UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

October 16, 2015

(b) (6) [redacted]

RE: Wilcox Oil Company Superfund Site – Residential Data Results

Dear Mr. and Mrs. (b) (6) [redacted]

This letter provides you with a summary of the soil data results for your property. Based on our review of the data, soil samples collected from your property did not exceed levels considered acceptable by EPA for short-term exposures. Although some concentrations exceeded their Residential Screening Level (RSL) for soil, this is merely an indication that further evaluation may be needed. The concentrations that exceeded the RSL are expected to fall within the accepted range established by EPA for long term exposures.

Table 1 presents the results for those chemicals detected in the soil and exceeding the RSL. All other data concentrations fell below the RSL. One metal and several organic chemicals were detected as levels that exceed the Residential Soil Screening Levels (RSL). Arsenic was detected in every sample with the highest result being 5.7 milligrams per kilogram (mg/kg) at a depth of 12 - 24 inches below ground surface (bgs). Published reports have documented the background range of arsenic concentrations for Oklahoma as being 0.6 to 21 mg/kg. The highest result of 5.7 mg/kg falls within the range of background concentrations. Several Polycyclic Aromatic Hydrocarbons were detected as presented below. In addition to these chemicals, oil-saturated soils were visually identified within sample Grid 4 at a depth of 12 inches and within sample Grid 6 at a depth of 18 inches.

Table 1

Grid	Depth	Chemical	Concentration mg/kg	Screening Level mg/kg
Grid 1	0 – 2 inches bgs	Benzo(a)pyrene	0.026	0.016
	2 – 6 inches bgs	Benzo(a)pyrene	0.11	0.016
		Benzo(b)fluoranthene	0.19	0.16
		Dibenzo(a,h)anthracene	0.024	0.016
Grid 2	0 – 2 inches bgs	Benzo(a)pyrene	0.063	0.016
		Dibenzo(a,h)anthracene	0.017	0.016
	2 – 6 inches bgs	Benzo(a)pyrene	0.017	0.016
Grid 3	0 – 2 inches bgs	Benzo(a)anthracene	0.19	0.16
		Benzo(a)pyrene	0.17	0.016
		Benzo(b)fluoranthene	0.27	0.16
		Dibenzo(a,h)anthracene	0.04	0.016
		Indeno(1,2,3-cd)pyrene	0.17	0.16

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Table 1				
Grid	**Depth**	**Chemical**	**Concentration mg/kg**	**Screening Level mg/kg**
Grid 3	2 – 6 inches bgs	Benzo(a)pyrene	0.12	0.016
		Benzo(b)fluoranthene	0.19	0.16
		Dibenzo(a,h)anthracene	0.03	0.016
	12 – 24 inches bgs Duplicate	Benzo(a)pyrene	0.023	0.016
Grid 4	0 – 2 inches bgs	Benzo(a)pyrene	0.059	0.016
		Dibenzo(a,h)anthracene	0.016	0.016
	0 – 2 inches bgs Duplicate	Benzo(a)pyrene	0.043	0.016
	2 – 6 inches bgs	Benzo(a)pyrene	0.11	0.016
		Benzo(b)fluoranthene	0.18	0.16
		Dibenzo(a,h)anthracene	0.025	0.016
	6 – 12 inches bgs	Benzo(a)anthracene	0.23	0.16
		Benzo(a)pyrene	0.2	0.016
		Benzo(b)fluoranthene	0.31	0.16
		Dibenzo(a,h)anthracene	0.051	0.016
		Indeno(1,2,3-cd)pyrene	0.22	0.16
	12 – 24 inches bgs	Benzo(a)anthracene	0.18	0.16
		Benzo(a)pyrene	0.16	0.016
		Benzo(b)fluoranthene	0.24	0.16
		Dibenzo(a,h)anthracene	0.039	0.016
		Indeno(1,2,3-cd)pyrene	0.18	0.16
Grid 5	0 – 2 inches bgs	Benzo(a)anthracene	0.37	0.16
		Benzo(a)pyrene	0.21	0.016
		Benzo(b)fluoranthene	0.2	0.16
		Dibenzo(a,h)anthracene	0.067	0.016
	2 – 6 inches bgs	Benzo(a)anthracene	2.1	0.16
		Benzo(a)pyrene	1.2	0.016
		Benzo(b)fluoranthene	0.95	0.16
		Dibenzo(a,h)anthracene	0.44	0.016
		Indeno(1,2,3-cd)pyrene	0.62	0.16
	6 – 12 inches bgs	Benzo(a)anthracene	0.31	0.16
		Benzo(a)pyrene	0.15	0.016
		Dibenzo(a,h)anthracene	0.062	0.016
Grid 6	0 – 2 inches bgs	Benzo(a)pyrene	0.023	0.016
	2 – 6 inches bgs	Benzo(a)pyrene	0.03	0.016
	6 – 12 inches bgs	Benzo(a)pyrene	0.055	0.016
	6 – 12 inches bgs Duplicate	Benzo(a)anthracene	0.25	0.16
		Benzo(a)pyrene	0.17	0.016
		Benzo(b)fluoranthene	0.28	0.16
		Indeno(1,2,3-cd)pyrene	0.17	0.16
	12 – 24 inches bgs	Benzo(a)pyrene	0.095	0.016

Table 1				
Grid	**Depth**	**Chemical**	**Concentration mg/kg**	**Screening Level mg/kg**
Grid 7	0 – 2 inches bgs	Benzo(a)anthracene	0.74	0.16
		Benzo(a)pyrene	0.32	0.016
		Benzo(b)fluoranthene	0.24	0.16
		Dibenzo(a,h)anthracene	0.11	0.016
	2 – 6 inches bgs	Benzo(a)anthracene	0.32	0.16
		Benzo(a)pyrene	0.16	0.016
		Dibenzo(a,h)anthracene	0.055	0.016
Grid 8	0 – 2 inches bgs	Benzo(a)pyrene	0.02	0.016

The Residential Soil Screening Levels represent conservative levels developed using risk assessment guidance from the EPA Superfund program. RSLs are considered by the Agency to be protective for humans (including sensitive groups) over a lifetime of exposure. RSLs are not cleanup standards and are used for site "screening" to help identify areas, contaminants, and conditions that may require further investigation at a particular site. Generally, at sites where contaminant concentrations fall below RSLs, no further action or study is warranted under the Superfund program, so long as the exposure assumptions at a site match those used to develop the RSL. Chemical concentrations above the RSL do not automatically trigger a response action; however, exceeding the RSL suggests that further evaluation of the potential risks by site contaminants is appropriate. In addition, further evaluation of the potential risks related to site contaminants that were detected in the soil but have no RSL is appropriate. As we move forward with our site investigation, we will be evaluating these contaminants in more detail through a Site-specific Human Health Risk Assessment to determine the potential risks these contaminants may pose. For additional information related to Arsenic and Polycyclic Aromatic Hydrocarbons, please see the enclosed contaminant profiles developed by the Agency for Toxic Substances and Disease Registry (ATSDR).

If you are concerned, please consider some of these options while we evaluate these contaminants in more detail.

- Ensure proper hygiene, especially frequent hand washing.
- Soil should be thoroughly shaken off clothes and footwear, before entering homes.
- Use a dust mask when mowing.
- Limit outside digging and soil moving activities.

We would like to follow-up with you during the week of October 26, 2015, to discuss the data presented in this letter and answer any questions that you may have. We will contact you by phone to schedule a time that fits your schedule. In the interim, should you want to talk with us, please contact me at 214-665-8143, or 1-800-533-3508, or contact Todd Downham, Oklahoma Department of Environmental Quality at 405-702-5136.

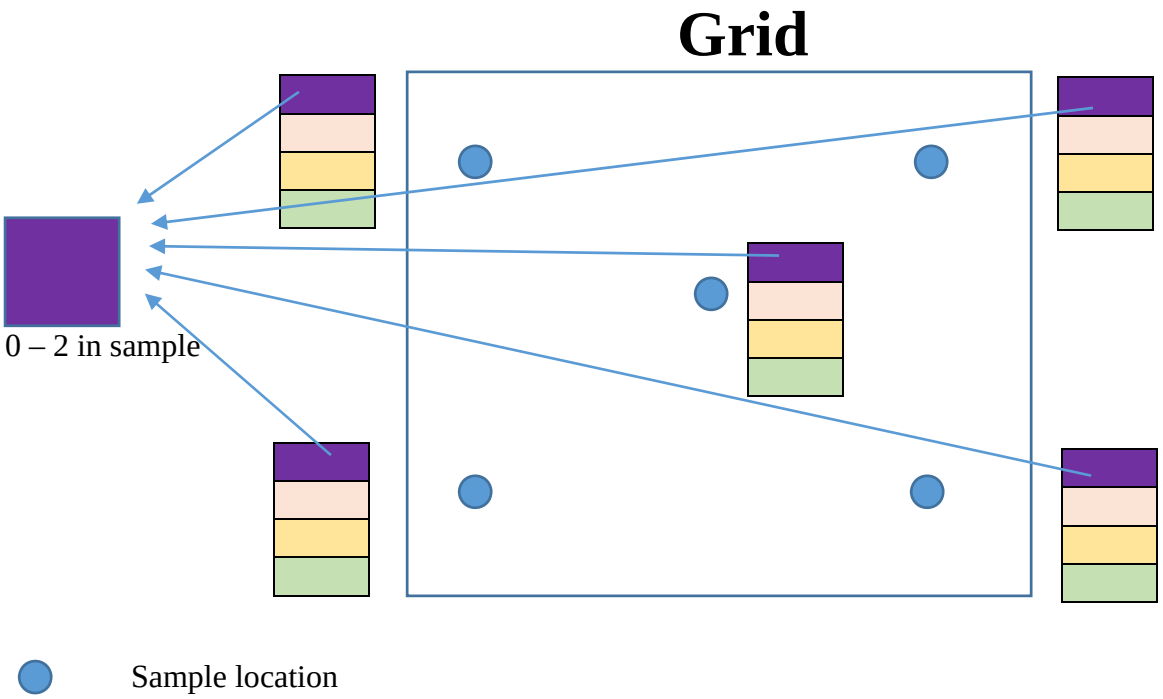
Sincerely,

Katrina Higgins-Coltrain,
Remedial Project Manager
LA/OK/NM Section

Enclosure 1: Understanding the Soil Collection Process

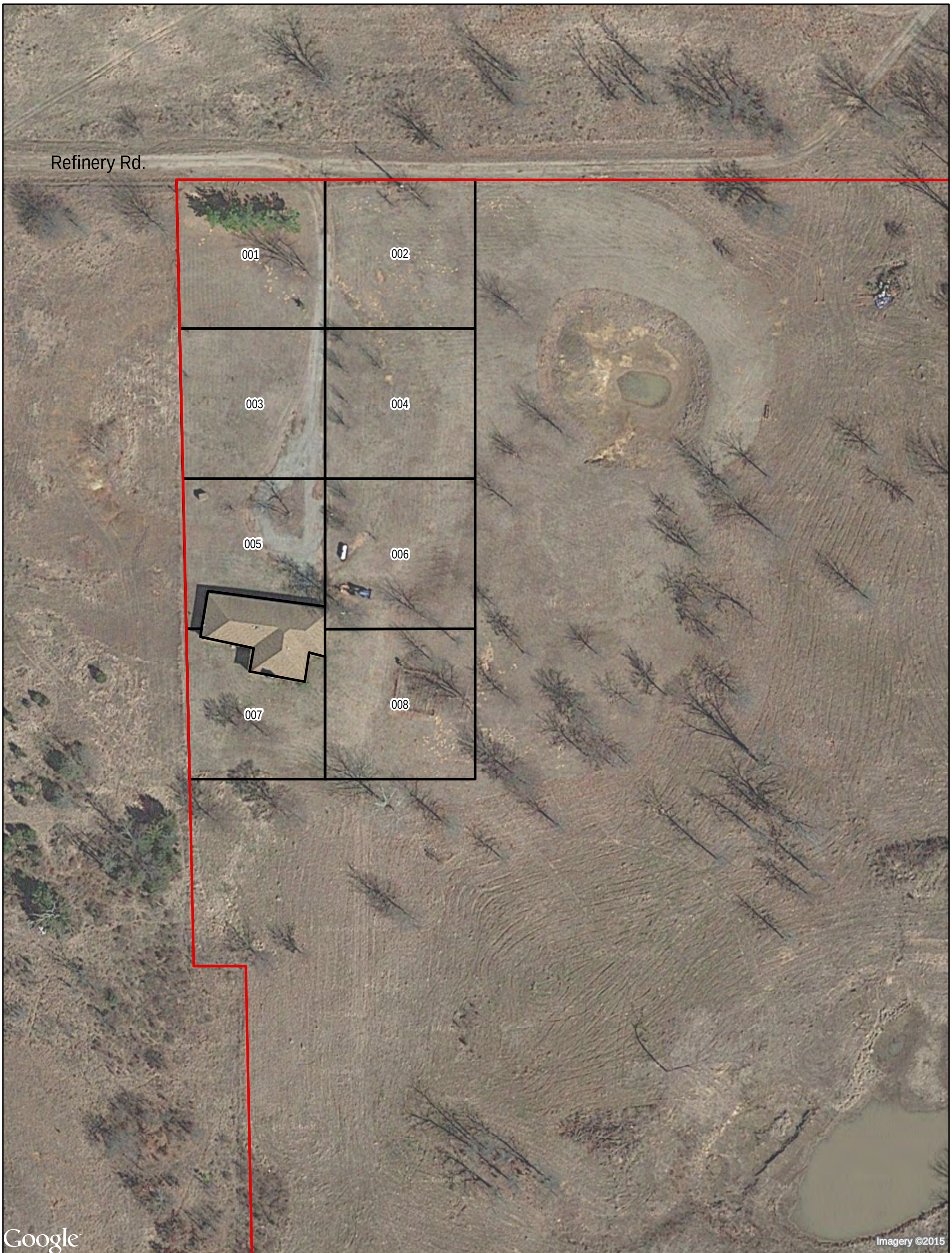
The following summary is provided to help you better understand how we sampled your property. The figure provided as Enclosure 2 shows that your property was divided into several sample grids. As shown in Figure 2, each Grid has five sample locations. From each of these five locations, a 24 inch long soil core was taken. The soil core was divided into depth intervals of 0-2 inches below ground surface (bgs), 2–6 inches bgs, 6-12 inches bgs, and 12-24 inches bgs. The soil from each depth interval was combined together to produce one sample representing that depth interval. For example, soil from 0–2 inches bgs was collected from each of the five sample locations and then combined into one sample that represents the 0–2 inch depth interval for that Grid. This process was used for each depth interval and results in a total of 4 soil samples for each Grid. One sample represents the 0–2 inches bgs, the second represents 2–6 inches bgs, the third represents 6–12 inches bgs, and the fourth represents 12–24 inches bgs. Figure 2 shows an example of the sample process. If there is no sample result for a depth interval, then we were not able to collect that sample due to little soil recovery or the core could not be pushed deeper because of rock. The table provided in Enclosure 3 summarizes the data results for all chemicals detected in the soil and provides the full list of chemicals that were analyzed. If a chemical is not summarized, then that chemical was not detected in the soil.

Figure 2: Example of Soil Collection Process



Depths for each Sample Location	
	0 – 2 inches below ground surface (bgs)
	2 – 6 inches bgs
	6 – 12 inches bgs
	12 – 24 inches bgs

Enclosure 2: Figure of Sample Grids



0 60 120
Feet

LEGEND
Property Boundary
Sample Grid Location

US EPA REGION 6

PROPERTY 006
SAMPLE LOCATION MAP
WILCOX OIL
WEST 221st STREET/REFINERY ROAD
BRISTOW, CREEK COUNTY, OKLAHOMA

DATE	PROJECT NO	SCALE
OCTOBER, 2015	20406.012.005.0919.01	AS SHOWN

TDD NO: 5/WESTON-042-15-004

SOURCE: 2010 Microsoft Corporation and its data suppliers

FILE: L:\20406_START3_R6\WILCOX_OIL\GIS\MXDs\Sample Location Maps\Property 006 - Sample Location Map.mxd 11:32:30 AM 10/2/2015 bondp

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 1 0-2in bgs 5/18/2015	Grid 1 2-6in bgs 5/22/2015	Grid 1 2-6in bgs 5/19/2015	Grid 1 6-12in bgs 5/22/2015	Grid 1 6-12in bgs 5/19/2015	Grid 1 12-24in bgs 5/22/2015	Grid 1 12-24in bgs 5/19/2015
Metals											
Aluminum	7429-90-5	mg/kg	77000	--	**1960**	NA	**2310**	NA	**6280**	NA	**6090**
Antimony	7440-36-0	mg/kg	31	--	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 UJ, U
Arsenic	7440-38-2	mg/kg	0.68	--	**1.2**	NA	**1.3**	NA	**1.3**	NA	**1.5**
Barium	7440-39-3	mg/kg	15000	--	**25.3**	NA	**26.4**	NA	**50.8**	NA	**40.9**
Beryllium	7440-41-7	mg/kg	160	--	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U
Calcium	7440-70-2	mg/kg	NP	--	**481**	NA	**355**	NA	**601**	NA	**427**
Chromium	7440-47-3	mg/kg	NP	--	**4.8**	NA	**5.6**	NA	**6.1**	NA	**6.1**
Cobalt	7440-48-4	mg/kg	23	--	**2.3**	NA	**2.2**	NA	**2.6**	NA	**3.1**
Copper	7440-50-8	mg/kg	3100	--	2 U	NA	**2.1**	NA	**3**	NA	**3.6**
Iron	7439-89-6	mg/kg	55000	--	**4450**	NA	**4770**	NA	**7520**	NA	**7760**
Lead	7439-92-1	mg/kg	400	--	**6.5**	NA	**6**	NA	**4.7**	NA	**4.1**
Magnesium	7439-95-4	mg/kg	NP	--	**234**	NA	**228**	NA	**548**	NA	**516**
Manganese	7439-96-5	mg/kg	1800	--	**157**	NA	**145**	NA	**47.1**	NA	**48.5 J**
Nickel	7440-02-0	mg/kg	1500	--	2 U	NA	2.1 U	NA	**3.6**	NA	**3.7**
Potassium	7440-09-7	mg/kg	NP	--	**257**	NA	**255**	NA	**385**	NA	**370**
Sodium	7440-23-5	mg/kg	NP	--	50.9 U	NA	51.5 U	NA	54 U	NA	52.9 U
Vanadium	7440-62-2	mg/kg	390	--	**6.8**	NA	**7.8**	NA	**12.9**	NA	**12.5**
Zinc	7440-66-6	mg/kg	23000	--	**11.6**	NA	**7.6**	NA	**5.8**	NA	**5**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 1 0-2in bgs 5/18/2015	Grid 1 2-6in bgs 5/22/2015	Grid 1 2-6in bgs 5/19/2015	Grid 1 6-12in bgs 5/22/2015	Grid 1 6-12in bgs 5/19/2015	Grid 1 12-24in bgs 5/22/2015	Grid 1 12-24in bgs 5/19/2015
Polychlorinated Biphenyls (None Detected)											
Pesticides											
4,4'-DDE	72-55-9	mg/kg	2	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
Benzaldehyde	100-52-7	mg/kg	7800	--	0.19 UJ	NA	0.19 UJ	NA	0.19 U	NA	0.2 U
Carbazole	86-74-8	mg/kg	NP	--	0.19 UJ	NA	0.19 UJ	NA	0.19 U	NA	0.2 U
Endosulfan I	959-98-8	mg/kg	NP	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
Endosulfan II	33213-65-9	mg/kg	NP	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
Endrin	72-20-8	mg/kg	19	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
Endrin ketone	53494-70-5	mg/kg	NP	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U
Methoxychlor	72-43-5	mg/kg	320	--	0.00112 U	NA	0.00111 U	NA	0.00113 U	NA	0.00112 U

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 1 0-2in bgs 5/18/2015	Grid 1 2-6in bgs 5/22/2015	Grid 1 2-6in bgs 5/19/2015	Grid 1 6-12in bgs 5/22/2015	Grid 1 6-12in bgs 5/19/2015	Grid 1 12-24in bgs 5/22/2015	Grid 1 12-24in bgs 5/19/2015
Semi-volatile Organic Compounds											
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	**0.019 LJ**	NA	0.19 UJ	NA	0.19 U	NA	0.2 U
Chrysene	218-01-9	mg/kg	16	--	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.19 UJ	NA	0.19 UJ	NA	0.19 U	NA	0.2 U
Phenanthrene	85-01-8	mg/kg	NP	--	NA	NA	NA	NA	NA	NA	NA
Pyrene	129-00-0	mg/kg	1800	--	NA	NA	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds (SIM)											
2-Methylnaphthalene	91-57-6	mg/kg	240	--	**0.002 LJ**	NA	0.037 U	NA	0.0038 U	NA	**0.001 LJ**
Acenaphthene	83-32-9	mg/kg	3600	--	0.0074 UJ	NA	0.037 U	NA	0.0038 U	NA	0.0038 U
Acenaphthylene	208-96-8	mg/kg	NP	--	**0.006 LJ**	NA	**0.023 LJ**	NA	0.0038 U	NA	0.0038 U
Anthracene	120-12-7	mg/kg	18000	--	**0.0065 LJ**	NA	**0.028 LJ**	NA	0.0038 U	NA	0.0038 U
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	**0.031 J**	NA	**0.15**	NA	**0.0021 LJ**	NA	0.0038 U
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	**0.026 J**	NA	**0.11**	NA	**0.0014 LJ**	NA	0.0038 U
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	**0.04 J**	NA	**0.19**	NA	**0.0024 LJ**	NA	0.0038 U
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	**0.014 J**	NA	**0.063**	NA	**0.00087 LJ**	NA	0.0038 U
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	**0.014 J**	NA	**0.063**	NA	**0.00087 LJ**	NA	0.0038 U
Chrysene	218-01-9	mg/kg	16	--	**0.04 J**	NA	**0.15**	NA	**0.0022 LJ**	NA	0.0038 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	**0.006 LJ**	NA	**0.024 LJ**	NA	0.0038 U	NA	0.0038 U
Fluoranthene	206-44-0	mg/kg	2400	--	**0.034 J**	NA	**0.17**	NA	**0.0022 LJ**	NA	0.0038 U
Fluorene	86-73-7	mg/kg	2400	--	0.0074 UJ	NA	0.037 U	NA	0.0038 U	NA	0.0038 U
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	**0.026 J**	NA	**0.11**	NA	**0.0015 LJ**	NA	0.0038 U
Naphthalene	91-20-3	mg/kg	3.8	--	0.0074 UJ	NA	0.037 U	NA	0.0038 U	NA	**0.001 LJ**
Phenanthrene	85-01-8	mg/kg	NP	--	**0.016 J**	NA	**0.016 LJ**	NA	0.0038 U	NA	0.0038 U
Pyrene	129-00-0	mg/kg	1800	--	**0.044 J**	NA	**0.17**	NA	**0.0037 LJ**	NA	0.0038 U

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 1 0-2in bgs 5/18/2015	Grid 1 2-6in bgs 5/22/2015	Grid 1 2-6in bgs 5/19/2015	Grid 1 6-12in bgs 5/22/2015	Grid 1 6-12in bgs 5/19/2015	Grid 1 12-24in bgs 5/22/2015	Grid 1 12-24in bgs 5/19/2015
Volatile Organic Compounds											
2-Butanone	78-93-3	mg/kg	27000	--	0.0043 U	0.012 U	NA	0.0082 U	NA	0.011 U	NA
Acetone	67-64-1	mg/kg	61000	--	0.0087 U	**0.057**	NA	**0.021**	NA	0.011 U	NA
Cyclohexane	110-82-7	mg/kg	6500	--	0.0043 U	0.0061 U	NA	0.0041 U	NA	0.0055 U	NA
Methylcyclohexane	108-87-2	mg/kg	NP	--	0.0043 U	0.0061 U	NA	0.0041 U	NA	0.0055 U	NA
Toluene	108-88-3	mg/kg	4900	--	0.0043 U	0.0061 U	NA	0.0041 U	NA	0.0055 U	NA

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL
Yellow highlighted cells exceed RSL
U - Not Detected at reported quantitation limit
L - Reported concentration is below the CRQL
mg/kg-milligrams per kilogram
BOLD-indicates a detected concentration
bgs-below ground surface

NA - Not Analyzed
NP - Not Published
J - Estimated Value
R - Unusable
SIM-selected ion monitoring
in-inches

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 2 0-2in bgs 5/18/2015	Grid 2 2-6in bgs 5/22/2015	Grid 2 2-6in bgs 5/19/2015	Grid 2 6-12in bgs 5/22/2015	Grid 2 6-12in bgs 5/19/2015	Grid 2 12-24in bgs 5/19/2015
Metals										
Aluminum	7429-90-5	mg/kg	77000	--	**1830**	NA	**1660**	NA	**4040**	**5230**
Antimony	7440-36-0	mg/kg	31	--	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U
Arsenic	7440-38-2	mg/kg	0.68	--	**1.6**	NA	**1.5**	NA	**1.3**	**3**
Barium	7440-39-3	mg/kg	15000	--	**29.4**	NA	**16.8**	NA	**26.3**	**31.1**
Beryllium	7440-41-7	mg/kg	160	--	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U
Calcium	7440-70-2	mg/kg	NP	--	**994**	NA	**280**	NA	**268**	**371**
Chromium	7440-47-3	mg/kg	NP	--	**3.9**	NA	**4.4**	NA	**5.9**	**8.4**
Cobalt	7440-48-4	mg/kg	23	--	2.1 U	NA	2 U	NA	2.1 U	**2.4**
Copper	7440-50-8	mg/kg	3100	--	**2.3**	NA	2 U	NA	**2.8**	**2.7**
Iron	7439-89-6	mg/kg	55000	--	**4300**	NA	**3890**	NA	**6090**	**10200**
Lead	7439-92-1	mg/kg	400	--	**10.4**	NA	**4.8**	NA	**4**	**3.2**
Magnesium	7439-95-4	mg/kg	NP	--	**445**	NA	**189**	NA	**307**	**512**
Manganese	7439-96-5	mg/kg	1800	--	**203**	NA	**63.7**	NA	**56.6**	**25.8**
Nickel	7440-02-0	mg/kg	1500	--	**2.3**	NA	2 U	NA	**3.1**	**5.5**
Potassium	7440-09-7	mg/kg	NP	--	**294**	NA	**186**	NA	**283**	**387**
Sodium	7440-23-5	mg/kg	NP	--	53.6 U	NA	50 U	NA	53.1 U	54.8 U
Vanadium	7440-62-2	mg/kg	390	--	**6.4**	NA	**7**	NA	**9.9**	**13.9**
Zinc	7440-66-6	mg/kg	23000	--	**19.7**	NA	**6.6**	NA	**4.6**	**4.7**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 2 0-2in bgs 5/18/2015	Grid 2 2-6in bgs 5/22/2015	Grid 2 2-6in bgs 5/19/2015	Grid 2 6-12in bgs 5/22/2015	Grid 2 6-12in bgs 5/19/2015	Grid 2 12-24in bgs 5/19/2015
Polychlorinated Biphenyls (None Detected)										
Pesticides										
4,4'-DDE	72-55-9	mg/kg	2	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
Benzaldehyde	100-52-7	mg/kg	7800	--	0.21 UJ	NA	0.2 UJ	NA	0.21 U	0.2 U
Carbazole	86-74-8	mg/kg	NP	--	0.21 UJ	NA	0.2 UJ	NA	0.21 U	0.2 U
Endosulfan I	959-98-8	mg/kg	NP	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
Endosulfan II	33213-65-9	mg/kg	NP	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
Endrin	72-20-8	mg/kg	19	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
Endrin ketone	53494-70-5	mg/kg	NP	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U
Methoxychlor	72-43-5	mg/kg	320	--	0.00116 U	NA	0.00111 U	NA	0.00114 U	0.00118 U

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 2 0-2in bgs 5/18/2015	Grid 2 2-6in bgs 5/22/2015	Grid 2 2-6in bgs 5/19/2015	Grid 2 6-12in bgs 5/22/2015	Grid 2 6-12in bgs 5/19/2015	Grid 2 12-24in bgs 5/19/2015
Semi-volatile Organic Compounds										
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	**0.023 LJ**	NA	0.2 UJ	NA	0.21 U	**0.018 LJ**
Chrysene	218-01-9	mg/kg	16	--	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.21 UJ	NA	0.2 UJ	NA	0.21 U	0.2 U
Phenanthrene	85-01-8	mg/kg	NP	--	NA	NA	NA	NA	NA	NA
Pyrene	129-00-0	mg/kg	1800	--	NA	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds (SIM)										
2-Methylnaphthalene	91-57-6	mg/kg	240	--	0.041 U	NA	0.0077 UJ	NA	0.0041 U	**0.0036 LJ**
Acenaphthene	83-32-9	mg/kg	3600	--	0.041 U	NA	0.0077 UJ	NA	0.0041 U	0.0038 U
Acenaphthylene	208-96-8	mg/kg	NP	--	**0.023 LJ**	NA	**0.0063 LJ**	NA	**0.0015 LJ**	0.0038 U
Anthracene	120-12-7	mg/kg	18000	--	**0.03 LJ**	NA	**0.0069 LJ**	NA	**0.0013 LJ**	0.0038 U
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	**0.061**	NA	**0.019 J**	NA	**0.0047**	0.0038 U
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	**0.063**	NA	**0.017 J**	NA	**0.0042**	0.0038 U
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	**0.15**	NA	**0.031 J**	NA	**0.0068**	0.0038 U
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	**0.038 LJ**	NA	**0.011 J**	NA	**0.0021 LJ**	0.0038 U
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	**0.044**	NA	**0.0087 J**	NA	**0.0022 LJ**	0.0038 U
Chrysene	218-01-9	mg/kg	16	--	**0.11**	NA	**0.036 J**	NA	**0.0055**	0.0038 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	**0.017 LJ**	NA	**0.0045 LJ**	NA	**0.00088 LJ**	0.0038 U
Fluoranthene	206-44-0	mg/kg	2400	--	**0.08**	NA	**0.025 J**	NA	**0.005**	0.0038 U
Fluorene	86-73-7	mg/kg	2400	--	0.041 U	NA	0.0077 UJ	NA	0.0041 U	0.0038 U
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	**0.08**	NA	**0.02 J**	NA	**0.0043**	0.0038 U
Naphthalene	91-20-3	mg/kg	3.8	--	0.041 U	NA	0.0077 UJ	NA	0.0041 U	**0.0015 LJ**
Phenanthrene	85-01-8	mg/kg	NP	--	**0.018 LJ**	NA	**0.0042 LJ**	NA	0.0041 U	**0.0013 LJ**
Pyrene	129-00-0	mg/kg	1800	--	**0.086**	NA	**0.025 J**	NA	**0.0067**	0.0038 U

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 2 0-2in bgs 5/18/2015	Grid 2 2-6in bgs 5/22/2015	Grid 2 2-6in bgs 5/19/2015	Grid 2 6-12in bgs 5/22/2015	Grid 2 6-12in bgs 5/19/2015	Grid 2 12-24in bgs 5/19/2015
Volatile Organic Compounds										
2-Butanone	78-93-3	mg/kg	27000	--	0.0047 U	0.0097 U	NA	0.0093 U	NA	**0.0044 LJ**
Acetone	67-64-1	mg/kg	61000	--	0.0094 U	0.0097 U	NA	0.0093 U	NA	**0.0052 LJ**
Cyclohexane	110-82-7	mg/kg	6500	--	0.0047 U	0.0048 U	NA	0.0047 U	NA	0.0046 U
Methylcyclohexane	108-87-2	mg/kg	NP	--	0.0047 U	0.0048 U	NA	0.0047 U	NA	0.0046 U
Toluene	108-88-3	mg/kg	4900	--	0.0047 U	**0.023**	NA	0.0047 U	NA	**0.00035 LJ**

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL
Yellow highlighted cells exceed RSL
U - Not Detected at reported quantitation limit
L - Reported concentration is below the CRQL
mg/kg-milligrams per kilogram
BOLD-indicates a detected concentration
bgs-below ground surface

NA - Not Analyzed
NP - Not Published
J - Estimated Value
R - Unusable
SIM-selected ion monitoring
in-inches

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 3 0-2in bgs 5/18/2015	Grid 3 2-6in bgs 5/19/2015	Grid 3 6-12in bgs 5/19/2015	Grid 3 12-24in bgs 5/19/2015	Grid 3-Duplicate 12-24in bgs 5/19/2015
Metals									
Aluminum	7429-90-5	mg/kg	77000	--	**3250**	**3980**	**4430**	**4240**	**4580**
Antimony	7440-36-0	mg/kg	31	--	0.6 UJ, U	0.5 U	0.5 U	0.5 U	0.5 U
Arsenic	7440-38-2	mg/kg	0.68	--	**3.3**	**3.4**	**1.9**	**2**	**2.7**
Barium	7440-39-3	mg/kg	15000	--	**32**	**34.6**	**24**	**21.3**	**24.3**
Beryllium	7440-41-7	mg/kg	160	--	0.6 U	0.5 U	0.5 U	0.5 U	0.5 U
Calcium	7440-70-2	mg/kg	NP	--	**701**	**483**	**383**	**355**	**418**
Chromium	7440-47-3	mg/kg	NP	--	**7.9**	**8.4**	**5.4**	**5.7**	**5.6**
Cobalt	7440-48-4	mg/kg	23	--	**4.6**	**4.4**	2.1 U	**2.3**	**2.2**
Copper	7440-50-8	mg/kg	3100	--	**9.6 J**	**11.6**	**4.1**	**4.9**	**5.3**
Iron	7439-89-6	mg/kg	55000	--	**29200**	**30900**	**7130**	**7000**	**9290**
Lead	7439-92-1	mg/kg	400	--	**15 J**	**14.3**	**5.4**	**9.1**	**12**
Magnesium	7439-95-4	mg/kg	NP	--	**343**	**323**	**301**	**293**	**311**
Manganese	7439-96-5	mg/kg	1800	--	**326**	**184**	**35.6**	**49.2**	**50.2**
Nickel	7440-02-0	mg/kg	1500	--	**5.7**	**6.8**	**2.5**	**2.4**	**2.7**
Potassium	7440-09-7	mg/kg	NP	--	**431**	**339**	**311**	**351**	**332**
Sodium	7440-23-5	mg/kg	NP	--	59.6 U	54.7 U	**78**	**57.3**	**60.5**
Vanadium	7440-62-2	mg/kg	390	--	**8**	**10.5**	**10**	**11.1**	**10.8**
Zinc	7440-66-6	mg/kg	23000	--	**40.5 J**	**18.3**	**8.1**	**10**	**7.6**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 3 0-2in bgs 5/18/2015	Grid 3 2-6in bgs 5/19/2015	Grid 3 6-12in bgs 5/19/2015	Grid 3 12-24in bgs 5/19/2015	Grid 3-Duplicate 12-24in bgs 5/19/2015
Polychlorinated Biphenyls (None Detected)									
Pesticides									
4,4'-DDE	72-55-9	mg/kg	2	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
Benzaldehyde	100-52-7	mg/kg	7800	--	0.2 UJ	0.19 UJ	0.38 UJ	0.39 UJ	0.2 UJ
Carbazole	86-74-8	mg/kg	NP	--	0.2 UJ	0.19 UJ	0.38 UJ	0.39 UJ	0.2 UJ
Endosulfan I	959-98-8	mg/kg	NP	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
Endosulfan II	33213-65-9	mg/kg	NP	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
Endrin	72-20-8	mg/kg	19	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
Endrin ketone	53494-70-5	mg/kg	NP	--	0.00127 U	0.00115 U	0.00112 U	**0.00166 RL**	0.00112 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00127 U	0.00115 U	0.00112 U	0.00111 U	0.00112 U
Methoxychlor	72-43-5	mg/kg	320	--	**0.00254 RL**	**0.00231 RL**	**0.00167 RL**	**0.00332 RL**	**0.0028 RL**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 3 0-2in bgs 5/18/2015	Grid 3 2-6in bgs 5/19/2015	Grid 3 6-12in bgs 5/19/2015	Grid 3 12-24in bgs 5/19/2015	Grid 3-Duplicate 12-24in bgs 5/19/2015
Semi-volatile Organic Compounds									
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	0.2 UJ	**0.026 LJ**	0.38 UJ	0.39 UJ	0.2 UJ
Chrysene	218-01-9	mg/kg	16	--	NA	NA	NA	NA	NA
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.2 UJ	0.19 UJ	0.38 UJ	0.39 UJ	0.2 UJ
Phenanthrene	85-01-8	mg/kg	NP	--	NA	NA	NA	NA	NA
Pyrene	129-00-0	mg/kg	1800	--	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds (SIM)									
2-Methylnaphthalene	91-57-6	mg/kg	240	--	0.04 U	0.038 U	0.0073 UJ	**0.002 LJ**	0.0076 UJ
Acenaphthene	83-32-9	mg/kg	3600	--	0.04 U	0.038 U	0.0073 UJ	0.0075 UJ	0.0076 UJ
Acenaphthylene	208-96-8	mg/kg	NP	--	**0.026 LJ**	**0.012 LJ**	**0.0041 LJ**	**0.0057 LJ**	**0.0075 LJ**
Anthracene	120-12-7	mg/kg	18000	--	**0.035 LJ**	**0.02 LJ**	**0.0033 LJ**	**0.0039 LJ**	**0.0074 LJ**
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	**0.19**	**0.14**	**0.011 J**	**0.011 J**	**0.026 J**
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	**0.17**	**0.12**	**0.01 J**	**0.013 J**	**0.023 J**
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	**0.27**	**0.19**	**0.017 J**	**0.021 J**	**0.039 J**
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	**0.085**	**0.048**	**0.0053 LJ**	**0.0056 LJ**	**0.0097 J**
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	**0.094**	**0.064**	**0.0036 LJ**	**0.0051 LJ**	**0.011 J**
Chrysene	218-01-9	mg/kg	16	--	**0.21**	**0.14**	**0.037 J**	**0.051 J**	**0.048 J**
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	**0.04**	**0.03 LJ**	**0.0041 LJ**	**0.004 LJ**	**0.006 LJ**
Fluoranthene	206-44-0	mg/kg	2400	--	**0.21**	**0.14**	**0.012 J**	**0.015 J**	**0.034 J**
Fluorene	86-73-7	mg/kg	2400	--	0.04 U	0.038 U	0.0073 UJ	0.0075 UJ	0.0076 UJ
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	**0.17**	**0.12**	**0.018 J**	**0.02 J**	**0.029 J**
Naphthalene	91-20-3	mg/kg	3.8	--	0.04 U	0.038 U	0.0073 UJ	0.0075 UJ	0.0076 UJ
Phenanthrene	85-01-8	mg/kg	NP	--	**0.021 LJ**	**0.01 LJ**	**0.0063 LJ**	**0.0071 LJ**	**0.0066 LJ**
Pyrene	129-00-0	mg/kg	1800	--	**0.23**	**0.16**	**0.014 J**	**0.017 J**	**0.033 J**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 3 0-2in bgs 5/18/2015	Grid 3 2-6in bgs 5/19/2015	Grid 3 6-12in bgs 5/19/2015	Grid 3 12-24in bgs 5/19/2015	Grid 3-Duplicate 12-24in bgs 5/19/2015
Volatile Organic Compounds									
2-Butanone	78-93-3	mg/kg	27000	--	**0.0062 B**	0.0085 U	0.0084 U	**0.01**	**0.0076 LJ**
Acetone	67-64-1	mg/kg	61000	--	**0.0302 B, K**	0.0085 U	**0.0048 LJ**	**0.012**	**0.01**
Cyclohexane	110-82-7	mg/kg	6500	--	0.0046 U	0.0043 U	0.0042 U	0.0046 U	0.0047 U
Methylcyclohexane	108-87-2	mg/kg	NP	--	0.0046 U	0.0043 U	0.0042 U	0.0046 U	0.0047 U
Toluene	108-88-3	mg/kg	4900	--	0.0046 U	**0.0003 LJ**	**0.00057 LJ**	**0.001 LJ**	**0.00019 LJ**

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL
Yellow highlighted cells exceed RSL
U - Not Detected at reported quantitation limit
L - Reported concentration is below the CRQL
mg/kg-milligrams per kilogram
BOLD-indicates a detected concentration
bgs-below ground surface

NA - Not Analyzed
NP - Not Published
J - Estimated Value
R - Unusable
SIM-selected ion monitoring
in-inches

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 4 0-2in bgs 5/18/2015	Grid 4- Duplicate 0-2in bgs 5/18/2015	Grid 4 2-6in bgs 5/19/2015	Grid 4 6-12in bgs 5/19/2015	Grid 4 12-24in bgs 5/19/2015
Metals									
Aluminum	7429-90-5	mg/kg	77000	--	**2620**	**2400**	**2460**	**2670**	**2090**
Antimony	7440-36-0	mg/kg	31	--	0.5 U	0.5 UJ, U	0.5 U	0.5 U	0.5 U
Arsenic	7440-38-2	mg/kg	0.68	--	**1.5**	0.5 UJ	**1.5**	**1.6**	**1**
Barium	7440-39-3	mg/kg	15000	--	**28.6**	**27.4**	**22.6**	**25.8**	**19.7**
Beryllium	7440-41-7	mg/kg	160	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Calcium	7440-70-2	mg/kg	NP	--	**790**	**587**	**395**	**351**	**270**
Chromium	7440-47-3	mg/kg	NP	--	**4.1**	**4.4**	**5.3**	**4.5**	**3.7**
Cobalt	7440-48-4	mg/kg	23	--	**2.6**	**2.6**	**2.3**	2.1 U	2.2 U
Copper	7440-50-8	mg/kg	3100	--	**3.4**	**3.5**	**3.3**	**4.4**	**4.2**
Iron	7439-89-6	mg/kg	55000	--	**5400**	**12100**	**5090**	**4220**	**4010**
Lead	7439-92-1	mg/kg	400	--	**8.7**	**12.2 J**	**8.7**	**15.7**	**3.2**
Magnesium	7439-95-4	mg/kg	NP	--	**349**	**274**	**258**	**220**	**172**
Manganese	7439-96-5	mg/kg	1800	--	**166**	**141 J**	**131**	**57.4**	**84.2**
Nickel	7440-02-0	mg/kg	1500	--	**2.5**	**2.5**	**2.1**	**2.3**	2.2 U
Potassium	7440-09-7	mg/kg	NP	--	**380**	**303**	**268**	**285**	**241**
Sodium	7440-23-5	mg/kg	NP	--	53.3 U	52 U	49.9 U	**254**	**90.8**
Vanadium	7440-62-2	mg/kg	390	--	**7.2**	**7.3**	**7.5**	**8.6**	**5.6**
Zinc	7440-66-6	mg/kg	23000	--	**16.3**	**14.9**	**11.7**	**23.8**	**5**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 4 0-2in bgs 5/18/2015	Grid 4-Duplicate 0-2in bgs 5/18/2015	Grid 4 2-6in bgs 5/19/2015	Grid 4 6-12in bgs 5/19/2015	Grid 4 12-24in bgs 5/19/2015
Polychlorinated Biphenyls (None Detected)									
Pesticides									
4,4'-DDE	72-55-9	mg/kg	2	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
Benzaldehyde	100-52-7	mg/kg	7800	--	0.21 UJ	0.21 UJ	0.19 UJ	3.8 U	3.9 U
Carbazole	86-74-8	mg/kg	NP	--	0.21 UJ	0.21 UJ	0.19 UJ	3.8 U	3.9 U
Endosulfan I	959-98-8	mg/kg	NP	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
Endosulfan II	33213-65-9	mg/kg	NP	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
Endrin	72-20-8	mg/kg	19	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
Endrin ketone	53494-70-5	mg/kg	NP	--	0.00116 U	0.00115 U	0.00112 U	**0.00461 RL**	0.00241 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00116 U	0.00115 U	0.00112 U	0.0023 U	0.00241 U
Methoxychlor	72-43-5	mg/kg	320	--	0.00116 U	0.00115 U	0.00112 U	**0.00691 RL**	**0.00361 RL**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 4 0-2in bgs 5/18/2015	Grid 4-Duplicate 0-2in bgs 5/18/2015	Grid 4 2-6in bgs 5/19/2015	Grid 4 6-12in bgs 5/19/2015	Grid 4 12-24in bgs 5/19/2015
Semi-volatile Organic Compounds									
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	**0.035 LJ**	0.21 UJ	**0.024 LJ**	3.8 U	3.9 U
Chrysene	218-01-9	mg/kg	16	--	NA	NA	NA	NA	NA
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.21 UJ	0.21 UJ	0.19 UJ	3.8 U	3.9 U
Phenanthrene	85-01-8	mg/kg	NP	--	NA	NA	NA	NA	NA
Pyrene	129-00-0	mg/kg	1800	--	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds (SIM)									
2-Methylnaphthalene	91-57-6	mg/kg	240	--	0.021 UJ	0.016 UJ	0.038 U	**0.94**	**0.72**
Acenaphthene	83-32-9	mg/kg	3600	--	0.021 UJ	0.016 UJ	0.038 U	**0.045 LJ**	**0.033 LJ**
Acenaphthylene	208-96-8	mg/kg	NP	--	**0.022 J**	**0.018 J**	**0.037 LJ**	**0.1 LJ**	**0.084 LJ**
Anthracene	120-12-7	mg/kg	18000	--	**0.021 J**	**0.02 J**	**0.036 LJ**	**0.067 LJ**	**0.056 LJ**
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	**0.068 J**	**0.051 J**	**0.12**	**0.23**	**0.18**
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	**0.059 J**	**0.043 J**	**0.11**	**0.2**	**0.16**
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	**0.11 J**	**0.08 J**	**0.18**	**0.31**	**0.24**
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	**0.04 J**	**0.031 J**	**0.045**	**0.13 LJ**	**0.098 LJ**
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	**0.029 J**	**0.024 J**	**0.054**	**0.095 LJ**	**0.072 LJ**
Chrysene	218-01-9	mg/kg	16	--	**0.12 J**	**0.084 J**	**0.14**	**0.63**	**0.47**
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	**0.016 LJ**	**0.011 LJ**	**0.025 LJ**	**0.051 LJ**	**0.039 LJ**
Fluoranthene	206-44-0	mg/kg	2400	--	**0.089 J**	**0.064 J**	**0.16**	**0.28**	**0.22**
Fluorene	86-73-7	mg/kg	2400	--	0.021 UJ	0.016 UJ	0.038 U	**0.12 LJ**	**0.093 LJ**
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	**0.075 J**	**0.051 J**	**0.12**	**0.22**	**0.18**
Naphthalene	91-20-3	mg/kg	3.8	--	0.021 UJ	0.016 UJ	0.038 U	**0.22**	**0.16**
Phenanthrene	85-01-8	mg/kg	NP	--	**0.016 LJ**	**0.012 LJ**	**0.021 LJ**	**0.58**	**0.45**
Pyrene	129-00-0	mg/kg	1800	--	**0.093 J**	**0.063 J**	**0.15**	**0.37**	**0.29**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 4 0-2in bgs 5/18/2015	Grid 4- Duplicate 0-2in bgs 5/18/2015	Grid 4 2-6in bgs 5/19/2015	Grid 4 6-12in bgs 5/19/2015	Grid 4 12-24in bgs 5/19/2015
Volatile Organic Compounds									
2-Butanone	78-93-3	mg/kg	27000	--	0.0046 U	0.0047 U	0.0099 U	**0.018**	**0.029**
Acetone	67-64-1	mg/kg	61000	--	0.0092 U	**0.0095 B**	0.0099 U	**0.036**	**0.06**
Cyclohexane	110-82-7	mg/kg	6500	--	0.0046 U	0.0047 U	0.005 U	**0.014 J^**	**0.0048 LJ**
Methylcyclohexane	108-87-2	mg/kg	NP	--	0.0046 U	0.0047 U	0.005 U	**0.016 J^**	**0.008 J^**
Toluene	108-88-3	mg/kg	4900	--	0.0046 U	0.0047 U	0.005 U	**0.018**	**0.024**

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL
Yellow highlighted cells exceed RSL
U - Not Detected at reported quantitation limit
L - Reported concentration is below the CRQL
mg/kg-milligrams per kilogram
BOLD-indicates a detected concentration
bgs-below ground surface

NA - Not Analyzed
NP - Not Published
J - Estimated Value
R - Unusable
SIM-selected ion monitoring
in-inches

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 5 0-2in bgs 5/18/2015	Grid 5 2-6in bgs 5/19/2015	Grid 5 6-12in bgs 5/19/2015	Grid 5 12-24in bgs 5/19/2015
Metals								
Aluminum	7429-90-5	mg/kg	77000	--	**2330**	**3920**	**5220**	**6180**
Antimony	7440-36-0	mg/kg	31	--	0.6 U	0.5 U	0.5 UJ, U	0.5 U
Arsenic	7440-38-2	mg/kg	0.68	--	**3.1**	**2.6**	**3.6**	**3.2**
Barium	7440-39-3	mg/kg	15000	--	**32**	**25.4**	**21.6**	**19.4**
Beryllium	7440-41-7	mg/kg	160	--	0.6 U	0.5 U	0.5 U	0.5 U
Calcium	7440-70-2	mg/kg	NP	--	**6620**	**650**	**240**	**253**
Chromium	7440-47-3	mg/kg	NP	--	**4**	**8.4**	**6.9**	**6.7**
Cobalt	7440-48-4	mg/kg	23	--	**4**	**4.5**	**3.4**	2 U
Copper	7440-50-8	mg/kg	3100	--	**5.2**	**5.5**	**5.7**	**6.1**
Iron	7439-89-6	mg/kg	55000	--	**11200**	**9250**	**13700**	**11700**
Lead	7439-92-1	mg/kg	400	--	**16.4**	**11.5**	**57.1 J**	**43.5**
Magnesium	7439-95-4	mg/kg	NP	--	**3340**	**405**	**329**	**381**
Manganese	7439-96-5	mg/kg	1800	--	**670**	**192**	**97.2 J**	**24**
Nickel	7440-02-0	mg/kg	1500	--	**4.1**	**3**	**3.6**	**2.9**
Potassium	7440-09-7	mg/kg	NP	--	**291**	**299**	**311**	**382**
Sodium	7440-23-5	mg/kg	NP	--	55.4 U	53.8 U	51.5 U	51.1 U
Vanadium	7440-62-2	mg/kg	390	--	**7.4**	**12.5**	**12.8**	**13.7**
Zinc	7440-66-6	mg/kg	23000	--	**78.8**	**15.4**	**17.3**	**14.4**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 5 0-2in bgs 5/18/2015	Grid 5 2-6in bgs 5/19/2015	Grid 5 6-12in bgs 5/19/2015	Grid 5 12-24in bgs 5/19/2015
Polychlorinated Biphenyls (None Detected)								
Pesticides								
4,4'-DDE	72-55-9	mg/kg	2	--	0.00124 U	0.00116 U	0.00111 U	0.00109 U
Benzaldehyde	100-52-7	mg/kg	7800	--	0.2 UJ	0.79 UJ	0.19 UJ	0.2 UJ
Carbazole	86-74-8	mg/kg	NP	--	**0.052 LJ**	**0.35 LJ**	**0.044 LJ**	0.2 UJ
Endosulfan I	959-98-8	mg/kg	NP	--	0.00124 U	0.00116 U	0.00111 U	0.00109 U
Endosulfan II	33213-65-9	mg/kg	NP	--	0.00124 U	**0.00289 RL**	0.00111 U	0.00109 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.00124 U	**0.00173 RL**	0.00111 U	0.00109 U
Endrin	72-20-8	mg/kg	19	--	0.00124 U	**0.00347 RL**	0.00111 U	0.00109 U
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00124 U	**0.00231 RL**	0.00111 U	0.00109 U
Endrin ketone	53494-70-5	mg/kg	NP	--	0.00124 U	**0.00173 RL**	0.00111 U	0.00109 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00124 U	0.00116 U	0.00111 U	0.00109 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00124 U	0.00116 U	0.00111 U	0.00109 U
Methoxychlor	72-43-5	mg/kg	320	--	**0.00248 RL**	**0.00578 RL**	**0.00166 RL**	0.00109 U

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 5 0-2in bgs 5/18/2015	Grid 5 2-6in bgs 5/19/2015	Grid 5 6-12in bgs 5/19/2015	Grid 5 12-24in bgs 5/19/2015
Semi-volatile Organic Compounds								
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	NA	**2.1 J**	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	**0.021 LJ**	0.79 UJ	0.19 UJ	**0.016 LJ**
Chrysene	218-01-9	mg/kg	16	--	NA	**4 J**	NA	NA
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.2 UJ	0.79 UJ	0.19 UJ	0.2 UJ
Phenanthrene	85-01-8	mg/kg	NP	--	NA	**5.8 J**	NA	NA
Pyrene	129-00-0	mg/kg	1800	--	NA	**3.9 J**	NA	NA
Semi-volatile Organic Compounds (SIM)								
2-Methylnaphthalene	91-57-6	mg/kg	240	--	**0.051 LJ**	**0.5**	**0.047 LJ**	**0.0041 J**
Acenaphthene	83-32-9	mg/kg	3600	--	0.12 U	0.19 U	0.11 U	0.0038 UJ
Acenaphthylene	208-96-8	mg/kg	NP	--	0.12 U	0.19 U	0.11 U	**0.0013 LJ**
Anthracene	120-12-7	mg/kg	18000	--	**0.051 LJ**	**0.32**	**0.04 LJ**	**0.0028 LJ**
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	**0.37**	NA	**0.31**	**0.015 J**
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	**0.21**	**1.2**	**0.15**	**0.0086 J**
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	**0.2**	**0.95**	**0.14**	**0.012 J**
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	**0.15**	**0.96**	**0.077 LJ**	**0.0046 J**
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	**0.037 LJ**	**0.16 LJ**	0.11 U	**0.003 LJ**
Chrysene	218-01-9	mg/kg	16	--	**0.62**	NA	**0.54**	**0.032 J**
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	**0.067 LJ**	**0.44**	**0.062 LJ**	**0.0032 LJ**
Fluoranthene	206-44-0	mg/kg	2400	--	**0.14**	**0.82**	**0.11 LJ**	**0.01 J**
Fluorene	86-73-7	mg/kg	2400	--	0.12 U	**0.12 LJ**	0.11 U	**0.0009 LJ**
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	**0.13**	**0.62**	**0.087 LJ**	**0.009 J**
Naphthalene	91-20-3	mg/kg	3.8	--	0.12 U	**0.12 LJ**	0.11 U	**0.0019 LJ**
Phenanthrene	85-01-8	mg/kg	NP	--	**0.78**	NA	**0.67**	**0.026 J**
Pyrene	129-00-0	mg/kg	1800	--	**0.61**	NA	**0.49**	**0.024 J**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 5 0-2in bgs 5/18/2015	Grid 5 2-6in bgs 5/19/2015	Grid 5 6-12in bgs 5/19/2015	Grid 5 12-24in bgs 5/19/2015
Volatile Organic Compounds								
2-Butanone	78-93-3	mg/kg	27000	--	**0.0052 B**	**0.011**	**0.022**	**0.0065 LJ**
Acetone	67-64-1	mg/kg	61000	--	**0.0217 B, K**	**0.02**	**0.029**	**0.013**
Cyclohexane	110-82-7	mg/kg	6500	--	0.0042 U	0.0049 U	0.0052 U	0.0057 U
Methylcyclohexane	108-87-2	mg/kg	NP	--	0.0042 U	0.0049 U	0.0052 U	0.0057 U
Toluene	108-88-3	mg/kg	4900	--	0.0042 U	**0.0011 LJ**	**0.0028 LJ**	**0.0012 LJ**

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL
Yellow highlighted cells exceed RSL
U - Not Detected at reported quantitation limit
L - Reported concentration is below the CRQL
mg/kg-milligrams per kilogram
BOLD-indicates a detected concentration
bgs-below ground surface

NA - Not Analyzed
NP - Not Published
J - Estimated Value
R - Unusable
SIM-selected ion monitoring
in-inches

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 6 0-2in bgs 5/18/2015	Grid 6 2-6in bgs 5/19/2015	Grid 6 6-12in bgs 5/19/2015	Grid 6- Duplicate 6-12in bgs 5/19/2015	Grid 6 12-24in bgs 5/19/2015
Metals									
Aluminum	7429-90-5	mg/kg	77000	--	**2310**	**2920**	**1700**	**2630**	**3860**
Antimony	7440-36-0	mg/kg	31	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Arsenic	7440-38-2	mg/kg	0.68	--	**1.9**	**1.8**	**1.6**	**0.9**	**1.7**
Barium	7440-39-3	mg/kg	15000	--	**31.2**	**30.1**	**21.7**	**26.1**	**42.7**
Beryllium	7440-41-7	mg/kg	160	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Calcium	7440-70-2	mg/kg	NP	--	**953**	**646**	**268**	**350**	**592**
Chromium	7440-47-3	mg/kg	NP	--	**3.6**	**5.3**	**2.6**	**3.5**	**8.1**
Cobalt	7440-48-4	mg/kg	23	--	**3.5**	**3.3**	**2.8**	**2.3**	**4**
Copper	7440-50-8	mg/kg	3100	--	**4.5**	**5.2**	**2.2**	**2.7**	**3**
Iron	7439-89-6	mg/kg	55000	--	**4890**	**6290**	**7080**	**4820**	**10200**
Lead	7439-92-1	mg/kg	400	--	**9.4**	**6.7**	**6.4**	**18.1**	**5.5**
Magnesium	7439-95-4	mg/kg	NP	--	**367**	**302**	**165**	**251**	**570**
Manganese	7439-96-5	mg/kg	1800	--	**251**	**193**	**152**	**128**	**123**
Nickel	7440-02-0	mg/kg	1500	--	**3**	**2.8**	2.1 U	**2.6**	**8.1**
Potassium	7440-09-7	mg/kg	NP	--	**348**	**298**	**199**	**248**	**452**
Sodium	7440-23-5	mg/kg	NP	--	54.8 U	**271**	**563**	**782**	**289**
Vanadium	7440-62-2	mg/kg	390	--	**6.3**	**9**	**4.7**	**7.6**	**13.3**
Zinc	7440-66-6	mg/kg	23000	--	**19.5**	**16.6**	**15**	**19.3**	**15**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 6 0-2in bgs 5/18/2015	Grid 6 2-6in bgs 5/19/2015	Grid 6 6-12in bgs 5/19/2015	Grid 6- Duplicate 6-12in bgs 5/19/2015	Grid 6 12-24in bgs 5/19/2015
Polychlorinated Biphenyls (None Detected)									
Pesticides									
4,4'-DDE	72-55-9	mg/kg	2	--	0.00118 U	0.00113 U	0.0023 U	0.00229 U	0.00228 U
Benzaldehyde	100-52-7	mg/kg	7800	--	0.23 UJ	0.2 UJ	2 U	3.9 U	2 U
Carbazole	86-74-8	mg/kg	NP	--	0.23 UJ	0.2 UJ	2 U	3.9 U	2 U
Endosulfan I	959-98-8	mg/kg	NP	--	0.00118 U	0.00113 U	0.0023 U	0.00229 U	0.00228 U
Endosulfan II	33213-65-9	mg/kg	NP	--	0.00118 U	0.00113 U	0.0023 U	0.00229 U	0.00228 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	**0.00178 RL**	0.00113 U	0.0023 U	0.00229 U	0.00228 U
Endrin	72-20-8	mg/kg	19	--	0.00118 U	0.00113 U	0.0023 U	0.00229 U	0.00228 U
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00118 U	0.00113 U	0.0023 U	0.00229 U	0.00228 U
Endrin ketone	53494-70-5	mg/kg	NP	--	**0.00237 RL**	0.00113 U	0.0023 U	0.00229 U	0.00228 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00118 U	0.00113 U	0.0023 U	0.00229 U	0.00228 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00118 U	0.00113 U	0.0023 U	0.00229 U	0.00228 U
Methoxychlor	72-43-5	mg/kg	320	--	**0.00651 RL**	0.00113 U	**0.0046 RL**	**0.00458 RL**	0.00228 U

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 6 0-2in bgs 5/18/2015	Grid 6 2-6in bgs 5/19/2015	Grid 6 6-12in bgs 5/19/2015	Grid 6- Duplicate 6-12in bgs 5/19/2015	Grid 6 12-24in bgs 5/19/2015
Semi-volatile Organic Compounds									
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	0.23 UJ	**0.04 LJ**	2 U	3.9 U	2 U
Chrysene	218-01-9	mg/kg	16	--	NA	NA	NA	NA	NA
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.23 UJ	0.2 UJ	2 U	3.9 U	2 U
Phenanthrene	85-01-8	mg/kg	NP	--	NA	NA	NA	NA	NA
Pyrene	129-00-0	mg/kg	1800	--	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds (SIM)									
2-Methylnaphthalene	91-57-6	mg/kg	240	--	**0.0057 LJ**	**0.0052 LJ**	**0.99**	**2.6**	**1.1**
Acenaphthene	83-32-9	mg/kg	3600	--	0.009 UJ	0.0077 UJ	0.19 U	0.38 U	0.19 U
Acenaphthylene	208-96-8	mg/kg	NP	--	**0.0039 LJ**	**0.0065 LJ**	**0.044 LJ**	**0.1 LJ**	**0.049 LJ**
Anthracene	120-12-7	mg/kg	18000	--	**0.0076 LJ**	**0.0079 J**	0.19 U	0.38 U	0.19 U
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	**0.039 J**	**0.042 J**	**0.085 LJ**	**0.25 LJ**	**0.15 LJ**
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	**0.023 J**	**0.03 J**	**0.055 LJ**	**0.17 LJ**	**0.095 LJ**
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	**0.029 J**	**0.047 J**	**0.091 LJ**	**0.28 LJ**	**0.14 LJ**
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	**0.014 J**	**0.011 J**	0.19 U	0.38 U	**0.042 LJ**
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	**0.0054 LJ**	**0.012 J**	0.19 U	**0.079 LJ**	**0.047 LJ**
Chrysene	218-01-9	mg/kg	16	--	**0.066 J**	**0.059 J**	**0.24**	**0.51**	**0.27**
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	**0.0087 LJ**	**0.0089 J**	0.19 U	0.38 U	0.19 U
Fluoranthene	206-44-0	mg/kg	2400	--	**0.022 J**	**0.04 J**	**0.1 LJ**	**0.33 LJ**	**0.17 LJ**
Fluorene	86-73-7	mg/kg	2400	--	0.009 UJ	0.0077 UJ	**0.097 LJ**	**0.2 LJ**	**0.1 LJ**
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	**0.02 J**	**0.031 J**	**0.057 LJ**	**0.17 LJ**	**0.087 LJ**
Naphthalene	91-20-3	mg/kg	3.8	--	**0.0021 LJ**	**0.0019 LJ**	**0.25**	**0.83**	**0.2**
Phenanthrene	85-01-8	mg/kg	NP	--	**0.074 J**	**0.036 J**	**0.4**	**0.82**	**0.51**
Pyrene	129-00-0	mg/kg	1800	--	**0.066 J**	**0.056 J**	**0.16 LJ**	**0.39**	**0.22**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 6 0-2in bgs 5/18/2015	Grid 6 2-6in bgs 5/19/2015	Grid 6 6-12in bgs 5/19/2015	Grid 6- Duplicate 6-12in bgs 5/19/2015	Grid 6 12-24in bgs 5/19/2015
Volatile Organic Compounds									
2-Butanone	78-93-3	mg/kg	27000	--	0.0047 U	0.0096 U	0.0096 U	**0.0055 LJ**	**0.0072 LJ**
Acetone	67-64-1	mg/kg	61000	--	**0.0128 B, K**	**0.018**	**0.0055 LJ**	**0.0079 LJ**	**0.012**
Cyclohexane	110-82-7	mg/kg	6500	--	0.0047 U	0.0048 U	0.0048 U	0.0043 U	0.0051 U
Methylcyclohexane	108-87-2	mg/kg	NP	--	0.0047 U	0.0048 U	0.0048 U	0.0043 U	0.0051 U
Toluene	108-88-3	mg/kg	4900	--	0.0047 U	0.0048 U	0.0048 U	0.0043 U	**0.00022 LJ**

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL
Yellow highlighted cells exceed RSL
U - Not Detected at reported quantitation limit
L - Reported concentration is below the CRQL
mg/kg-milligrams per kilogram
BOLD-indicates a detected concentration
bgs-below ground surface

NA - Not Analyzed
NP - Not Published
J - Estimated Value
R - Unusable
SIM-selected ion monitoring
in-inches

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 7 0-2in bgs 5/18/2015	Grid 7 2-6in bgs 5/19/2015	Grid 7 6-12in bgs 5/19/2015	Grid 7 12-24in bgs 5/19/2015	Grid 8 0-2in bgs 5/18/2015	Grid 8 2-6in bgs 5/19/2015	Grid 8 6-12in bgs 5/19/2015	Grid 8 12-24in bgs 5/19/2015
Metals												
Aluminum	7429-90-5	mg/kg	77000	--	**2460**	**4910**	**3630**	**6600**	**1530**	**2220**	**4420**	**4600**
Antimony	7440-36-0	mg/kg	31	--	0.6 U	0.5 U	0.5 U	0.6 U	0.5 U	0.5 U	**0.6**	0.5 U
Arsenic	7440-38-2	mg/kg	0.68	--	**1.4**	**3**	**1.8**	**5.7**	**0.7**	**1.4**	**2**	**1.7**
Barium	7440-39-3	mg/kg	15000	--	**34.6**	**27.8**	**34.4**	**50.6**	**23.4**	**23.6**	**31.3**	**30.2**
Beryllium	7440-41-7	mg/kg	160	--	0.6 U	0.5 U	0.5 U	**1**	0.5 U	0.5 U	0.5 U	0.5 U
Calcium	7440-70-2	mg/kg	NP	--	**1070**	**415**	**299**	**1260**	**490**	**406**	**435**	**407**
Chromium	7440-47-3	mg/kg	NP	--	**4.1**	**13.7**	**7.1**	**14.5**	**2.8**	**5.4**	**13.7**	**7.1**
Cobalt	7440-48-4	mg/kg	23	--	**3.1**	**4.4**	**5.5**	**12.8**	**2.2**	**2.6**	**3.4**	**3**
Copper	7440-50-8	mg/kg	3100	--	**3.8**	**4.6**	**4.4**	**4.1**	**2.3**	**2.4**	**3.9**	**3.9**
Iron	7439-89-6	mg/kg	55000	--	**5140**	**14100**	**9310**	**23000**	**3100**	**4770**	**10300**	**9450**
Lead	7439-92-1	mg/kg	400	--	**10.1**	**6.6**	**5.3**	**4.6**	**5.2**	**4.4**	**3.2**	**3.4**
Magnesium	7439-95-4	mg/kg	NP	--	**383**	**421**	**312**	**1470**	**222**	**319**	**398**	**420**
Manganese	7439-96-5	mg/kg	1800	--	**195**	**124**	**243**	**135**	**178**	**142**	**80.5**	**45.4**
Nickel	7440-02-0	mg/kg	1500	--	**2.8**	**4.8**	**4.3**	**34.4**	2.1 U	**4.6**	**5.1**	**4.9**
Potassium	7440-09-7	mg/kg	NP	--	**411**	**414**	**286**	**906**	**313**	**376**	**410**	**391**
Sodium	7440-23-5	mg/kg	NP	--	59.7 U	52.5 U	52.6 U	**290**	52.6 U	50.9 U	51.3 U	53.3 U
Vanadium	7440-62-2	mg/kg	390	--	**6.6**	**17.3**	**12.4**	**25.3**	**4.3**	**7.4**	**17.3**	**14.9**
Zinc	7440-66-6	mg/kg	23000	--	**20.2**	**7.2**	**6.1**	**10.8**	**19.4**	**7.9**	**4.7**	**4.2**

Wilcox Oil
Soil Analytical Data
Bristow, OK

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 006 Sample ID Depth Date	Grid 7 0-2in bgs 5/18/2015	Grid 7 2-6in bgs 5/19/2015	Grid 7 6-12in bgs 5/19/2015	Grid 7 12-24in bgs 5/19/2015	Grid 8 0-2in bgs 5/18/2015	Grid 8 2-6in bgs 5/19/2015	Grid 8 6-12in bgs 5/19/2015	Grid 8 12-24in bgs 5/19/2015
Polychlorinated Biphenyls (None Detected)												
Pesticides												
4,4'-DDE	72-55-9	mg/kg	2	--	0.00133 U	0.00115 U	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	**0.00019 LJ**
Benzaldehyde	100-52-7	mg/kg	7800	--	**0.02 LJ**	0.19 UJ	0.21 U	0.19 U	0.21 UJ	0.19 U	0.2 U	0.2 U
Carbazole	86-74-8	mg/kg	NP	--	**0.11 LJ**	**0.034 LJ**	0.21 U	0.19 U	0.21 UJ	0.19 U	0.2 U	0.2 U
Endosulfan I	959-98-8	mg/kg	NP	--	0.00133 U	**0.00172 RL**	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	0.002 U
Endosulfan II	33213-65-9	mg/kg	NP	--	0.00133 U	**0.00344 RL**	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	0.0038 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.00133 U	**0.00286 RL**	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	**0.000072 LJ**
Endrin	72-20-8	mg/kg	19	--	0.00133 U	**0.00401 RL**	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	**0.0011 LJ**
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00133 U	**0.00344 RL**	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	0.0038 U
Endrin ketone	53494-70-5	mg/kg	NP	--	0.00133 U	**0.00229 RL**	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	**0.000034 LJ**
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00133 U	0.00115 U	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	**0.000018 LJ**
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00133 U	0.00115 U	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	**0.00012 LJ**
Methoxychlor	72-43-5	mg/kg	320	--	0.00133 U	**0.00515 RL**	0.00112 U	0.00122 U	0.00114 U	0.00115 U	0.00115 U	**0.00029 LJ**

Wilcox Oil
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Bristow, OK

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Semi-volatile Organic Compounds												
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	**0.028 LJ**	**0.079 LJ**	**0.029 LJ**	**0.028 LJ**	**0.018 LJ**	**0.045 LJ**	0.2 U	0.2 U
Chrysene	218-01-9	mg/kg	16	--	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	**0.016 LJ**	0.19 UJ	0.21 U	0.19 U	0.21 UJ	0.19 U	0.2 U	0.2 U
Phenanthrene	85-01-8	mg/kg	NP	--	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	129-00-0	mg/kg	1800	--	NA	NA	NA	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds (SIM)												
2-Methylnaphthalene	91-57-6	mg/kg	240	--	**0.12 LJ**	**0.034 LJ**	**0.0033 LJ**	**0.0015 LJ**	**0.0038 LJ**	**0.013**	**0.0017 LJ**	0.0038 U
Acenaphthene	83-32-9	mg/kg	3600	--	0.19 U	0.11 U	0.008 U	0.0037 U	0.0081 UJ	0.0037 U	0.0039 U	0.0038 U
Acenaphthylene	208-96-8	mg/kg	NP	--	0.19 U	0.11 U	0.008 U	**0.0011 LJ**	**0.0046 LJ**	**0.00089 LJ**	**0.0013 LJ**	0.0038 U
Anthracene	120-12-7	mg/kg	18000	--	**0.1 LJ**	**0.033 LJ**	**0.0031 LJ**	**0.0019 LJ**	**0.0082 J**	0.0037 U	**0.0021 LJ**	0.0038 U
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	**0.74**	**0.32**	**0.018**	**0.0085**	**0.034 J**	**0.004**	**0.0097**	0.0038 U
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	**0.32**	**0.16**	**0.01**	**0.0053**	**0.02 J**	**0.0023 LJ**	**0.0064**	0.0038 U
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	**0.24**	**0.13**	**0.011**	**0.0074**	**0.036 J**	**0.0031 LJ**	**0.0089**	0.0038 U
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	**0.21**	**0.087 LJ**	**0.0033 LJ**	**0.0017 LJ**	**0.012 J**	**0.00093 LJ**	**0.0019 LJ**	0.0038 U
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	0.19 U	**0.026 LJ**	**0.0029 LJ**	**0.0019 LJ**	**0.0073 LJ**	**0.00086 LJ**	**0.0027 LJ**	0.0038 U
Chrysene	218-01-9	mg/kg	16	--	**1.2**	**0.53**	**0.029**	**0.012**	**0.055 J**	**0.0067**	**0.014**	0.0038 U
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	**0.11 LJ**	**0.055 LJ**	**0.0031 LJ**	**0.0014 LJ**	**0.0073 LJ**	0.0037 U	**0.0018 LJ**	0.0038 U
Fluoranthene	206-44-0	mg/kg	2400	--	**0.22**	**0.099 LJ**	**0.0094**	**0.0064**	**0.022 J**	**0.0031 LJ**	**0.0079**	0.0038 U
Fluorene	86-73-7	mg/kg	2400	--	0.19 U	0.11 U	0.008 U	0.0037 U	0.0081 UJ	**0.0011 LJ**	0.0039 U	0.0038 U
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	**0.15 LJ**	**0.081 LJ**	**0.0071 LJ**	**0.0045**	**0.023 J**	**0.002 LJ**	**0.0057**	0.0038 U
Naphthalene	91-20-3	mg/kg	3.8	--	0.19 U	0.11 U	0.008 U	**0.00083 LJ**	**0.0016 LJ**	**0.0045**	**0.0012 LJ**	0.0038 U
Phenanthrene	85-01-8	mg/kg	NP	--	**1.7**	**0.62**	**0.032**	**0.012**	**0.049 J**	**0.0077**	**0.012**	0.0038 U
Pyrene	129-00-0	mg/kg	1800	--	**1.1**	**0.48**	**0.029**	**0.014**	**0.052 J**	**0.0068**	**0.016**	0.0038 U

Wilcox Oil
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Bristow, OK

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Volatile Organic Compounds												
2-Butanone	78-93-3	mg/kg	27000	--	**0.0118**	0.014 U	0.0098 U	**0.0065 LJ**	0.005 U	0.013 U	0.0099 U	0.011 U
Acetone	67-64-1	mg/kg	61000	--	**0.0404 B, K**	**0.016**	**0.0092 LJ**	**0.0099**	**0.0107 B, K**	**0.0095 LJ**	**0.011**	**0.011 LJ**
Cyclohexane	110-82-7	mg/kg	6500	--	0.0051 U	0.0072 U	0.0049 U	0.0048 U	0.005 U	0.0064 U	0.0049 U	0.0057 U
Methylcyclohexane	108-87-2	mg/kg	NP	--	0.0051 U	0.0072 U	0.0049 U	0.0048 U	0.005 U	0.0064 U	0.0049 U	0.0057 U
Toluene	108-88-3	mg/kg	4900	--	0.0051 U	**0.0014 LJ**	**0.00046 LJ**	**0.00062 LJ**	0.005 U	0.0064 U	**0.00045 LJ**	**0.00024 LJ**

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL
Yellow highlighted cells exceed RSL
U - Not Detected at reported quantitation limit
L - Reported concentration is below the CRQL
mg/kg-milligrams per kilogram
BOLD-indicates a detected concentration
bgs-below ground surface

NA - Not Analyzed
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SIM-selected ion monitoring
in-inches

Enclosure 3: Table 2

Wilcox Oil
Soil Analytical Data
Bristow, OK

Full List of Chemicals Anlyzed in the Soil

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
Metals			
Aluminum	7429-90-5	mg/kg	77000
Antimony	7440-36-0	mg/kg	31
Arsenic	7440-38-2	mg/kg	0.68
Barium	7440-39-3	mg/kg	15000
Beryllium	7440-41-7	mg/kg	160
Cadmium	7440-43-9	mg/kg	71
Calcium	7440-70-2	mg/kg	NP
Chromium	7440-47-3	mg/kg	NP
Cobalt	7440-48-4	mg/kg	23
Copper	7440-50-8	mg/kg	3100
Iron	7439-89-6	mg/kg	55000
Lead	7439-92-1	mg/kg	400
Magnesium	7439-95-4	mg/kg	NP
Manganese	7439-96-5	mg/kg	1800
Mercury	7439-97-6	mg/kg	9.4
Nickel	7440-02-0	mg/kg	1500
Potassium	7440-09-7	mg/kg	NP
Selenium	7782-49-2	mg/kg	390
Silver	7440-22-4	mg/kg	390
Sodium	7440-23-5	mg/kg	NP
Thallium	7440-28-0	mg/kg	0.78
Vanadium	7440-62-2	mg/kg	390
Zinc	7440-66-6	mg/kg	23000
Pesticides			
4,4'-DDD	72-54-8	mg/kg	2.3
4,4'-DDE	72-55-9	mg/kg	2
4,4'-DDT	50-29-3	mg/kg	1.9
Acetophenone	98-86-2	mg/kg	7800
Aldrin	309-00-2	mg/kg	0.039
alpha-BHC	319-84-6	mg/kg	0.086
alpha-Chlordane	5103-71-9	mg/kg	NP
Atrazine	1912-24-9	mg/kg	2.4
Benzaldehyde	100-52-7	mg/kg	7800
beta-BHC	319-85-7	mg/kg	0.3
Caprolactam	105-60-2	mg/kg	31000
Carbazole	86-74-8	mg/kg	NP
delta-BHC	319-86-8	mg/kg	NP
Dieldrin	60-57-1	mg/kg	0.034
Endosulfan I	959-98-8	mg/kg	NP
Endosulfan II	33213-65-9	mg/kg	NP
Endosulfan sulfate	1031-07-8	mg/kg	NP
Endrin	72-20-8	mg/kg	19
Endrin aldehyde	7421-93-4	mg/kg	NP
Endrin ketone	53494-70-5	mg/kg	NP
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57
gamma-Chlordane	5103-74-2	mg/kg	NP
Heptachlor	76-44-8	mg/kg	0.13
Heptachlor epoxide	1024-57-3	mg/kg	0.07
Methoxychlor	72-43-5	mg/kg	320
Toxaphene	8001-35-2	mg/kg	0.49

mg/kg-milligrams per kilogram

NP - Not Published

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
Polychlorinated Biphenyls			
Aroclor-1016	12674-11-2	mg/kg	4.1
Aroclor-1221	11104-28-2	mg/kg	0.17
Aroclor-1232	11141-16-5	mg/kg	0.17
Aroclor-1242	53469-21-9	mg/kg	0.23
Aroclor-1248	12672-29-6	mg/kg	0.23
Aroclor-1254	11097-69-1	mg/kg	0.24
Aroclor-1260	11096-82-5	mg/kg	0.24
Aroclor-1262	37324-23-5	mg/kg	NP
Aroclor-1268	11100-14-4	mg/kg	NP
Volatile Organic Compounds			
1,1,1-Trichloroethane	71-55-6	mg/kg	8100
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	0.6
1,1,2-Trichloroethane	79-00-5	mg/kg	1.1
1,1-Dichloroethane	75-34-3	mg/kg	3.6
1,1-Dichloroethene	75-35-4	mg/kg	230
1,2,3-Trichlorobenzene	87-61-6	mg/kg	63
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	0.0053
1,2-Dibromoethane	106-93-4	mg/kg	0.036
1,2-Dichlorobenzene	95-50-1	mg/kg	1800
1,2-Dichloroethane	107-06-2	mg/kg	0.46
1,2-Dichloropropane	78-87-5	mg/kg	1
1,3-Dichlorobenzene	541-73-1	mg/kg	NP
1,4-Dichlorobenzene	106-46-7	mg/kg	2.6
2-Butanone	78-93-3	mg/kg	27000
2-Hexanone	591-78-6	mg/kg	200
4-Methyl-2-Pentanone	108-10-1	mg/kg	5300
Acetone	67-64-1	mg/kg	61000
Benzene	71-43-2	mg/kg	1.2
Bromochloromethane	74-97-5	mg/kg	150
Bromodichloromethane	75-27-4	mg/kg	0.29
Bromoform	75-25-2	mg/kg	19
Bromomethane	74-83-9	mg/kg	6.8
Carbon disulfide	75-15-0	mg/kg	770
Carbon tetrachloride	56-23-5	mg/kg	0.65
Chlorobenzene	108-90-7	mg/kg	280
Chloroethane	75-00-3	mg/kg	14000
Chloroform	67-66-3	mg/kg	0.32
Chloromethane	74-87-3	mg/kg	110
cis-1,2-Dichloroethene	156-59-2	mg/kg	160
cis-1,3-Dichloropropene	10061-01-5	mg/kg	NP
Cyclohexane	110-82-7	mg/kg	6500
Dibromochloromethane	124-48-1	mg/kg	0.75
Dichlorodifluoromethane	75-71-8	mg/kg	87
Ethylbenzene	100-41-4	mg/kg	5.8
Isopropylbenzene	98-82-8	mg/kg	1900
m,p-Xylene	8-38-3/106-4	mg/kg	550
Methyl acetate	79-20-9	mg/kg	78000
Methyl tert-butyl ether	1634-04-4	mg/kg	47
Methylcyclohexane	108-87-2	mg/kg	NP
Methylene chloride	75-09-2	mg/kg	57
o-Xylene	95-47-6	mg/kg	650
Styrene	100-42-5	mg/kg	6000
Tetrachloroethene	127-18-4	mg/kg	24
Toluene	108-88-3	mg/kg	4900
trans-1,2-Dichloroethene	156-60-5	mg/kg	1600
trans-1,3-Dichloropropene	10061-02-6	mg/kg	NP
Trichloroethene	79-01-6	mg/kg	0.94
Trichlorofluoromethane	75-69-4	mg/kg	730
Vinyl chloride	75-01-4	mg/kg	0.059

Enclosure 3: Table 2

Wilcox Oil
Soil Analytical Data
Bristow, OK

Full List of Chemicals Anlyzed in the Soil

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
Semi-volatile Organic Compounds			
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	mg/kg	40000
1,1'-Biphenyl	92-52-4	mg/kg	47
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg	23
1,2,4-Trichlorobenzene	120-82-1	mg/kg	24
1,4-Dioxane	123-91-1	mg/kg	5.3
2,2'-Oxybis(1-chloropropane)	108-60-1	mg/kg	4.9
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg	1900
2,4,5-Trichlorophenol	95-95-4	mg/kg	6300
2,4,6-Trichlorophenol	88-06-2	mg/kg	49
2,4-Dichlorophenol	120-83-2	mg/kg	190
2,4-Dimethylphenol	105-67-9	mg/kg	1300
2,4-Dinitrophenol	51-28-5	mg/kg	130
2,4-Dinitrotoluene	121-14-2	mg/kg	1.7
2,6-Dinitrotoluene	606-20-2	mg/kg	0.36
2-Chloronaphthalene	91-58-7	mg/kg	4800
2-Chlorophenol	95-57-8	mg/kg	390
2-Methylnaphthalene	91-57-6	mg/kg	240
2-Methylphenol	95-48-7	mg/kg	3200
2-Nitroaniline	88-74-4	mg/kg	630
2-Nitrophenol	88-75-5	mg/kg	NP
3,3'-Dichlorobenzidine	91-94-1	mg/kg	1.2
3-Nitroaniline	99-09-2	mg/kg	NP
4,6-Dinitro-2-methylphenol	534-52-1	mg/kg	5.1
4-Bromophenyl-phenylether	101-55-3	mg/kg	NP
4-Chloro-3-methylphenol	59-50-7	mg/kg	6300
4-Chloroaniline	106-47-8	mg/kg	2.7
4-Chlorophenyl-phenylether	7005-72-3	mg/kg	NP
4-Methylphenol	106-44-5	mg/kg	6300
4-Nitroaniline	100-01-6	mg/kg	27
4-Nitrophenol	100-02-7	mg/kg	NP
Benzo(a)anthracene	56-55-3	mg/kg	0.16
Benzo(a)pyrene	50-32-8	mg/kg	0.016
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16
Bis(2-chloroethoxy)methane	111-91-1	mg/kg	190
Bis(2-chloroethyl)ether	111-44-4	mg/kg	0.23
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39
Butylbenzylphthalate	85-68-7	mg/kg	290
Chrysene	218-01-9	mg/kg	16
Dibenzofuran	132-64-9	mg/kg	73
Diethylphthalate	84-66-2	mg/kg	51000
Dimethylphthalate	131-11-3	mg/kg	NP
Di-n-butylphthalate	84-74-2	mg/kg	6300
Di-n-octylphthalate	117-84-0	mg/kg	630
Fluoranthene	206-44-0	mg/kg	2400
Hexachlorobenzene	118-74-1	mg/kg	0.21
Hexachlorobutadiene	87-68-3	mg/kg	1.2
Hexachlorocyclopentadiene	77-47-4	mg/kg	1.8
Hexachloroethane	67-72-1	mg/kg	1.8
Isophorone	78-59-1	mg/kg	570
Nitrobenzene	98-95-3	mg/kg	5.1
N-Nitroso-di-n-propylamine	621-64-7	mg/kg	0.078
N-Nitrosodiphenylamine	86-30-6	mg/kg	110
Pentachlorophenol	87-86-5	mg/kg	1
Phenanthrene	85-01-8	mg/kg	NP
Phenol	108-95-2	mg/kg	19000
Pyrene	129-00-0	mg/kg	1800

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
Semi-volatile Organic Compounds (SIM)			
2-Methylnaphthalene	91-57-6	mg/kg	240
Acenaphthene	83-32-9	mg/kg	3600
Acenaphthylene	208-96-8	mg/kg	NP
Anthracene	120-12-7	mg/kg	18000
Benzo(a)anthracene	56-55-3	mg/kg	0.16
Benzo(a)pyrene	50-32-8	mg/kg	0.016
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6
Chrysene	218-01-9	mg/kg	16
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016
Fluoranthene	206-44-0	mg/kg	2400
Fluorene	86-73-7	mg/kg	2400
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16
Naphthalene	91-20-3	mg/kg	3.8
Pentachlorophenol	87-86-5	mg/kg	1
Phenanthrene	85-01-8	mg/kg	NP
Pyrene	129-00-0	mg/kg	1800

mg/kg-milligrams per kilogram

SIM-selected ion monito

NP - Not Published

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Enclosure 4: Agency for Toxic Substances and Disease Registry fact sheets for Arsenic and Polycyclic Aromatic Hydrocarbons

Arsenic - ToxFAQs™

CAS # 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic

Arsenic

CAS # 7440-38-2

compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Health and Human Services. Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

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