Arkwood, Inc. Superfund Site
Groundwater Remediation Summary
June 2012

Site History/Record of Decision

The Arkwood, Inc. Superfund Site (Arkwood Site or Site) is a former wood treating site where wood treating fluids contaminated the soil and groundwater. The Site is located in Omaha, AR. The Site was developed in the 1950's when a railroad company excavated about 40 to 50 feet below natural grade to obtain fill dirt for constructing a railroad embankment. Arkwood, Inc. began wood treating operations at the Site in 1962 using creosote and pentachlorophenol (PCP) in its process.

In 1973, the site owner leased the wood-treating facility to Mass Merchandisers, Inc. (MMI). MMI continued to operate the Arkwood plant until June 1984. Subsequently, the remaining inventory was sold or removed from the site. In January 1985, MMI's lease expired and was not renewed. The owner dismantled the plant in 1986.

In 1985, EPA proposed that the Site be added to the National Priorities List (NPL). The Site was formally added to the NPL on March 31, 1989.

With EPA oversight, MMI conducted a Remedial Investigation and Feasibility Study (RI/FS) between 1987 and 1990 pursuant to an Administrative Order on Consent (AOC). The Regional Administrator of EPA Region VI approved the Record of Decision (ROD) for the Site on September 28, 1990.

The 1990 ROD documented that the principle threat from the Site was direct contact with soils contaminated above health-based levels. In addition, the 1990 ROD stated that these soils posed a long-term threat to groundwater. Site soils were affected with pentachlorophenol (PCP), polynuclear aromatic hydrocarbons (PNAs), and dioxin. Affected materials were defined as "all Site materials that contain greater than 300 mg/kg PCP, greater than 20 µg/kg dioxin as 2,3,7,8-TCDD equivalents (dioxin), or greater than 6.0 mg/kg carcinogenic polynuclear aromatic hydrocarbons (c-PNAs) as benzo-a-pyrene equivalents". The groundwater exits at New Cricket Spring which is located about one-quarter mile downgradient of the wood treating area. New Cricket Spring contained concentrations of PCP above the Arkansas Water Quality Standard.

In April 1991, a Consent Decree (CD) was entered between the United States of America, on behalf of the USEPA, and MMI to remediate the Site. The CD includes the ROD and a Statement of Work (SOW) as Appendices A and B, respectively, (collectively the Consent Decree). A corrected CD was entered on September 23, 1992, including the same attachments.

The soil remedy was implemented in 1994 and 1995. The remediation area is fenced with signs and locked gates.

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Post Soil Remediation Spring Sampling

As set forth in the CD and based on the results of a Dye Tracing Study, spring sampling was conducted quarterly for two years after the soil remediation was completed (Table 1).

Table 1
Post Soil Remediation Spring Sampling

Date	New Cricket Spring Flow Rate (GPM)	New Cricket Spring PCP Concentration (ug/L)
7/2/1996	112	688
10/11/1996	2	651
1/20/1997	34	681
3/16/1997	34	330
7/18/1997	2	775
9/30/1997	50	560

New Cricket Spring Treatment System

Since the PCP concentration at New Cricket Spring exceeded the cleanup level for PCP of 9.3 micrograms per liter (µg/l or ppb) monthly average and 18.7 µg/l daily average set by Arkansas Department of Pollution Control & Ecology (ADPCE), an ozone pilot system was installed in April 1997. Data was collected during varying flow events and equipment settings. Based on the results, the treatment system was upgraded during November 1997 through January 1998 and a new, higher capacity system was installed during October through December 1999. The upgraded system continued to operate and to meet ADPCE requirements. Regular evaluation of the analytical data indicated the concentrations observed at the New Cricket Spring had plateaued at between approximately 75-150 ppb by 2004 (Table 2).

Table 2
New Cricket Spring Remediation Sampling (1998-2004)

Date	New Cricket Spring Flow Rate (GPM)	New Cricket Spring PCP Concentration (ug/L)
1/20/1998	42	561
5/7/1998	65	196
7/23/1998	3	561
11/4/1998	8	570
1/29/1999	60	288
7/12/1999	42	ND
3/8/2000	5	284
5/15/2000	2	272
6/23/2000	75	389
7/28/2000	3	627

8/20/2000	2	424
9/25/2000	1	577
10/26/2000	1	114
11/27/2000	25	632
2/26/2001	3	338
3/13/2001	3	376
4/27/2001	3	349
5/27/2001	2	388
7/27/2001	48	560
8/27/2001	6	372
9/27/2001	2	895
10/22/2001	6	275
11/30/2001	28	441
12/22/2001	60	114
1/28/2002	12	373
2/21/2002	15	372
3/8/2002	22	318
3/22/2002	42	226
4/22/2002	22	79
5/28/2002	70	71
6/26/2002	17	259
8/2/2002	17	231
8/27/2002	12	178
9/25/2002	10	95
10/28/2002	8	461
12/7/2002	2	398
12/29/2002	35	218
2/3/2003	7	340
3/7/2003	35	228
4/8/2003	12	274
6/4/2003	42	147
7/7/2003	9	220
8/7/2003	10	221
8/28/2003	6	71
9/29/2003	2	534
10/28/2003	24	200
12/10/2003	21	150
1/3/2004	26	139
2/3/2004	29	144
3/3/2004	28	84
4/3/2004	30	85

5/5/2004	65	115
5/15/2004	20	102
6/9/2004	12	300
6/30/2004	30	222
9/3/2004		43
10/4/2004	12	
11/3/2004	94	155
11/14/2004	26	75
11/22/2004	28	75
12/1/2004	35	72
12/21/2004	9	253

Injection of Ozonated Water

An ozone injection pilot study was installed and began operation in December 2005 to evaluate the potential for accelerating reduction of residual PCP in the subsurface between the Site and New Cricket Spring. Injection points were located in the vicinity of the sinkhole since it is hydraulically connected to New Cricket Spring through subsurface fractures. The system operated between December 2005 and August 2009. The ozone injection system was discontinued due to equipment failures and the inability to obtain replacement parts. Significant reductions in concentration at New Cricket Spring were observed during the injection period but were stabilizing prior to the equipment failure (Table 3). The approximate average PCP concentration observed in New Cricket Springs during the operation of the injection system was 116 ppb in 2005, 36 ppb in 2006, 96 ppb in 2007, 64 ppb in 2008, and 16 ppb in 2009.

Table 3
New Cricket Spring Remediation Sampling (2005-2009)

Date	New Cricket Spring Flow Rate (GPM)	New Cricket Spring PCP Concentration (µg/L)
1/3/2005	10	279
2/3/2005	12	155
3/1/2005	34	208
4/4/2005	9	148
4/25/2005	6	121
5/3/2005	9	150
6/2/2005	3	151
6/20/2005	2	55
7/13/2005	2	95
8/3/2005	12	85
10/3/2005	27	63
11/3/2005	6	278

11/14/2005	6	15
11/28/2005	8	47
12/20/2005	27	7
12/26/2005	27	11
1/2/2006	21	42
1/9/2006	20	32
1/16/2006	28	32
1/23/2006	33	16
1/30/2006	41	34
2/6/2006	38	<5.10
2/13/2006	34	24
2/20/2006	21	6
2/27/2006	26	20
3/6/2006	16	25
3/13/2006	57	107
3/20/2006	48	26
3/27/2006	27	4.09J
4/3/2006	24	11
4/10/2006	16	39
4/17/2006	22	8
4/24/2006	16	7
4/27/2006	50	11
4/29/2006	193	28
5/1/2006	94	23
5/8/2006	59	52
5/15/2006	22	15
5/22/2006	16	<5.00
5/30/2006	17	6
6/7/2006	3	253
6/12/2006	2	LE
6/19/2006	17	52
6/26/2006	17	75
7/5/2006	22	10
7/17/2006	17	22
8/7/2006	17	24
8/14/2006	17	<5.00
9/5-6/2006	23	7
9/18/2006	24	6
10/2/2006	24	17
10/16/2006	41	40
10/16/2006	81	92

10/18/2006	27	118
11/7/2006	41	53
11/20/2006	24	57
11/30/2006	636	<50.0
12/4/2006	59	<54.3
12/6/2006	37	<52.6
12/18/2006	21	24
1/8/2007	21	17
1/22/2007	79	35
2/5/2007	27	26
2/19/2007	47	20
3/5/2007	27	<5.00
3/19/2007	25	NA
4/9/2007	23	<5.00
4/23/2007	30	7
5/7/2007	21	2.90J
5/21/2007	20	4.36J
6/4/2007	20	<5.00
6/18/2007	21	10
7/9/2007	20	15
7/23/2007	18	9
8/6/2007	1	191
9/10/2007	23	217
9/24/2007	18	16
10/10/2007	18	6
10/22/2007	18	1190
11/5/2007	18	209
11/19/2007	18	20
12/3/2007	18	20
12/17/2007	32	87
1/7/2008	23	<5.00
1/21/2008	23	58
2/4/2008	24	52
2/18/2008	83	57
3/3/2008	580	<5.00
3/17/2008	44	11
4/7/2008	78	10
4/12/2008	240	7
4/13/2008	100	7
4/14/2008	78	8
5/10/2008	68	75

5/27/2008	18	189
6/9/2008	30	77
6/23/2008	580	6
7/7/2008	80	194
7/10/2008	140	254
7/21/2008	42	477
8/4/2008	22	108
8/18/2008	36	31
9/1/2008	25	32
9/22/2008	40	22
10/6/2008	21	20
10/20/2008	21	13
11/3/2008	24	<5.00
11/17/2008	30	28
12/1/2008	24	12
12/22/2008	24	<5.00
1/5/2009	32	7
1/26/2009	27	<5.00
2/9/2009	90	<5.00
2/23/2009	31	6
3/9/2009	30	6
3/23/2009	30	<5.00
4/6/2009	38	6
4/20/2009	243	9
5/4/2009	343	8
5/18/2009	51	6
6/8/2009	38	<5.00
6/29/2009	25	9
7/20/2009	47	39
8/10/2009	24	31
9/13/2009	22	8
10/12/2009	104	21
11/9/2009	45	<50
12/7/2009	28	8

Injection of Non-Ozonated Water

After equipment issues caused the discontinuation of ozone generation at the sinkhole area, non-ozonated water injection was continued. The rationale for continuing with injection of non-ozonated water was to improve operations at New Cricket Spring by maintaining a higher average water flow rate and by providing water to flush PCP concentrations. During the water injection processes, flow rates at New Cricket Spring were increased by approximately 20

gallons per minute (gpm). During low flow periods of the year, typically mid-summer and early winter, flow rates would often dwindle to less than two gpm resulting in higher ozone concentrations recirculating in the treatment equipment and accelerated decomposition of gaskets and o-rings. Maintaining the New Cricket Spring flow rate at greater than 20 gpm significantly reduced degradation of the treatment system components (Table 4).

Table 4
New Cricket Spring Remediation Sampling (2010-March 2011)

Date	New Cricket Spring Flow Rate (GPM)	New Cricket Spring PCP Concentration (µg/L)
1/10/2010	42	13
2/15/2010	87	11
3/15/2010	35	<5.00
4/15/2010	40	10
5/17/2010	180	11
6/13/2010	43	15
7/8/2010	33	66
8/19/2010	17	16
9/21/2010	33	28
10/18/2010	20	15
11/20/2010	21	5
12/16/2010	24	6
1/18/2011	22.83	3.39
2/9/2011	26.76	10.4
3/17/2011	49.03	14.2

During the period of April 2011 through November 2011, the non-ozonated water injection process was halted to evaluate spring concentrations without the impact of the non-ozonated water injection process (Table 5). The non-ozonated water injection process was re-started in November 2011 in response to a request from the EPA.

Table 5
New Cricket Spring Remediation Sampling (April 2011-Nov 2011)

Date	New Cricket Spring Flow Rate (GPM)	New Cricket Spring PCP Concentration (ug/L)
4/19/2011	57.55	12.5
5/2/2011	310	11
5/3/2011	271	8.92
5/4/2011	156	10.8
5/4/2011	123	15.8
5/5/2011	83	18
5/9/2011	33.91	43.8

6/9/2011	6.8	52.4
7/18/2011	0.575	18.6
8/15/2011	1.004	38.9
9/13/2011	0.132	<5.00
10/18/2011	23.71	52.4
11/16/2011	29.64	30.6

After re-starting the non-ozonated water injection process, analytical concentrations at New Cricket Spring returned to concentration levels approaching the ADPCE standards (Table 6).

Table 6
New Cricket Spring Remediation Sampling (Dec 2011-April 2012)

Date	New Cricket Spring Flow Rate (GPM)	New Cricket Spring PCP Concentration (µg/L)
12/19/2011	60.25	11.5
1/19/2012	31.82	<5.00
2/14/2012	40.38	<5.00
3/29/2012	50.81	7.95
4/18/2012	22.54	20
5/23/12	18	10.9

Conclusions and Recommendations

It is recommended that the treatment system located at New Cricket Spring continue to operate until the PCP concentration in the spring water achieves ADEQ standards. Based on the data, it appears that the pilot injection system successfully enhanced the degradation of the residual PCP in the source area resulting in reduced concentrations emanating from New Cricket Spring. Since the current PCP concentrations are approaching the cleanup standard for PCP, it is recommended that the injection of non-ozonated water be discontinued for the next six months. During this period, make-up water can be routed from municipal or deep groundwater sources to the treatment system, as necessary, to maintain efficient treatment system operations during low flow conditions. It is recommended that analytical sampling at the mouth of New Cricket Spring continue on a monthly basis during the next six months to monitor for potential rebound effects. Based on the updated cleanup standard for PCP presented by ADEQ in their April 4, 2011, the monthly average concentration limit is 17.38 µg/L and the daily maximum limit is 34.86 µg/L. If the analytical data indicates limited rebound (reported concentrations of less than 34.86 µg/L in any given month), monitoring would change to quarterly sampling. If analytical results measure concentrations in excess of 34.86 µg/L, injection of non-ozonated water may be reinitiated to enhance flushing operations. A summary of data and a recommendation will be submitted to the EPA at the end of the six-month period.

The need for treatment at New Cricket Spring will be evaluated, at a minimum, in the Annual Report. At such time that it is considered that the ADEQ standard has been met, MMI will submit a request to the EPA for discontinuation of treatment operations.