of petcoke are summarized in the following sections.

Environmental Fate

Most chemical analyses of petcoke, as referenced by EPA, find it to be highly stable and non-reactive at ambient environmental conditions.

Due to the extreme conditions under which petcoke is produced, qualities such as melting point, boiling point, vapor pressure, and water solubility exist well outside the range of ambient conditions. If released to the environment, petcoke would not be expected to undergo many of the environmental fate pathways which could lead to environmental risks. Depending on the particle size and density of the material, terrestrial releases of petcoke become incorporated into the soil or transported via wind or surface water flow. If released to the aquatic environment, petcoke incorporates into sediment or floats on the surface, depending on the particle size and density in relation to water. Chemically, petcoke is essentially inert. That is, petcoke does not vaporize into the atmosphere, does not react chemically in the presence of water, and does not react chemically

---

[14] U.S. Environmental Protection Agency's High Production Volume (HPV) Challenge Program, http://www.epa.gov/chemrtk/index.htm.

[15] U.S. Environmental Protection Agency, *Robust Summaries & Test Plans: Petroleum Coke*, http://www.epa.gov/chemrtk/pubs/summaries/ptrlcoke/c12563tc.htm.

[16] The American Petroleum Institute Petroleum HPV Testing Group, Petroleum Coke Category Analysis and Hazard Characterization, submitted to EPA December 28, 2007, http://www.epa.gov/hpv/pubs/summaries/ptrlcoke/c12563rr2.pdf.

[17] U.S. Environmental Protection Agency, Screening-Level Hazard Characterization, Petroleum Coke Category, June 2011, http://www.epa.gov/chemrtk/hpvis/hazchar/Category_Petroleum%20Coke_June_2011.pdf.

in the presence of light. Furthermore, it is not biodegradable, nor does it bio-accumulate substances—such as toxic chemicals—into its structure.[18]

Environmental Toxicity

Most eco-toxicity analyses of petcoke, as referenced by EPA, find it has a low potential to cause adverse effect on aquatic or terrestrial environments.

The environmental effects of petcoke have been tested along various pathways for exposure in the environment, including both aquatic and terrestrial endpoints in plants and animals. Aquatic and terrestrial toxicity tests have been performed to assess the hazard of petcoke releases to representative aquatic organisms and terrestrial soil-dwelling invertebrates and plants. In these studies, petcoke was found to be non-toxic to terrestrial plants and animals, non-toxic to aquatic animals (both vertebrates and invertebrates), and showed only slight effects on aquatic plants at the exposure levels tested (i.e., studies found slight growth inhibition in freshwater algae).[19] (The exposure levels and durations were conducted in accordance with EPA and Organization for Economic Co-operation and Development (OECD) recommendations, although, presumably, these tests could be re-administered at higher dosages or intervals to assess the effects of greater concentrations.)

Human Health Effects

Most toxicity analyses of petcoke, as referenced by EPA, find it has a low health hazard potential in humans, with no observed carcinogenic, reproductive, or developmental effects. Only animal cases studies of repeated-dose and chronic inhalation have shown respiratory inflammation attributed to the non-specific effects of dust particles rather than the specific effects of petcoke.

Inhalation of and skin contact with petcoke were assessed to be the most likely exposure routes to humans. Most repeated-dose inhalation exposure studies (on rats and primates) found cases of irreversible respiratory effects and significantly increased lung weights. These effects were considered to be non-specific responses of the respiratory tract to high concentrations of dust particles rather than compound specific-induced effects. Petcoke was not found to be carcinogenic via inhalation. No excess skin or visceral cancers were observed in a lifetime skin painting study. Petcoke was not found to produce genetic mutations in bacteria and mammalian cells in standard in vitro toxicity tests or to produce chromosome aberrations of bone marrow in

---

[18] Petcoke's volatilization is negligible, its rate of hydrolysis is negligible, and its rate of atmospheric photo-oxidation is negligible. Neither biodegradation nor bioaccumulation is applicable.

[19] Environmental toxicity studies referenced by the EPA analysis include Wildlife International, Ltd., *Petroleum Coke: A 96-Hour Static-Renewal Acute Toxicity Test with the Fathead Minnow (Pimephales promelas), Final Report,* Project No. 472A-1134, 2006; Wildlife International, Ltd., *Petroleum Coke: A 48-Hour Static-Renewal Acute Immobilisation Test with the Cladocern (Daphnia magna), Final Report*, Project No. 472A-112, 2006; Wildlife International, Ltd., *Petroleum Coke: A 96-Hour Toxicity Test with the Freshwater Alga (Selenastrum capricornutum), Final Report,* Project No. 472A-114, 2006; Wildlife International, Ltd., *Petroleum Coke: A 21-Day Toxicity Test to Determine the Effects of the Test Substance on Seedling Emergence and Growth of Terrestrial Plants, Final Report,* Project No. 472-102, 2006; Wildlife International, Ltd., *Petroleum Coke: A 14-Day Acute Toxicity Test with the Earthworm (Eisenia fetida), Final Report,* Project No. 472-101, 2006.

standard in vivo toxicity tests. Petcoke was not found to produce any reproductive or developmental effects following repeated inhalation or exposure to the skin.[20]

Reactivity

Petcoke is generally stable under normal conditions; however, the substance has the potential to become flammable or explosive. Emissions from the combustion—either accidentally or purposefully—of petcoke can have impacts on human health and the environment, including the release of common pollutants, hazardous substances, and greenhouse gases.

When petcoke is combusted, common pollutants and hazardous decomposition products may be produced such as carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen oxides, particulate matter, and heavy metals, depending upon the chemical composition of the feedstock (see **Table 1** for the chemical composition of petcoke). These releases may take place unintentionally, through the natural or unintended combustion of surface or air-borne dust particles, or intentionally, through the combustion of petcoke for electrical power generation or other like purposes.

Petcoke's use as a fuel is criticized because it commonly has higher greenhouse gas emissions relative to the amount of heat it generates when burned. **Table 3** presents potential carbon dioxide (CO_2) emissions for petcoke in comparison to metallurgical coke and several grades of steam coal. When petcoke or coal combust, CO_2 forms from one carbon atom (C) uniting with two oxygen atoms (O).[21] Assuming complete combustion, 1 pound of carbon combines with 2.667 pounds of oxygen to produce 3.667 pounds of carbon dioxide. Petcoke with a carbon content of 90% and a heating value of 14,200 Btu per pound emits about 232 pounds of carbon dioxide per million Btu when completely burned.[22] Comparatively, Powder River Basin coal with a carbon content of 48% and a heating value of 8,800 Btu per pound emits about 202 pounds of carbon dioxide per million Btu when completely burned, or 15% less than petcoke. Because coal has high hydrogen-to-carbon ratio compared to petcoke, part of its energy content comes from the combustion of hydrogen that is emitted as water vapor instead of carbon dioxide.

---

[20] Toxicity studies referenced by the EPA analysis include Huntingdon Life Sciences, Study No. 03-4246, "Petroleum Coke: Reproduction/Developmental Toxicity Screening Study in Rats via Nose-Only Inhalation Exposures," 2006; Klonne, D. R., Burns, J. M., Halder, C. A., Holdsworth, C. E. and Ulrich, C. E., "Two Year Inhalation Study of Petroleum Coke in Rats and Monkeys." *American Journal of Industrial Medicine*, 11:375-389, 1987; and IRDC (International Research & Development Corporation), "Chronic Inhalation Toxicity Study of Petroleum Coke (Delayed Process) in Rats and Monkeys," API Publication number 32-30234, 1985.

[21] B. D. Hong and E. R. Slatick, *Carbon Dioxide Emission Factors for Coal*, U.S. Energy Information Administration, http://www.eia.gov/coal/production/quarterly/co2_article/co2.html.

[22] Potential carbon dioxide emissions can be calculated by use of the following formula: percent carbon ÷ Btu per pound x 36,670 = pounds (lbs.) of carbon dioxide per million Btu.

Table 3. Petcoke vs. Coal: Combustion Emissions

Fuel	Coal Rank	Sulfur %wt.	Btu / lb.	Carbon %wt.	CO_2 lbs./ Million Btu
Petcoke	n.a.	1.5–6.0	14,200	89–92	232
Metcoke	Metallurgic	0.4–0.7	12,600	91–92	266
Steam Coal					
Pittsburgh #8	Bituminous	3.0	13,000	73–74	207
Illinois #6	Bituminous	3.9	11,000	60–61	201
Powder River Basin	Sub-bituminous	0.5	8,800	48–49	202

Source: MIT, The Future of Coal Appendices, p. P5.

Notes: Potential carbon dioxide emissions calculated by percent carbon ÷ Btu per pound x 36,670 = pounds (lbs.) of carbon dioxide per million Btu.

Federal Regulatory Requirements

Various aspects of the production, handling, storage, transportation, combustion, and use of petcoke have been addressed at local, state, and federal levels to protect human health and the environment. While some federal statutes address certain environmental impacts of petcoke's life-cycle, most regulatory action and oversight has been undertaken at the state and local levels, generally through facility-specific permitting requirements. With few exceptions, petcoke is not specifically regulated by local, state, or federal codes.[23] Rather, it is petcoke's potential contribution to more general hazards (e.g., air and water quality impacts such as haze, fugitive dust, and stormwater runoff) that is monitored and controlled through various permitting and reporting requirements at the state and local levels. This report focuses on the federal response to petcoke and on the rules that may be implemented during the handling, storage, and transportation phases of petcoke's life-cycle. States may also have their own laws or regulations related to the handling, storage, and transportation of petcoke, specifically, or high-production-volume industrial substances like petcoke, more generally; a full review of state and local code is beyond the scope of this report.

Regulatory agencies at all levels of government commonly aim to manage the human health and environmental impacts of industrial materials (e.g., petcoke) based upon thorough assessments of their hazardous exposure pathways. Because of its relative inertness, exposure to petcoke is considered to pose few human health and environmental risks. Thus, federal law generally exempts petcoke from classification as either a solid or hazardous waste. Despite these exemptions, petcoke may nevertheless present significant nuisance concerns. A "nuisance" is the unreasonable, unwarranted and/or unlawful use of property, which causes inconvenience or damage to others, either to individuals or to the general public.[24] A nuisance may not violate any

---

[23] In a survey of state statutes, conducted by the U.S. Library of Congress's Law Library for this report on August 9, 2013, California was found to be the only state which has passed laws to directly manage the environmental impacts from the handling, storage, and transportation of petcoke. California State Code on petcoke included California Code–HSC Section 40459 (requirements for enclosing piles of petcoke when storing the substance prior to shipment), http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=40001-41000&file=40440-40459, and California Code–VEH Section 23114 (requirements for the transportation of petcoke by vehicle), http://www.leginfo.ca.gov/cgi-bin/displaycode?section=veh&group=23001-24000&file=23100-23135.

[24] A nuisance may be either a private nuisance or a public nuisance. An activity constitutes a *private* nuisance if it is a (continued...)

regulatory standard or cause demonstrable environmental or health impacts; however, if a nuisance interferes with a person's use of his or her property, it may be the basis for a lawsuit for damages or an injunction. For example, fugitive dust from petcoke storage piles can be deposited on and in nearby waterways, outdoor areas, or residents' homes, leaving a black- or grey-colored residue. This deposition may result in undesirable and unsightly conditions, interfering with residents' comfort and use of their property. Similarly, dust from coke piles can challenge the operations of commercial or industrial facilities, such as pharmaceutical research and production plants, electronics assembly, or fuel cell membrane manufacturing. Dust from nearby coke piles can increase filtration costs or threaten the integrity of strict quality control standards required for such high technology operations.

In light of these issues, the monitoring and management of petcoke at the federal level is summarized in the following sections.

Waste Classifications

Federal law generally exempts petcoke from classification as either a solid or hazardous waste.

The exemption for petcoke from classification as either a solid or hazardous waste stems from the scope of the statutory term "solid waste" as decided in *American Mining Congress v. U.S. EPA.*[25] In that decision, the court held that materials recycled and reused in an ongoing manufacturing or industrial process were not considered to be "discarded," and hence, not considered to be "solid wastes." Furthermore, in 1998, EPA identified a list of petroleum refining wastes that would be subject to federal regulations applicable to the management of hazardous waste established under the Resource Conservation and Recovery Act (RCRA).[26] In this rulemaking, EPA stated that petcoke is not a refining waste, but rather a "co-product" of the refining process.[27] In separate rulemaking, EPA included petcoke among other fuels in its definition of "traditional fuels" (at 40

(...continued)

substantial and unreasonable invasion of another's interest in the private use and enjoyment of land, without involving trespass. Private nuisance actions are brought by the aggrieved landowner. An activity is a *public* nuisance if it creates an "unreasonable" interference with a right common to the general public. Unreasonableness may rest on the activity significantly interfering with, among other things, public health and safety. Public nuisance cases are usually brought by the government rather than private entities, but may be brought by the latter if they suffer special injury.

[25] *American Mining Congress v. U.S. EPA*, 824 F.2nd 1177 (D.C. Cir. 1987). The court held that the EPA exceeded its authority by amending its definition of "solid waste" under the Resource Conservation and Recovery Act (RCRA) to include secondary materials destined for reuse within an industry's ongoing production process. The court held that EPA's interpretation is contrary to RCRA's plain language (§ 1004(5) defines solid waste to include "discarded material"), and that EPA's inclusion of materials retained for immediate use as discarded material strains the everyday usage of that term.

[26] 42 U.S.C. 6901 et seq. For further discussion of the authorities of RCRA, see CRS Report RL30798, *Environmental Laws: Summaries of Major Statutes Administered by the Environmental Protection Agency*, coordinated by David M. Bearden.

[27] See U.S. Environmental Protection Agency, Final Rule, "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Petroleum Refining Process Wastes; Land Disposal Restrictions for Newly Identified Wastes; and CERCLA Hazardous Substance Designation and Reportable Quantities," August 6, 1998, 63 *Federal Register* 42110. "The coke product itself may best be characterized as a co-product of the coking operation, while the principal products are the light ends that are returned to the refining process. Thus, the Agency is affirming that the conventional coking operation is a production process, resids are normal feedstocks to this process and petroleum coke is a legitimate fuel product." Id, at page 42121.

C.F.R. 241.2). As a result of these determinations, unless or until it is discarded, petcoke would not be subject to federal waste management requirements established under RCRA.

Petcoke would not be subject to the federal cleanup authorities of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, often referred to as Superfund)[28] because of the exclusion of petroleum from the statute. The response authorities of CERCLA specifically apply to the release of hazardous substances, pollutants, or contaminants into the environment. Hazardous substances under CERCLA are broader than hazardous wastes under RCRA and include hundreds of toxic chemicals. However, CERCLA defines a hazardous substance, pollutant, or contaminant to exclude "petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance."[29] EPA's interpretation has been that hazardous substances present in petroleum that are naturally occurring or are normally added during the refining process are fractions of the petroleum that would fall within the scope of the exclusion from CERCLA. EPA's position has been that CERCLA may be applied to the cleanup of wastes containing petroleum, if the wastes contain hazardous substances that are not part of the petroleum product itself.[30] Hazardous substances that may leach from a petroleum product into the environment, and therefore no longer be part of the petroleum product, may raise other issues.

Industrial Stormwater Runoff

The handling and storage of petcoke may be regulated under certain provisions of the National Pollutant Discharge Elimination System (NPDES) permit program,[31] as authorized by the Clean Water Act (CWA),[32] if it is determined that runoff from storage sites due to rain or snowmelt has the potential to transport the substance to nearby surface waters.

Activities that take place at industrial facilities, such as material handling and storage, are often exposed to the weather. As runoff from rain or snowmelt comes into contact with these activities, it can pick up pollutants and transport them to a nearby storm sewer system or directly to a river, lake, or coastal water. Recognition of the water quality problems of stormwater runoff led Congress in 1987—when it last comprehensively amended the CWA—to direct EPA to implement a specific permit program for stormwater discharges from industrial sources and municipalities (P.L. 100-4). These stormwater requirements were incorporated into the National

---

[28] 42 U.S.C. 9601 et seq. For further discussion of the authorities of CERCLA, see CRS Report R41039, *Comprehensive Environmental Response, Compensation, and Liability Act: A Summary of Superfund Cleanup Authorities and Related Provisions of the Act*, by David M. Bearden.

[29] The definition of the term "hazardous substance" in Section 101 (14) of CERCLA is codified at 42 U.S.C. 9601(14). The definition of the terms "pollutant" and "contaminant" in Section 101(33) of CERCLA is codified at 42 U.S.C. 9601(33).

[30] U.S. Environmental Protection Agency, Office of General Counsel, *Scope of the CERCLA Petroleum Exclusion Under Sections 101(14) and 104(a)(2)*, July 31, 1987. Section 104(a)(2) of CERCLA, as originally enacted in 1980, defined the term "pollutant or contaminant." Section 101(f) of the Superfund Amendments and Reauthorization Act of 1986 re-designated the definition of this term in Section 101(33) of CERCLA, cited above. The full text of the 1987 guidance is available at http://www.epa.gov/compliance/resources/policies/cleanup/superfund/petro-exclu-mem.pdf.

[31] For further discussion on the NPDES Permit Program, see CRS Report 97-290, *Stormwater Permits: Status of EPA's Regulatory Program*, by Claudia Copeland, as well as U.S. Environmental Protection Agency, "National Pollutant Discharge Elimination System," http://cfpub.epa.gov/npdes/.

[32] 33 U.S.C. §§1251-1387. For further discussion of the authorities of CWA, see CRS Report RL30030, *Clean Water Act: A Summary of the Law*, by Claudia Copeland.

Pollutant Discharge Elimination System (NPDES), a comprehensive permit program authorized in Section 402 of the CWA. Under the act, it is illegal to discharge pollutants from point sources (e.g., industrial plant pipes, sewage treatment plants, or storm sewers) into the nation's waters without a permit. NPDES permits are the fundamental compliance and enforcement mechanism of the law. EPA manages the NPDES stormwater program in four states (Idaho, Massachusetts, New Hampshire, and New Mexico), plus the District of Columbia and most U.S. territories, and has delegated that authority to the remaining 46 states and the Virgin Islands. Therefore, the vast majority of industrial and other facilities obtain NPDES permit coverage for stormwater discharge through their state. Petroleum refining facilities are one of several categories of facilities that are specifically covered under the CWA stormwater regulatory program.

Common requirements for coverage under an industrial stormwater permit include development of a written stormwater pollution prevention plan (SWPPP), implementation of control measures, and submittal of a request for permit coverage, usually referred to as the Notice of Intent (NOI). The SWPPP is a written assessment of potential sources of pollutants in stormwater runoff and control measures that will be implemented at the facility to minimize the discharge of these pollutants in runoff from the site. These control measures include site-specific best management practices, maintenance plans, inspections, employee training, and reporting. The procedures detailed in the SWPPP must be implemented by the facility and updated as necessary, with a copy of the SWPPP kept on-site. The industrial stormwater permit also requires collection of visual, analytical, and compliance monitoring data to determine the effectiveness of implemented best management practices. Stormwater permits are valid for up to five years and must be renewed.

Best management practices for the prevention of industrial stormwater runoff include ensuring adequate storage facilities and equipment, spill detection and repair, and employee training. Many environmental agencies, including EPA, provide extensive summaries of best management practices.[33]

Fugitive Dust

The handling, storage, and transportation of petcoke may create instances of reduced air quality due to weather or activity related releases of fugitive dust into the atmosphere. Most of the impacts of fugitive dust are localized; and thus, much of the regulatory oversight is implemented at the local and state level and generally takes the form of a fugitive dust control program.

Facilities may be required by state or local agencies to develop a fugitive dust control program for many reasons. State and local agencies, based on their own air emission measurements, their own code of regulations, environmental consent orders, or complaints of nuisance, may require a fugitive dust program from any facility if it processes, uses, stores, transports, or conveys bulk materials from a highly emitting dust source. Further, these programs are often a necessary component to any air permitting requirements at the state and local level, including permits to install, operate, or decommission a facility. At the federal level, Clean Air Act (CAA)[34] National

---

[33] An extensive list of best management practices for stormwater runoff, included under the general categories of "good housekeeping practices," "minimize exposure," "erosion and sediment control," and "management of runoff," can be found in U.S. Environmental Protection Agency, *Industrial Stormwater, Fact Sheet Series, Sector C: Chemical and Allied Products Manufacturing and Refining,* U.S. EPA Office of Water, EPA-833-F-06-018, December 2006, http://www.epa.gov/npdes/pubs/sector_c_chemical.pdf.

[34] 33 U.S.C. §§1251-1387. For further discussion of the authorities of CWA, see CRS Report RL30030, *Clean Water Act: A Summary of the Law*, by Claudia Copeland.

Ambient Air Quality Standards (NAAQS) have been set nationwide by EPA for particulate matter (PM).[35] NAAQS are standards for outdoor (ambient) air that are intended to protect public health and welfare from harmful concentrations of pollution. If fugitive dust generation is determined to be an issue at a facility that produces, handles, stores, transports, or uses petcoke, and if the facility is situated in an area that is identified by the EPA as "nonattainment" for PM NAAQS, then it may be possible for state authorities to ask the facility to report on and manage its fugitive dust emissions—if it is not doing so already—within the context of their State Implementation Plans (SIPs).

Whether petcoke storage is considered a significant source of PM depends a number of factors, including how the coke is handled (e.g., number of drops), individual petcoke particle sizes and the size of the overall petcoke piles, as well as the storage method. In some cases, petcoke may have been processed through pulverization that generates dust which could be monitored and controlled at $PM_{2.5}$ (less than 2.5 microns). $PM_{2.5}$ can produce greater health impacts because it is more respirable than "coarse" PM which is larger than 2.5 microns. PM that is greater than about 10 microns is generally considered less of a health risk because it is less respirable. As illustrated in **Figure 1**, most forms of petcoke are comprised of granules orders of magnitude larger than $PM_{2.5}$, and are not likely respirable, but may pose a nuisance concern. Also, in some cases, petcoke storage may be ephemeral because markets support frequent elimination of stored inventories.

The management of fugitive dust commonly involves the submission of a fugitive dust plan to state or local agencies. These plans would include an analysis of the quantity and opacity of fugitive dust from the facility; a determination of the type of fugitive dust control methods that would be the most effective, taking into account the quantity, moisture content, specific gravity, and particle size distribution of the bulk materials on-site; an assessment of the type of control technologies, methods, and equipment to be implemented or installed, and the schedule for implementation or installation; and a report on the level of recordkeeping and maintenance requirements for activities that are implemented under the dust program. Fugitive dust plans commonly set out an operating program designed to significantly reduce emissions to the lowest level that a particular source is capable of achieving by the application of control technology that is both reasonably available and based on technological and economic feasibility. The requirement for fugitive dust plans for a given facility and the plan's enforcement remain at the discretion of the state and local agencies.

Best management practices for the prevention of fugitive dust include ensuring adequate storage facilities and equipment, emission detection and repair, and employee training. Many environmental agencies, including the U.S. EPA, provide extensive summaries of best management practices.[36]

---

[35] For further discussion of particulate matter, see CRS Report RL34762, *The National Ambient Air Quality Standards (NAAQS) for Particulate Matter (PM): EPA's 2006 Revisions and Associated Issues*, by Robert Esworthy.

[36] An extensive list of emission control techniques for fugitive dust can be found in U.S. Environmental Protection Agency, *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures,* U.S. EPA Office of Air and Radiation, EPA-450/2-92-004, September 1992, http://www.epa.gov/oaqps001/lead/pdfs/1992_09_fugitive_dust.pdf.

Regulatory Standards for Petcoke Combustion in Power Generation

The combustion of petcoke, and the resulting emissions from this combustion, may be regulated under several different provisions in the CAA and the CWA.

When petcoke is used for industrial or power generating purposes, emissions from its combustion are regulated under the standards set on the respective facilities. For example, some of the federal regulations which may be implemented by the combustion of petcoke at industrial or power generating facilities include EPA's New Source Performance Standards for Electricity Generating Units, Clean Air Interstate Rule (CAIR) for NO_x and SO_2, CAA Title V Permitting Requirements, GHG Reporting Program, Steam Electric Effluent Guidelines, recently finalized Mercury and Air Toxics Standards/Utility MACT, and proposed Coal Combustion Waste Rules, as well as the various state rules under State Implementation Plans.

A full description of these requirements is beyond the scope of this report.

Conclusion

Petcoke production depends on the crude oil demand of operating refineries that in tum depend on the availability of heavy and light crude oils and their comparative cost advantages. The domestic production of petcoke may increase as U.S. refineries continue to add coking capacity to take advantage of competitively priced petroleum produced from Canada's oil sands and other heavy crude oil sources. Conversely, as U.S. light crude oil production increases, U.S. coking refineries may find an economic advantage in switching to lighter crude oils and idle their coking units. If that occurs, the production and export of U.S. petcoke may reverse.

Community stakeholder and regulator concerns about fugitive dust emission into the air and stormwater runoff into waterways are likely to continue in situations where there is not sufficient mitigation and abatement. In some states, permit conditions have been imposed to mitigate the emissions from petcoke storage and handling. The specific permit conditions (e.g., enclosed conveyors and storage silos) are generally based on best management practices as determined by state regulators. At the federal level, Clean Air Act (CAA) National Ambient Air Quality Standards (NAAQS) for outdoor (ambient) air continue to protect public health and welfare from harmful concentrations of particulate matter pollution. If states determine that fugitive dust generation is an issue at a facility that produces, handles, stores, transports, or uses petcoke, and if the facility is situated in an area that is identified by the EPA as "nonattainment" for PM NAAQS, then state authorities may ask the facility to report on and manage its fugitive dust emissions—if it is not doing so already—within the context of their State Implementation Plans (SIPs). States and localities may also have their own regulatory standards for fugitive dust, independent of whether the area is in nonattainment of federal PM NAAQS.

In light of these concerns, industry, regulators, and compliance officers have shown a continued interest in impact assessment and best practices related to the storing, containing, and managing of petcoke. Two bills have been introduced in the 113th Congress regarding petcoke: H.R. 2298, the Petroleum Coke Transparency and Public Health Study Act (introduced 6/6/2013), and S. 1388, Petroleum Coke Transparency and Public Health Study Act (introduced 7/30/2013). Each would require the Secretary of Health and Human Services, in consultation with the Administrator of the Environmental Protection Agency, to conduct a study on the public health and environmental impacts of the production, transportation, storage, and use of petcoke.

Appendix. Petroleum Refining and Petcoke Production

Petroleum refineries use several key processes to convert crude oil systematically into refined products; these include atmospheric distillation, hydrocracking, hydrotreating, reforming, and ultimately coking. The refinery's atmospheric distillation column initially separates crude oil into lighter streams of hydrocarbons based on their boiling temperatures. The gasoline-range of petroleum distillates condense at the top of the column. Middle distillate fuels (kerosene, jet, and diesel fuels) condense in the middle of the column. The heavier-still range of gas oils condense lower in the column. Residuum, a heavy tar-like material figuratively referred to as the "bottom of the barrel," has such a high boiling temperature that it remains at the bottom of the column.

In order to produce more gasoline, refineries "crack" the heavier distillation products into the gasoline range with heat, pressure, hydrogen, and catalysts. Hydrotreating removes elemental sulfur from gasoline and middle-distillate fuels through a reaction with hydrogen gas.

Coking dates back to the late 1920s, but became an important process for U.S. refineries during the 1980s and 1990s. During this time, refineries faced a dwindling supply of light sweet crude oils favored for making gasoline and distillate fuels. They began switching to increasingly more available, heavy-sour crude oils. The resid that remained after refining heavier crudes initially found use as "ship's bunker fuel" and as boiler fuel in electric power plants. With the implementation of Clean Air Act regulations, power plants switched from boiler fuel to cleaner burning natural gas. During the same era, the demand for gasoline increased, and refineries began adding coking to convert the "resid" into motor fuels.

Coking initially converts petroleum residuum into lighter range hydrocarbons; low-Btu gas that can serve as a fuel in refinery operations; and "green coke."

Refineries commonly employ one of three types of coking processes:

- *delayed coking*—a thermal cracking process that converts residuum into gasified products streams and concentrated carbon coke. It is called "delayed coking" because cracking takes place in a coke drum rather than in a furnace or reactor. The residuum is heated in a furnace first, and then fed into the bottom of the coke drum. The "cracked" light products are drawn off at the top of the drum and sent to a fractionator which separates out gasoline, naphtha, gas oil, and lighter products. The drums are "de-coked" by hydraulic or mechanical cutting processes. In delayed coking, one coking drum is filled while a second is de-coked (emptied). First commercialized in 1928, delayed coking predominates among U.S. refineries that process heavy crude oil. See **Figure A-1**.
- *flexi-coking*—a continuous fluidized-bed thermal cracking process integrated with coke gasification. It converts most of the carbon coke to carbon monoxide (CO), which is then mixed with carbon (C2) and lighter hydrocarbons to produce a low quality fuel gas. The process was commercialized in 1976. See **Figure A-2**.
- *fluid coking*—a variation on flexi-coking that uses a cyclone to separate the coke. The process was commercialized in 1954.

Figure A-1. Shell Delayed Coking Unit

Puget Sound Refinery

Source: Shell.

Figure A-2. ExxonMobil Flexi-Coking Unit

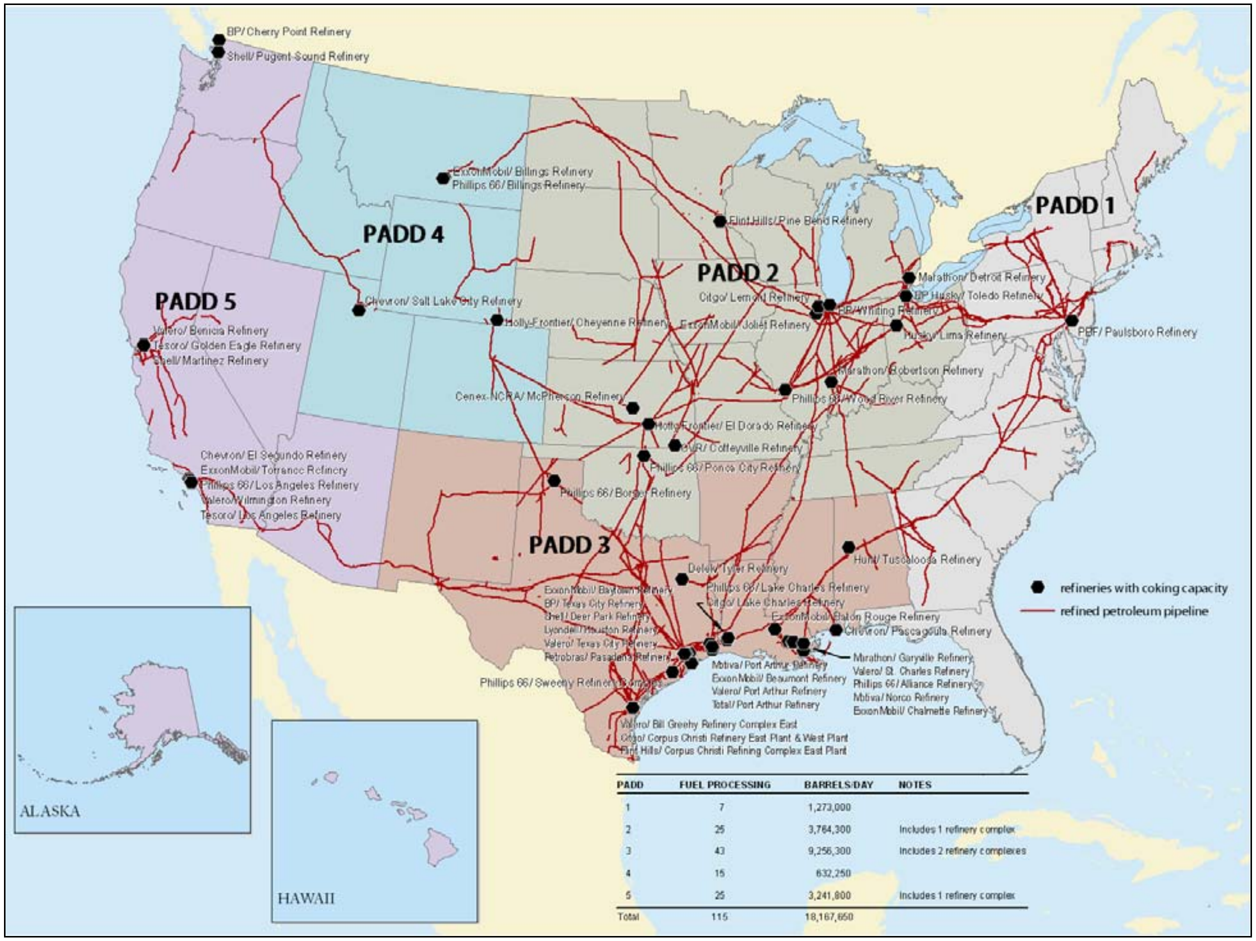
Rotterdam, The Netherlands

Source: ExxonMobil Research & Engineering Company, Upgrading of Heavy Oils with Flexicoking.

Independent processors convert the green coke into to either fuel grade or anode grade coke depending upon the crude oil refined and the coking process used.

Figure A-3. U.S. Refineries with Coking Capacity

by Petroleum Adminstration for Defense Districts (PADD)

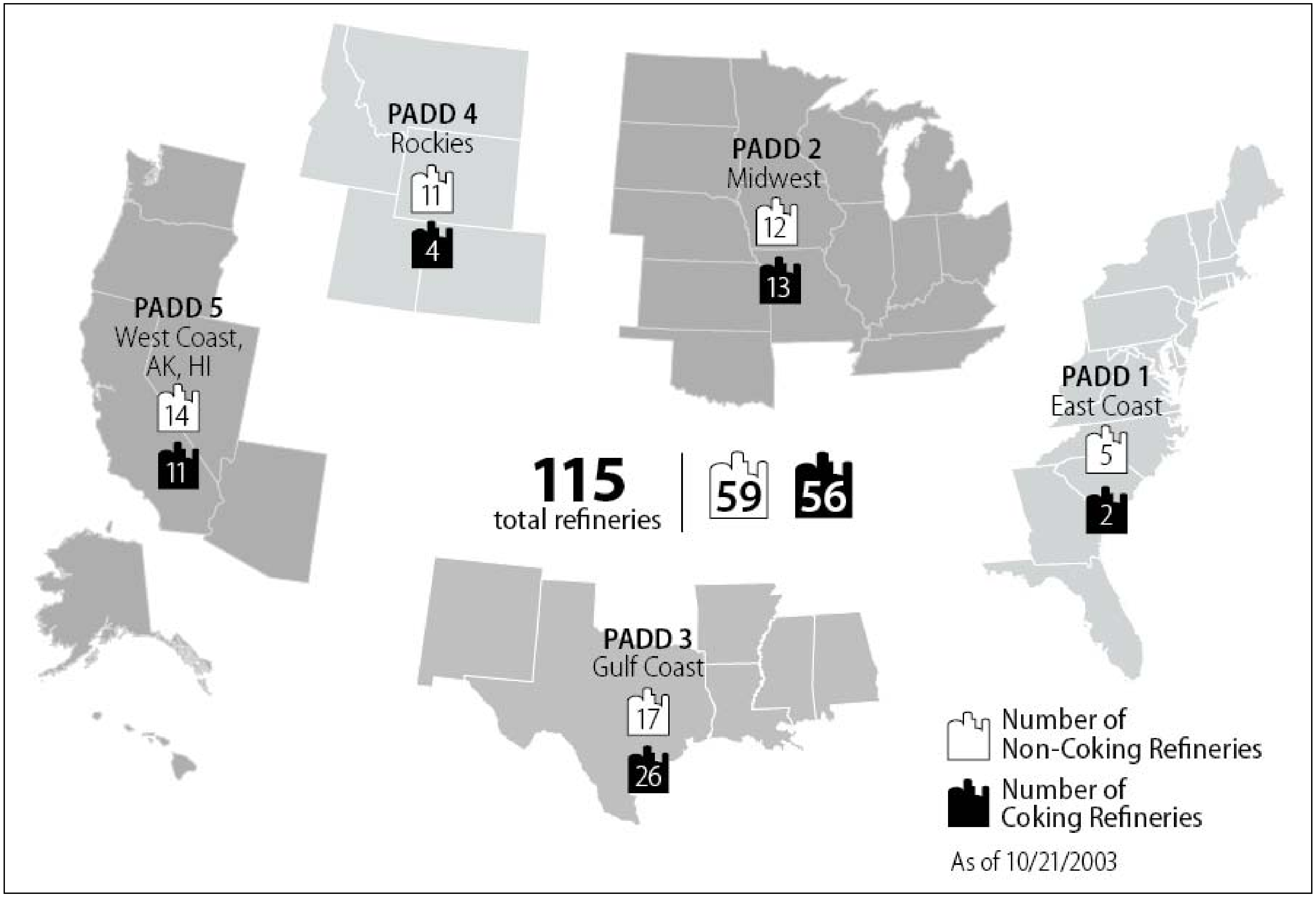


PADD	FUEL PROCESSING	BARRELS/DAY	NOTES
1	7	1,273,000	
2	25	3,764,300	Includes 1 refinery complex
3	43	9,256,300	Includes 2 refinery complexes
4	15	632,250	
5	25	3,241,800	Includes 1 refinery complex
Total	115	18,167,650	

Source: Prepared for CRS by the Library of Congress.

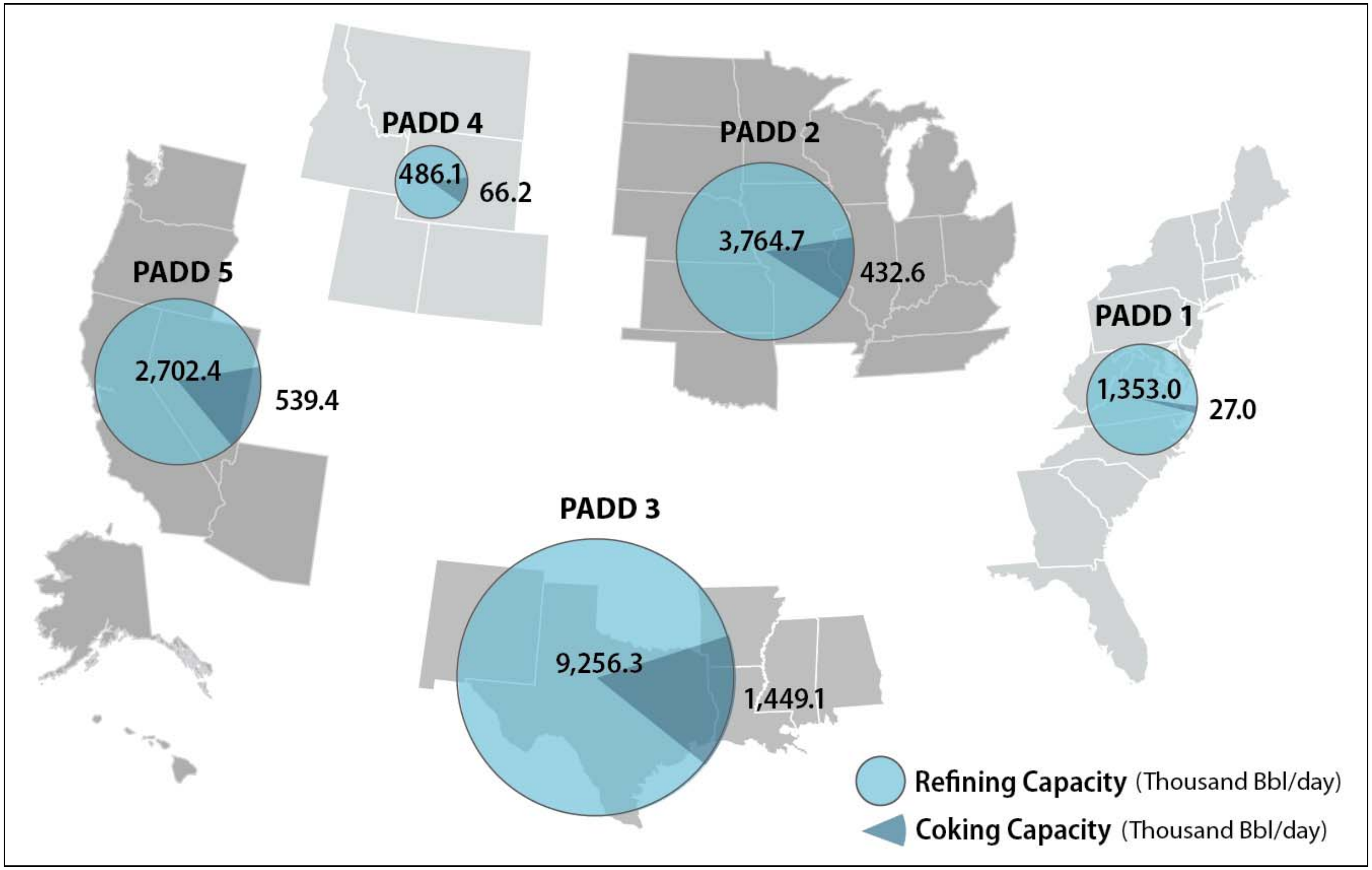
Notes: See **Table A-1** for a list of refineries.

Figure A-4. Coking Refineries by PADD



Source: Compiled by CRS from various sources.

Figure A-5. Refining and Coking Capacity by PADD



Source: Compiled by CRS from various sources.

Notes: Coking capacity denotes the throughput capacity to process petroleum resid.

Table A-1. U.S. Refineries with Coking Capacity

Advertised Refinery Capacity in Barrels per Day (Bbl/D)

PADD	St	City	Zip	Facility	Bbl/D	Congressional District
1	NJ	Paulsboro	08066	PBF/ Paulsboro Refinery	180,000	1st New Jersey
1	DE	Delaware	19706	PBF/Delaware City	190,000	At large Delaware
2	IL	Roxana	62084	Phillips 66/ Wood River Refinery	306,000	12th Illinois
2	IL	Drummond	60410	ExxonMobil/ Joliet Refinery	250,000	16th Illinois
2	IL	Robinson	62454	Marathon/ Robinson Refinery	206,000	15th Illinois
2	IL	Lemont	60439	Citgo/ Lemont Refinery	167,000	3rd Illinois
2	IN	Whiting	46394	BP/ Whiting Refinery	413,000	1st Indiana
2	KS	El Dorado	67042	Holly-Frontier/ El Dorado Refinery	135,000	4th Kansas
2	KS	Coffeyville	67337	CVR Coffeyville Refinery	115,000	2nd Kansas
2	KS	McPherson	67460	Cenex-NCRA/ McPherson Refinery	85,000	1st Kansas
2	MI	Detroit	48217	Marathon/ Detroit Refinery	106,000	13th Michigan
2	MN	Rosemont	55068	Flint Hills/ Pine Bend Refinery	320,000	2nd Minnesota
2	OH	Oregon	43616	BP-Husky/ Toledo Refinery	160,000	9th Ohio
2	OH	Lima	45804	Husky/ Lima Refinery	155,000	4th Ohio
2	OK	Ponca City	74601	Phillips 66/ Ponca City Refinery	187,000	3rd Oklahoma
3	AL	Tuscaloosa	35401	Hunt/ Tuscaloosa Refinery	72,000	7th Alabama
3	LA	Baton Rouge	70805	ExxonMobil/ Baton Rouge Refinery	503,500	2nd Louisiana
3	LA	Garyville	70051	Marathon/ Garyville Refinery	490,000	2nd Louisiana
3	LA	Lake Charles	70601	Citgo/ Lake Charles Refinery	425,000	3rd Louisiana
3	LA	Norco	70079	Valero/ St. Charles Refinery	270,000	6th Louisiana
3	LA	Belle Chasse	70037	Phillips 66/ Alliance Refinery	247,000	1st Louisiana

PADD	St	City	Zip	Facility	Bbl/D	Congressional District
3	LA	Westlake	70669	Phillips 66/ Lake Charles Refinery	239,000	3rd Louisiana
3	LA	St. Charles Parrish	70079	Motiva/ Norco Refinery	234,700	6th Louisiana
3	LA	Chalmette	70043	ExxonMobil/ Chalmette Refinery	192,500	1st Louisiana
3	MS	Pascagoula	39581	Chevron/ Pascagoula Refinery	330,000	4th Mississippi
3	TX	Port Arthur	77641	Motiva/ Port Arthur Refinery	600,000	14th Texas
3	TX	Baytown	77520	ExxonMobil/ Baytown Refinery	573,000	36th Texas
3	TX	Texas City	77590	Marathon/ Texas City Refinery	475,000	14th Texas
3	TX	Beaumont	77703	ExxonMobil/ Beaumont Refinery	365,000	14th Texas
3	TX	Deer Park	77536	Shell/ Deer Park Refinery	340,000	36th Texas
3	TX	Corpus Christi	78407	Valero/ Bill Greehy Refinery Complex East	325,000	27th Texas
3	TX	Port Arthur	77641	Valero/ Port Arthur Refinery	310,000	14th Texas
3	TX	Houston	77017	Lyondell/ Houston Refinery	268,000	29th Texas
3	TX	Sweeny	77463	Phillips 66/ Sweeny Refinery Complex	247,000	14th Texas
3	TX	Texas City	77590	Valero/ Texas City Refinery	245,000	14th Texas
3	TX	Port Arthur	77642	Total/ Port Arthur Refinery	174,000	14th Texas
3	TX	Corpus Christi	78047	Citgo/ Corpus Christi Refinery East & West Plant	165,000	27th Texas
3	TX	Corpus Christi	78408	Flint Hills/ Corpus Christi Refining Complex East Plant	150,000	27th Texas
3	TX	Borger	79007	Phillips 66/ Borger Refinery	146,000	13th Texas
3	TX	Pasadena	77506	Petrobras/ Pasadena Refinery	100,000	29th Texas
3	TX	Tyler	75702	Delek/ Tyler Refinery	60,000	1st Texas
4	MT	Billings	59101	ExxonMobil/ Billings Refinery	60,000	At Large Montana
4	MT	Billings	59101	Phillips 66/ Billings Refinery	58,000	At Large Montana
4	UT	Salt Lake City	84116	Chevron/ Salt Lake City Refinery	45,000	2nd Utah

PADD	St	City	Zip	Facility	Bbl/D	Congressional District
4	WY	Cheyenne	82007	Holly-Frontier/ Cheyenne Refinery	52,000	At Large Montana
5	CA	Paramount	90723	Alon/ California Refineries	70,000	40th California
5	CA	El Segundo	90245	Chevron/ El Segundo Refinery	290,000	33rd California
5	CA	Benicia	94510	Valero/ Benicia Refinery	170,000	5th California
5	CA	Martinez	94553	Tesoro/ Golden Eagle Refinery	166,000	5th California
5	CA	Martinez	94553	Shell/ Martinez Refinery	165,000	5th California
5	CA	Torrance	90509	ExxonMobil/ Torrance Refinery	150,000	43rd California
5	CA	Carson	90745	Phillips 66/ Los Angeles Refinery	139,000	44th California
5	CA	Wilmington	90744	Valero/ Wilmington Refinery	135,000	44th California
5	CA	Wilmington	90744	Tesoro Los/ Angeles Refinery	97,000	44th California
5	WA	Blaine	98230	BP/ Cherry Point Refinery	230,000	1st Washington
5	WA	Anacortes	98221	Shell/ Puget Sound Refinery	145,000	2nd Washington

Source: Various

Notes: Alon operates three units in Bakersfield, Paramount, and Long Beach, CA, as one refinery, but the delayed coker is reported as inactive.

Author Contact Information

Anthony Andrews
Specialist in Energy Policy
aandrews@crs.loc.gov, 7-6843

Richard K. Lattanzio
Analyst in Environmental Policy
rlattanzio@crs.loc.gov, 7-1754

Acknowledgments

Amber Hope Wilhelm, Graphics Specialist, Congressional Research Service

Jacqueline V. Nolan, Cartographer, Library of Congress

Cassandra Foley, Law Librarian, Congressional Research Service

James Werner, Environmental Policy Section Research Manager, Congressional Research Service

Exhibit 2

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

February 18, 2014

To: File for Petroleum Coke (CAS No. 64741-79-3)

From: Michael Depa, Air Quality Division, Toxics Unit

Subject: Toxicity Assessment

This memo describes a human health toxicity assessment for the uncalcined form of petroleum coke (“green coke”), which will be herein simply referred to as petcoke. Previously, an AQD assessment of the potential human health concerns for airborne petcoke dust associated with area sources (storage piles) concluded that the storage pile emissions did not pose a significant public health risk for inhalation exposure, based on the available information (Sills, 2013). The purpose of the present assessment was to include an updated and expanded information review and consider if it would be reasonable and appropriate to establish screening levels for petcoke emissions under Rule 225 for application in New Source Review permit reviews.

The conclusion of this assessment is consistent with that of the previous toxicity assessment (Sills, 2013). Human exposure to fine particulate matter (PM) emissions from petcoke storage piles, at sufficiently high concentrations and durations of exposure, could cause respiratory and cardiovascular effects characteristic of PM inhalation exposures. The U.S. Environmental Protection Agency (US EPA) established National Ambient Air Quality Standards (NAAQS) for PM to protect the public health. There is no evidence indicating that PM from petcoke is more potent than other forms of PM that are regulated by the PM primary NAAQS. Also, petcoke dust does not pose a significant carcinogenicity risk, based on negative carcinogenicity findings from chronic animal bioassays in two species and consideration of the elemental composition of petcoke. Therefore, human health concerns for petcoke inhalation exposure from industrial sources may be appropriately addressed via the NAAQS; it does not appear to be appropriate or necessary to establish specific screening levels for petcoke air emissions.

The following information sources were searched as part of the toxicity assessment for petroleum coke: US EPA’s Integrated Risk Information System (IRIS), the Registry of Toxic Effects of Chemical Substances (RTECS, 2014), the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV), National Institute of Occupational Safety and Health (NIOSH) Pocket Guide to Hazardous Chemicals, Chemical Abstract Service (CAS) –Online (1/13/2014), International Agency for Research on Cancer Monographs, National Library of Medicine, Health Effects Assessment Summary Tables, and National Toxicology Program Status Report. The US EPA has not established a reference concentration (RfC) for petroleum coke. California Office of Environmental Health Hazard Assessment (Cal-OEHHA) has not established reference exposure levels for petroleum coke. The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) has not established a chronic minimal risk level for petroleum coke. Neither the ACGIH nor NIOSH have established occupational exposure levels. A description of petroleum coke is shown below as well as in Appendix A.

> Petroleum coke is a solid material resulting from high temperature treatment of petroleum fractions. It consists of carbonaceous material and contains some hydrocarbons having a high carbon-to-hydrogen ratio.

Table 1 shows the percent composition of major elements found in petroleum coke.

Table 1. Percent Composition of Select Components of Green Coke

Analyte	Green Coke[1]	DBS Coke[2]
Carbon	89.58–91.80	89
Hydrogen	3.71–5.04	
Oxygen	1.30–2.14	
Nitrogen	0.95–1.20	
Sulfur	1.29–3.42	6
Ash (including heavy metals such as nickel and vanadium)	0.19–0.35	See Appendix A
Carbon-Hydrogen Ratio	18:1–24:1	

[1] Congressional Research Service, 2013
[2] Detroit Bulk Storage Sample, Analysis by Hazen Research, Inc., Golden Colorado: Report to Jeff Korniski, MDEQ-AQD Detroit Office, Reported 4-9-2013

Summary of Inhalation Studies

Sprague-Dawley rats and Cynomolgus monkeys were exposed to dust aerosol concentrations (0, 10.2, and 30.7 mg/m^3) of micronized delayed process petroleum coke for 6 hr/day, 5 days/week over 2 years (Klonne et al., 1987). With the exception of pulmonary effects, particularly in the rats, no significant adverse treatment-related effects were observed. Both dust-exposed groups of both species exhibited a gray to black discoloration of the lung, an observation consistent with pulmonary deposition of the coke dust, as well as increased absolute and/or relative lung weight values. The pulmonary histopathology in the monkeys was limited to the deposition and phagocytosis of the test material by pulmonary macrophages. The rats also exhibited these responses, but with concomitant signs of chronic inflammation and focal areas of fibrosis, bronchiolization, sclerosis, squamous alveolar metaplasia, and keratin cyst formation. No difference in the mortality rate was observed between the control and exposed groups of rats. Lastly, no significant increases in chromosomal aberrations were observed in rodents of the 10.2 or 30.7 mg/m^3 exposure groups when examined after 5 days, 12 months, and 22 months of exposure. The lowest dose (10.2 mg/m^3)[1] was identified as the lowest-observed-adverse-effect-level (LOAEL).

A combined reproductive/developmental toxicity screening test with petroleum coke dust showed no reproductive or developmental effects following inhalation exposure in rats; however, pulmonary inflammation (macrophage accumulation, lymphocyte hyperplasia and squamous metaplasia of respiratory epithelium) was observed in all exposed parental animals (EPA, 2011). The no-observed-adverse-effect-level (NOAEL) for reproductive/developmental toxicity is 300 mg/m^3, the highest concentration tested.

Health Benchmarks for Petroleum Coke

Texas Commission on Environmental Quality (TCEQ) regulates petroleum coke for air permit evaluations using Effects Screening Levels (ESLs). The TCEQ has 2 interim ESLs for petroleum coke:

1. Short-term: 50 µg/m^3 (PM10) 1-hour averaging time

---

[1] Units corrected from µg/m^3.

2. Long-term: 5 µg/m³ (PM10) annual averaging time

The TCEQ ESLs are based on the revoked National Ambient Air Quality Standard (NAAQS) for Particulate Matter, PM10 (particles less than 10 µm in diameter) (Lee, 2014), previously set at 50 µg/m³ annual average.

A potential ITSL could be developed for further consideration, from the Klonne, et al. (1987) study. Both rats and monkeys exhibited lung inflammation effects at the lowest dose test: 10 mg/m³. Given that monkeys have lung structure and function similar to humans it was deemed appropriate to use monkeys for the development of a screening level. The animal and human dose were considered equivalent. The experimental dose was adjusted for continuous exposure by multiplying the dose by the number of hours per day and number of days per week the animals were exposed.

Adjusted Dose = experimental dose x 6hr/24hr x 5days/7days
Adjusted Dose = 10 mg/m³ x 6/24 x 5/7
Adjusted Dose = 1.79 mg/m³

A potential ITSL was calculated as follows:

Potential ITSL = (Adjusted Dose)/(UF_A x UF_L x UF_H)

Where UF is an uncertainty factor, and the appropriate UF values consistent with risk assessment practice would be:

UF_A = 3 to10 for extrapolating between animals (monkeys) and humans (interspecies extrapolation)
UF_L = 10 for extrapolating from lowest-observed-adverse-effect-level (LOAEL) to NOAEL
UF_H = 10 for the protection of sensitive individuals (intraspecies extrapolation).

The potential ITSL is then:

Potential ITSL = (1.79 mg/m³)/((3 to10) x 10 x 10) x 1000 µg/mg
Potential ITSL = 2 to 6 µg/m³ with 1 significant figure (annual averaging time)

This potential ITSL is based on a chronic inhalation study adjusted for continuous exposure and derived using uncertainty factors to adjust for lifetime exposure, therefore an appropriate averaging time would be annual average. The value of the potential ITSL of 2 to 6 µg/m^3 (annual average), including a total uncertainty factor of 300 to 1000, may be compared to the annual primary NAAQS for $PM_{2.5}$ of 12 µg/m^3 based on a wealth of human epidemiology studies and the peer review and scrutiny afforded a national ambient air quality standard. It would not be reasonable and appropriate to establish an ITSL for petcoke at the level of the above potential ITSL based on an animal bioassay and a relatively large uncertainty factor, when there is no evidence indicating that the NAAQS levels would not be protective for the petcoke toxicity findings (a chronic monkey LOAEL of 10 mg/m^3, adjusted to 1.79 mg/m^3).

Concerns for the potential for petcoke dust exposures to pose a carcinogenicity hazard are not supported by the negative bioassay findings in two species as summarized above. Additionally, Sills (2013) considered the levels of two carcinogens (nickel and benzo(a)pyrene) that have been reported as constituents of petcoke, and found that under some worst-case assumptions such as lifetime continuous exposure to petcoke dust at the PM2.5 NAAQS of 12 µg/m^3 (annual average), the reported levels of these two constituents would be associated with a plausible upper bound lifetime incremental cancer risk of approximately 0.5 in one million and 10 in one million, respectively. These findings, along with the negative carcinogenicity findings from animal bioassays, do not suggest the need to address the potential cancer risk of specific petcoke constituents.

It may be noted that the inorganic constituents of petcoke, as described in Appendix A, may also be anticipated to be present as natural constituents in topsoil, and therefore also present in airborne dust originating from topsoil erosion and atmospheric suspension. Appendix A includes a column for the Michigan topsoil concentrations for the inorganic constituents of petcoke, for information purposes and to help lend perspective to the consideration of petcoke dust health concerns.

Discussion

Petroleum coke has no observed carcinogenic, reproductive, or developmental effects. Inhalation exposure to high concentrations of petroleum coke dust can lead to an inflammatory response in the lungs of both humans and animals. As noted above, animal toxicity studies of repeated-dose and chronic inhalation have shown respiratory inflammation attributed to the non-specific effects of dust particles rather than the specific effects of petroleum coke. On this basis, it seems most appropriate to evaluate the emissions and impacts pf petroleum coke and its risk of inflammatory effects on the lung in terms of particulate matter less than 10 µm in diameter (PM10) or 2.5 µm in diameter (PM2.5). The health-protective primary NAAQS for PM2.5 are appropriate for evaluating the impacts of processes that emit petroleum coke dust.

References:

Congressional Research Service. 2013. Petroleum Coke: Industry and Environmental Issues. Anthony Andrews, Richard K. Lattanzio. Octorber 29, 2013. 7-5700. www.crs.gov, r43263. https://www.hsdl.org/?view&did=746955

EPA. 2011. Petroleum Coke Category. Hazard Characterization Document. U.S. Environmental Protection Agency June, 2011.

Klonne DR, Burns JM, Halder CA, Holdsworth CE, Ulrich CE. 1987. Two-year inhalation toxicity study of petroleum coke in rats and monkeys. American Journal of Industrial Medicine 11:375-389.

Lee, Jong Song, Ph.D. 2014. Personal communication. Mr. Lee is a toxicologist with the Texas Commission on Environmental Quality, Toxicology.

Sills, R. 2013. Petroleum Coke: Summary of Composition and Evaluation of Inhalation Toxicity. April 12, 2013. Unpublished MDEQ-AQD report.

TCEQ. 2014. Texas Commission on Environmental Quality. Toxicology. Effects Screening Levels (ESLs). http://www.tceq.texas.gov/toxicology/esl/ESLMain.html

Appendix B: Ecology Center Petroleum Coke Analysis and Comparison to MDEQ Sample Analysis

Sample	Delayed Process Green Coke - 2003 Sample[1]				API Sample #4-1-140 [2]	Micronized Delayed Process Green Coke – 1981 sample [3]		DBS Green Coke[6]	Mich. Top Soil[7]
	pellet (initial)[4]	pellet (final)[5]	micro-nized (initial)	micro-nized (final)	Delayed Process Coke	1981 Analysis	1984 Analysis	MDEQ 2013	MDEQ 2005
Avg. Particle Size, Mass Median Aerodynamic, µm	2000*	2000*	2.3/3.3*		5**	3.1	3.1		
Elemental Analysis, % wt									
Carbon					89.93	89.97	89.58	89.8	
Hydrogen					3.71	5.04	3.89		
Oxygen					1.3	1.62	2.14		
Sulphur	7.4		5.8		3.36	3.27	3.42	6	
Nitrogen					1.1	1.1	1.2		
Other Analysis, % wt									
SiO2					0.04	<0.04	<0.02		
Ash					0.21	0.19	0.28		
Trace Metals, ppm									
Al (aluminum)	321	205.1	300.2	250.7					4572
As (arsenic)	<19.3	<2.3	<29.6	<2.3	<0.001	0.3	0.7	ND	5.67
B (boron)	<19.3		<29.6						
Ba (barium)	<19.3	7.74	<29.6	6.9				1.8	37.7
Be (beryllium)	<9.6		<14.8					ND	<0.2
Bi (bismuth)	<19.3		<29.6						
Ca (calcium)	178	81.7	121.6	158.7					
Cd (cadmium)	<9.6		<14.8					ND	<2
Co (cobalt)	<9.6	1.9	<14.8	1.7				0.88	<5
Cr (chromium)	<9.6	3.9	<14.8	4.6				ND	12.9
Cu (copper)	<11.6	1.8	<17.8	2.3				ND	10.1
Fe (iron)	310	215.9	247	276.1				78	9547
Hg (mercury)					<1	<1	<0.01	ND	<0.1
K (potassium)	<28.9	10.9	<44.4	20.5					
Li (lithium)	<9.6	<1.2	<14.8	<1.16					4.5
Mg (magnesium)	77.4	50.3	60.9	65.5					1576
Mn (manganese)	<19.3	5.3	<29.6	7.3				1.4	475
Mo (molybdenum)	<19.3	16.7	<29.6	16.0				20	<5
Na (sodium)	133	87.8	114.6	99.0					
Ni (nickel)	367.1	319.6	351.7	304.6	95	78	85	190	8.8
P (phosphorus)	<19.3	19.8	30.3	25.0					
Pb (lead)	<19.3	4.88	<29.61	7.4				ND	11.7
Pd (palladium)		<6.9		<6.9					
Pt (platinum)		3.8		4.5					
S (sulfur)	73920		58060						
Sb (antimony)	<48.2		<74.0					ND	
Se (selenium)	<19.3		<29.6		4.5	<0.2	<0.5	ND	<1
Si (silicon)	743.2	86.75		204					
Sn (tin)	<28.9	<2.3		<2.3					
Ti (titanium)	12.9	11.7	<14.8	14.4					94.5
V (vanadium)	1938	1559	1805	1580	145	140	130	470	20.9
Zn (zinc)	12.0	8.9	<14.8	11.2				2.2	43.2
Benzene Extract, % wt					1.79	2.08	2.64		

Appendix B: Ecology Center Petroleum Coke Analysis and Comparison to MDEQ Sample Analysis

Sample	Delayed Process Green Coke - 2003 Sample[1]				API Sample #4-1-140 [2]	Micronized Delayed Process Green Coke – 1981 sample [3]		DBS Green Coke[6]	Mich. Top Soil[7]
	pellet (initial)[4]	pellet (final)[5]	micro-nized (initial)	micro-nized (final)	Delayed Process Coke	1981 Analysis	1984 Analysis	MDEQ 2013	MDEQ 2005
PAHs, ppm									
Naphthalene	3.6	3.6	11	11					
1-methyl naphthalene	2.7	3.1	10	12					
2-methyl naphthalene	11	12	26	26					
Acenaphthene	ND	0.18	ND	0.51					
Acenaphthylene	ND	0.12	ND	0.5					
Fluorene	0.34	0.37	1.5	1.5	11	ND	ND		
Phenanthrene	0.69	0.64	7.8	8.2	ND	ND	ND		
Anthracene	ND	0.29	3.3	3.6					
Pyrene	1.3	1.2	8.6	10	ND	165	158		
Fluroanthene	ND	0.1	1.4	1.6					
Benzofluorenes					ND	ND	ND		
Benzo(a)anthracene	0.58	0.59	7.1	8	544				
Benzp(a,b)anthrcene						280	287		
Chrysene	0.88	1.1	9.4	10	126	210	255		
Benzo(a)pyrene	1.8	1.7	11	13	440	175	190		
Benzo(e)pyrene					110	85	134		
Beno(b)fluoranthene	0.52	0.62	3.8	3.9	ND	ND	ND		
Benzo(k)fluoranthene	ND	ND	ND	1.5					
Perylene					ND				
Methyl benzo(a)pyrene					ND	ND			
Benzo(g,h,i)perylene	1.1	1.4	8.7	12	439	120	167		
Dibenzo(a,h)anthracene	0.49	0.51	4.1	4.3	ND	NQ	ND		
Benzo(g,h,i)fluoranthene					ND	ND	ND		
Indeno(1,2,3-cd)pyrene	0.34	0.45	3.5	3.3					
Dimethylbenz(a)anthracene							ND		
Methylbenzo(g,h,i)perylene							377		
Coronene					ND	ND	ND		

Toxicology study(s) in which samples were used:

1 OECD 203 Fish acute toxicity test; OECD 202 Invertebrate acute toxicity test; OECD 201 Algal growth inhibition test; OECD 208 Seedling emergence and growth of terrestrial plants; OECD 207 Earthworm acute toxicity test; OECD 421 Reproduction/developmental toxicity screening test

2 Mouse dermal carcinogenicity study; *Salmonella* assay; mouse lymphoma cell assay

3 Rat chronic inhalation study; Monkey chronic inhalation study; *Salmonella* assay; Rat *in vivo* cytogenicity assay

4 initial refers to analyses conducted prior to initiation of the toxicology studies

5 final refers to analyses conducted following completion of the toxicology studies

6 DBS = Detroit Bulk Storage sample. Trace metals analysis by MDEQ Lab. Reported 4-9-2013 ; Carbon, sulfur analysis by Hazen Research, Inc., Golden Colorado: Report to Jeff Korniski, MDEQ-AQD Detroit Office, Reported 4-9-2013

7 Michigan Background Soil Survey 2005. Huron–Erie glacial lobe. Mean (average) topsoil values. http://www.michigan.gov/documents/deq/deq-whm-hwp-Michigan-Background-Soil-revJuly2005_248097_7.pdf

ND = not detected

NQ = detected, but not quantifiable Blank cells = analysis not performed

* values are average mean particle size

** size not measured; value estimated from scanning electron micrographs

References: Aveka, Inc., 2003; CONCAWE, 1993; Chevron Products Company, 2003, 2005; Lancaster Laboratories, Inc., 2003, 2005.

Exhibit 3

ENVIRONMENTAL
HEALTH & ENGINEERING

**Environmental Health
& Engineering, Inc.**

117 Fourth Avenue
Needham, MA
02494-2725

TEL 800-825-5343
781-247-4300
FAX 781-247-4305

www.eheinc.com

August 18, 2014

Mr. George T. Czerniak
Director, Air and Radiation Division
U.S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60647

Ms. Nicole Cantello
Attorney-Advisor
U.S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60647

RE: Analysis of HVAC Air Filters from Southeast Chicago (EH&E 19251)

Dear Mr. Czerniak and Ms. Cantello:

Environmental Health & Engineering, Inc. (EH&E) provides this report summarizing the chemical analyses of air filter samples obtained by the U.S. Environmental Protection Agency (EPA) of heating, ventilating, and air conditioning systems (HVAC) of two homes in the South Deering and East Side neighborhoods (“the Neighborhoods”) of Chicago, Illinois, during July 2014.

In summary, the levels of polynuclear aromatic hydrocarbons (PAHs) and metals in the air filters are not consistent with the presence of petroleum coke or coal, but instead are associated with indoor and outdoor air, settled house dust, and soil reported for Chicago and other urban areas in the United States. As detailed below, this conclusion is based on comparing proportions of indicator chemicals[1] measured in the air filters to proportions measured in 1) indoor and

---

[1] Indicators include the ratio of vanadium to nickel and proportions of 16 PAHs (naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene. Values for additional PAHs (1- and 2-methylnaphthalene) were provided in lab analysis for the HVAC air filters but were unavailable in some of the reference data. We did examine proportions of the 16 PAHs included in this report, plus these additional PAHs in the media for which these data were available (i.e., soil, petroleum coke, coal), and our findings remain unchanged.

outdoor air, settled house dust, and soil of Chicago and other urban areas; and 2) petroleum coke and coal from the KCBX Terminal Company North and South terminals in Southeast Chicago.

HVAC AIR FILTER SAMPLES

EPA provided samples of air filters reported to have been obtained from the HVAC systems of two homes in the Neighborhoods during July 2014. EPA also provided additional filter material to be used as blank samples, although information on the origin of this material was not provided. EH&E received the samples on July 17, 2014. The samples were analyzed for PAHs and metals the following week.[2]

The HVAC filter results were compared to one another during a preliminary analysis. The total loading of PAHs and metals was greater in one of the filters compared to the other; however, the levels of PAHs and metals were strongly correlated between the two filters.[3] Levels of PAHs and metals found in the two blank filters were comparable to one another. Proportions of metals detected in the used HVAC air filters were also consistent with proportions found in the blank samples. We also note that levels of naphthalene and 2-methylnaphthalene in one of the blank samples were higher than levels observed in its corresponding used HVAC air filter sample.

PETROLEUM COKE AND COAL SAMPLES

Petroleum coke and coal samples were collected from the KCBX North and South terminals in November 2013 and March 2014, then subsequently analyzed for concentrations of PAHs and metals. Results of those analyses were reported previously by EH&E[4] and EPA.[5]

REFERENCE DATA

To aid with interpretation of the filter results, data were obtained for PAHs and metals in environmental media that could reasonably be expected to contribute to material captured by residential HVAC air filters. These media include: indoor air and outdoor air, settled house dust, and soil. These reference data include information for Chicago and other U.S. cities obtained from the peer-reviewed scientific literature as well as prior chemical analyses of soil from the Neighborhoods and surrounding areas.

---

[2] Chemical analyses of the air filters were carried out by TestAmerica Laboratories, Inc. located in Burlington, VT. For determination of PAHs, the filter samples were digested according to EPA Method 3550C and analyzed by gas chromatography-mass spectrometry in selective ion monitoring mode according to EPA Method 8270D SIM. For determination of metals, the metal wire integral to the filters was removed and then the filter media was digested according to EPA Method 3050B and analyzed by inductively coupled plasma-mass spectrometry according to EPA Method 6020A.

[3] PAHs: $r = 0.82$, p-value = <0.01. Metals: $r = 0.86$, p-value = <0.01

[4] http://www2.epa.gov/sites/production/files/2014-03/documents/petcoke-coal-test-results-20130112.pdf

[5] http://www2.epa.gov/petroleum-coke-chicago/analysis-pet-coke-samples

Outdoor air values for Chicago from the Northbrook Water Plant air quality monitoring station were accessed from the EPA AirData web portal[6] and from the Illinois Institute of Technology were obtained from the published literature.[7] Settled house dust data for PAHs were obtained from a study conducted in urban areas within the United States.[8] Values for indicator metals in settled house dust were not identified by the literature search conducted for this analysis. Indoor air values for indicator metals in Chicago were not identified at this time; therefore, data from elsewhere in the U.S. was used.[9] In November 2013 soil samples were collected at bus stops, intersections, and parks throughout the Neighborhoods, and results of the PAH and metals analyses from those soil samples have been reported previously.[10] At that time, additional soil samples were also collected in other Southeast Chicago neighborhoods adjacent to the South Deering/East Side neighborhoods. Additional reference values for soil in Chicago were obtained from a study conducted by the U.S. Geological Survey (USGS)[11] and from the Illinois Tiered Approach for Corrective Action (TACO) program.[12]

ANALYSIS

The proportions of 16 PAHs and the ratio of V:Ni in the HVAC air filter samples were compared to the corresponding values in petroleum coke and coal from the KCBX terminals, and in the reference air, settled dust, and soil.

---

[6] http://www.epa.gov/airquality/airdata/ Values were averaged over a five year period (2009-2013).

[7] Franz, et al., 1998.

[8] Whitehead et al., 2011. Data from the Mahler et al. (2010) study referenced in Table 4 (Whitehead, et al., 2011) was used in the HVAC filter analysis. These values from seven locations are the most complete median PAH profiles identified in the literature. All seven locations were well correlated with one another ($0.52 < r < 0.96$), indicating that PAH concentrations in settled house dust are relatively consistent across the country. The authors attribute minor differences in PAH concentrations mainly to geographic differences in traffic density and in use of coal-tar based pavement sealants.

[9] Clougherty et al., 2010; Graney et al., 2004; Habre et al., 2014; Kinney et al., 2002; Polidori et al., 2009; Yankoleva et al., 1999.

[10] http://www2.epa.gov/sites/production/files/2014-03/documents/petcoke-coal-test-results-20130112.pdf

[11] USGS, 2003.

[12] Illinois EPA, 2001.

PAHs in the HVAC air filters are not associated with petroleum coke or coal based on the correlation analysis summarized in Table 1. As shown in the "Source Material" rows of the table, correlations between PAHs found in the HVAC filters and source materials (i.e., petroleum coke and coal from the KCBX terminals) were weak and not statistically significant. In contrast, proportions of PAHs in the HVAC filter samples were strongly and statistically significantly associated with the proportions in outdoor air measured in Chicago, settled house dust measured in urban areas of the United States, the TACO program, and soil samples collected in other locations in Chicago (USGS) as well as in the Neighborhoods and surrounding areas ("Reference Data" listed in Table 1). The highly consistent correlations among these media show the strong influence of urban background levels of PAHs.

Table 1 Comparison of Profiles of PAHs Measured in HVAC Air Filter Samples to Petroleum Coke and Coal Samples and Reference Data

Data Source	Correlation Coefficient Filter 1	p-value	Correlation Coefficient Filter 2	p-value
Source Material				
Petroleum coke[1]	0.06	0.84	0.12	0.67
Coal[1]	0.14	0.62	0.08	0.78
Reference Data				
Outdoor air*[2]	0.89	<0.01	0.87	<0.01
Settled house dust[3]	0.74	<0.01	0.76	<0.01
USGS (soil)[4]	0.79	<0.01	0.72	<0.01
TACO (soil)[5]	0.82	<0.01	0.80	<0.01
Southeast Chicago neighborhoods (soil)[1]	0.78	<0.01	0.73	<0.01
South Deering/East Side neighborhoods (soil)[1]	0.74	<0.01	0.70	<0.01

Correlation coefficients range between -1 to 1. Absolute values greater than 0.7 indicate a strong correlation between groups.

p-values <0.01 indicate that the correlation between groups are statistically significantly different from zero at the 0.01 confidence level.

[1] Sampling data
[2] Franz, et al, 1998.
[3] Whitehead et al., 2011.
[4] USGS, 2003.
[5] Illinois EPA, 2001

V:Ni ratios measured in HVAC filter samples (median ratio=0.68) were similar to those observed in the indoor air of homes in urban areas in the U.S as well as in the outdoor air of Chicago, as shown in Figure 1. The V:Ni ratios measured in soil and air were nearly ten-fold less than ratios observed in petroleum coke and coal (median values 3.5 and 4.4, respectively), also shown in Figure 1.

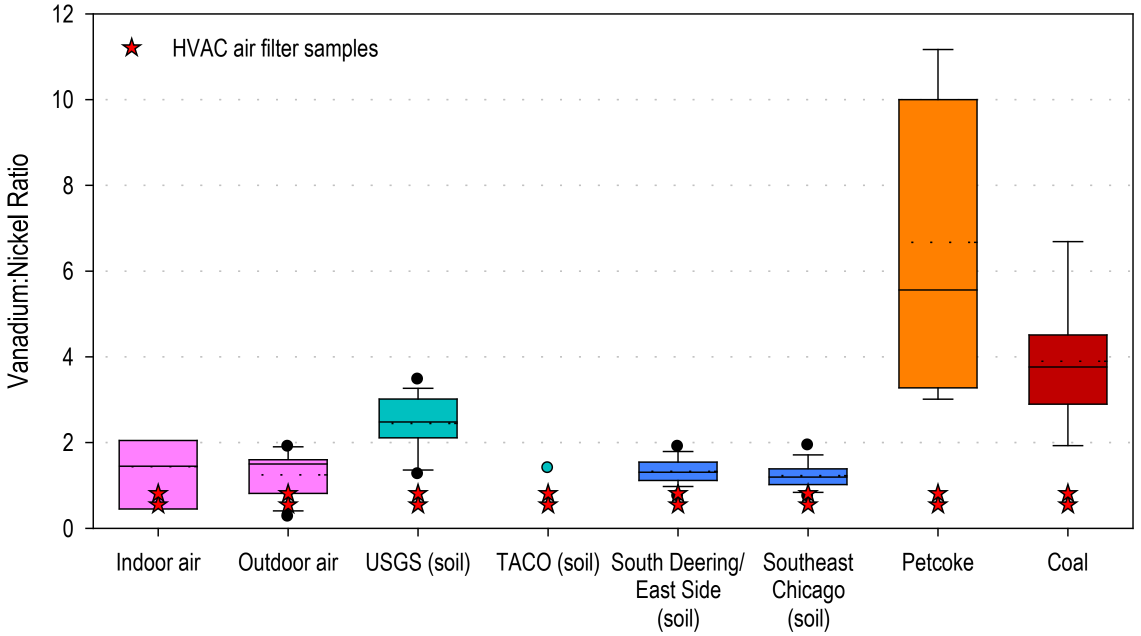


Figure 1 Vanadium to Nickel Ratios for Reference Soil and Air Samples and Source Material Samples of Petcoke and Coal Compared to HVAC Air Filter Samples from Two Chicago Homes

CONCLUSION

The data available for the two HVAC air filters at this time provide no evidence of windborne transport of petroleum coke and coal from the KCBX terminals to the surrounding community. Instead, levels of PAHs and metals in the HVAC air filter samples are highly consistent with anthropogenic background levels observed in air, settled house dust, and soil of Chicago and other urban areas in the U.S. These findings indicate that the PAHs and metals found in air filters from the Neighborhoods reflect background conditions in the Southeast Chicago area rather than impacts of petroleum coke or coal.

If you have any comments or questions regarding this report, please contact me at 1-800-TALK EHE (1-800-825-5343).

Sincerely,

David L. MacIntosh, Sc.D., C.I.H.
Chief Science Officer

Appendix A	Bibliography
Appendix B	Laboratory Report for HVAC Filter Analyses

P:\19251\Monitoring Results\HVAC Air Filter Summary Report.docx

APPENDIX A

BIBLIOGRAPHY

BIBLIOGRAPHY

Clougherty JE, Houseman EA, and Levy JI, 2011. Source apportionment of indoor residential fine particulate matter using land use regression and constrained factor analysis. *Indoor Air*, 21(1):53-66.

Franz TP, Eisenreich SJ, Holsen TM. 1998. Dry deposition of particulate polychlorinated biphenyls and polycyclic aromatic hydrocarbons to Lake Michigan. *Environmental Science & Technology*, 32:3681-3688.

Gigliotti CL, Totten LA, Offenberg JH, Dachs J, Reinfelder JR, Nelson ED, Glenn TR, Eisenberg SJ. 2005. Atmospheric concentrations and deposition of polycyclic aromatic hydrcarbons in the Mid-Atlantic East Coast region. *Environmental Science & Technology*, 39(15):5550-5559.

Graney JR, Landis MS, and Norris GA. 2004. Concentrations and solubility of metals from indoor and personal exposure $PM_{2.5}$ samples. *Atmospheric Environment*, 38(2):237-247.

Habre R, Coull B, Moshier R, Godbold J, Grunin A, Nath A, Castro W, Schachter N, Rohr A, Kattan M, Spengler J, and Koutrakis P. 2014. Source of indoor air pollution in New York City residences of asthmatic children. *Journal of Exposure Science and Environmental Epidemiology*, 24(3):269-278.

Illinois EPA. 2001. City of Chicago. *Urban Area Polycyclic Aromatic Hydrocarbons Study Tiered Approach to Corrective Action Objectives.* Chicago, IL: Illinois Environmental Protection Agency.

Kinney PL, Chillrud AN, Ramstrom S, Ross J, and Spengler JD. 2002. Exposures to multiple air toxics in New York City. *Environmental Health Perspectives,* 110(4):539-546.

Mahler BJ, Van Metre PC, Wilson JT, Musgrove M, Burbank TL, Ennis TE, and Bashara TJ. 2010. Coal-tar based parking lot sealcoat: An unrecognized source of PAH to settled house dust. *Environmental Science & Technology*, 44(3):894-900.

Polidori A, Cheung KL, Arhami M, Delfino RJ, Schauer JJ, and Sioutas C. 2009. Relationships between size-fractioned indoor and outdoor trace elements at four retirement communities in southern California. *Atmospheric Chemistry and Physics*, 9(14):4521-4536.

USGS. 2003. *Concentrations of Polynuclear Aromatic Hydrocarbons and Inorganic Constituents in Ambient Surface Soils, Chicago, Illinois: 2001-2002*. By Kay RT, Arnold TL, Cannon WF, Graham D, Morton E, and Bienert R. Water-Resources Investigations Report 03-4105. Urbana, Illinois: U.S. Geological Survey, U.S. Department of the Interior.

Van Winkle MR and Scheff PA. 2001. Volatile organic compounds, polycyclic aromatic hydrocarbons and elements in the air of ten urban homes. *Indoor Air*, 11(1):49-64.

Whitehead T, Metayer C, Buffler P, and Rappaport SM. 2011. Estimating exposures to indoor contaminants using residential dust. *Journal of Exposure Science and Environmental Epidemiology*, 21(6):549-564.

Yakovlena E, Hopke PK, and Wallace L. 1999. Receptor modeling assessment of particle total exposure assessment methodology data. *Environmental Science & Technology*, 33(20):3645-3652.

APPENDIX B

LABORATORY REPORT FOR HVAC FILTER ANALYSES

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Burlington
30 Community Drive
Suite 11
South Burlington, VT 05403
Tel: (802)660-1990

TestAmerica Job ID: 200-23277-1
Client Project/Site: Filter Sample

For:
Environmental Health & Engineering
117 Fourth Avenue
Needham, Massachusetts 02494-2725

Attn: Kathleen Brown

Authorized for release by:
7/30/2014 6:34:30 PM

Stephanie Sanders, Project Manager I
(303)736-0196
stephanie.sanders@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

LINKS

Review your project results through
TotalAccess

Have a Question?
Ask The Expert

Visit us at:
www.testamericainc.com

Table of Contents

Job ID: 200-23277-1

Laboratory: TestAmerica Burlington

Narrative

CASE NARRATIVE

Client: Environmental Health & Engineering

Project: Filter Sample

Report Number: 200-23277-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 07/22/2014; the samples arrived in good condition, properly preserved and on ice. The temperature of the cooler at receipt was 3.2 C.

PAH containers received in clear 16oz jars and wrapped in aluminum foil.

No date or times listed on the container labels. Logged in per sample date and times listed on the COC.

Per client request, the sample filters were weighed and measured prior to analysis. The following are the weights and measurements for the samples:

Sample 1407001-15 PAH Filter dimensions of 15.8cm x 10.9cm and weight of 2.43g (metal mesh included)
Sample 1407001-15 Metals Filter dimensions of 17.4cm x 10.0cm and weight of 1.40g (metal mesh removed)
Sample 1407001-16 PAH Filter dimensions of 12.0cm x 10.5cm and weight of 2.93g (metal mesh included)
Sample 1407001-16 Metals Filter dimensions of 12.4cm x 9.9cm and weight of 1.35g (metal mesh removed)
Sample 1407004-01 PAH Filter dimensions of 19.2cm x 9.5cm and weight of 2.72g (metal mesh included)
Sample 1407004-01 Metals Filter dimensions of 16.7cm x 9.5cm and weight of 0.91g (metal mesh removed)
Sample 1407004-02 PAH Filter dimensions of 17.9cm x 8.7cm and weight of 2.12g (metal mesh included)
Sample 1407004-02 Metals Filter dimensions of 18.3cm x 9.0cm and weight of 0.89g (metal mesh removed)

SEMIVOLATILE ORGANIC COMPOUNDS - SELECTED ION MODE (SIM)

Samples 1407001-15, 1407001-16, 1407004-01 and 1407004-02 were analyzed for semivolatile organic compounds - Selected Ion Mode (SIM) in accordance with 8270D SIM. The samples were prepared on 07/24/2014 and analyzed on 07/29/2014.

The samples were received by the lab outside the validated holding time for extraction solid matrix samples. The results reported the samples are flagged accordingly.

Internal standard (ISTD) response for the following samples was outside control limits: 1407004-01, 1407004-02. The samples were re-analyzed with concurring results and both sets of data have been reported.

Samples 1407001-15[3.33X] and 1407001-16[2X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

Job ID: 200-23277-1 (Continued)

Laboratory: TestAmerica Burlington (Continued)

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

METALS (ICPMS)

Samples 1407001-15, 1407001-16, 1407004-01 and 1407004-02 were analyzed for metals (ICPMS) in accordance with 6020A. The samples were prepared on 07/25/2014 and analyzed on 07/28/2014 and 07/29/2014.

Due to sample matrix effect on the internal standard (ISTD), a dilution was required for the following sample for Arsenic, Selenium, and Lead: 1407001-15.

The following sample was diluted to bring the concentration of Sodium and Zinc within the calibration range: 1407001-15. Elevated reporting limits (RLs) are provided.

Internal standard responses were outside of acceptance limits for the following sample: 1407001-15. The sample shows evidence of matrix interference. Thallium recovers below the reporting limit when run both undiluted and at dilutions, therefore the undiluted analysis is reported.

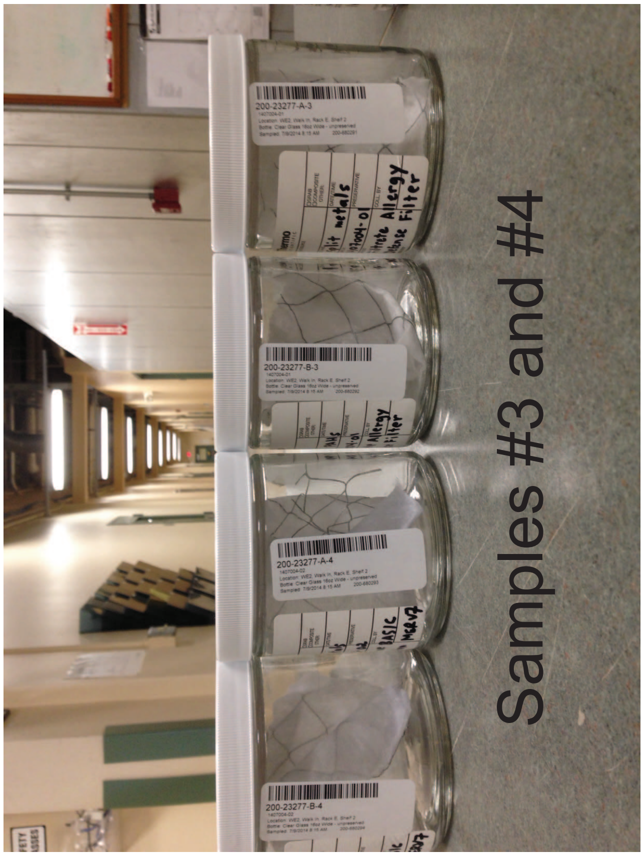
Arsenic and Thallium were detected in method blank MB 200-75341/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

Samples 1407001-15[10X] and 1407001-15[2X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

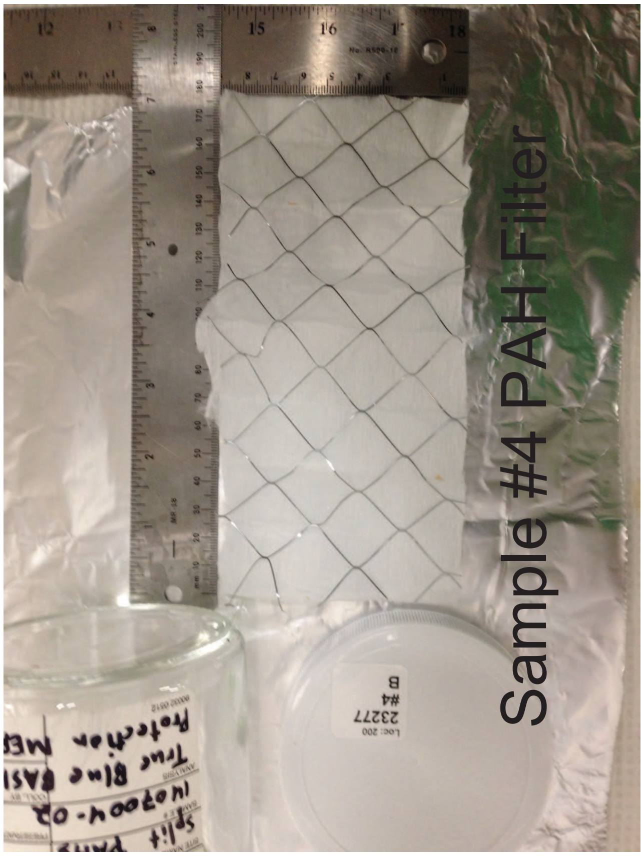

Samples #1 and #2


Samples at receipt


Samples #3 and #4

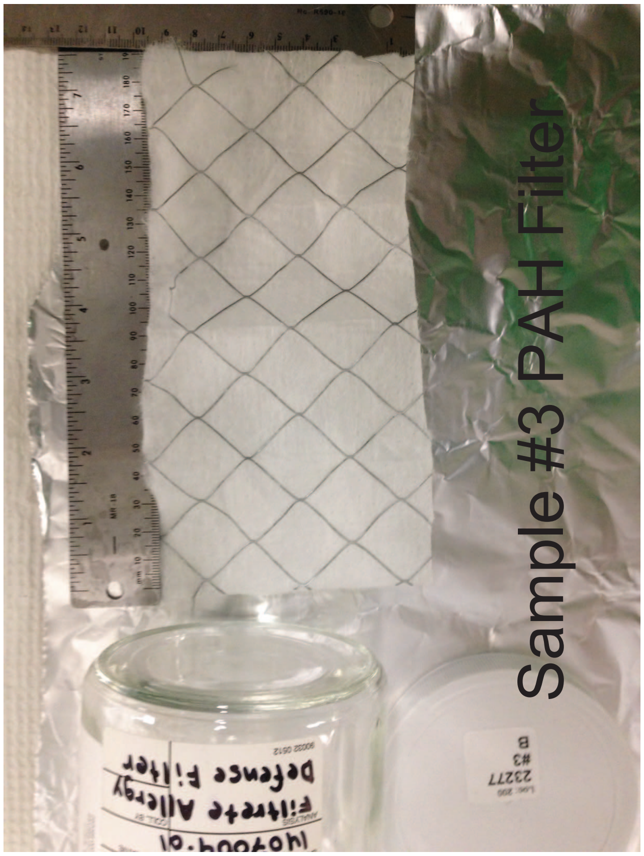
1
2
3
4
5
6
7
8
9

Sample #2 PAH Filter



Sample #4 PAH Filter

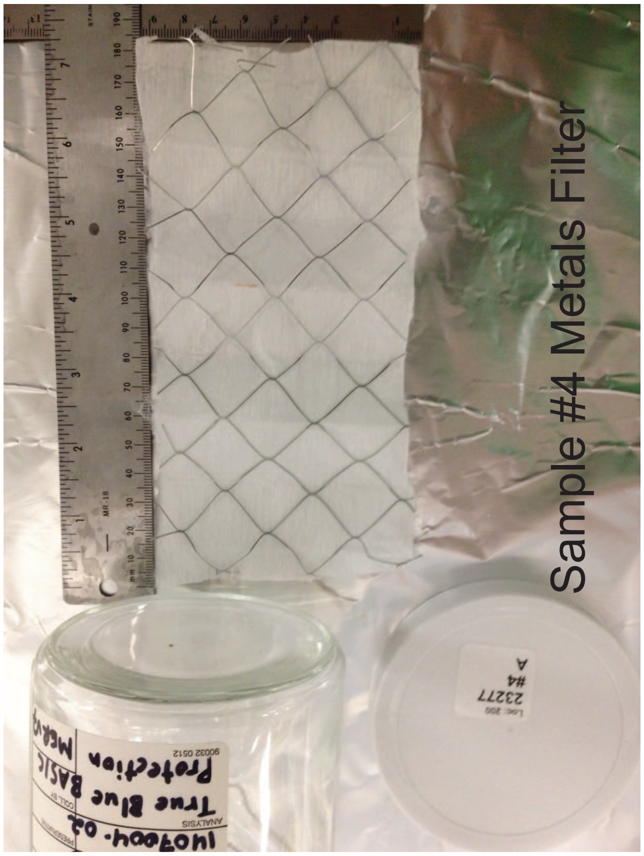
Sample #1 PAH Filter



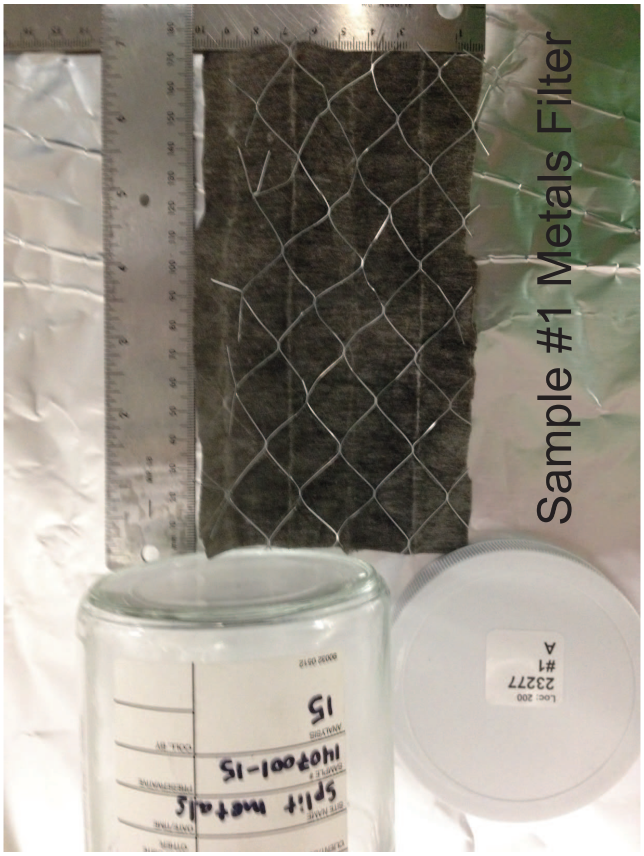
Sample #3 PAH Filter

1
2
3
4
5
6
7
8
9

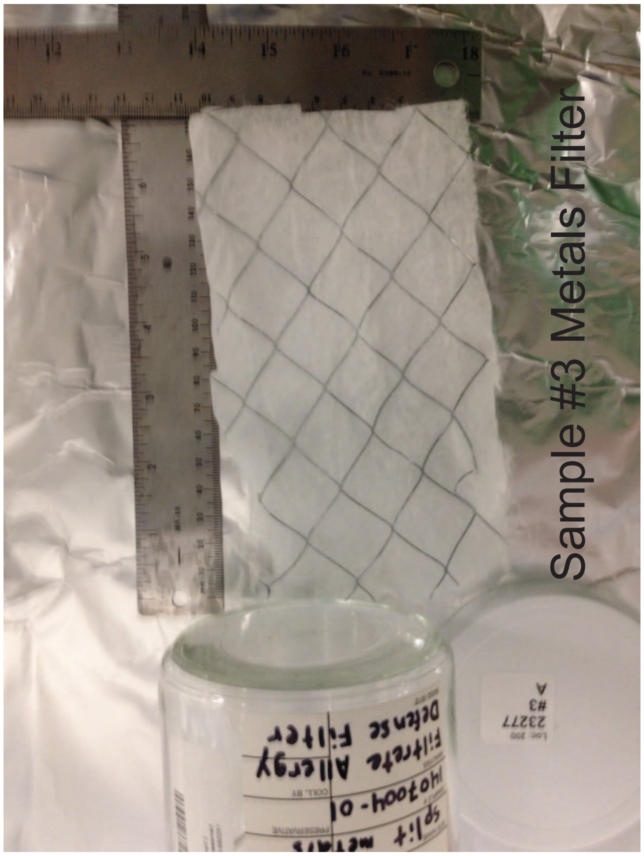
Sample #2 Metals Filter



Sample #4 Metals Filter

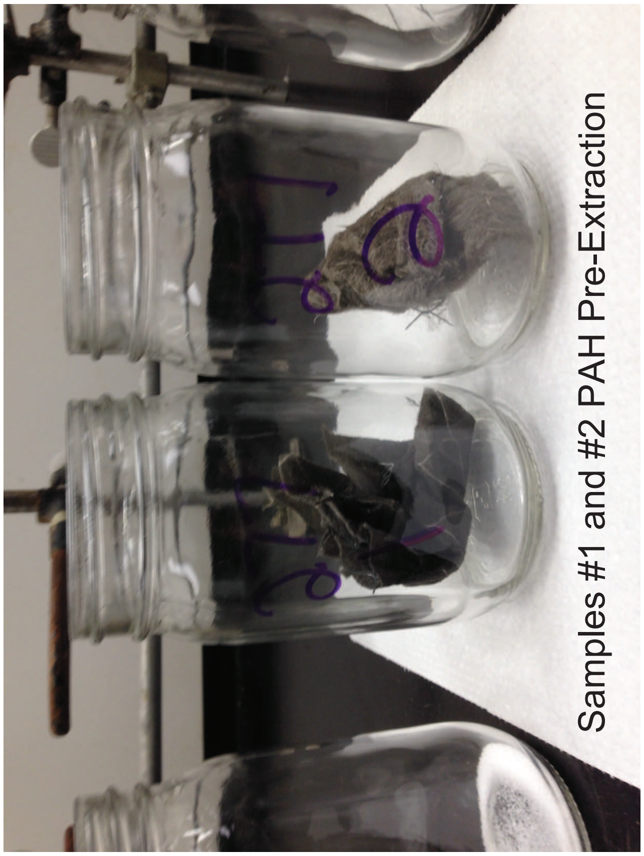


Sample #1 Metals Filter

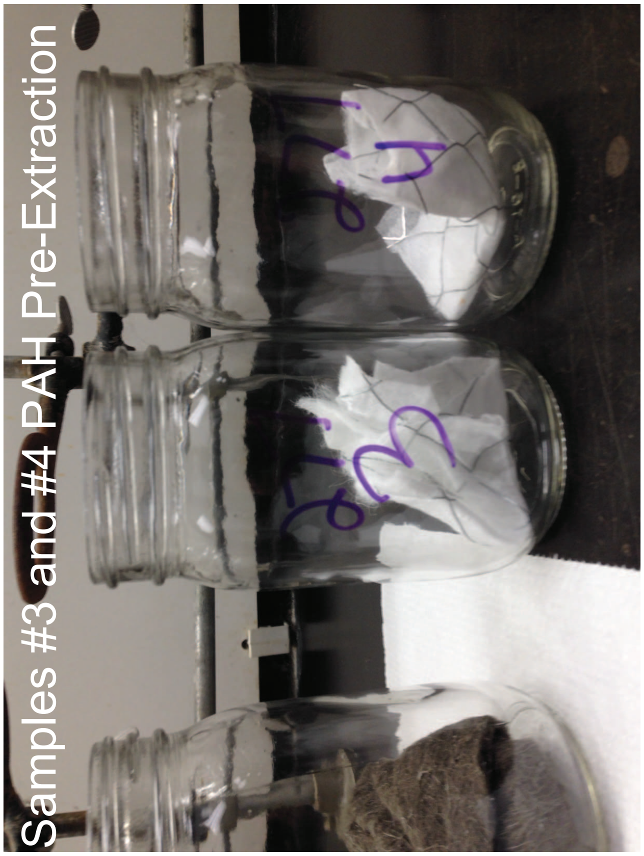


Sample #3 Metals Filter

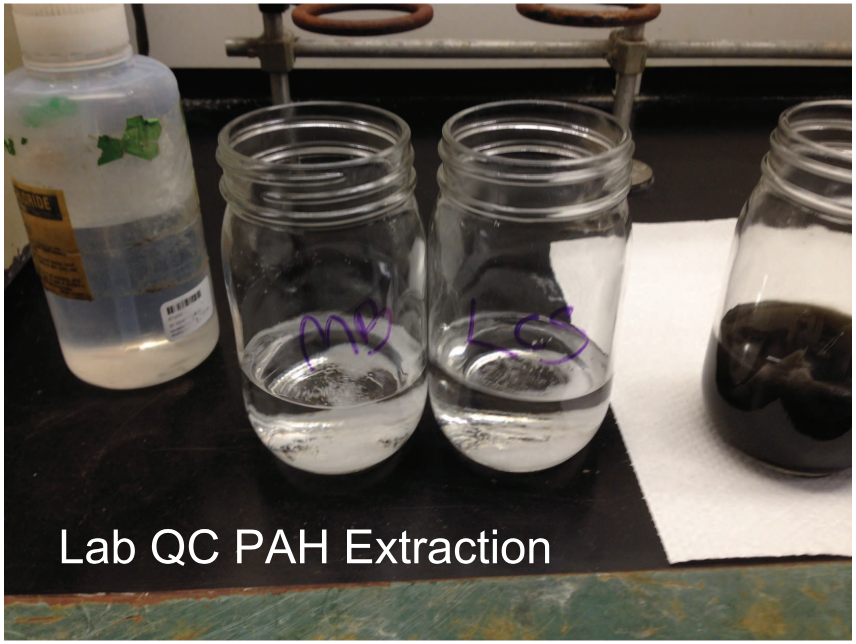
Lab QC PAH Pre-Extraction



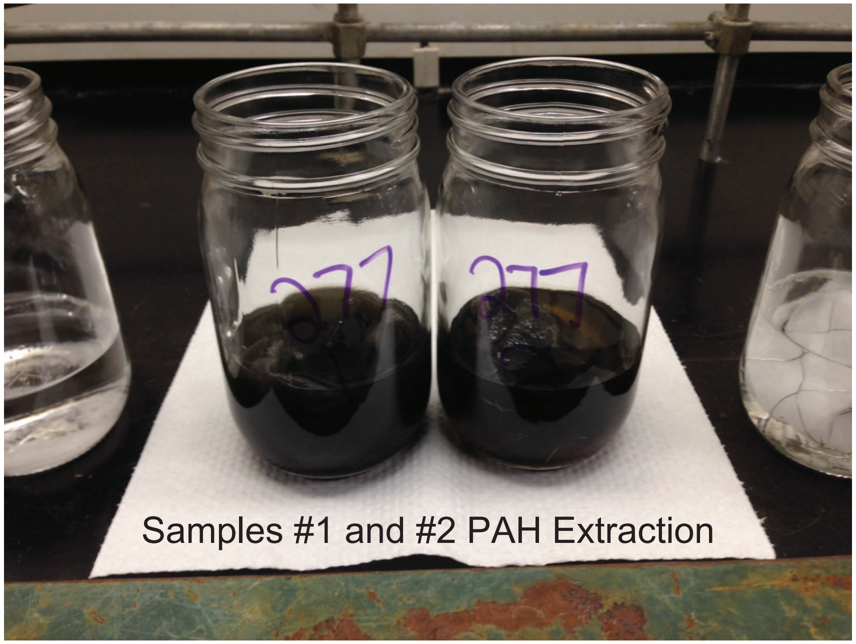
Samples #1 and #2 PAH Pre-Extraction



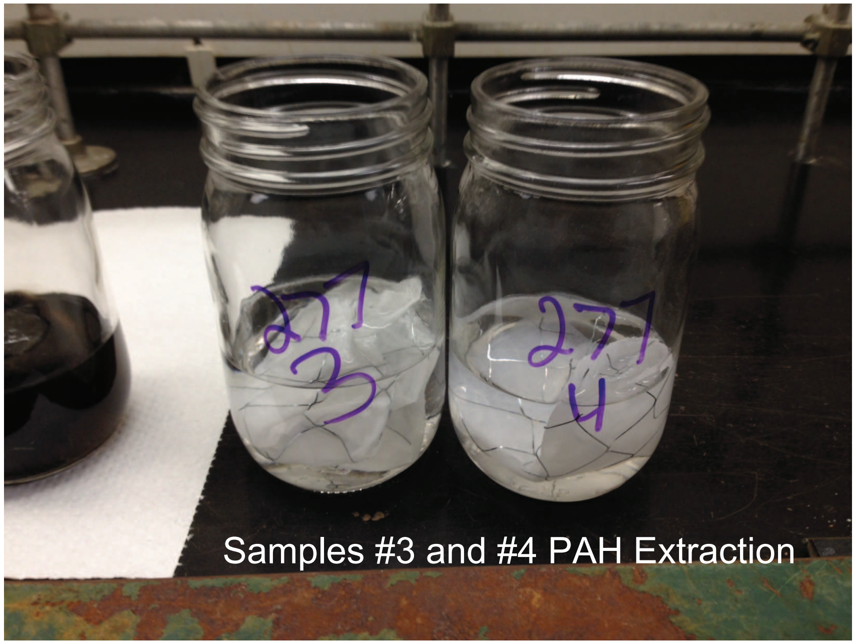
Samples #3 and #4 PAH Pre-Extraction



Lab QC PAH Extraction

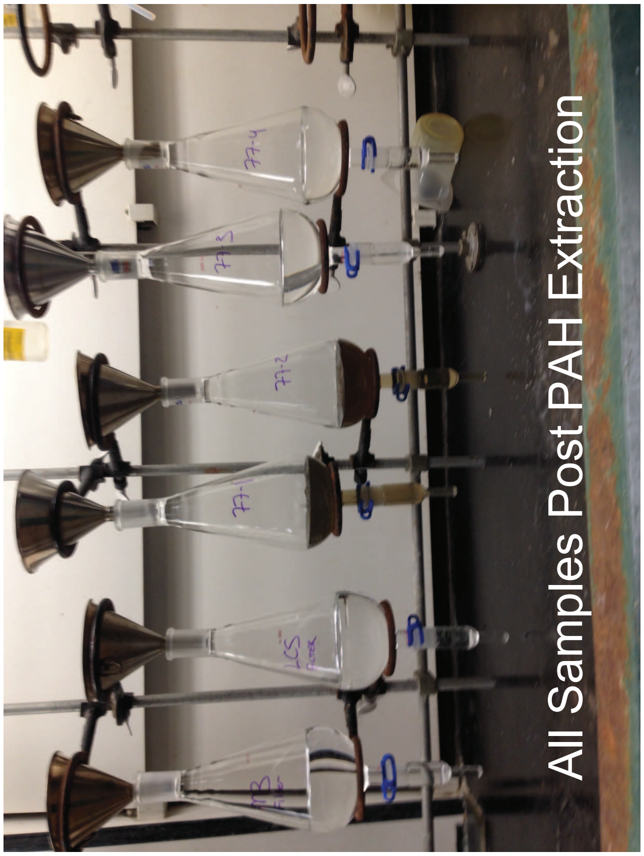


Samples #1 and #2 PAH Extraction

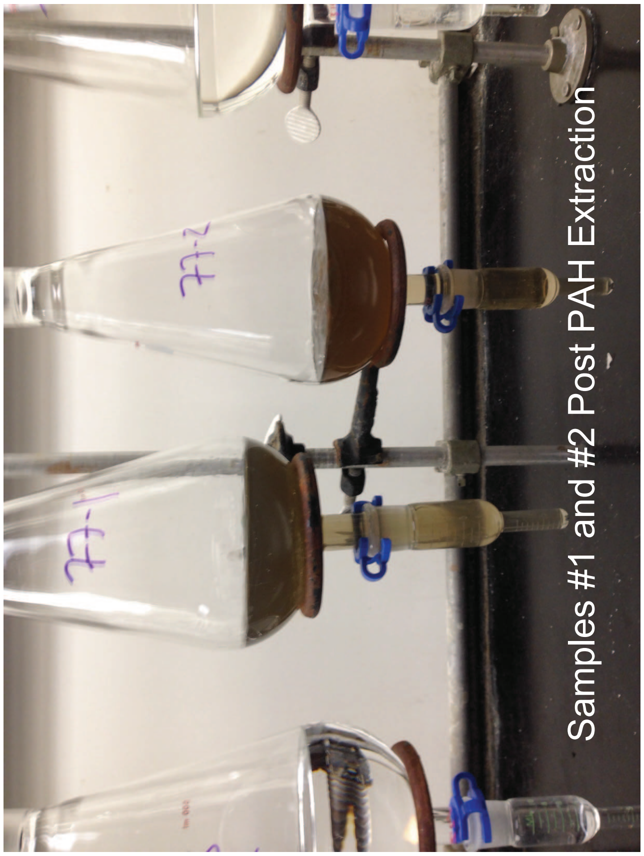


Samples #3 and #4 PAH Extraction

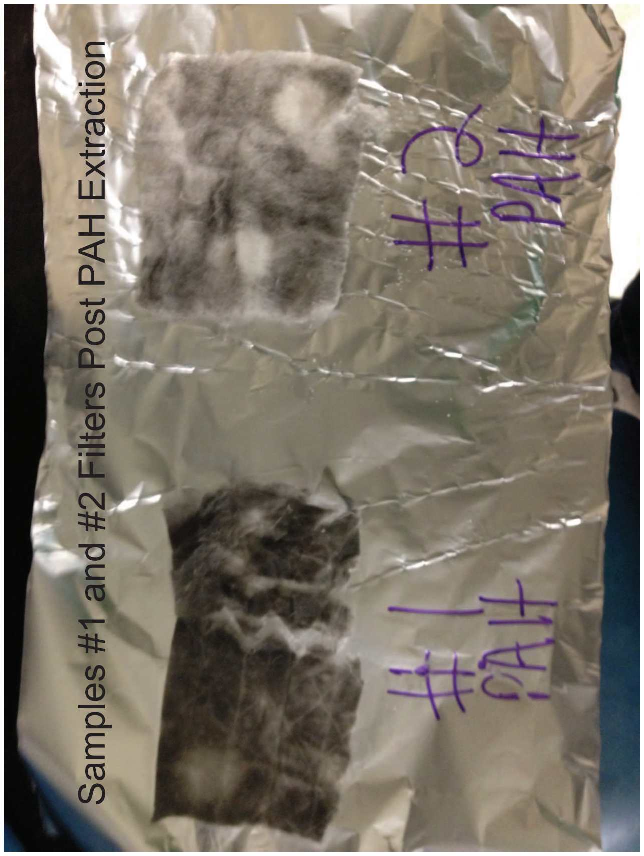
Samples #1 and #2
Sonication



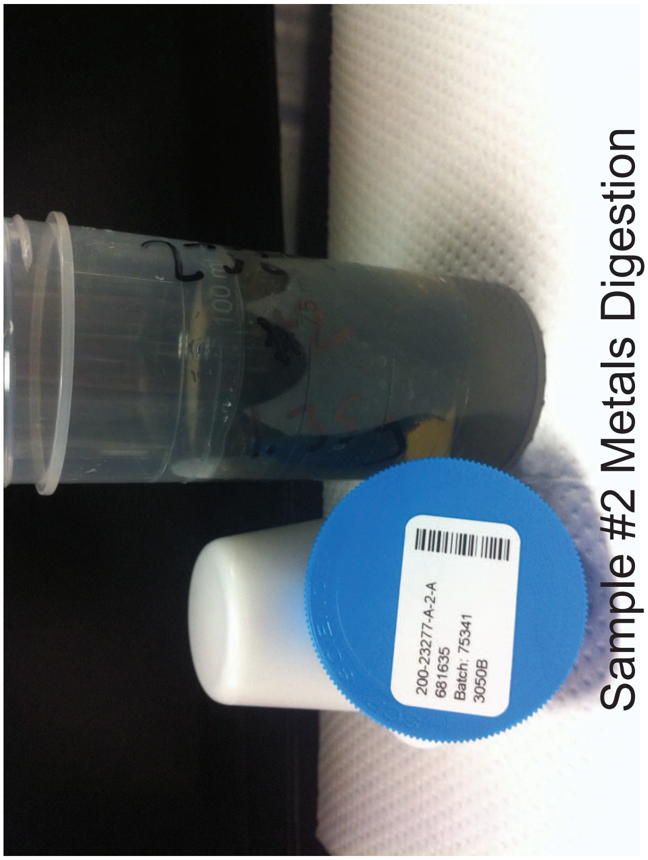
All Samples Post PAH Extraction



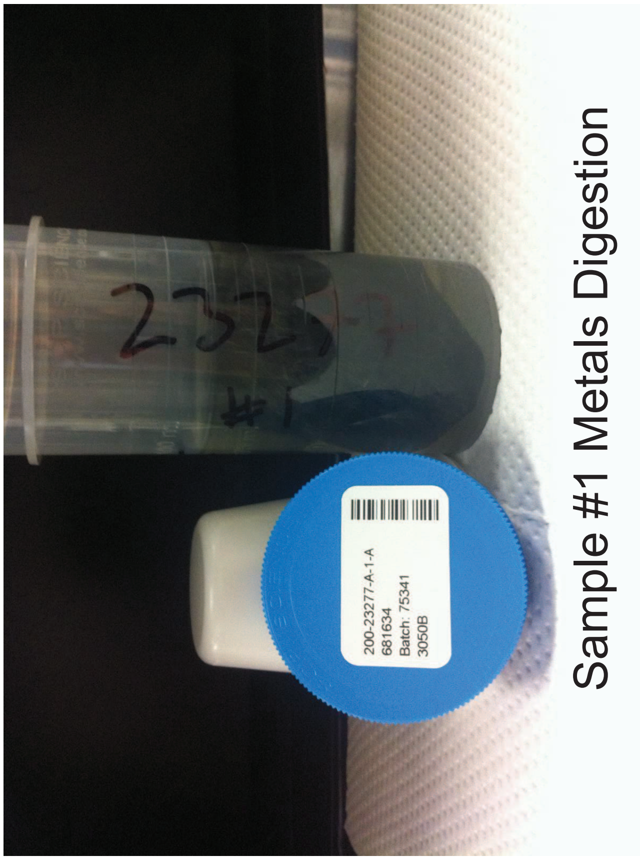
Samples #1 and #2 Post PAH Extraction



Samples #1 and #2 Filters Post PAH Extraction



Sample #2 Metals Digestion



Sample #1 Metals Digestion

All Samples Metals Digestion

Method Summary

Client: Environmental Health & Engineering
Project/Site: Filter Sample

TestAmerica Job ID: 200-23277-1

Method	Method Description	Protocol	Laboratory
8270D SIM	Semivolatile Organic Compounds (GC/MS SIM)	SW846	TAL BUR
6020A	Metals (ICP/MS)	SW846	TAL BUR

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL BUR = TestAmerica Burlington, 30 Community Drive, Suite 11, South Burlington, VT 05403, TEL (802)660-1990

Sample Summary

Client: Environmental Health & Engineering
Project/Site: Filter Sample

TestAmerica Job ID: 200-23277-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
200-23277-1	1407001-15	Filter	07/01/14 14:16	07/22/14 08:55
200-23277-2	1407001-16	Filter	07/01/14 14:26	07/22/14 08:55
200-23277-3	1407004-01	Filter	07/09/14 08:15	07/22/14 08:55
200-23277-4	1407004-02	Filter	07/09/14 08:15	07/22/14 08:55

Detection Summary

1 2 3 4 5 6 7 8 9

Client Sample ID: 1407001-15 Lab Sample ID: 200-23277-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Naphthalene	0.20	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
2-Methylnaphthalene	0.22	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
1-Methylnaphthalene	0.093	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Fluorene	0.094	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Phenanthrene	2.0	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Fluoranthene	1.4	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Pyrene	1.3	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Benzo[a]anthracene	0.35	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Chrysene	1.2	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Benzo[b]fluoranthene	1.3	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Benzo[k]fluoranthene	0.96	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Benzo[e]pyrene	1.2	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Benzo[a]pyrene	0.34	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Indeno[1,2,3-cd]pyrene	0.32	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Dibenz(a,h)anthracene	0.13	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Benzo[g,h,i]perylene	0.54	H	0.067	0.067	ug/Filter	3.33		8270D SIM	Total/NA
Silver	0.62		0.20	0.0032	ug/Filter	1		6020A	Total/NA
Aluminum	1300		8.0	0.30	ug/Filter	1		6020A	Total/NA
Arsenic	4.5	B	0.40	0.00060	ug/Filter	2		6020A	Total/NA
Barium	97		10	0.030	ug/Filter	1		6020A	Total/NA
Beryllium	0.084	J	0.20	0.013	ug/Filter	1		6020A	Total/NA
Calcium	15000		100	0.86	ug/Filter	1		6020A	Total/NA
Cadmium	5.8		0.20	0.0047	ug/Filter	1		6020A	Total/NA
Cobalt	1.1		1.0	0.0059	ug/Filter	1		6020A	Total/NA
Chromium	12		0.40	0.011	ug/Filter	1		6020A	Total/NA
Copper	110		2.0	0.010	ug/Filter	1		6020A	Total/NA
Iron	3500		20	0.40	ug/Filter	1		6020A	Total/NA
Potassium	2100		100	0.71	ug/Filter	1		6020A	Total/NA
Magnesium	2500		100	0.39	ug/Filter	1		6020A	Total/NA
Manganese	200		0.40	0.027	ug/Filter	1		6020A	Total/NA
Sodium	14000		1000	5.4	ug/Filter	10		6020A	Total/NA
Nickel	8.6		2.0	0.010	ug/Filter	1		6020A	Total/NA
Lead	210		2.0	0.028	ug/Filter	10		6020A	Total/NA
Antimony	3.1		2.0	0.20	ug/Filter	1		6020A	Total/NA
Selenium	1.3		0.40	0.032	ug/Filter	2		6020A	Total/NA
Thallium	0.060	J B	0.20	0.0016	ug/Filter	1		6020A	Total/NA
Vanadium	4.7		0.40	0.0070	ug/Filter	1		6020A	Total/NA
Zinc	3400		20	0.51	ug/Filter	10		6020A	Total/NA

Client Sample ID: 1407001-16 Lab Sample ID: 200-23277-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Naphthalene	0.063	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
2-Methylnaphthalene	0.040	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Fluorene	0.059	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Phenanthrene	0.40	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Fluoranthene	0.34	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Pyrene	0.31	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Benzo[a]anthracene	0.24	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Chrysene	0.60	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 1407001-16 (Continued) Lab Sample ID: 200-23277-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzo[b]fluoranthene	0.29	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Benzo[k]fluoranthene	0.33	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Benzo[e]pyrene	0.15	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Benzo[a]pyrene	0.21	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Perylene	0.066	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Indeno[1,2,3-cd]pyrene	0.074	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Benzo[g,h,i]perylene	0.075	H	0.040	0.040	ug/Filter	2		8270D SIM	Total/NA
Silver	0.018	J	0.20	0.0032	ug/Filter	1		6020A	Total/NA
Aluminum	38		8.0	0.30	ug/Filter	1		6020A	Total/NA
Arsenic	0.41	B	0.20	0.00030	ug/Filter	1		6020A	Total/NA
Barium	5.3	J	10	0.030	ug/Filter	1		6020A	Total/NA
Calcium	560		100	0.86	ug/Filter	1		6020A	Total/NA
Cadmium	1.2		0.20	0.0047	ug/Filter	1		6020A	Total/NA
Cobalt	0.036	J	1.0	0.0059	ug/Filter	1		6020A	Total/NA
Chromium	0.66		0.40	0.011	ug/Filter	1		6020A	Total/NA
Copper	6.4		2.0	0.010	ug/Filter	1		6020A	Total/NA
Iron	100		20	0.40	ug/Filter	1		6020A	Total/NA
Potassium	440		100	0.71	ug/Filter	1		6020A	Total/NA
Magnesium	100		100	0.39	ug/Filter	1		6020A	Total/NA
Manganese	9.7		0.40	0.027	ug/Filter	1		6020A	Total/NA
Sodium	380		100	0.54	ug/Filter	1		6020A	Total/NA
Nickel	0.32	J	2.0	0.010	ug/Filter	1		6020A	Total/NA
Lead	3.3		0.20	0.0028	ug/Filter	1		6020A	Total/NA
Antimony	0.49	J	2.0	0.20	ug/Filter	1		6020A	Total/NA
Selenium	0.29		0.20	0.016	ug/Filter	1		6020A	Total/NA
Thallium	0.056	J B	0.20	0.0016	ug/Filter	1		6020A	Total/NA
Vanadium	0.26	J	0.40	0.0070	ug/Filter	1		6020A	Total/NA
Zinc	86		2.0	0.051	ug/Filter	1		6020A	Total/NA

Client Sample ID: 1407004-01 Lab Sample ID: 200-23277-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Naphthalene	0.031	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
2-Methylnaphthalene	0.025	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Acenaphthene	0.36	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Fluorene	0.13	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Phenanthrene	0.068	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Benzo[b]fluoranthene	0.039	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Benzo[k]fluoranthene	0.026	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Naphthalene - RE	0.030	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
2-Methylnaphthalene - RE	0.024	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Acenaphthene - RE	0.38	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Fluorene - RE	0.13	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Phenanthrene - RE	0.068	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Benzo[b]fluoranthene - RE	0.051	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Benzo[k]fluoranthene - RE	0.029	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Aluminum	5.1	J	8.0	0.30	ug/Filter	1		6020A	Total/NA
Arsenic	0.014	J B	0.20	0.00030	ug/Filter	1		6020A	Total/NA
Barium	0.13	J	10	0.030	ug/Filter	1		6020A	Total/NA
Calcium	75	J	100	0.86	ug/Filter	1		6020A	Total/NA

Detection Summary

Client Sample ID: 1407004-01 (Continued) Lab Sample ID: 200-23277-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cadmium	1.9		0.20	0.0047	ug/Filter	1		6020A	Total/NA
Cobalt	0.0060	J	1.0	0.0059	ug/Filter	1		6020A	Total/NA
Chromium	0.36	J	0.40	0.011	ug/Filter	1		6020A	Total/NA
Copper	1.7	J	2.0	0.010	ug/Filter	1		6020A	Total/NA
Iron	40		20	0.40	ug/Filter	1		6020A	Total/NA
Potassium	33	J	100	0.71	ug/Filter	1		6020A	Total/NA
Magnesium	5.8	J	100	0.39	ug/Filter	1		6020A	Total/NA
Manganese	0.29	J	0.40	0.027	ug/Filter	1		6020A	Total/NA
Sodium	120		100	0.54	ug/Filter	1		6020A	Total/NA
Nickel	0.48	J	2.0	0.010	ug/Filter	1		6020A	Total/NA
Lead	0.24		0.20	0.0028	ug/Filter	1		6020A	Total/NA
Thallium	0.0062	J B	0.20	0.0016	ug/Filter	1		6020A	Total/NA
Vanadium	0.044	J	0.40	0.0070	ug/Filter	1		6020A	Total/NA
Zinc	21		2.0	0.051	ug/Filter	1		6020A	Total/NA

Client Sample ID: 1407004-02 Lab Sample ID: 200-23277-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Naphthalene	0.27	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
2-Methylnaphthalene	0.14	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
1-Methylnaphthalene	0.053	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Acenaphthene	0.32	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Fluorene	0.062	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Phenanthrene	0.063	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Benzo[a]pyrene	0.042	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Naphthalene - RE	0.27	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
2-Methylnaphthalene - RE	0.14	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
1-Methylnaphthalene - RE	0.053	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Acenaphthene - RE	0.32	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Fluorene - RE	0.062	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Phenanthrene - RE	0.068	H	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Benzo[e]pyrene - RE	0.030	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Benzo[a]pyrene - RE	0.044	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Dibenz(a,h)anthracene - RE	0.041	H *	0.020	0.020	ug/Filter	1		8270D SIM	Total/NA
Aluminum	1.3	J	8.0	0.30	ug/Filter	1		6020A	Total/NA
Arsenic	0.029	J B	0.20	0.00030	ug/Filter	1		6020A	Total/NA
Barium	0.089	J	10	0.030	ug/Filter	1		6020A	Total/NA
Calcium	150		100	0.86	ug/Filter	1		6020A	Total/NA
Cadmium	3.0		0.20	0.0047	ug/Filter	1		6020A	Total/NA
Cobalt	0.030	J	1.0	0.0059	ug/Filter	1		6020A	Total/NA
Chromium	0.073	J	0.40	0.011	ug/Filter	1		6020A	Total/NA
Copper	1.3	J	2.0	0.010	ug/Filter	1		6020A	Total/NA
Iron	14	J	20	0.40	ug/Filter	1		6020A	Total/NA
Potassium	16	J	100	0.71	ug/Filter	1		6020A	Total/NA
Magnesium	19	J	100	0.39	ug/Filter	1		6020A	Total/NA
Manganese	0.25	J	0.40	0.027	ug/Filter	1		6020A	Total/NA
Sodium	410		100	0.54	ug/Filter	1		6020A	Total/NA
Nickel	0.23	J	2.0	0.010	ug/Filter	1		6020A	Total/NA
Lead	0.35		0.20	0.0028	ug/Filter	1		6020A	Total/NA
Antimony	1.6	J	2.0	0.20	ug/Filter	1		6020A	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 1407004-02 (Continued) Lab Sample ID: 200-23277-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Thallium	0.014	J B	0.20	0.0016	ug/Filter	1		6020A	Total/NA
Vanadium	0.045	J	0.40	0.0070	ug/Filter	1		6020A	Total/NA
Zinc	33		2.0	0.051	ug/Filter	1		6020A	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 1407001-15

Date Collected: 07/01/14 14:16
Date Received: 07/22/14 08:55

Lab Sample ID: 200-23277-1
Matrix: Filter

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	**0.20**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
2-Methylnaphthalene	**0.22**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
1-Methylnaphthalene	**0.093**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Acenaphthylene	ND	H	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Acenaphthene	ND	H	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Fluorene	**0.094**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Phenanthrene	**2.0**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Anthracene	ND	H	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Fluoranthene	**1.4**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Pyrene	**1.3**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Benzo[a]anthracene	**0.35**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Chrysene	**1.2**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Benzo[b]fluoranthene	**1.3**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Benzo[k]fluoranthene	**0.96**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Benzo[e]pyrene	**1.2**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Benzo[a]pyrene	**0.34**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Perylene	ND	H	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Indeno[1,2,3-cd]pyrene	**0.32**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Dibenz(a,h)anthracene	**0.13**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33
Benzo[g,h,i]perylene	**0.54**	**H**	0.067	0.067	ug/Filter		07/24/14 13:02	07/29/14 16:04	3.33

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Methylnaphthalene-d10	*79*		*30 - 120*	*07/24/14 13:02*	*07/29/14 16:04*	*3.33*
Fluorene-d10	*64*		*30 - 130*	*07/24/14 13:02*	*07/29/14 16:04*	*3.33*
Fluoranthene-d10	*105*		*10 - 165*	*07/24/14 13:02*	*07/29/14 16:04*	*3.33*
Benzo(a)pyrene-d12	*77*		*20 - 130*	*07/24/14 13:02*	*07/29/14 16:04*	*3.33*

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	**0.62**		0.20	0.0032	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Aluminum	**1300**		8.0	0.30	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Arsenic	**4.5**	**B**	0.40	0.00060	ug/Filter		07/25/14 15:30	07/29/14 20:04	2
Barium	**97**		10	0.030	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Beryllium	**0.084**	**J**	0.20	0.013	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Calcium	**15000**		100	0.86	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Cadmium	**5.8**		0.20	0.0047	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Cobalt	**1.1**		1.0	0.0059	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Chromium	**12**		0.40	0.011	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Copper	**110**		2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Iron	**3500**		20	0.40	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Potassium	**2100**		100	0.71	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Magnesium	**2500**		100	0.39	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Manganese	**200**		0.40	0.027	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Sodium	**14000**		1000	5.4	ug/Filter		07/25/14 15:30	07/29/14 20:11	10
Nickel	**8.6**		2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Lead	**210**		2.0	0.028	ug/Filter		07/25/14 15:30	07/29/14 20:11	10
Antimony	**3.1**		2.0	0.20	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Selenium	**1.3**		0.40	0.032	ug/Filter		07/25/14 15:30	07/29/14 20:04	2
Thallium	**0.060**	**J B**	0.20	0.0016	ug/Filter		07/25/14 15:30	07/28/14 17:06	1
Vanadium	**4.7**		0.40	0.0070	ug/Filter		07/25/14 15:30	07/28/14 17:06	1

Client Sample Results

Client Sample ID: 1407001-15

Lab Sample ID: 200-23277-1

Date Collected: 07/01/14 14:16
Matrix: Filter
Date Received: 07/22/14 08:55

Method: 6020A - Metals (ICP/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Zinc	**3400**		20	0.51	ug/Filter		07/25/14 15:30	07/29/14 20:11	10

Client Sample ID: 1407001-16

Lab Sample ID: 200-23277-2

Date Collected: 07/01/14 14:26
Matrix: Filter
Date Received: 07/22/14 08:55

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	**0.063**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
2-Methylnaphthalene	**0.040**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
1-Methylnaphthalene	ND	H	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Acenaphthylene	ND	H	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Acenaphthene	ND	H	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Fluorene	**0.059**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Phenanthrene	**0.40**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Anthracene	ND	H	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Fluoranthene	**0.34**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Pyrene	**0.31**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Benzo[a]anthracene	**0.24**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Chrysene	**0.60**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Benzo[b]fluoranthene	**0.29**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Benzo[k]fluoranthene	**0.33**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Benzo[e]pyrene	**0.15**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Benzo[a]pyrene	**0.21**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Perylene	**0.066**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Indeno[1,2,3-cd]pyrene	**0.074**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Dibenz(a,h)anthracene	ND	H	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2
Benzo[g,h,i]perylene	**0.075**	**H**	0.040	0.040	ug/Filter		07/24/14 13:02	07/29/14 18:38	2

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Methylnaphthalene-d10	*76*		*30 - 120*	*07/24/14 13:02*	*07/29/14 18:38*	*2*
Fluorene-d10	*78*		*30 - 130*	*07/24/14 13:02*	*07/29/14 18:38*	*2*
Fluoranthene-d10	*87*		*10 - 165*	*07/24/14 13:02*	*07/29/14 18:38*	*2*
Benzo(a)pyrene-d12	*60*		*20 - 130*	*07/24/14 13:02*	*07/29/14 18:38*	*2*

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	**0.018**	**J**	0.20	0.0032	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Aluminum	**38**		8.0	0.30	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Arsenic	**0.41**	**B**	0.20	0.00030	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Barium	**5.3**	**J**	10	0.030	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Beryllium	ND		0.20	0.013	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Calcium	**560**		100	0.86	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Cadmium	**1.2**		0.20	0.0047	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Cobalt	**0.036**	**J**	1.0	0.0059	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Chromium	**0.66**		0.40	0.011	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Copper	**6.4**		2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Iron	**100**		20	0.40	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Potassium	**440**		100	0.71	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Magnesium	**100**		100	0.39	ug/Filter		07/25/14 15:30	07/28/14 17:13	1

Client Sample ID: 1407001-16

Lab Sample ID: 200-23277-2

Date Collected: 07/01/14 14:26

Matrix: Filter

Date Received: 07/22/14 08:55

Method: 6020A - Metals (ICP/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Manganese	**9.7**		0.40	0.027	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Sodium	**380**		100	0.54	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Nickel	**0.32**	**J**	2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Lead	**3.3**		0.20	0.0028	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Antimony	**0.49**	**J**	2.0	0.20	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Selenium	**0.29**		0.20	0.016	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Thallium	**0.056**	**J B**	0.20	0.0016	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Vanadium	**0.26**	**J**	0.40	0.0070	ug/Filter		07/25/14 15:30	07/28/14 17:13	1
Zinc	**86**		2.0	0.051	ug/Filter		07/25/14 15:30	07/28/14 17:13	1

Client Sample ID: 1407004-01

Lab Sample ID: 200-23277-3

Date Collected: 07/09/14 08:15

Matrix: Filter

Date Received: 07/22/14 08:55

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	**0.031**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
2-Methylnaphthalene	**0.025**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
1-Methylnaphthalene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Acenaphthylene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Acenaphthene	**0.36**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Fluorene	**0.13**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Phenanthrene	**0.068**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Fluoranthene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Benzo[a]anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Chrysene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Benzo[b]fluoranthene	**0.039**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Benzo[k]fluoranthene	**0.026**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Benzo[e]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Benzo[a]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Perylene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Indeno[1,2,3-cd]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Dibenz(a,h)anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1
Benzo[g,h,i]perylene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Methylnaphthalene-d10	*89*		*30 - 120*	*07/24/14 13:02*	*07/29/14 17:21*	*1*
Fluorene-d10	*34*	***	*30 - 130*	*07/24/14 13:02*	*07/29/14 17:21*	*1*
Fluoranthene-d10	*88*		*10 - 165*	*07/24/14 13:02*	*07/29/14 17:21*	*1*
Benzo(a)pyrene-d12	*93*		*20 - 130*	*07/24/14 13:02*	*07/29/14 17:21*	*1*

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM) - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	**0.030**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
2-Methylnaphthalene	**0.024**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
1-Methylnaphthalene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Acenaphthylene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Acenaphthene	**0.38**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1

Client Sample Results

Client Sample ID: 1407004-01
Date Collected: 07/09/14 08:15
Date Received: 07/22/14 08:55

Lab Sample ID: 200-23277-3
Matrix: Filter

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM) - RE (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluorene	**0.13**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Phenanthrene	**0.068**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Fluoranthene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Benzo[a]anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Chrysene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Benzo[b]fluoranthene	**0.051**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Benzo[k]fluoranthene	**0.029**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Benzo[e]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Benzo[a]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Perylene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Indeno[1,2,3-cd]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Dibenz(a,h)anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1
Benzo[g,h,i]perylene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:16	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Methylnaphthalene-d10	*88*		*30 - 120*	*07/24/14 13:02*	*07/29/14 19:16*	*1*
Fluorene-d10	*35*	***	*30 - 130*	*07/24/14 13:02*	*07/29/14 19:16*	*1*
Fluoranthene-d10	*86*		*10 - 165*	*07/24/14 13:02*	*07/29/14 19:16*	*1*
Benzo(a)pyrene-d12	*99*		*20 - 130*	*07/24/14 13:02*	*07/29/14 19:16*	*1*

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.20	0.0032	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Aluminum	**5.1**	**J**	8.0	0.30	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Arsenic	**0.014**	**J B**	0.20	0.00030	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Barium	**0.13**	**J**	10	0.030	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Beryllium	ND		0.20	0.013	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Calcium	**75**	**J**	100	0.86	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Cadmium	**1.9**		0.20	0.0047	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Cobalt	**0.0060**	**J**	1.0	0.0059	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Chromium	**0.36**	**J**	0.40	0.011	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Copper	**1.7**	**J**	2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Iron	**40**		20	0.40	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Potassium	**33**	**J**	100	0.71	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Magnesium	**5.8**	**J**	100	0.39	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Manganese	**0.29**	**J**	0.40	0.027	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Sodium	**120**		100	0.54	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Nickel	**0.48**	**J**	2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Lead	**0.24**		0.20	0.0028	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Antimony	ND		2.0	0.20	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Selenium	ND		0.20	0.016	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Thallium	**0.0062**	**J B**	0.20	0.0016	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Vanadium	**0.044**	**J**	0.40	0.0070	ug/Filter		07/25/14 15:30	07/28/14 17:20	1
Zinc	**21**		2.0	0.051	ug/Filter		07/25/14 15:30	07/28/14 17:20	1

Client Sample Results

Client: Environmental Health & Engineering
Project/Site: Filter Sample

TestAmerica Job ID: 200-23277-1

Client Sample ID: 1407004-02
Date Collected: 07/09/14 08:15
Date Received: 07/22/14 08:55

Lab Sample ID: 200-23277-4
Matrix: Filter

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	**0.27**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
2-Methylnaphthalene	**0.14**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
1-Methylnaphthalene	**0.053**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Acenaphthylene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Acenaphthene	**0.32**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Fluorene	**0.062**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Phenanthrene	**0.063**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Fluoranthene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Benzo[a]anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Chrysene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Benzo[b]fluoranthene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Benzo[k]fluoranthene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Benzo[e]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Benzo[a]pyrene	**0.042**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Perylene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Indeno[1,2,3-cd]pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Dibenz(a,h)anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1
Benzo[g,h,i]perylene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 17:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Methylnaphthalene-d10	*89*		*30 - 120*	*07/24/14 13:02*	*07/29/14 17:59*	*1*
Fluorene-d10	*42*	***	*30 - 130*	*07/24/14 13:02*	*07/29/14 17:59*	*1*
Fluoranthene-d10	*91*		*10 - 165*	*07/24/14 13:02*	*07/29/14 17:59*	*1*
Benzo(a)pyrene-d12	*96*		*20 - 130*	*07/24/14 13:02*	*07/29/14 17:59*	*1*

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM) - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	**0.27**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
2-Methylnaphthalene	**0.14**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
1-Methylnaphthalene	**0.053**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Acenaphthylene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Acenaphthene	**0.32**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Fluorene	**0.062**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Phenanthrene	**0.068**	**H**	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Fluoranthene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Pyrene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Benzo[a]anthracene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Chrysene	ND	H	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Benzo[b]fluoranthene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Benzo[k]fluoranthene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Benzo[e]pyrene	**0.030**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Benzo[a]pyrene	**0.044**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Perylene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Indeno[1,2,3-cd]pyrene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Dibenz(a,h)anthracene	**0.041**	**H ***	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1
Benzo[g,h,i]perylene	ND	H *	0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 19:55	1

Client Sample Results

Client Sample ID: 1407004-02

Lab Sample ID: 200-23277-4

Date Collected: 07/09/14 08:15

Matrix: Filter

Date Received: 07/22/14 08:55

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Methylnaphthalene-d10	*89*		*30 - 120*	*07/24/14 13:02*	*07/29/14 19:55*	*1*
Fluorene-d10	*42*	***	*30 - 130*	*07/24/14 13:02*	*07/29/14 19:55*	*1*
Fluoranthene-d10	*82*		*10 - 165*	*07/24/14 13:02*	*07/29/14 19:55*	*1*
Benzo(a)pyrene-d12	*107*	***	*20 - 130*	*07/24/14 13:02*	*07/29/14 19:55*	*1*

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		0.20	0.0032	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Aluminum	**1.3**	**J**	8.0	0.30	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Arsenic	**0.029**	**J B**	0.20	0.00030	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Barium	**0.089**	**J**	10	0.030	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Beryllium	ND		0.20	0.013	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Calcium	**150**		100	0.86	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Cadmium	**3.0**		0.20	0.0047	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Cobalt	**0.030**	**J**	1.0	0.0059	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Chromium	**0.073**	**J**	0.40	0.011	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Copper	**1.3**	**J**	2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Iron	**14**	**J**	20	0.40	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Potassium	**16**	**J**	100	0.71	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Magnesium	**19**	**J**	100	0.39	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Manganese	**0.25**	**J**	0.40	0.027	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Sodium	**410**		100	0.54	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Nickel	**0.23**	**J**	2.0	0.010	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Lead	**0.35**		0.20	0.0028	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Antimony	**1.6**	**J**	2.0	0.20	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Selenium	ND		0.20	0.016	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Thallium	**0.014**	**J B**	0.20	0.0016	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Vanadium	**0.045**	**J**	0.40	0.0070	ug/Filter		07/25/14 15:30	07/28/14 17:27	1
Zinc	**33**		2.0	0.051	ug/Filter		07/25/14 15:30	07/28/14 17:27	1

Definitions/Glossary

Client: Environmental Health & Engineering
Project/Site: Filter Sample

TestAmerica Job ID: 200-23277-1

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
*	ISTD response or retention time outside acceptable limits

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

GC/MS Semi VOA

Prep Batch: 75286

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
200-23277-1	1407001-15	Total/NA	Filter	3550C	
200-23277-2	1407001-16	Total/NA	Filter	3550C	
200-23277-3	1407004-01	Total/NA	Filter	3550C	
200-23277-3 - RE	1407004-01	Total/NA	Filter	3550C	
200-23277-4	1407004-02	Total/NA	Filter	3550C	
200-23277-4 - RE	1407004-02	Total/NA	Filter	3550C	
LCS 200-75286/2-A	Lab Control Sample	Total/NA	Filter	3550C	
MB 200-75286/1-A	Method Blank	Total/NA	Filter	3550C	

Analysis Batch: 75435

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
200-23277-1	1407001-15	Total/NA	Filter	8270D SIM	75286
200-23277-2	1407001-16	Total/NA	Filter	8270D SIM	75286
200-23277-3	1407004-01	Total/NA	Filter	8270D SIM	75286
200-23277-3 - RE	1407004-01	Total/NA	Filter	8270D SIM	75286
200-23277-4	1407004-02	Total/NA	Filter	8270D SIM	75286
200-23277-4 - RE	1407004-02	Total/NA	Filter	8270D SIM	75286
LCS 200-75286/2-A	Lab Control Sample	Total/NA	Filter	8270D SIM	75286
MB 200-75286/1-A	Method Blank	Total/NA	Filter	8270D SIM	75286

Metals

Prep Batch: 75341

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
200-23277-1	1407001-15	Total/NA	Filter	3050B	
200-23277-2	1407001-16	Total/NA	Filter	3050B	
200-23277-3	1407004-01	Total/NA	Filter	3050B	
200-23277-4	1407004-02	Total/NA	Filter	3050B	
LCS 200-75341/2-A	Lab Control Sample	Total/NA	Filter	3050B	
MB 200-75341/1-A	Method Blank	Total/NA	Filter	3050B	

Analysis Batch: 75431

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
200-23277-1	1407001-15	Total/NA	Filter	6020A	75341
200-23277-2	1407001-16	Total/NA	Filter	6020A	75341
200-23277-3	1407004-01	Total/NA	Filter	6020A	75341
200-23277-4	1407004-02	Total/NA	Filter	6020A	75341
LCS 200-75341/2-A	Lab Control Sample	Total/NA	Filter	6020A	75341
MB 200-75341/1-A	Method Blank	Total/NA	Filter	6020A	75341

Analysis Batch: 75475

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
200-23277-1	1407001-15	Total/NA	Filter	6020A	75341
200-23277-1	1407001-15	Total/NA	Filter	6020A	75341

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Matrix: Filter **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		MND10	FD10	FLN	BAP
Lab Sample ID	Client Sample ID	(30-120)	(30-130)	(10-165)	(20-130)
200-23277-1	1407001-15	79	64	105	77
200-23277-2	1407001-16	76	78	87	60
200-23277-3	1407004-01	89	34 *	88	93
200-23277-3 - RE	1407004-01	88	35 *	86	99
200-23277-4	1407004-02	89	42 *	91	96
200-23277-4 - RE	1407004-02	89	42 *	82	107 *
LCS 200-75286/2-A	Lab Control Sample	80	84	84	80
MB 200-75286/1-A	Method Blank	82	86	90	81

Surrogate Legend

MND10 = 2-Methylnaphthalene-d10
FD10 = Fluorene-d10
FLN = Fluoranthene-d10
BAP = Benzo(a)pyrene-d12

QC Sample Results

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM)

Lab Sample ID: MB 200-75286/1-A
Matrix: Filter
Analysis Batch: 75435

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 75286

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
2-Methylnaphthalene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
1-Methylnaphthalene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Acenaphthylene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Acenaphthene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Fluorene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Phenanthrene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Anthracene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Fluoranthene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Pyrene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Benzo[a]anthracene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Chrysene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Benzo[b]fluoranthene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Benzo[k]fluoranthene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Benzo[e]pyrene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Benzo[a]pyrene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Perylene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Indeno[1,2,3-cd]pyrene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Dibenz(a,h)anthracene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1
Benzo[g,h,i]perylene	ND		0.020	0.020	ug/Filter		07/24/14 13:02	07/29/14 15:25	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Methylnaphthalene-d10	*82*		*30 - 120*	*07/24/14 13:02*	*07/29/14 15:25*	*1*
Fluorene-d10	*86*		*30 - 130*	*07/24/14 13:02*	*07/29/14 15:25*	*1*
Fluoranthene-d10	*90*		*10 - 165*	*07/24/14 13:02*	*07/29/14 15:25*	*1*
Benzo(a)pyrene-d12	*81*		*20 - 130*	*07/24/14 13:02*	*07/29/14 15:25*	*1*

Lab Sample ID: LCS 200-75286/2-A
Matrix: Filter
Analysis Batch: 75435

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 75286

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Naphthalene	0.400	0.383		ug/Filter		96	30 - 130
2-Methylnaphthalene	0.400	0.320		ug/Filter		80	30 - 135
1-Methylnaphthalene	0.400	0.321		ug/Filter		80	30 - 135
Acenaphthylene	0.400	0.395		ug/Filter		99	30 - 130
Acenaphthene	0.400	0.372		ug/Filter		93	30 - 130
Fluorene	0.400	0.360		ug/Filter		90	35 - 130
Phenanthrene	0.400	0.355		ug/Filter		89	35 - 130
Anthracene	0.400	0.345		ug/Filter		86	35 - 135
Fluoranthene	0.400	0.346		ug/Filter		87	35 - 140
Pyrene	0.400	0.431		ug/Filter		108	20 - 155
Benzo[a]anthracene	0.400	0.375		ug/Filter		94	35 - 150
Chrysene	0.400	0.382		ug/Filter		96	40 - 125
Benzo[b]fluoranthene	0.400	0.384		ug/Filter		96	40 - 135
Benzo[k]fluoranthene	0.400	0.407		ug/Filter		102	35 - 130
Benzo[e]pyrene	0.400	0.343		ug/Filter		86	40 - 125
Benzo[a]pyrene	0.400	0.353		ug/Filter		88	35 - 135

Method: 8270D SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

Lab Sample ID: LCS 200-75286/2-A
Matrix: Filter
Analysis Batch: 75435

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 75286

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Perylene	0.400	0.329		ug/Filter		82	35 - 125
Indeno[1,2,3-cd]pyrene	0.400	0.322		ug/Filter		81	20 - 140
Dibenz(a,h)anthracene	0.400	0.307		ug/Filter		77	20 - 145
Benzo[g,h,i]perylene	0.400	0.338		ug/Filter		84	20 - 135

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Methylnaphthalene-d10	*80*		*30 - 120*
Fluorene-d10	*84*		*30 - 130*
Fluoranthene-d10	*84*		*10 - 165*
Benzo(a)pyrene-d12	*80*		*20 - 130*

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 200-75341/1-A
Matrix: Filter
Analysis Batch: 75431

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 75341

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silver	ND		200	3.2	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Aluminum	ND		8000	300	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Arsenic	7.20	J	200	0.30	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Barium	ND		10000	30	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Beryllium	ND		200	13	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Calcium	ND		100000	860	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Cadmium	ND		200	4.7	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Cobalt	ND		1000	5.9	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Chromium	ND		400	11	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Copper	ND		2000	10	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Iron	ND		20000	400	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Potassium	ND		100000	710	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Magnesium	ND		100000	390	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Manganese	ND		400	27	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Sodium	ND		100000	540	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Nickel	ND		2000	10	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Lead	ND		200	2.8	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Antimony	ND		2000	200	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Selenium	ND		200	16	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Thallium	7.50	J	200	1.6	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Vanadium	ND		400	7.0	ug/Filter		07/24/14 18:00	07/28/14 16:52	1
Zinc	ND		2000	51	ug/Filter		07/24/14 18:00	07/28/14 16:52	1

Lab Sample ID: LCS 200-75341/2-A
Matrix: Filter
Analysis Batch: 75431

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 75341

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Silver	2000	2040		ug/Filter		102	80 - 120
Aluminum	80000	80900		ug/Filter		101	80 - 120

Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 200-75341/2-A
Matrix: Filter
Analysis Batch: 75431

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 75341

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	2000	1910		ug/Filter		96	80 - 120
Barium	50000	50700		ug/Filter		101	80 - 120
Beryllium	2000	2140		ug/Filter		107	80 - 120
Calcium	1000000	940000		ug/Filter		94	80 - 120
Cadmium	2000	2090		ug/Filter		105	80 - 120
Cobalt	10000	10100		ug/Filter		101	80 - 120
Chromium	4000	4040		ug/Filter		101	80 - 120
Copper	10000	10500		ug/Filter		105	80 - 120
Iron	200000	206000		ug/Filter		103	80 - 120
Potassium	1000000	1080000		ug/Filter		108	80 - 120
Magnesium	1000000	1080000		ug/Filter		108	80 - 120
Manganese	4000	4000		ug/Filter		100	80 - 120
Sodium	1000000	1050000		ug/Filter		105	80 - 120
Nickel	10000	10300		ug/Filter		103	80 - 120
Lead	2000	1960		ug/Filter		98	80 - 120
Antimony	10000	10200		ug/Filter		102	80 - 120
Selenium	2000	1990		ug/Filter		100	80 - 120
Thallium	2000	1930		ug/Filter		97	80 - 120
Vanadium	4000	3850		ug/Filter		96	80 - 120
Zinc	10000	10800		ug/Filter		108	80 - 120

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

CHAIN OF CUSTODY RECORD

REGION 5
77 West Jackson Boulevard
Chicago, Illinois 60604

Activity Code:

PROJ. NO. 1407004/ 1407001

PROJECT NAME: SE Chicago Petcoke

SAMPLERS: *(Print Name and Sign)* Smith, Wagner

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Analyte: Metals	PAHs	TAG NUMBERS
15	7/1/14	1416			Furnace Filter #1	2	X	X	Split of CRL 1407001-15
16	7/1/14	1426			Furnace Filter #2	2	X	X	Split of CRL 1407001-16
01	7/2/14	0815			3M Filtrete Allergy Defense	2	X	X	Split of CRL 1407004-01
02	7/2/14	0805			True Blue BASIC pollution	2	X	X	Split of CRL 1407004-02

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
	7/5/14 1400	
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
		Kath 7/17/14 10:20
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)* TABer — Date / Time 7/22/14 0855

Ship To:

200-23277 Chain of Custody

ATTN:

Airbill Number

Chain of Custody Seal Numbers

Distribution: White - Accompanies Shipment; Pink - Coordinator Field Files; Yellow - Laboratory File

Printed on Recycled Paper/Printed with Soy-Based Ink

5-68551

00191

00200

FedEx Express Package US Airbill

FedEx Tracking Number 8055 4694 8899

Form ID No. 0215

1 From
Date 7/11/14 [redacted]
Sender's Name Vladimir Allin Jr Phone [illegible]
Company [illegible]
Address [illegible]
Dept./Floor/Suite/Room
City [illegible] State MA ZIP [illegible]

2 Your Internal Billing Reference 17251

3 To
Recipient's Name Stephanie Sanders Phone 802 660-1990
Company Test America
Address 30 Community Drive Ste 11
We cannot deliver to P.O. boxes or P.O. ZIP codes.
Dept./Floor/Suite/Room
Address
Use this line for the HOLD location address or for continuation of your shipping address.
City South Burlington State VT ZIP 05403

☐ HOLD Weekday FedEx location address REQUIRED. NOT available for FedEx First Overnight.
☐ HOLD Saturday FedEx location address REQUIRED. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

8055 4694 8899

4 Express Package Service *To most locations.
NOTE: Service order has changed. Please select carefully.
Packages up to 150 lbs. For packages over 150 lbs., use the FedEx Express Freight US Airbill.

Next Business Day
☒ FedEx First Overnight Earliest next business morning delivery to select locations. Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
☐ FedEx Priority Overnight Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
☐ FedEx Standard Overnight Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days
☐ FedEx 2Day A.M. Second business morning.* Saturday Delivery NOT available.
☐ FedEx 2Day Second business afternoon.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
☐ FedEx Express Saver Third business day.* Saturday Delivery NOT available.

5 Packaging *Declared value limit $500.
☐ FedEx Envelope* ☐ FedEx Pak* ☐ FedEx Box ☐ FedEx Tube ☒ Other

6 Special Handling and Delivery Signature Options
☐ SATURDAY Delivery NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver.
☐ No Signature Required Package may be left without obtaining a signature for delivery.
☐ Direct Signature Someone at recipient's address may sign for delivery. *Fee applies.*
☐ Indirect Signature If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. *Fee applies.*

Does this shipment contain dangerous goods?
One box must be checked.
☒ No ☐ Yes As per attached Shipper's Declaration. ☐ Yes Shipper's Declaration not required. ☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____ kg
Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.
☐ Cargo Aircraft Only

7 Payment *Bill to:*
Enter FedEx Acct. No. or Credit Card No. below.
☒ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check ☐ Obtain Recip. Acct. No.
[redacted] [redacted]
Total Packages 1 Total Weight ____ lbs. Credit Card Auth.

†Our liability is limited to US$100 unless you declare a higher value. See the current FedEx Service Guide for details.

611

Rev. Date 2/12 • Part #163134 • ©1994–2012 FedEx • PRINTED IN U.S.A. SRS

fedex.com 1.800.GoFedEx 1.800.463.3339

Login Sample Receipt Checklist

Client: Environmental Health & Engineering

Job Number: 200-23277-1

Login Number: 23277

List Number: 1

Creator: Gagne, Eric M

List Source: TestAmerica Burlington

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	Lab does not accept radioactive samples.
The cooler's custody seal, if present, is intact.	True	NO SEALS
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	3.2ºC. IR GUN ID 181. CF = -0.2
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	NO COLLECTION TIME OR DATE ON CONTAINER LABELS.
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Certification Summary

Client: Environmental Health & Engineering
Project/Site: Filter Sample

TestAmerica Job ID: 200-23277-1

Laboratory: TestAmerica Burlington

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Connecticut	State Program	1	PH-0751	09-30-15
DE Haz. Subst. Cleanup Act (HSCA)	State Program	3	NA	02-13-15
Florida	NELAP	4	E87467	06-30-15
L-A-B	DoD ELAP		L2336	02-26-17
Maine	State Program	1	VT00008	04-17-15
Minnesota	NELAP	5	050-999-436	12-31-14
New Hampshire	NELAP	1	2006	12-18-14
New Jersey	NELAP	2	VT972	06-30-15
New York	NELAP	2	10391	03-31-15
Pennsylvania	NELAP	3	68-00489	04-30-15
Rhode Island	State Program	1	LAO00298	12-30-14
US Fish & Wildlife	Federal		LE-058448-0	02-28-15
USDA	Federal		P330-11-00093	10-28-16
Vermont	State Program	1	VT-4000	12-31-14
Virginia	NELAP	3	460209	12-14-14

Exhibit 4

Petroleum Coke: Essential to Manufacturing

Petroleum coke, or ***petcoke***, is produced during the oil refining process. After crude oil is processed into gasoline, diesel fuel, jet fuel, lubricating oils and waxes, the remaining product is further refined into petcoke. This product resembles coal but has certain unique characteristics, such as a higher heating value and higher carbon content. As a result, petcoke is used in a wide range of industrial applications and as a fuel for electricity generation.

Petcoke is produced at more than 140 refineries around the world, and has been produced in the United States since the 1930s. About 80 percent of petcoke is used as a fuel for electric utilities and cement kilns. The remainder is further refined into calcined petcoke, which is then used by manufacturers.

Industrial uses of Petcoke

Fuel: About 80 percent of worldwide petcoke production is fuel-grade petcoke, used for electricity generation and in cement kilns.

Aluminum: Calcined petcoke is necessary to make anodes for smelting and is the only commercially viable method to do so. It boasts a superior combination of electrical conductivity, resistance to chemical and physical degradation in the smelting pot, higher carbon content, and low contaminants (i.e. ash).

Paint and Colorings: Calcined petcoke is used in the production of titanium dioxide (TiO2), a mineral that is used as a substitute for lead in paint. TiO2 is also used as a pigment in sunscreen, plastic and food coloring.

Steel: Calcined petcoke is a partial replacement for metallurgical coal as a feedstock for coke oven batteries, and as a partial substitute for pulverized coal directly injected into blast furnaces. Petcoke that is specially produced to have a needle-like crystal structure is called needle coke. Needle coke is used to produce the electrodes used in electric arc furnace (EAF) steel production. No other material has needle coke's combination of electrical conductivity and physical properties required for EAF electrodes.

Paper: Calcined petcoke is gasified to produce ammonia and urea ammonium nitrate, which is then to produce pulp and paper. Calcined petcoke is also used in the production of titanium dioxide, a mineral that is used as a whitener for paper.

Brick and Glass: Calcined petcoke is used by brick and glass manufacturers because it has a significantly lower ash content compared to other fuels.

Fertilizer: Calcined petcoke is gasified to produce ammonia and urea ammonium nitrate, which is then used in fertilizer production.

Storage and Transportation

Petcoke is stored in 32 states, by refiners, intermediaries and customers. It is typically stored uncovered.

- 80 percent of refineries store petcoke uncovered.
- 87 percent of intermediaries store petcoke uncovered.
- 78 percent of customers and end-users store petcoke uncovered.

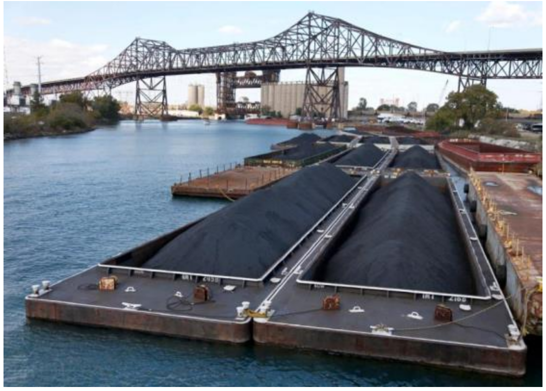
Petcoke is safely stored, handled and transported by ocean freight, barges, rail and truck.

Regulations Governing Petroleum Coke

Petcoke storage and handling facilities are governed by a wide range of federal and state environmental and safety regulations. These include:

- Petcoke storage and handling facilities are or can be required to obtain approval of Fugitive Dust Control Plans. These plans are mandated through the Clean Air Act, and state law where applicable.
  - State agencies frequently monitor petcoke storage facilities to ensure that fugitive dust does not create issues.

- Petcoke storage facilities are subject to the Clean Water Act and are often required to obtain industrial storm water permits and submit a Storm Water Pollution Prevention Plan. These plans also address:
  - Employee training
  - Preventative maintenance
  - Risk identification
  - Spill prevention and response procedures
  - Recordkeeping and internal reporting procedures



- The International Fire Code, adopted by most states, requires facilities producing combustible dust to obtain operational permits. Petcoke can, in certain conditions, become a combustible dust. Petcoke storage and handling facilities therefore must obtain combustible dust permits which must adhere to National Fire Protection Association standards.

Exhibit 5

Response to June 3, 2014 Notice of Violation

David L. MacIntosh, Sc.D., C.I.H., Chief Science Officer, Director of Advanced Analytics

June 24, 2014

ENVIRONMENTAL HEALTH
& ENGINEERING, INC.

Scope – EPA NOV

- "On April 23, 2014, KCBX presented information to EPA about the ratio of vanadium to nickel (V:N) in the soil in the Chicago area and in petroleum coke. Specifically, KCBX informed EPA that the V:N in background soil is about 1 and in petroleum coke ranges from 4 to 12." ¶21

- "On May 20,2014, EPA received results from the preliminary wipe sampling conducted on April17, 2014. The wipe samples from five of the eleven locations sampled showed the presence of both vanadium and nickel, with V:N in excess of 1 in several instances." ¶22

- "The V:N at the sampling locations was highest at the location closest to KCBX and decreased as distance of the sampling location from KCBX increased." ¶23

Outline

- Background
- Typical V:Ni ratios in Chicago
- V:Ni in the EPA samples from the South Deering and East Side neighborhoods
- V:Ni with distance from the petroleum coke and coal terminals in SE Chicago
- Summary

Background

- There are no components of petroleum coke or coal that are not also present in soil of Chicago, including vanadium and nickel.

- The ratio of vanadium-to-nickel and other components in petroleum coke and coal are distinguishable from background soil.

- Vanadium and nickel exist in the soil of Chicago, but …
  - the ratio of vanadium to nickel is 300% - 400% higher in petroleum coke and coal than in soil.

- None of EPA's samples showed a V:Ni ratio indicative of petroleum coke or coal.

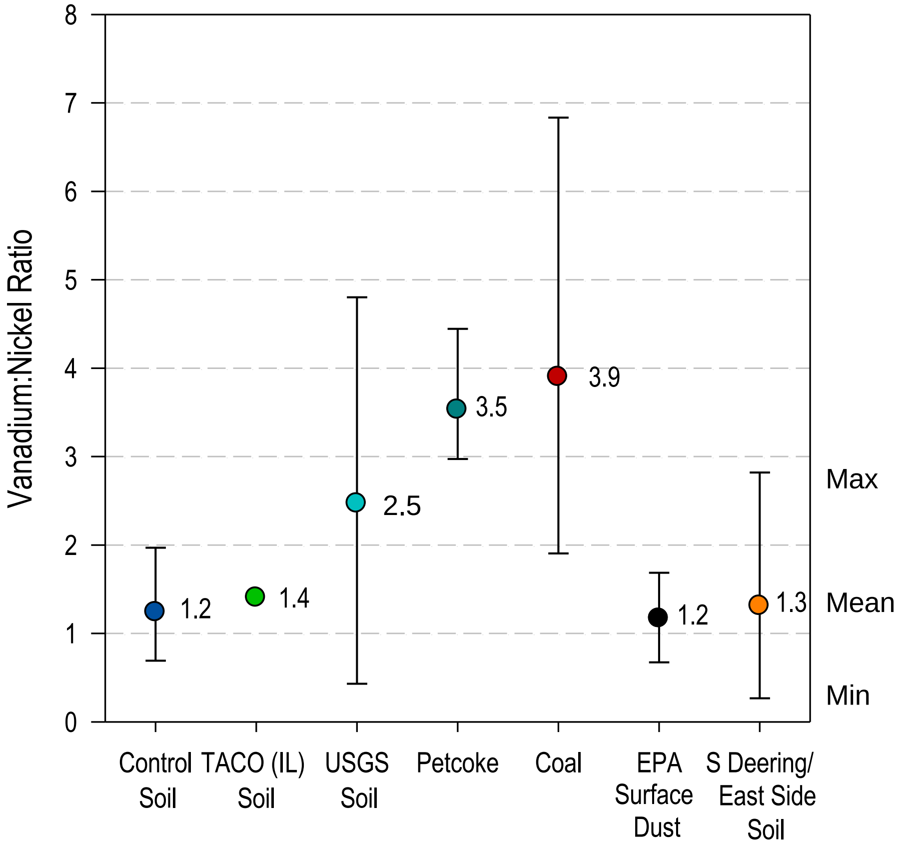
V:Ni Ratios in EPA Samples

EPA NOV:

"On May 20,2014, EPA received results from the preliminary wipe sampling conducted on April17, 2014. The wipe samples from five of the eleven locations sampled showed the presence of both vanadium and nickel, with V:N in excess of 1 in several instances."

Available Data:

- V:Ni in the surface wipes collected by EPA:
  - averaged 1.2 and ranged from 0.7 – 1.7
  - are nearly identical to V:Ni in soil throughout Chicago, including South Deering and East Side.



EPA Data Not Reported in the NOV

- The NOV indicates that EPA did not consider the following available data that show:
  - Vanadium and/or nickel were not detected in more than half (6 of 11) of its surface wipe samples.

Results of Wipe Sampling Conducted by USEPA Region 5 on April 17, 2014

Sample ID	V (mg/wipe)	Ni (mg/wipe)	V:Ni
1A	0.00043	ND*	--
2A	0.00075	0.00077*	1.0
3A	ND	ND*	--
4A	ND	ND	--
5A	0.00236	0.00140	1.7
7A	ND	ND	--
8A	ND	ND	--
10A	0.00084	0.00061*	1.4
11A	0.00104	0.00093*	1.1
12A	0.00038	ND*	--
13A	0.00078	0.00116	0.7

V	vanadium
Ni	nickel
V:Ni	vanadium to nickel ratio
mg/wipe	milligrams per wipe

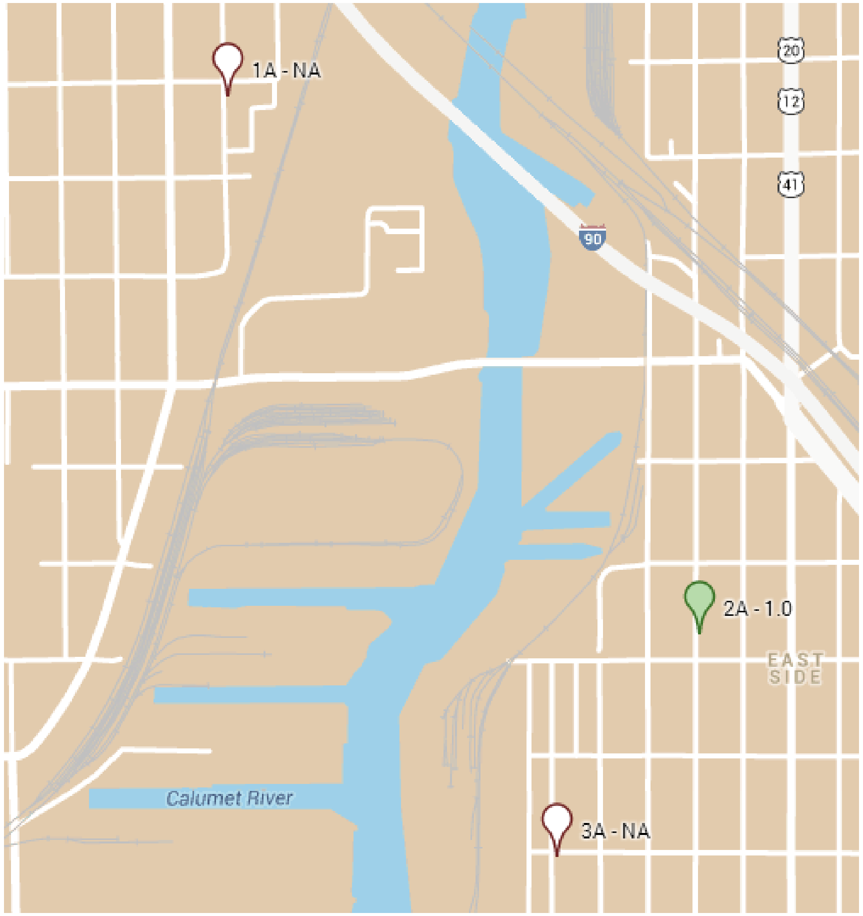
* Indicates the reported value may be biased low. The actual value is expected to be greater than the reported value. Reporting limit for vanadium was 0.00025 mg/wipe and for nickel 0.0003 mg/wipe.

V:Ni and Distance to North Terminal

EPA NOV:
"The V:N at the sampling locations was highest at the location closest to KCBX and decreased as distance of the sampling location from KCBX increased."

Available Data for KCBX North:

- Only 1 of 3 samples had detectable levels of both vanadium and nickel, *which does not show the presence of petroleum coke and coal in the community*.



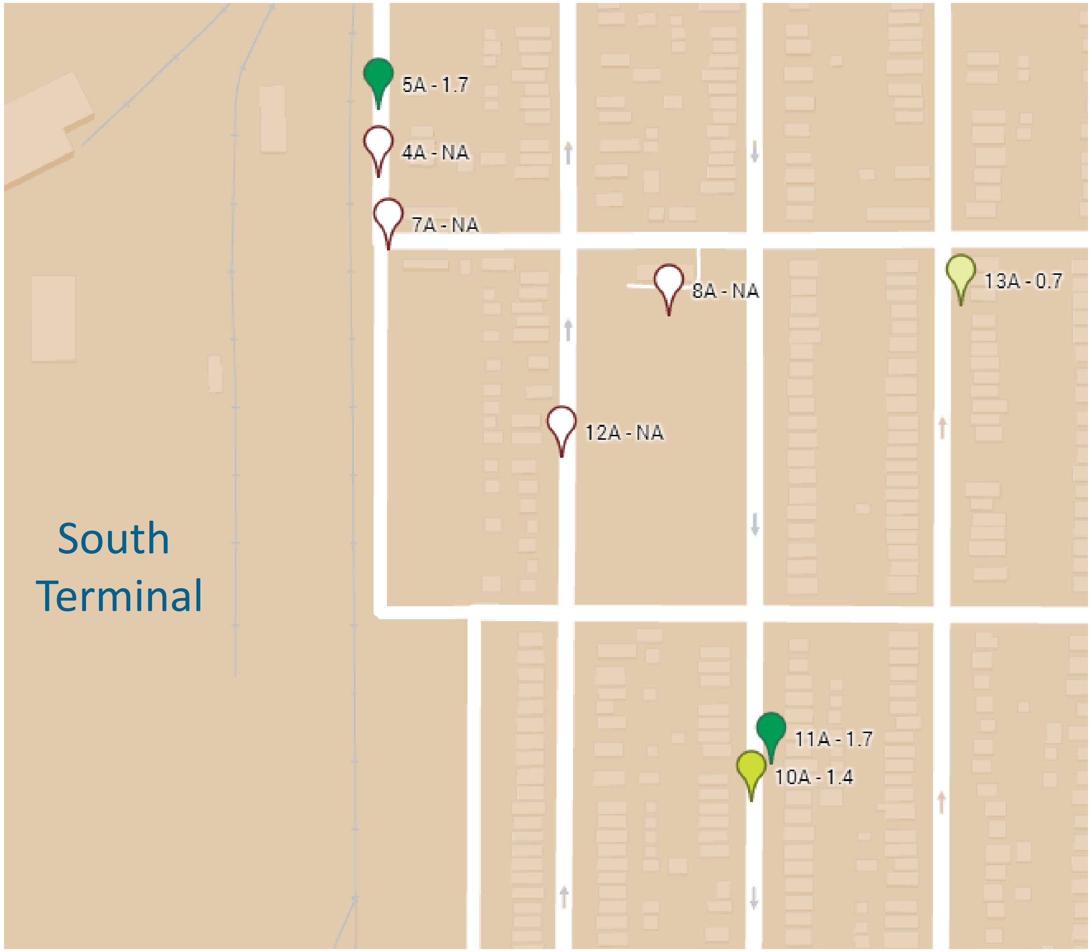
Map of approximate locations of V:Ni for EPA surface dust samples (North Site). White pins indicate locations with V and/or Ni concentrations less than the detection limit; For other locations, the magnitude of the V:Ni ratio increases with increasing color saturation.

V:Ni and Distance to South Terminal

Available Data for KCBX South:

- Only 4 of 8 samples had detectable levels of both V and Ni.
- V and/or Ni was non-detect in 2 of 3 samples collected along a street adjacent to KCBX South.
- V and Ni were detected at the location farthest from KCBX South, but not in 4 locations closer to the terminal

All of which does not show the presence of petroleum coke and coal in the community.



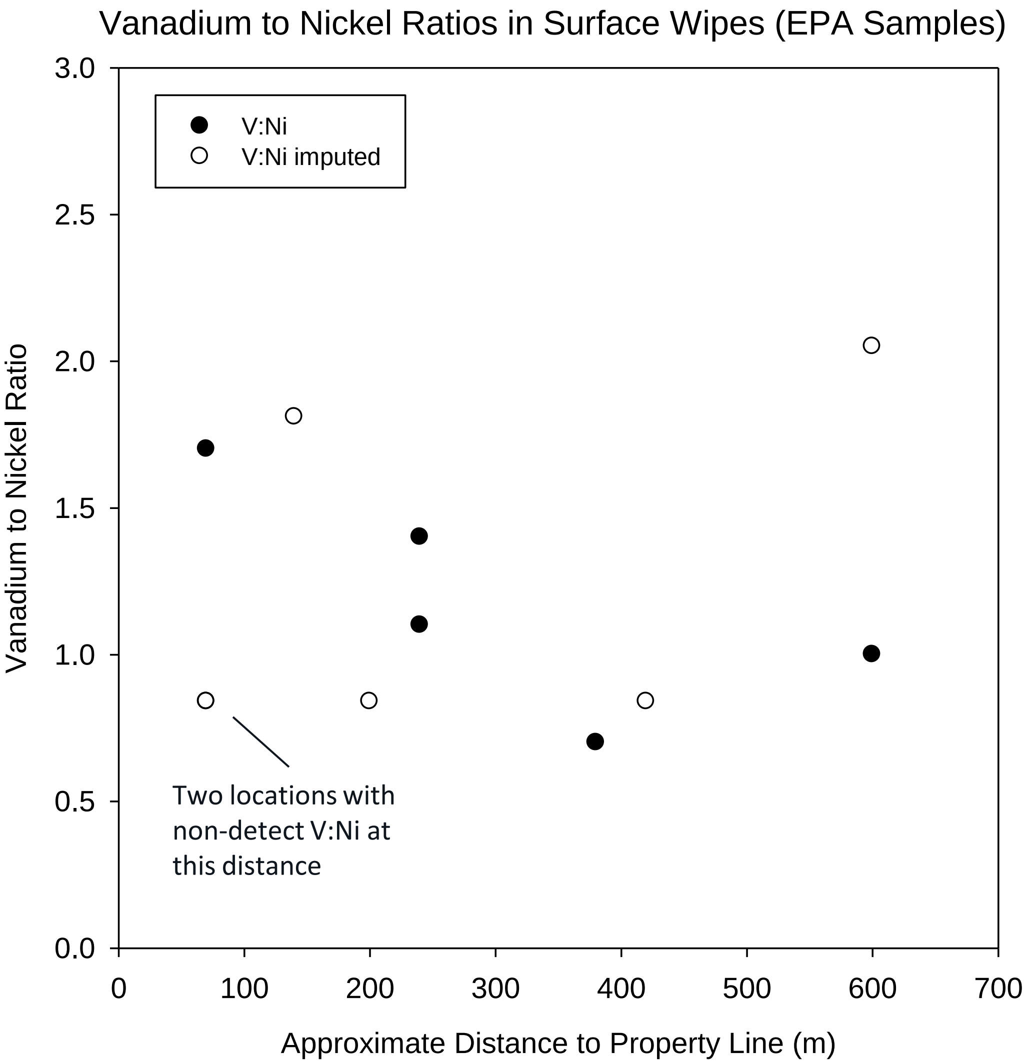
Map of approximate locations of V:Ni for EPA surface dust samples (North Site). White pins indicate locations with V and/or Ni concentrations less than the detection limit; For other locations, the magnitude of the V:Ni ratio increases with increasing color saturation.

V:Ni and Distance to North and South

EPA NOV:
"The V:N at the sampling locations was highest at the location closest to KCBX and *decreased as distance of the sampling location from KCBX increased*."

Available Data:

- V:Ni ranges from about 1 to 2 both near and far from the terminals, which means that the *V:Ni ratio does not decrease with increasing distance from the KCBX terminals*.
- Important scientifically to consider all of the available data.



Two locations with non-detect V:Ni at this distance

Summary

- A thorough analysis of the information described in the NOV shows that there is no discernible evidence of petroleum coke or coal on surfaces or in soil of the South Deering and East Side neighborhoods.

- EPA's V:Ni ratios are very similar to other neighborhoods throughout Chicago and are do not show the presence of petroleum coke or coal in the community.

- EPA's V:Ni ratios do not decrease with distance from the petroleum coke and coal terminals.
  - Instead, the V:Ni ratios are typical of background soil, with lower and higher values both near and far from the KCBX terminals.

Response to June 3, 2014 Notice of Violation

David L. MacIntosh, Sc.D., C.I.H., Chief Science Officer, Director of Advanced Analytics

June 24, 2014

ENVIRONMENTAL HEALTH
& ENGINEERING, INC.

Exhibit 6

NOV-Related Data Analyses

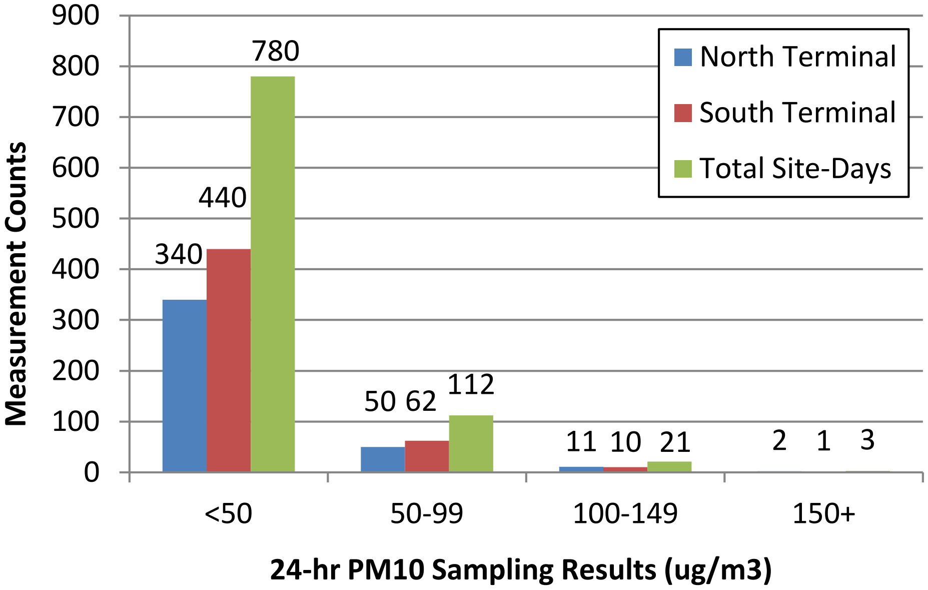
Lyle Chinkin
Sonoma Technology, Inc.

June 24, 2014

Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

Air Monitoring – Summary Statistics

- North Terminal: 5 to 156 µg/m^3
- South Terminal: 5 to 156 µg/m^3
- 85% of daily concentrations < 50 µg/m^3
- 97% of daily concentrations < 100 µg/m^3



Sonoma Technology, Inc.

Overview

- PM_{10} measurements at KCBX are impacted by regional/local background concentrations.
- Conditions on the two NOV dates of April 12 and May 8, 2014 show that KCBX's contribution was minor:
  - PM_{10} > 150 µg/m^3 at NE monitoring site(s)
  - Gusty winds from the south/southwest
  - Small incremental PM_{10} impacts from KCBX
- PM_{10} concentrations decrease significantly with distance from ground-based sources (such as bulk material piles)
- EPA relies on readings from source monitors, which do not measure ambient air.

April 12, 2014

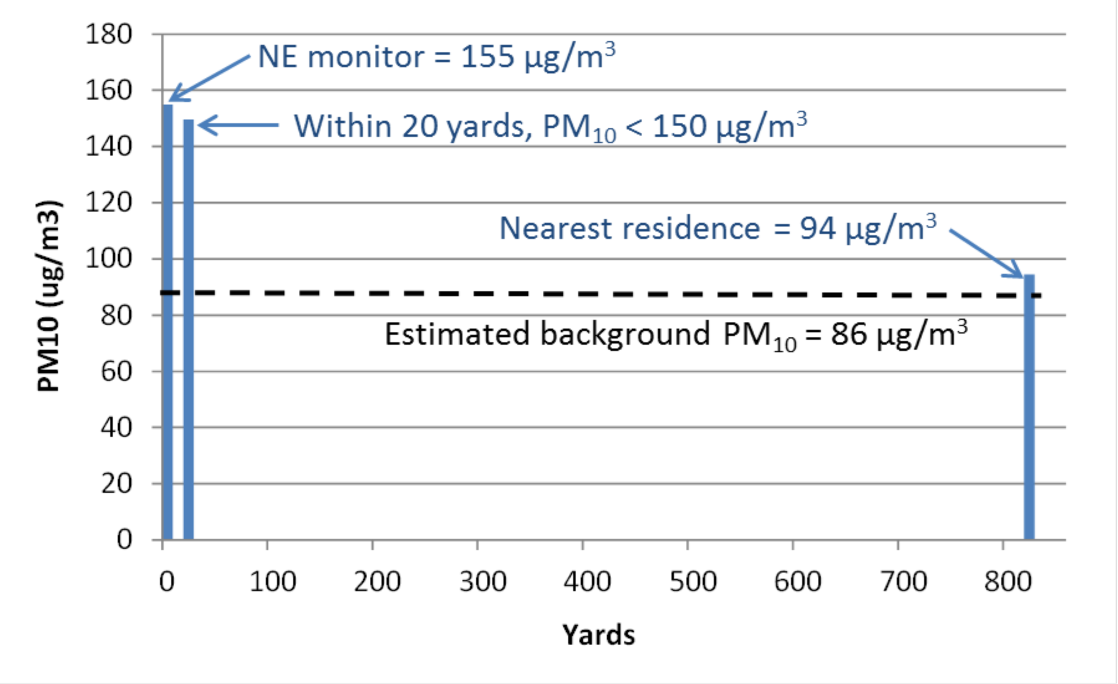
April 12, 2014

North Terminal:

- Upwind PM_{10} (SE) = 146 µg/m^3
- Downwind PM_{10} (NE) = 155 µg/m^3 (net increment = 9 µg/m^3)

April 12, 2014 Modeling

- Preliminary dispersion modeling with EPA – approved AERMOD model shows that PM_{10} concentrations decrease rapidly with distance from the monitors
- On April 12, PM10 concentrations are expected to have dropped below 150 µg/m³ within 20 yards of the NE monitor



Sonoma Technology, Inc.

May 8, 2014 North Terminal

Sonoma Technology, Inc.

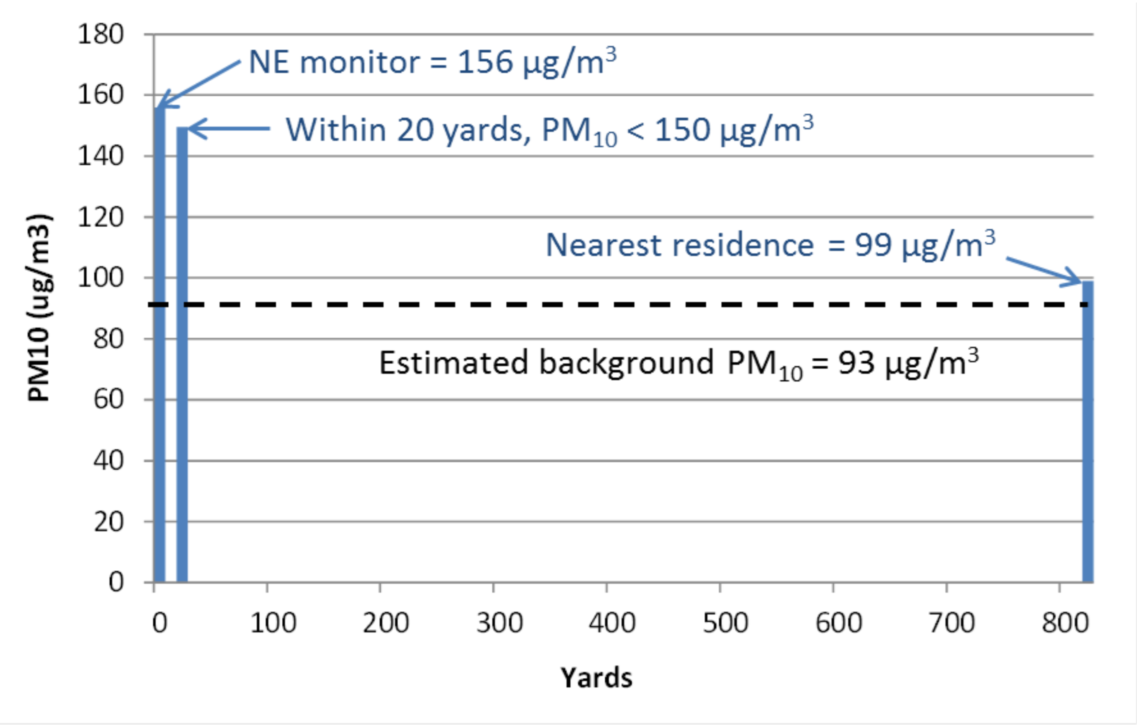
May 8, 2014

- Upwind PM_{10} at North Terminal (SE) = 144 µg/m^3
- Upwind PM_{10} at South Terminal (southwest/center east) = ~100 µg/m^3
- Downwind PM_{10} (NE) at both terminals = 156 µg/m^3
  - North Terminal net increment = 12 µg/m^3
  - South Terminal net increment = ~50 µg/m^3

May 8, 2014 South Terminal

May 8, 2014 Modeling

- PM_{10} concentrations decrease rapidly with distance from the monitors
- May 8, PM_{10} concentrations are expected to drop below 150 µg/m^3 within 20 yards of the NE monitor at both terminals



April 10, 2014

- April 10, 2014
  - – Similar meteorological conditions as April 12 and May 8, but not as gusty
  - – The KCBX terminals acted as a PM_{10} “sink” and provided a net removal of PM_{10} (net increment = -20 µg/m^3)

April 10, 2014

Illustration of Local Background PM_{10}

- High levels of windblown dust from neighboring facilities were observed and videotaped on March 31, 2014
- 24-hour average PM_{10} concentrations in excess of 100 µg/m^3 were measured at both terminals
- Winds were predominantly from the south

March 31, 2014

March 31, 2014

Sonoma Technology, Inc.


Salt pile(s), covered
Morton Salt, Inc.
North Site
Black aggregate piles
Chicago Ship Yard
Railroad
Dark aggregate metal recycling
Elg Metals, Inc.
Black aggregate piles
S.H. Bell Company
Covered aggregate
Chicago Dry Dock, Inc.
Light aggregate piles
Marblehead Lime Co.
Metal recycling facility
State Line Energy, LLC
Beemsterboer Slag Co.
Vacant
Vehicle scrap yard
Cronimet Corporation
Metal recycling
V M & I Corp.
Fuel tanks
Calumet River Terminals
Pig Iron/Iron Ore/Specialty Metals
Vacant & quarry
South Site
Pipe etc. storage yard
Surneier & Surneier, Inc.
Calumet Transload
Salt Storage/Demo/Recycling
George Washington High School
Zinc smelter
Horsehead Corp.
Metal recycling facility
Reserve Marine Term
900 m
Google earth

Community PM_{10} NAAQS Monitor

- Most proximate ambient air monitor to KCBX; <1 mile southeast

- Acquired most recent 4 years of PM_{10} data, 2010-2013

- No exceedance of PM_{10} NAAQS (150 µg/m^3 averaged over 24 hours)

Conclusions

- Meteorological conditions on April 12 and May 8, 2014 were similar
- On both of these days, PM_{10} originating off-site was an important contributor to the measured PM_{10} concentrations at KCBX
- Source monitor data relied upon for analysis
- Modeling used for off-site assessment
- No PM_{10} > 150 µg/m^3 averaged over 24 hours at nearest downwind residence

Exhibit 7

STi
Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

July 21, 2014

Re: Material pile heights and associated air quality impacts at the KCBX Terminals

This letter provides an overview of the impact of material pile heights at the KCBX Terminals on emissions and ambient concentrations of particulate matter with a diameter of 10 micrometers or less (PM_{10}). Proposed rules would limit the height of material piles at KCBX to 30 ft, and the facility has requested a variance that would allow piles of up to 45 ft in height. The configuration of material piles at KCBX affects two processes that influence local PM_{10} concentrations:

1. Windblown dust emissions, which are a function of wind speed and pile size (i.e., footprint); and
2. Air dispersion, which is a function of wind speed and the height from which emissions are released.

Because windblown dust emissions are a small part of the overall PM_{10} emissions inventory for the KCX Terminals, one would not expect changes to this source category to have a large impact on local PM_{10} concentrations. For example, during 2013, monthly emission reports compiled for the KCBX South Terminal show that wind erosion from stockpiles accounted for only 13% of the total PM_{10} for the year, with the remaining PM_{10} being emitted by vehicle activity, material handling, etc.

Though this is a small emissions source, we evaluated the impact of pile height by performing emissions calculations and AERMOD dispersion model runs for sample material piles with heights of 30 ft and 45 ft. We found that, for a given volume of material, lowering the pile height from 45 ft to 30 ft would increase windblown dust emissions and reduce the dispersion of those emissions in the atmosphere. Combined, these effects would actually *increase* maximum PM_{10} concentrations associated with windblown dust by up to 12%.[1] These results are described in detail below.

Emissions

The U.S. Environmental Protection Agency's (EPA) AP-42 emission factors compendium provides an equation for estimating wind erosion from active material piles. This equation is based on wind speed and pile footprint, as show below (U.S. Environmental Protection Agency, 1998).

---

[1] Note that this increase does not represent the change in total PM_{10} concentrations with all emissions source included, but only for the component of PM_{10} associated with windblown erosion from the material piles.

$$TSP = 0.72 \times U \times S$$

Where:

TSP^2 = Total suspended particulate emission rate (lb/hr)

U = Wind speed (mph)

S = Pile footprint size (acres)

For a given volume of material, the configuration of the material determines its footprint and the amount of surface area exposed to the wind. For example, **Figure 1** below shows a simplified stockpile configuration that can be used to estimate the pile volume and footprint for a given height (h), length (L), top width (wt), and angle of repose (Ω).[3]

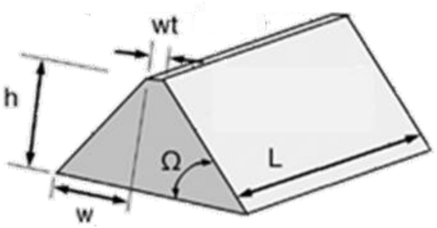


Figure 1. Simplified stockpile configuration for volume calculations (source: http://www.arthon.com/calculators/stockpile.shtml).

If we assume a pile height of 45 ft, a length of 300 ft, a top width of zero (sharp peak), and an angle of repose of 37°, then the pile volume is approximately 1,000,000 ft^3 and the footprint is 0.8 acres. However, if we take the same amount of material and reduce the pile height to 30 ft, the pile must now be spread out over a larger area, exposing more material to the wind (imagine scraping off the top 15 feet of material and pushing it down toward the base of the pile). **Table 1** shows that the effect of this change would be to increase the pile footprint to 0.9 acres and to increase total wind erosion emissions by 14%.

Table 1. Pile characteristics for 45 ft and 30 ft pile heights.

Parameter	45 ft height	30 ft height
Volume (ft^3)	1,000,000	1,000,000
Base length (ft)	300	300
Base width (ft)	120	138
Base area (acres)	0.8	0.9
PM_{10} emissions (lb/day)[a]	14	16

[a] Emissions estimated using the equation above and wind speed data from March 20, 2014 (one of the sample days modeled).

---

[2] PM_{10} is a subset of TSP. According to monthly emissions reports for the South Terminal, about half of the TSP emissions are emitted as PM_{10}.

[3] The angle of repose of a granular material such as coal or petcoke is the steepest angle to which the material can be piled without any sliding of material.

It should also be noted that emissions from wind erosion are a small component of the overall PM_{10} emissions inventory for the KCBX Terminals. During 2013, total PM_{10} emissions from the South Terminal averaged 125 lb/day, while windblown dust emissions averaged only 16 lb/day (comparable to the values shown in Table 1).

Dispersion

The dispersion of emissions in the atmosphere and the resulting surface-level concentrations are a function of the emissions release height. In general, a higher release height results in greater dispersion and reduced surface-level concentrations, as the emitted material has to travel through a greater depth of the atmosphere before reaching the surface. To evaluate differences in dispersion for the 30 ft and 45 ft piles, we placed the sample piles characterized in Table 1 in the center of the South Terminal and modeled their emission rates and release heights using the AERMOD dispersion model. We ran AERMOD using meteorology from 3 days in 2014 during which elevated PM_{10} concentrations were observed at the South Terminal. However, meteorological variations are not expected to impact the overall results, as the modeled PM_{10} concentrations are low for windblown erosion because this source is a small component of total PM_{10} emissions from the KCBX Terminals. In addition, we are primarily concerned here with relative differences in PM_{10} concentrations for the two pile heights modeled.

Table 2 shows the maximum 24-hr average PM_{10} concentrations predicted by AERMOD for each date and pile height modeled. As noted above, these fenceline PM_{10} concentrations are all quite low (< 3 $\mu g/m^3$), as windblown erosion is a relatively small emissions source. The AERMOD results show that the impact of lowering pile heights from 45 ft to 30 ft is to increase the peak fenceline PM_{10} concentrations by up to 12%. These increases in PM_{10} concentrations are due to the enhanced PM_{10} emissions from the lower pile (discussed above) and to the reduced dispersion associated with a lower release height.

Table 2. Maximum 24-hr average PM_{10} concentrations predicted by AERMOD.

Date	Peak 24-hr average PM_{10} concentration ($\mu g/m^3$)		Percent change
	45 ft pile	30 ft pile	
March 9, 2014	2.1	2.3	10%
March 20, 2014	2.4	2.5	4%
March 31, 2014	2.6	2.9	12%

These findings indicate that lowering pile heights from 45 ft to 30 ft will have a small influence on the overall air quality impacts from the KCBX Terminals, and is likely to slightly increase those impacts.

Sincerely,

Lyle R. Chinkin
President

References

U.S. Environmental Protection Agency (1998) Compilation of air pollutant emission factors, AP-42. Vol. 1: stationary point and area sources. Section 11.9, Western surface coal mining. October.