

ARSENIC & OLD LAND

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D'APPOLONIA



Oakmont is an affluent riverfront community on Allegheny River, within 15 miles of downtown Pittsburgh. Not a typical Southwestern PA Milltown, Oakmont has PGA Tour stop at Oakmont Country Club, but also had local steel mill, 57 acre site of electric arc furnaces until 2002 .

Regional Industrial Development Corp. became owner of mill buildings and northern 34 acres as result of bankruptcy. Local contractor acquired southern 23 acres with slag heap.

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**Southern 23 ac. portion of millsite
is focus of this study**

Slag Pile

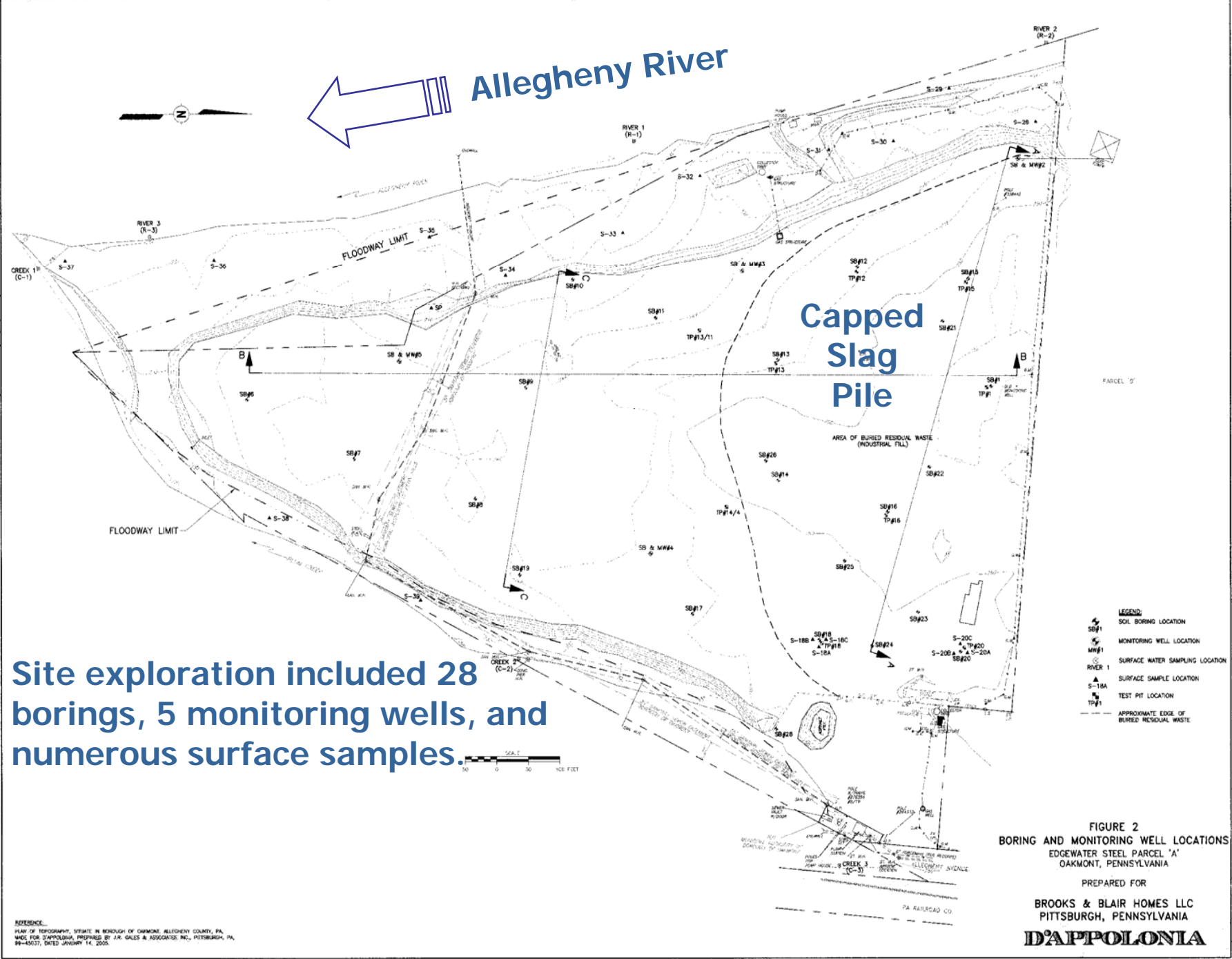
**Contractor capped slag (residual
waste as per PADEP) and placed
other miscellaneous fill on site.**

**Plum Creek flows into Allegheny
River at south end of site.
Location is attractive for
riverfront residential
development**

Plum Creek



DRAWING NUMBER 041183-M1
 CHECKED BY
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 DATE 2/23/05



Site exploration included 28 borings, 5 monitoring wells, and numerous surface samples.

FIGURE 2
 BORING AND MONITORING WELL LOCATIONS
 EDGEWATER STEEL PARCEL 'A'
 OAKMONT, PENNSYLVANIA
 PREPARED FOR
 BROOKS & BLAIR HOMES LLC
 PITTSBURGH, PENNSYLVANIA
D'APPOLONIA

REFERENCE:
 PLAN OF RECOGNITION, SITE IN BOROUGH OF OAKMONT, ALLEGHENY COUNTY, PA.
 MADE FOR D'APPOLONIA, PREPARED BY J.R. GALES & ASSOCIATES, INC., PITTSBURGH, PA.
 88-45037, DATED JANUARY 14, 2005.

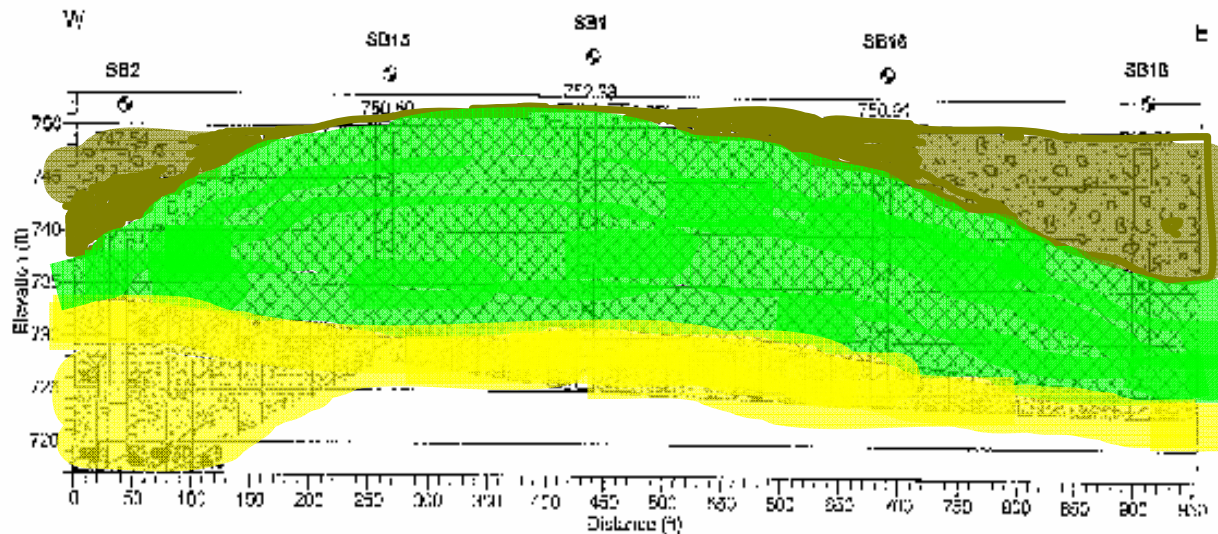
Table 3

Chemical Analyses Results for Initial Solid Samples
Oakmont Riverfront Community Site
Oakmont, Pennsylvania

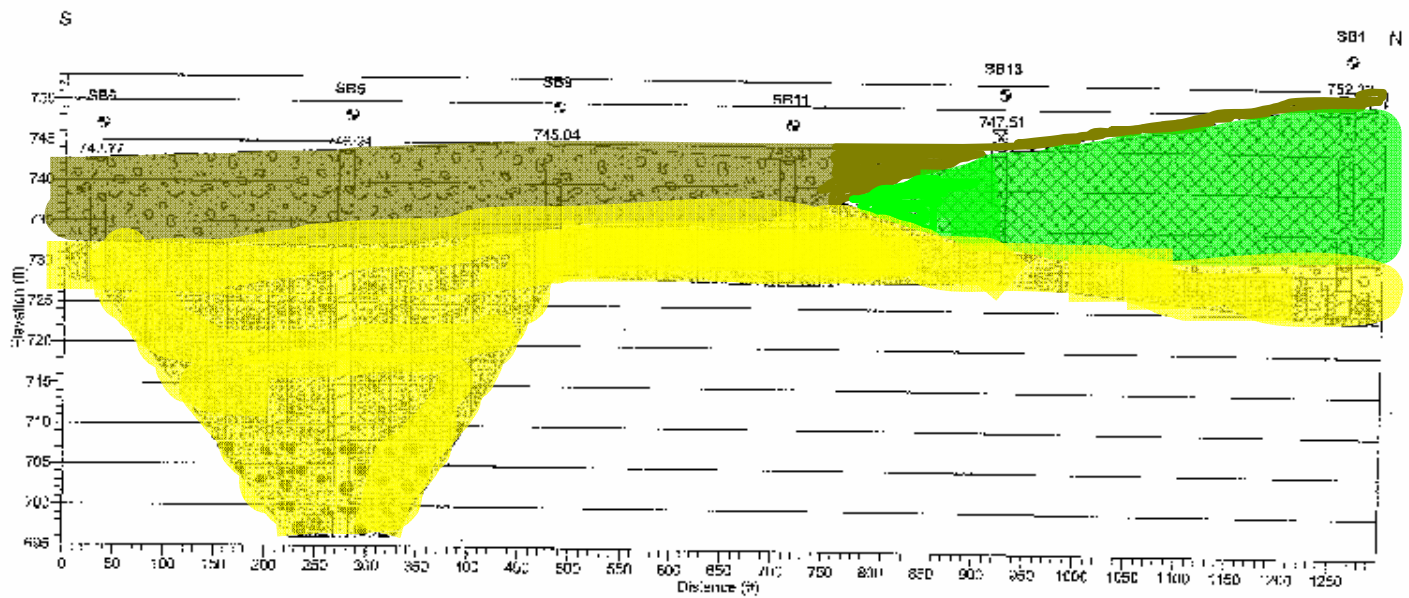
Sample Number		SB1S5	SB2S1	SB3S5	SB4S2	SB5S7	SB6-S6	SB8-S4	SB10-S3	SB12-S8	SB14-S7	SB18-S8	SB20S2	PA SWH Std.	
Depth (ft.)		5-8.5	0-2	8-10	2-4	12-14	7.5-9	4.5-8	3-4.5	10.5-12	9-10.5	10.5-12	1.5-3	Direct Contact	Soil to GrWtr
Aluminum	mg/kg	7,700	7,500	12,000	16,000	11,000	15,000	9,300	13,000	3,200	16,000	17,000	820	190,000	na
Antimony	mg/kg	<1.8	<0.50	0.52	<0.50	<0.50	<0.50	<0.50	<0.50	<3.3	<2.5	<0.50	<2.4	88	27
Arsenic	mg/kg	13	15	13	13	13	12	12	28	15	14	75	12	12	180
Barium	mg/kg	90	91	250	240	140	200	80	110	260	240	170	1300	15000	8200
Beryllium	mg/kg	<0.20	0.36	1.2	1.4	1.1	1.2	0.58	1.1	<0.29	0.59	1.2	<2.1	440	320
Cadmium	mg/kg	5.5	<0.20	1.4	0.56	0.82	0.66	0.38	1.1	20	5.3	0.68	3.4	47	38
Calcium	mg/kg	53,000	18,000	2,800	60,000	2,500	64,000	1,500	15,000	14,000	69,000	3,900	<2100	na	na
Chromium	mg/kg	490	6	45	22	23	29	11	22	640	540	38	460	94/190,000	190/190,000
Cobalt	mg/kg	11	1.8	15	9.3	14	9.5	8.2	15	53	25	18	43	4400	73
Copper	mg/kg	240	3.7	76	29	33	25	22	29	540	270	31	1200	8200	36000
Iron	mg/kg	120,000	4,800	43,000	23,000	33,000	28,000	23,000	29,000	500,000	79,000	42,000	300,000	66,000	na
Lead	mg/kg	95	81	240	96	120	28	90	30	120	160	15	670	500	450
Magnesium	mg/kg	10,000	1,100	1,900	6,500	1,800	7,600	1,700	4,600	1,000	33,000	7,200	<530	na	na
Manganese	mg/kg	5900	260	990	1,200	1,200	1,100	570	600	3,400	8,300	1,300	2,200	31,000	pending
Mercury	mg/kg	<0.10	<0.10	0	0	0	<0.10	<0.10	0	<0.10	<0.10	<0.10	<0.10	66	10
Nickel	mg/kg	250	3	73	23	27	24	15	33	910	470	42	810	4,400	650
Potassium	mg/kg	390	780	1,500	2,500	1,400	2,500	740	3,100	180	1,600	2,100	<1,100	na	na
Selenium	mg/kg	<0.50	<0.50	2	1	2	<0.51	<0.50	2	19	2	<0.50	<5.3	1,100	26
Silver	mg/kg	7	0	2	1	2	2	2	4	73	11	3	19	1,100	84
Sodium	mg/kg	<500	520	<570	<500	<580	850	<500	<640	<720	<540	<500	<5300	na	na
Thallium	mg/kg	<2.0	<2.0	<2.3	<2.0	<2.3	<2.1	<2.0	<2.5	<29	<21	<2.0	<21	15	14
Vanadium	mg/kg	52	16	25	25	21	25	18	25	38	90	33	16	1,500	26,000
Zinc	mg/kg	490	19	280	110	150	150	71	90	240	430	93	220	66000	12000

Aroclor-1016		72
Aroclor-1221		0.63
Aroclor-1232		0.5
Aroclor-1242		16
Aroclor-1248		18
Aroclor-1254		75
Aroclor-1260		500
PCB Total-TCL		

Despite a long history of disposal of various mill wastes, the site's major constituent of concern is arsenic, which can exceed PA residential direct contact MSC in all site materials. Highest arsenic concentrations occur in slag, which also contains MSC exceedences for lead and iron.



Cross section perpendicular to river. Slag pile occurs beneath miscellaneous fill cap. All fill underlain by alluvium.



Cross section parallel to river. Slag pile to north.

Table 4

Arsenic and Lead Analyses Results for Solid Samples
Oakmont Riverfront Community
Oakmont, Pennsylvania
concentrations in milligrams per kilogram dry weight

Sample	Material	Depth (ft.)	Arsenic	Lead
SB1S1A	fill	0-2	7.4	26
SB1S5	industrial fill	5-6.5	18	85
SB2S1	fill	0-2	7.6	81
SB3S1A	fill	0-2	4.2	320
SB3S5	fill	8-10	18	240
SB4S2	fill	2-4	10	98
SB5S1A	fill	0-2	8.9	43
SB5S7	native	12-14	14	120
SB5S1A	fill	0-2	8.9	
SB5S4	fill	6-8	3.7	
SB5S8	fill	10-12	3.3	
SB6S8	fill	7.5-9	12	28
SB7S10	fill	13.5-15	11	
SB8S4	fill	4.5-8	12	90
SB9S8	native	10.5-12	10	
SB10S3	fill	3-4.5	11	30
SB12S1A	fill	0-2	3.9	130
SB12S8	industrial fill	10.5-12	28	120
SB14S1A	fill	0-2	24	22
SB14S7	fill	9-10.5	15	160
SS17B	fill	0-0.5	18	32
S17E	fill	0-0.5	9.8	
S17W	fill	0-0.5	18	
S17S	fill	0-0.5	14	
SB18S1A	fill	0-2	7	650
SB18S4	fill	4.5-8	12	
SB18S7	fill	9-10.5	9.8	
SB18S8	fill	10.5-12	14	26
SB18A	fill	0-2	8.7	320
SB18B	fill	0-2	9.4	110
SB18C	fill	0-2	9.2	310
SB19S1	industrial fill	0-1.5	5.9	41
SB19S6	industrial fill	7.5-9	8.5	40
SS19B	industrial fill	0-0.5	11	51
SB20S1A	industrial fill	0-2	12	230
SB20S2	industrial fill	1.5-3	75	670
SB20S4	industrial fill	4.5-8	12	
SB20S7	industrial fill	9-10.5	8.2	
SB20A	industrial fill	0-2	53	180
SB20B	industrial fill	0-2	20	180
SB20C	industrial fill	0-2	32	920
SB20D	industrial fill	1.5-3	40	260
SB21S1	industrial fill	3-4.5	32	560
SB21S2	industrial fill	6-7.5	33	480
SB22S1	industrial fill	3.5-5	17	85
SB23S1	industrial fill	6.5-8	3.7	16
SB23S2	industrial fill	9.5-11	8.1	34
PA SWH Residential Direct Contact			12	500

shaded concentrations exceed PA MSC for residential direct contact

p1/2

Table 4

Arsenic and Lead Analyses Results for Solid Samples
Oakmont Riverfront Community
Oakmont, Pennsylvania
concentrations in milligrams per kilogram dry weight

Sample	Material	Depth (ft.)	Arsenic	Lead
SB24S2	industrial fill	13-14.5	10	98
SB26S1	industrial fill	10.5-12	5.2	39
SB26S1	industrial fill	9.5-11	6.8	21
SB27S6	industrial fill	7.5-9	18	150
SB27S10	industrial fill	13.5-15	13	49
S28	industrial fill		45	320
S29	industrial fill	0-0.5	45	520
S30	native	0-0.5	13	390
S31	native	0-0.5	11	210
S32	native	0-0.5	14	45
S33	native	0-0.5	25	160
S34	native	0-0.5	14	46
S35	native	0-0.5	12	39
S36	native	0-0.5	12	37
S37	native	0-0.5	9.7	28
S38	native	0-0.5	13	100
S39	native	0-0.5	11	60
TS	native	0-0.5	18	79
PA SWH Residential Direct Contact			12	500

shaded concentrations exceed PA MSC for residential direct contact

p2/2

Arsenic can exceed MSC throughout site, although concentrations are clearly higher in industrial fill as compared with miscellaneous fill and alluvium.

Considering the varying concentrations detected in different materials, the source of the arsenic is unclear. Is it anthropogenic or natural?

Sources of Arsenic from Steelmaking/Finishing

- alloying agents
- metal finishing
- flyash
- slag

Other Anthropogenic Sources of Arsenic

- Treated lumber,
- Coal refuse
- glass production,
- semiconductors,
- herbicide,
- pesticide,
- antimicrobial additive to poultry and swine feed
- lead-acid batteries,
- coke oven emissions,
- flyash,
- coal refuse,
- wastewater sludge

Natural Arsenic Concentrations in Soil

1998 Study by the Association for the
Environmental Health of Soils

From 34 State responses:

- Natural Concentrations 0.1 – 40 ppm
(Tennessee reports 120 ppm)
- Regulated Concentrations (residential)
0.1 – 22 ppm (Montana - 250 ppm)

**Borrow area for additional cap over site.
Undeveloped hillside within 5 miles of site.**

**Test pit soils sampled for geotechnical
properties, arsenic, and lead.**

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Pointer 40°30'26.26" N 79°48'15.80" W elev 1178 ft Streaming ||||| 100%

Eye alt 3842 ft

Borrow Area Samples

Sample	Arsenic	Lead
PH1	5.7	43
PH2	9.3	31
PH3	15	26
TP1	3.3	20
TP5	14	49
TP7	8.4	26
TP9	7.5	29
TP11	8.2	18
TP13	25	28
TP18	9.8	36
Avg.	10.62	30.6
PA SWH	12	500

Testing results indicate exceedences for arsenic of up to twice the residential direct contact MSC.

Background Standard

(of Pennsylvania Act 2)

- Allows concentrations consistent with widespread area levels, either natural or anthropogenic
- Considerable offsite sampling required
- Toxicity not addressed – not suitable for residential development

Arsenic Species in Soil

- Pentavalent – most stable in vadose zone, relatively less toxic
- Trivalent – most toxic, basis for MSC
- Organic – less common

Speciation Testing

- Could show that less toxic form of arsenic is present
- Expensive – 10x cost of total As analysis
- Additional sampling needed
- Non-standard test – only one lab certified by PA (for non-certified test)

Table 8

Arsenic Speciation Testing
Oakmont Riverfront Community, Oakmont, Pennsylvania
all concentrations in mg/kg dry weight

Sample	Total As	Trivalent As
Miscellaneous fill		
AS1	5.8	<0.452
AS2	5.1	<0.437
AS3	7.3	<0.458
AS4	9.7	<4.9
AS5	9.8	<0.448
AS6	12.2	<0.443
AS7	14.4	12.4
AS8	22.9	<0.488
Follow up samples		
AS7E	14	<0.484
AS7S	17	<0.455
AS7W	15	<4.380
Alluvial soil		
S33	13.8	<0.58
(Alluvial) Topsoil stockpile		
TS	17	<0.382

Speciation testing indicates that, although most As is present in pentavalent form, trivalent As is present in a single sample at concentration above residential direct contact MSC.

Although results are generally favorable, speciation testing alone will not address arsenic concentrations

Risk Assessment

- Conducted for both child and adult site residents
- Arsenic bioavailability is reduced by occurrence in soil matrix (based on toxicological studies)
- Concentrations of 65 ppm and below do not pose unacceptable human health risks, based on Pennsylvania criteria
- Risk assessment was conservatively conducted using parameters appropriate for trivalent arsenic, whereas testing showed that only about 12 percent of arsenic is trivalent (based on single outlier), so actual risks are lower than those used for assessment

Regulatory Status

- PADEP has approved Site Characterization, Risk Assessment, and Cleanup Plan
- Infrastructure, soil cap, and Housing Construction is pending